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Draft

Environmental Impact Statement

Metolius Basin Forest Management Project

Sisters Ranger District, Deschutes National Forest
Jefferson County, Oregon

METOLIUS BASIN FOREST MANAGEMENT PROJECT
Draft Environmental Impact Statement
Jefferson County, Oregon

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Abstract: The USDA Forest Service is proposing to implement fuel reduction and forest health management activities in order to meet the goals of reducing the risk of catastrophic wildfire, insect or disease events in the project area; protecting people, property and tribal and natural resource values; restoring old-growth forests, and protecting water and soil quality. Proposed actions include thinning dense forest stands, burning surface fuels, mowing dense shrubs, and closing roads, on approximately 12,600 acres of National Forest lands. Approximately 1.6 miles of temporary roads may be developed to aid in the access to and removal of trees. An additional action would be a site-specific amendment of visual quality standards and guidelines in the Deschutes National Forest Land and Resource Management Plan to allow short-term visibility of thinning and burning activities.

This project is located in the Metolius Basin on the Sisters Ranger District in Central Oregon. The entire project area is within a Late-Successional Reserve and encompasses a portion of the Metolius Basin Wild and Scenic River.

Five alternatives were fully analyzed to gain an understanding of potential impacts of different strategies for meeting project goals. Alternative 4, with an emphasis on balancing landscape-scale risk reduction with providing late-successional habitat, is the preferred Alternative. However, the Forest Supervisor would like to consider some elements from Alternative 3 in certain areas, and elements from Alternative 5 in certain areas (i.e. larch restoration). As such, readers are encouraged to review all of the Alternatives, and comment on elements of the other alternatives that the Forest Service should consider in the final decision.

Review and Comment: Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers should structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. Comments on the draft environmental impact statement 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:	**Kris Martinson, Project Leader** Sisters Ranger District PO Box 249 Sisters, OR 97759
Date Comments Must be Received:	**February 15, 2003**

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SUMMARY

Purpose and Need

The local community of Camp Sherman, which has been watching the declining health of their surrounding forest lands, approached the Forest Service with concerns about the safety of their community to wildfire, and the safety of the surrounding natural resources, including the clean, clear waters of the Metolius Wild and Scenic River, and the beautiful old-growth ponderosa pine forests. The community's concerns were heightened after the severe ice storms of 1999/2000 in the Camp Sherman area damaged thousands of trees.

In response to these concerns, the Sisters Ranger District initiated the Metolius Basin Forest Management Project. This project will not only address community concerns, but help continue implementation of the long-term strategic fuel reduction and forest health plan across the District. The District plan has involved vegetation and fuel management both at the landscape-scale and in focused, strategic zones (i.e. cross-District fuel breaks and defensible space around communities).

It is important to continue the landscape fuel management strategy so that forest resources and adjacent communities are protected. During the last 10 years, there have been 14 large wildfires on the Sisters Ranger District, each burning with greater speed and intensity. Because of extreme fire behavior, these fires have been difficult to control; homes have been lost; late-successional habitat has been lost; lives have been threatened.

Ponderosa pine forests in the East Cascades, including within the project area, are dry, fire-adapted ecosystems. These forests historically burned every 8-12 years. However, 80 years of fire exclusion means that 7-10 fire cycles have been missed, allowing decades of vegetation to accumulate.

Forest health in these over-dense stands is declining, resulting in an increasing risk of losing late-successional habitat to wildfire, insects or disease. In addition, due to the extensive accumulation of fuels, there is a higher risk of losing the well-established old-growth ponderosa pine, which are resilient to low-intensity fires but can be lost in high-intensity burns.

Proposed Action

The Deschutes National Forest proposes to:

1. Reduce the risk of catastrophic wildfire, insect and disease
2. Protect safety of people, property, and tribal and natural resources
3. Restore late-successional (old-growth) forests
4. Protect and restore watershed conditions

The type of actions proposed to improve forest health include thinning trees to reduce stand densities and reduce stress on current and future late-successional forests; and reducing miles of open road to help protect forest resources (water, soil, late-successional habitat, spread of noxious weeds). The type of actions proposed to reduce the risk of catastrophic wildfire include thinning trees, mowing small vegetation, prescribed burning to reduce the amount and arrangement of fuel.

Project implementation would begin in the summer of 2003. Implementation would occur as quickly as possible, depending on funding, but could take 5 or more years to complete. Broad-scale forest health and risk reduction actions would occur across the project area, and focused fuel reduction treatments would occur within the defensible space corridors adjacent to residential and high public use areas, and along evacuation routes.

The project would be implemented through a combination of traditional service contracts, timber sale contracts, stewardship contracts, and partnerships. The Metolius Basin Forest Management Project is a pilot under the Stewardship Pilot Authority that allows us to try new contracting methods to implement the project, working more closely with the community and forest industry.

Decision to be Made

Based upon the effects of the alternatives, the responsible official will decide:

- Should proposed vegetation and fuel management actions be implemented in the Metolius Basin Forest Management Project Area to reduce risk of high severity wildfire and improve forest health?
- If so, then what areas are to receive vegetation and fuel treatments, when are they to be treated, and what methods will be used?
- What roads should remain open within the project area to meet resource needs and public uses?
- Should a site-specific amendment to the Deschutes National Forest Land and Resource Management Plan be made to allow some actions that may not meet visual quality standards and guidelines in the short-term?
- Should a site-specific amendment to the Deschutes National Forest Land and Resource Management Plan be made to allow fuelwood collection in the Metolius Heritage area as a tool for implementing the project?

Issues

The major issues that arose during public scoping of the proposed action relate to concerns about:

1. Management of Vegetation in Late-Successional Reserves

Though the use of vegetation management in a Late-Successional Reserves is authorized under the Northwest Forest Plan, there is debate about the type and amount of management that should be done.

2. Size of Trees Removed

What is the socially acceptable diameter limit of trees that can be cut and removed to meet project objectives, and what is the ecologically optimal range of tree size and structure to leave in forest stands to meet the needs of late-successional species?

3. *Fire/Fuels Management*

Prescribed fire can be an effective tool for reducing fuel levels and risk of high intensity wildfires. Will residents and visitors to the Metolius Basin accept short-term impacts from fire, such as smoke and blackened trees, produced by controlled burning to meet project objectives?

4. *Water Quality and Soil Health*

Tree harvest to reduce fuel levels and improve forest health can have impacts on soil and water. What are the best ways to mitigate these impacts?

5. *Road Access*

Reducing miles of roads can help reduce resource impacts and mitigate effects from vegetation management, particularly sedimentation in the river system, but also reduces public access to certain sites in the project area. What is the best network of roads to maintain for public use, while protecting forest resources?

Alternatives

The 4 action Alternatives propose vegetation and fuel treatments on many of the same areas, and at first glance may appear the same. In fact, Alternative 3 and 4 are very similar, with the only difference being the potential upper limit of trees removed. After considerable discussion, Alternative 3 was added, so that a full range of effects relating to tree size (a key issue) could be analyzed. The other two action Alternatives, 2 and 5, propose much different types of treatments, again some of it relating to the size of trees removed, and are expected to have different results in the ability to reduce the risk of high severity wildfire and improve forest health. The Proposed Action, Alternative 4, is a mix of vegetation (fuel) treatments that are expected to help make the forest more resilient to catastrophic disturbances. These actions are based on the assumption that reducing stand densities can be very effective in meeting project goals.

Alternative 1- No Action

Under the No Action alternative existing processes and habitat cycles in the project area would continue largely without intervention. Current management of recreation use and services, fire suppression, hazard trees, standard road maintenance and re-closure of breached roads would continue. However, no actions would be taken to reduce risk at a landscape scale, or to actively develop a defensible space around homes and roads. This alternative will be evaluated as the baseline condition.

Alternative 2

The objective of this Alternative is to reduce short-term risk while minimizing short-term watershed and resource effects that can be associated with tree harvest, and to address the key issues of limiting tree harvest in Late-Successional Reserves, and limiting the size of trees that could be removed. This Alternative would reduce surface and some ladder fuels, but is not expected to contribute much to the reduction of stand or crown densities. The defensible space strategy would be implemented, though only trees 12" diameter or less would be removed. Approximately 71 percent of the total project area (12,135 acres) would be treated by proposed actions, mostly through burning, mowing and small tree (12” diameter or less) thinning. Approximately 25 miles of roads would be closed.

Alternatives 3 and 4. Alternative 4 is the Proposed Action.

> **Tree Size Limit.** *It is important to understand that an upper limit on the size of trees that could be removed does not mean that* ***all*** *trees within these size limits would be removed. It is estimated that the majority of trees that would be removed under any Alternative would be smaller than 8” diameter.*

These Alternatives are the same, *except* for variations on the size of trees that could be removed, so are described together. Alternative 3 has a lower limit on the size of trees that could be removed (16” diameter) than Alternative 4 (21” diameter). These alternatives focus on balancing risk reduction across the landscape with maintaining adequate late-successional habitat for a diversity of species. Approximately 74 percent (12,648 acres) of the total project area would be treated by proposed actions. The vegetation management that would occur would primarily be thinning, combined with burning and mowing. The defensible space strategy would be fully implemented. Approximately 50 miles of roads would be closed.

Alternative 5

The focus of this Alternative is to maximize risk reduction across the landscape and addresses the project goals of reducing the potential losses from catastrophic wildfire, insects and diseases. The emphasis would be on providing habitat for species associated open fire-adapted stands. Approximately 75 percent (12,914 acres) of the total project area would be treated by proposed actions. Though there would not be a upper diameter limit specified under this Alternative, trees larger than 21” diameter would only be removed under certain conditions.

The vegetation management would again be primarily thinning, burning and mowing, but there would also be some regeneration harvest in stands with high mortality from bark beetle, and some small group openings to restore declining larch stands. The defensible space strategy would be fully implemented. Approximately 60 miles of roads would be closed.

Major conclusions include:

- Risk of high severity wildfire would be greatly reduced under all of the action Alternatives. However, risk of high severity wildfire would not be reduced across *every* acre under any of the Alternatives. Given the complex variety of habitats required for the range of late-successional species in the project area, some areas would be left in a dense, though less resilient condition.
- A full range of tree age and size classes would remain across the landscape under any Alternative. The greatest reduction in tree size removed would be less than 8 “ diameter, particularly in the defensible space zones. However, variety in sizes, clumps and thickets, would remain scattered across the landscape. Alternative 2 would remove the fewest number of trees and Alternative 5 would remove the greatest number of trees.

Habitat for late-successional species associated with open mature pine stands would benefit more under Alternatives 3 and 4 than under Alternative 2.

- Alternative 1, no action, leaves more than 90% of the project area at risk of moderate to high severity wildfire, and thus poses the greatest risk to people, property and resources. In addition, the absence of proposed watershed mitigation of reducing road miles, leaves the greatest risk of sediment loss from roads. The No Action Alternative would not be consistent with all of the objectives of the Aquatic Conservation Strategy, and would have the greatest negative effects on habitat for species associated with more open, fire-adapted late-successional conditions (such as Peck's penstemon and white-headed woodpecker). In the absence of a catastrophic disturbance, Alternative 1 would continue to provide short-term habitat for species associated with dense interior forests.
- Of the Action Alternatives, Alternative 2 results in the least short-term negative impacts to watershed conditions and soils. Alternative 2 is predicted to result in the best habitat conditions for species associated with dense, multi-storied forests (spotted owl, Canada lynx, pacific fisher, harlequin duck). Though all of the action Alternatives reduce the risk of *high* severity wildfire, Alternative 2 would still leave 83% of the project area at risk of mixed severity wildfire. Alternative 2 is also the least effective in reducing the risk of catastrophic insect or disease. As such, people, property and resources would remain at a greater risk than under the other Action Alternatives. Reduction of road miles, focused within riparian areas, would help reduce potential sediment delivery into streams.
- Alternative 3 and 4 would leave 63%-57% of the project area at risk of mixed and high severity wildfire, but would balance risk reduction with maintenance of areas of higher stand densities. Both of these Alternatives would have fewer potential soil and watershed effects than Alternative 5. Alternatives 3 and 4 are predicted to result in the best habitat conditions for species associated with more open forests (white-headed woodpecker, bald eagle, goshawk).
- Alternative 5 results in the greatest potential watershed effects, and greatest short-term impacts on habitat for late-successional species associated with dense interior forests. However, this Alternative is the most effective at reducing the risk of moderate and high severity wildfire, both within the defensible space corridors, and throughout the landscape. As such, this Alternative would reduce the risk of wildfire effects to people, property and resources the most. Approximately 46% of the project would still remain at risk, but the stands at risk would be important habitat for late-successional species that require more dense forest conditions, and along riparian areas, where it is more desirable to have higher stand densities. This alternative is also the most effective at reducing stand densities and thus the risk of habitat loss from insects or disease. The reduction of approximately 60 miles of roads would help mitigate watershed effects from vegetation management actions.

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Document Structure

The Forest Service has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five chapters:

- *Chapter 1. Purpose and Need for Action:* This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment*: This chapter describes the relevant natural and social environment. The chapter is organized by resources, with those resources that are "key " to the analysis identified.
- *Chapter 4. Environmental Consequences*: This chapter describes the environmental effects of implementing the proposed action and other alternatives. The significant issues, followed by descriptions of other relevant resources, organize this chapter.
- *Chapter 5. Consultation and Coordination:* This chapter provides a list of prepares and agencies consulted during the development of the Environmental Impact Statement.
- *Appendices*: The appendices provide more detailed information to support the analyses presented in the Environmental Impact Statement.
- *Index:* The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Sisters Ranger District, Sisters, Oregon.

Background

Brief History Leading to this Project

- **1990s** – The Sisters Ranger District plans and begins implementing projects that concentrate on risk reduction and forest health in areas with high mortality from a catastrophic spruce budworm outbreak. Tens of thousands of forested acres in Late-Successional Reserves collapse, creating an enormous down fuel load, and extensive fragmentation across the landscape. Projects focus on reducing risk by removing dead trees, thinning over dense stands, and creating cross-District fuel breaks. Because the Metolius Basin had not been affected much by the spruce budworm outbreak, and had less mortality than other areas of the District, continuing the fuel reduction and forest health landscape strategy in the basin had not yet been scheduled.
- **Summer 1999** – Friends of Metolius initiated a cooperative project with the Sisters Ranger District, the Metolius Heritage Demonstration Project, located neat Camp Sherman, to demonstrate forest management techniques on a small scale in a highly visible location. The objective of the Metolius Heritage Demonstration Project is to increase local awareness and understanding about the methods used in controlling stand densities and fuels, and to show people what the outcomes look like, in anticipation of similar activities that may be used across the Metolius Basin to address forest health issues.

- **Winter of 1999/2000** – Severe ice storms damage hundreds of thousands of small trees in the Metolius Basin. These bent and broken trees make the extremely high density of small trees in the Metolius Basin more visible.
- **Spring 2000** – Residents of Camp Sherman, in the Metolius Basin, approach the Sisters Ranger District to find out what can be done to clean up the storm-damaged trees around their homes and on adjacent National Forest lands to reduce fuel and the risk of catastrophic wildfire. The decline of forest health across the Metolius Basin becomes more evident to residents.
- **Summer 2000** – Camp Sherman residents contact Senator Wyden and ask for assistance in working the Forest Service to protect their homes and surrounding forestland. The Sisters Ranger District makes plans to move up the date for analyzing wildfire risk and forest health in the Metolius Basin.
- **Fall 2000** – The Sisters Ranger District provides an avenue for Camp Sherman residents to clean up small dead and down wood on National Forest lands within 300 feet of their property through a personal fuelwood permit. This is a temporary solution to reducing

some ground and ladder fuels adjacent to homes, until planning for the Metolius Basin Forest Management project is complete and implementation can begin.

- **Fall-Summer 2000** - Field reconnaissance to assess conditions in the project area, and plant and animal surveys (as required under the Northwest Forest Plan survey and manage direction, and under the Endangered Species Act) are completed.
- **Fall 2001** – The planning process to complete the Metolius Basin Forest Management Environmental Impact Statement begins. A working group of the Deschutes Provincial Advisory Council organizes to participate in the planning process, including representatives from Senator Wyden's office, Friends of the Metolius, Camp Sherman, The Confederated Tribes of Warm Springs, local environmental groups and forest industry.

A Sense of Place for the Metolius Basin

The values we put upon a landscape or a place become the character, or the "sense of place"[1], that we want to sustain through time. People want to hold on to the memories and feelings a place invokes and recognize that the spirit of the place is still the same when they return.

Located in a forested valley east of the Cascade Mountain crest, the Metolius Basin is a place treasured by generations of people. It is a landscape of spring-fed waters, mountain vistas, and clean air. Guarded by the ancient volcano Black Butte, the old-growth pine forests and world famous Metolius River create a peaceful setting that has been used for thousands of years.

The beautiful ponderosa pine forests were born in fire. Low ground fires frequently swept through forests, burning needles and thinning small shrubs and trees. Large ponderosa pine trees, protected by thick bark, survived. Surveyor notes in the 1870's describe huge tracts of open grown mature pine, larch, and cedar, with open grassy understories, and scattered shrubs.

Salmon were once a part of this landscape. Native Americans fished the headwaters for "Metolla", a fish they also called dog salmon. Spawning spring chinook were plentiful and sockeye salmon traveled up the Metolius to Suttle Lake, one of two lake systems in Oregon that supported historic runs of these ocean-going fish. Early European explorers, such as Fremont in 1843, were told by their Indian guides this

[1] **Sense of place** is the collection of meanings, beliefs, symbols, and feelings that individuals or groups associate with a locality.

was a "salmon river" and shown huge fish traps nestled in downed pine trees on the river bottom. In 1855, John Abbott, a railroad surveyor, bought a 25-pound salmon, caught with an iron pointed fish spear, from a group of Indian families.

> *"…We entered a most beautiful valley, and crossed a clear, quiet stream some one hundred feet wide and about 18-20 inches deep. Here we camped. We discovered two springs flowing underneath the mountain, which furnished all the water of the pleasant little river flowing at our feet. We christened the place "Big Spring Valley".*
>
> John Gray, 1860, early explorer

Trails along the Metolius River led to hunting grounds and huckleberry fields in the mountains. A Warm Springs legend says that long ago when the mountains were people, Black Butte was a woman on a journey. The day was hot and she sat down to rest. The Metolius River was formed from her sweat or her tears over her husband, Green Ridge. The Metolius Basin is still highly valued by the Confederated Tribes of Warm Springs as part of their cultural landscape and is protected by treaty rights.

European settlers began to homestead the Metolius Basin in the 1880's. As settlers arrived, the forests began to change with the suppression of wildfires and logging of pine to supply lumber to growing local communities. Around 1910 the area became a favorite camping retreat for residents of Sherman County, who by 1917 had established a seasonal community known as Camp Sherman. Beginning in the 1930's, Civilian Conservation Corps (CCC) campground projects and private resort developments provided shelters, lodging and amenities. Generations of Oregonians came to the Metolius to camp, fish, and enjoy the natural beauty.

Although the expansive ponderosa pine forests of the Basin were recognized as a valuable timber resource, conservation has been a long-term theme of the area as well. In the 1890's the establishment of the Cascade Forest Reserve withdrew the area from settlement claims and preserved recreational opportunities on what later became public lands of the Deschutes National Forest. The Headwaters of the Metolius was acquired in 1924 as a site for a mill pond and lumber mill, but by 1927, the Governor of Oregon was trying to secure the site as a state park. In the 1970's the owners worked with the Forest Service to negotiate a scenic easement to protect the classic view of the Headwaters and Mt Jefferson. In 1928, the Deschutes National Forest recommended the exclusion of 640 acres as a "yellow pine museum". Three years later, the Metolius Research Natural Area was established

> *"But it is not too early for Central Oregon people who do not wish to see one of the finest outing places of the state destroyed, to begin thinking the matter over and planning to preserve a strip along the river as a national park. Under the big pines, by the crystal-clear and cold waters of the Metolius is an ideal place for camping trips. The fishing is good, the air incomparable, and the sunshine and shade makes it delightful for resting the mind and body and forgetting the cares and worries of the world.*
>
> *There will be some, naturally who will oppose such a proposed park…. But there will be other land available for raising crops, whereas if the outing possibilities of the Metolius are destroyed, there will be a void that cannot be filled-- there is only one such stream and one such place for recreation."*
>
> *Bend Bulletin, 1913*

protecting 1300 acres of old growth pine forest for scientific study. The Metolius River was protected by Congress as a Wild and Scenic River in 1988.

In 1990, the Deschutes National Forest established the Metolius Conservation Area in response to public interest, included from a group called "Save the Metolius". There was a shift in management philosophy from timber production toward recreation and environmental protection. Within the Metolius Conservation Area, 10 management areas were designated to emphasize unique qualities of the Metolius Basin. This management direction also emphasized planning for the future with community involvement and creative solutions to natural resource issues.

Metolius Conservation Management Areas

The Metolius Basin is truly unique in the quality and diversity of its natural resource and spiritual values. The River's headwaters well from the ground in scenic springs, ensuring pristine water quality and excellent fisheries. …Big, yellow-barked ponderosa pine trees are a highlight of the Basin. The Metolius ecosystem provides habitat for a wide variety of plant and animal species.

LRMPs, pg. 4-164

Forest ecosystem management continued to evolve in the 1990's and resulted in further specialized management direction for the Metolius Basin. Today, much of the area is identified as a Late-Successional Reserve under the Northwest Forest Plan, and managed to protect old growth ecosystems. The important role of fire in maintaining forest health was recognized and the Sisters Ranger District became a leader in the scientific reintroduction of low intensity fire with prescribed burns in the Metolius Research Natural Area. Watershed-level assessments based on landscape ecology, natural processes, and the needs of old growth species and ecosystems now guide forest management.

Traditional uses, spiritual value, history, and natural beauty are part of the "sense of place" that makes the Metolius Basin so important to people today and to future generations.

Purpose & Need for Action

The local community of Camp Sherman, which has been watching the declining health of their surrounding forest lands, approached the Forest Service with concerns about the safety of their community to wildfire, and the safety of the surrounding natural resources, including the clean, clear waters of the Metolius Wild and Scenic River, and the beautiful old-growth ponderosa pine forests. The community's concerns were heightened after the severe ice storms of 1999/2000 in the Camp Sherman area damaged thousands of trees. Residents became afraid of losing something they treasured.

In response to these concerns, the Sisters Ranger District initiated the Metolius Basin Forest Management Project (see figure 1-1 for project location). This project will not only address community concerns, but help continue implementation of the long-term strategic fuel reduction and forest health plan across the District. The District plan has involved vegetation and fuel management both at the landscape-scale and in focused, strategic zones (i.e. cross-District fuel breaks and defensible space around communities). Improving forest health and reducing the risk of catastrophic loss from wildfire, insects or disease is well supported by direction in the Deschutes National Forest Land and Resource Management Plan and recommendations from the Metolius Late-Successional Reserve Assessment and Watershed Assessment.

It is important to continue the landscape fuel management strategy so that forest resources and adjacent communities are protected. During the last 10 years, there have been 14 large wildfires on the Sisters Ranger District, each burning with greater speed and intensity. Because of extreme fire behavior, these fires have been difficult to control; homes have been lost; late-successional habitat has been lost, lives have been threatened.

Why reduce the risk of wildfire across the landscape, and not just around homes?

Reducing fuels within the wildland urban interface can help reduce the rate of spread and increase the ability to control low to moderate intensity wildfire within these corridors. Reducing fuels at a larger landscape scale reduces the risk of high intensity crown or spotting fires moving through or over wildland urban interface fuel reduction areas. Also, there are many other important forest values (i.e. late-successional habitat, water quality, soil productivity, and scenic beauty) that can be protected outside of the wildland urban interface. "The Metolius Basin is truly unique in the quality and diversity of its natural resources and spiritual values" (LRMP, Metolius Conservation Area goals, pg. 4-164). We cannot afford to ignore this potential risk, and must act now to protect these values.

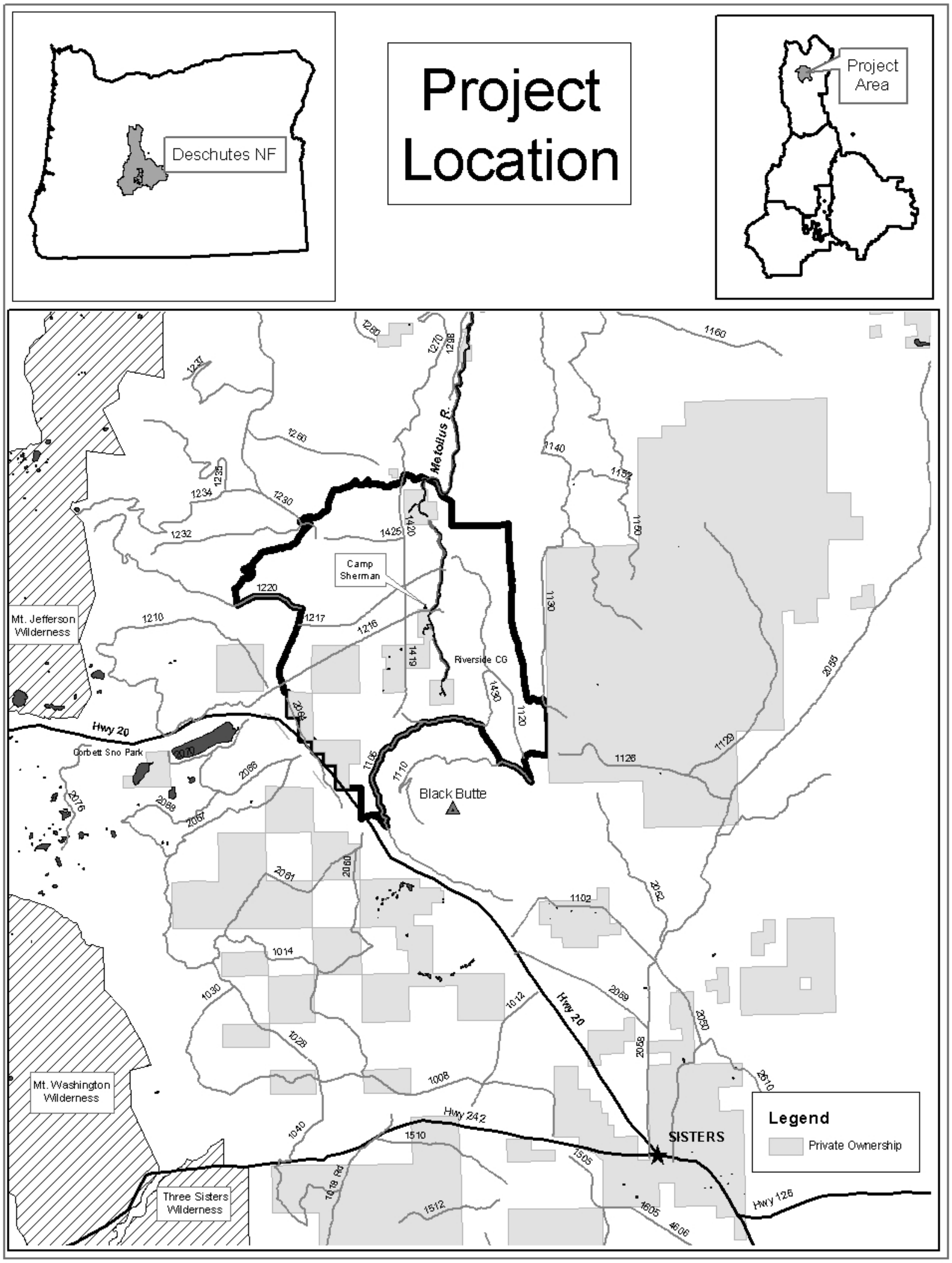


Figure 1-1. Project Location.

Declining Forest Health

Ponderosa pine forests in the East Cascades, including within the project area, are dry, fire-adapted ecosystems. These forests historically burned every 8-12 years. However, 80 years of fire exclusion means that 7-10 fire cycles have been missed, allowing decades of vegetation to accumulate.

Forest health in these over-dense stands is declining, resulting in an increasing risk of losing late-successional habitat to wildfire, insects or disease. In addition, due to the extensive accumulation of fuels, there is a higher risk of losing the well-established old-growth ponderosa pine, which are resilient to low-intensity fires but can be lost in high-intensity burns, and which are considered a highlight of the basin (Land and Resource Management Plan, pg. 4-164).

Concern about Roads

Another concern about impacts to the health of the Metolius Basin forest and streams are the high density of Forest System and user-created roads. Roads that cross or are adjacent to rivers can be an avenue for sediment delivery into streams and contribute to cumulative watershed impacts. Reducing the miles of open roads could help mitigate potential resource effects that may occur from proposed vegetation and fuel treatments, and can help move toward the Land and Resource Management Plan guidelines on road density.

Proposed Action

What: The Forest Service proposes to address the purpose and need by meeting 4 goals:

1. Reduce the risk of catastrophic wildfire, insect and disease
2. Protect safety of people, property, tribal and natural resources
3. Restore late-successional (old-growth) forest conditions
4. Protect and restore watershed conditions

Actions proposed to reduce the risk of catastrophic wildfire and protect people, property and resources would include thinning trees, mowing small vegetation, and prescribed burning to reduce the amount and arrangement of fuel. Actions to restore forest health and protect watershed conditions include thinning trees to reduce stand densities and reduce stress on current and future late-successional forests; restoring the rare but important features of aspen stands, larch stands, and meadows in order to restore habitat diversity (LRMP, M-19: 4-165); and reduce miles of open road to help mitigate effects from vegetation and fuel treatments, move toward Land and Resource Management Plan guidelines for road density, and protect forest resources (water, soil, late-successional habitat, spread of noxious weeds).

Why: Approximately 82% of forest stands on National Forest lands in the project area are at stand densities higher than can be sustained over the long-term, and approximately 97% of the project area is at risk of moderate to high severity wildfire. People, property, late-successional habitat and forest resources are at risk.

When: Project implementation would begin in the summer of 2003. The plan would be implemented as quickly as possible, depending on funding, but could take 5 or more years.

Where: Broad-scale forest health and risk reduction actions would be implemented on approximately 12,100 acres across the project area (Figure 2-2, Chapter 2), including focused fuel reduction treatments within the defensible space corridors adjacent to residential and high public use areas, and along evacuation route roads.

How: The project would be implemented through a combination of traditional service contracts, timber sale contracts, stewardship contracts and partnerships. The Metolius Basin Forest Management Project is a pilot under the Stewardship Pilot Authority that allows new contracting methods to implement the project, working more closely with the community and forest industry.

See a more detailed description of Alternative 4, *the Proposed Action*, in Chapter 2.

The proposed action responds to the goals and objectives outlined in the Deschutes National Forest Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan and Wild and Scenic River Plan, and helps move the project area towards desired conditions described in those plans and associated watershed and Late-Successional Reserve assessments. The proposed action is also consistent with direction from the President's Healthy Forest Initiative, the National Fire Plan, and Oregon's 11 point plan. The following summarizes relevant goals and direction.

DIRECTION FROM AND CONSISTENCY WITH THE FOREST PLAN AND AREA ASSESSMENTS

Deschutes National Forest LRMP (1990), Metolius Conservation Area Goals

The Deschutes National Forest Plan established the Metolius Conservation Area with standards and guidelines for timber harvest, developed and dispersed recreation, protection of big trees, old growth, spring-fed streams and scenic quality in the Metolius Basin (Figure 2-1).

The Record of Decision for the LRMP states that the key to successfully meeting the plan objectives for the Metolius Conservation Area is through participation and cooperative partnerships with the Metolius community (ROD, pg. 24).

Four of the Metolius Conservation Area management allocations are within this project area.

> Metolius Heritage Area (MA 19). This management allocation covers approximately 66% of the project area. The area goal is to perpetuate a unique ecosystem represented by large "yellow-belly" ponderosa pine and spring-fed streams that are part of Oregon's heritage. This ecosystem is an integral part of the Metolius Basin as a whole, and should be managed with that consideration (LRMP, pg. 165).

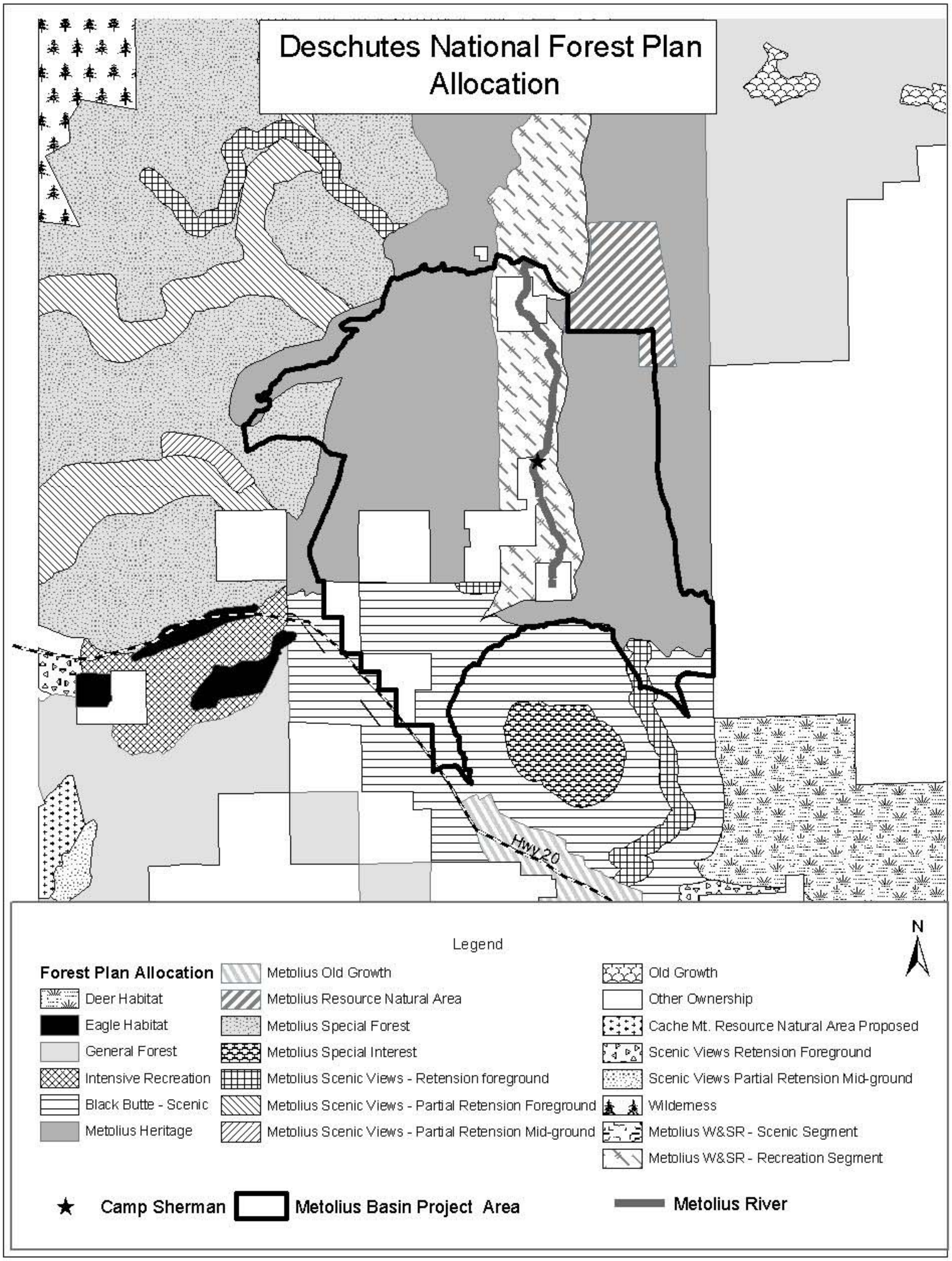


Figure 1-2. Deschutes National Forest Land and Resource Management Plan Allocations.

Metolius Black Butte Scenic (MA 21). This management allocation covers approximately 15% of the project area. The area goal is to perpetuate the unique scenic quality of Black Butte (LRMP, pg. 173).

Metolius Wild and Scenic River (MA 28). This management allocation covers approximately 9% of the project area, and management directions are outlined in the River Management Plan (1997). The area goals are to protect and enhance the outstandingly remarkable values of scenery, recreation, cultural resources, geology, water quality, fisheries, wildlife, and ecological. Vegetation management activities that help meet these goals are permitted within the river corridor.

Metolius Special Forest (MA 22). This management allocation covers approximately 3% of the project. The area goal is to rehabilitate and sustain a healthy forest with an emphasis on timber production, while maintaining a near natural appearance and providing a range of recreational opportunities for public use and enjoyment (LRMP, pg. 178).

Additional references to Land and Resource Management Plan standards and guidelines can be founding Chapter 2 under Mitigation.

Consistency with the Land and Resource Management Plan

The proposed actions are consistent with the Deschutes National Forest Land and Resource Management Plan, except certain visual quality standards and guidelines, which may not be met in the short-term due to visible effects from thinning and prescribed burning activities. A site-specific amendment to these standards and guidelines has been proposed.

An amendment to the fuelwood collection standard and guideline in the Metolius Heritage area is also proposed under this analysis, though the proposed actions do not rely on permitting fuelwood collection and would still be consistent with this standard if not amended.

See Chapter 4, Forest Plan Amendments, for further discussion and predicted effects.

Northwest Forest Plan

The Northwest Forest Plan amended the Deschutes National Forest LRMP in 1994 with direction for managing late-successional and old-growth habitat within the range of the spotted owl. The entire project area lies within the range of the Northwest Forest Plan, and is designated as a Late-Successional Reserve (Figure 3-1). Under the direction of the Northwest Forest Plan, watershed and Late-Successional Reserve assessments were required prior to implementing projects in these areas. The direction from these assessments is summarized below.

Metolius Watershed Analysis (1996)

The Metolius is one of seven key watersheds found on the Deschutes National Forest. A Watershed Analysis is required in key watersheds in order to develop a landscape level assessment to guide project planning. The Metolius Watershed Analysis identified eleven landscape areas where biological and social patterns and trends were similar.

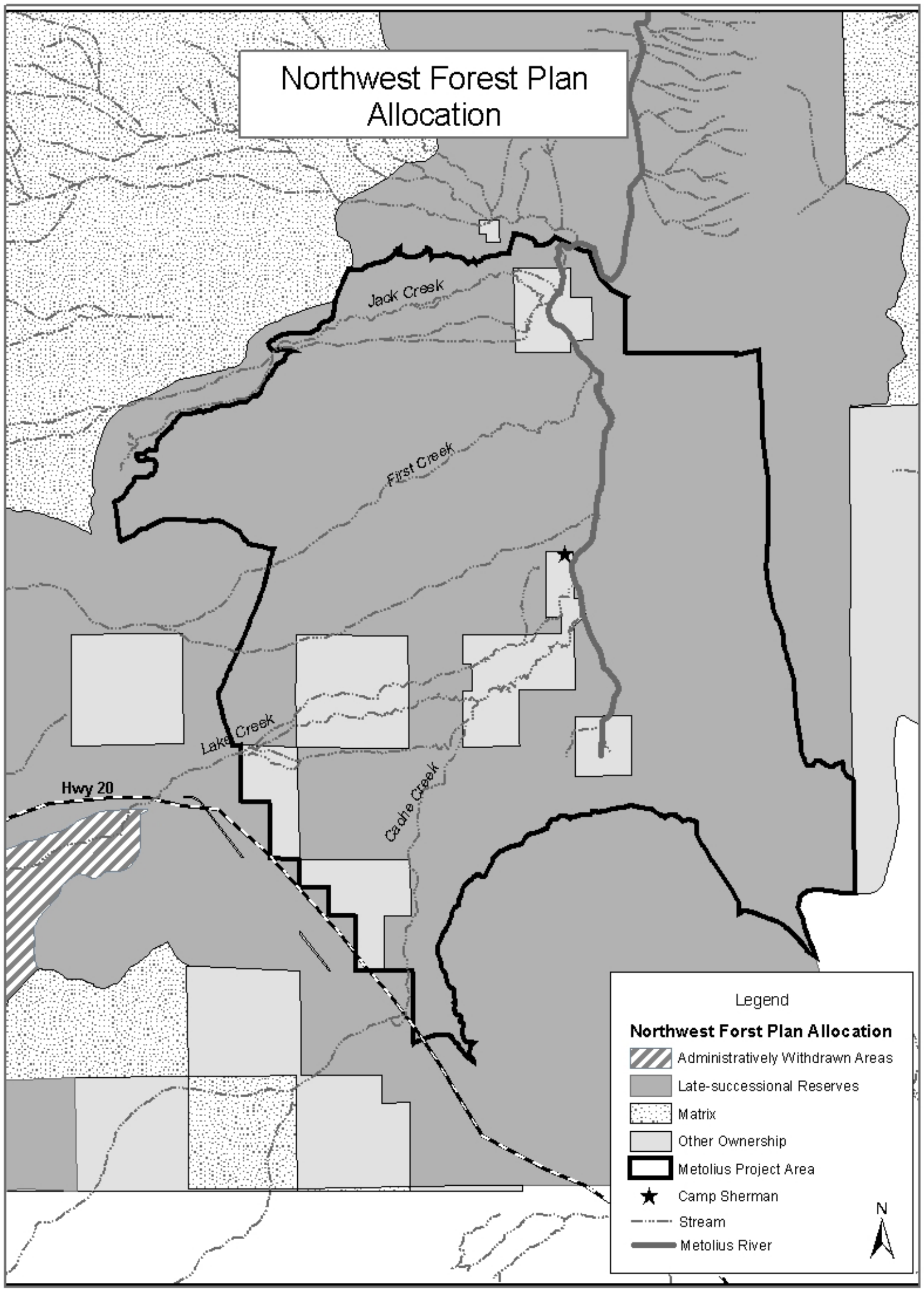


Figure 1-3. Northwest Forest Plan Allocations.

Five of the landscape areas - *Central Basin, Highway 20 Corridor, Scarp, Upper Tributaries* and *Black Butte* - are found within the Metolius Basin Forest Management Project.

The analysis recommends managers consider the following habitat restoration and vegetation management goals (pg. 142):

- Aim for a balance of vegetation within each plant association group consistent with the historic natural range of variability. These are a desired condition, not static, and will change over time.
- Restore fire-climax late-successional conditions.
- Reduce potential for habitat loss due to stand replacement wildfires. Protect this habitat from loss due to large-scale fires, insect and disease epidemics and major human impacts so that late-successional ecosystems and biodiversity are maintained.
- Generate commercial yields of wood as a result of implementing vegetation management opportunities to meet previous goals.
- Use prescribed fire when possible, either in conjunction with other silvicultural treatments such as thinning, or alone, to achieve previous goals. This benefits many species that have evolved with periodic fire.
- Riparian Reserves are important habitat connections throughout the Metolius Basin (including the Metolius River, Lake Creek, First Creek, Davis Creek, Cache Creek, and Jack Creek). Maintain large wood, stable and vegetated streambanks and flood prone areas. Maintain clean substrates with low fine sediment levels; provide cover and quality spawning habitats. Protect forest structural diversity and soil moisture.

Metolius Late Successional Reserve Assessment (1996)

The project area is also located within a Late-Successional Reserve, a management allocation under the Northwest Forest Plan (1994) with the objective of protecting and enhancing late-successional and old growth forest ecosystems which serve as habitat for species dependent on these conditions, including the northern spotted owl, and to maintain a functional, interacting ecosystem. Management direction under the Northwest Forest Plan supercedes management direction under individual National Forest plans, except where the local direction provides greater protection for late-successional species.

Specific goals of the Metolius Late-Successional Reserve are to: 1) provide sustainable vegetative conditions within the natural range of variability typical of Eastern Oregon Cascade province where vegetation developed under natural fire regimes, 2) maintain habitat for spotted owls, where sustainable, and 3) restore and maintain riparian ecosystems while protecting them from fire, insects and disease.

Further objectives address reintroduction of fire, thinning overcrowded stands to promote big trees, removing encroaching white fir in ponderosa pine forests, removing some dead trees in areas of high mortality, using silvicultural techniques to develop more big trees, designing fuelbreaks, reducing forest fragmentation and protecting connectivity, and retaining down wood and snags (pgs. 64-66).

Consistency with the Metolius Late-Successional Reserve Assessment

The Late-Successional Reserve Assessment recommends a range of silvicultural actions to help improve the health of late-successional habitat, and to reduce the risk of catastrophic disturbances. Most of the actions proposed under this analysis are addressed, except applying shelterwood treatments (only under Alternative 5) to 296 acres with higher insect and disease impacts. Approval by the Regional Ecosystem Office of these additional actions would be needed to be fully consistent with the Late-Successional Reserve Assessment. Activities that were not reviewed initially can be proposed and reviewed on a project-specific basis. See Chapter 4, under the discussion of Late-Successional Habitat for a more detailed consistency review.

Healthy Forest Initiative (August 2002)

In response to one of the worst wildfire seasons on record, the Bush Administration initiated a plan to restore forest health across the nation to reduce the risk of catastrophic wildfires. The initiative established a framework for protecting communities and the environment through local collaboration on thinning, planned burns and forest restoration projects. It incorporated core components of the National Fire Plan's 10-year Comprehensive Strategy and Implementation Plan. The initiative emphasized the need for active forest management to reduce the accumulation of fuels and restore the health of ecosystems.

National Fire Plan (2002)

Following the extreme fire season of 2000, Congress directed Federal land management agencies to work with State governments to develop a national strategy for the restoration of fire-adapted ecosystems. The National Fire Plan was intended to respond to severe wildland fires, reduce impacts on rural communities, and ensure effective firefighting capacity. The resulting 10-Year Comprehensive Strategy represents the joint effort of Federal, State, Tribal, and local governments and non-governmental representatives. The Strategy is meant to facilitate collaboration between fire management organizations and communities to reach local and landscape-level goals, such as protection of property and restoration of fire-prone ecosystems, and to establish cost effective measures and reporting procedures to ensure accountability.

The goals of the 10-Year Strategy are to improve prevention and suppression, to reduce hazardous fuels, to restore fire-adapted ecosystems, and to promote community assistance. Specific actions designed to reach those goals include prioritizing management activities so that communities that are most at risk in the wildland-urban interface receive priority for hazardous fuels treatments, develop strategies to address fire-prone ecosystem problems that augment fire risk or threaten sustainability, and promote public knowledge of wildland fire and its role in natural ecosystem processes.

Oregon 11 Point Action Plan

In the mid 1990s, Governor Kitzhaber's administration began to seek a balance between Oregon's economic needs, environmental needs, and social or community needs. They recognized that the key to meeting these needs lies in the restoration and development of a healthy watershed, which can provide clean water, a thriving forest, abundant timber, and healthy forest species. To respond to this idea, they developed the Governor's 11-point Action Plan. The intent of this strategy is to apply a scientific foundation to actively manage the land to promote ecosystem health, while avoiding areas of high public controversy, such as roadless areas and fish habitat. The strategy recognizes the diversity of groups who are dependent upon Oregon's forest resources, including Native American Tribes, timber dependent communities, and recreationists, and stresses that management should maintain both forest and community health.

Specific management activities identified in the 11-point Plan include cutting trees, prescribed fire, road treatments, stream rehabilitation, noxious weed management, protection of ecologically sensitive areas, and protection of soils. In particular, the use of understory thinning and prescribed fire was recommended to mimic natural processes in appropriate stands, to restore historic open stand structure and protect and maintain old growth stands of pine, larch and aspen.

Desired Future Condition

The Metolius Basin Forest Management Project protects the heart of Camp Sherman and the Metolius River. The desired future condition for the area is a place dominated by the beauty of the forest setting, the river, and the Cascade peaks. The majestic park-like stands of old-growth ponderosa pine would be the primary characteristic. However, there would still be diverse vegetation including larch, firs, and thickets of young trees. Large dead trees would be scattered through the forests, providing homes for birds, small mammals, and insects. Some forest areas would be moist and shady, with a variety of pines, firs, larch, cedar, yew, and vine maple. Signs of fire would be present in places with the blackened bark of large pine and contrasting against an open forest floor of bright green grasses and wildflowers.

Forests would be more resilient to impacts from wildfires and firefighters would be better able to protect homes and developments from wildfires. Forest conditions would allow most wildfires to burn near the forest floor rather than climb into tree crowns.

The waters of the Metolius River, Jack Creek, First Creek, and other streams would be crystal-clear and very cold. Quiet pools laced with large down trees would provide homes for trout and other riparian-dependent life. Salmon (kokanee, chinook, and sockeye) would once again run the Metolius. Excellent water quality and habitat would combine to create a river where large bull trout thrive and anglers practice the graceful art of fly-fishing.

Streamsides would showcase healthy riparian areas with a diversity of plants providing shade and cover. Shrubs such as alder, serviceberry, wild rose, mallow ninebark, and snowberry would be evident. The river and creeks would be full of wildflower islands in the summer, formed of large in-stream wood covered with yellow monkey flowers, blue lupine, and white spires of hellebore. Sedges and bulrush filter shallows of slow water. Meadows would be open and full of native grasses and plants. Noxious weeds would be rare.

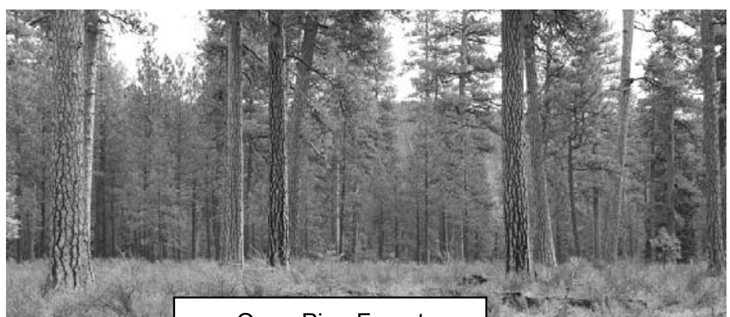
Wildlife would be abundant, including white-headed woodpeckers, goshawks, eagles, and owls, and herds of deer and elk. Forest and river habitats would support populations of butterflies, insects, lizards, and frogs. Mushrooms, mosses, and bright forest lichens would often be seen. The Metolius Basin would be known for its wildflowers and feature a changing profusion of species, including the rare Peck's penstemon and tall agoseris.

The Metolius Basin would remain a place for families, as it has been for generations. People would visit for rest, recreation and solitude. Camping, hiking, nature study, sightseeing, fishing, biking, skiing, and horseback riding remain popular. Rustic Cascadian forest campgrounds and day use areas would have historic characteristics. Facilities, dispersed sites, roads, and parking areas would blend into, and not detract from the beauty of the outdoor setting. Visitors and residents would find places where they could learn more about the natural and human history of the area and the Metolius watershed. Community-based stewardship of the natural resources would be emphasized.

What does a healthy forest look like?

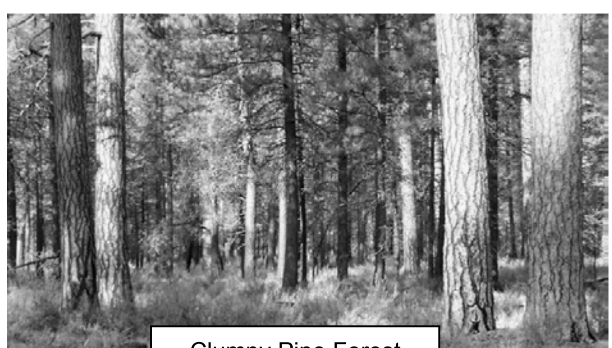
Focal Species Habitat. The Metolius Basin Forest Management project area, within a designated Late Successional Reserve under the Northwest Forest Plan, provides important habitat for a range of late-successional species. The project was designed to address the needs of the primary, or "focal" late-successional species, by dividing the project area into habitat zones, depending on environmental factors such as moisture, soil productivity, and elevation (Figure 1-4). Each zone has different forest conditions that can best support the desired habitat.

1. Open Pine Forest – open stands of mature ponderosa pine with scattered younger trees, typically 1 or sometimes 2 canopy layers, low brush heights and densities, and low stand densities. Provides late-successional habitat for White-headed Woodpecker and Peck's penstemon.



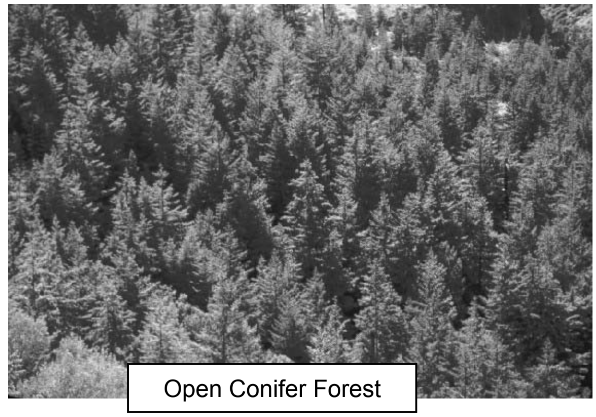
Open Pine Forest

2. Clumpy Pine Forests - Mosaic pine forests, with open stands and denser pine thickets, 1 or 2 canopy layers. Provides late-successional habitat for Goshawk.

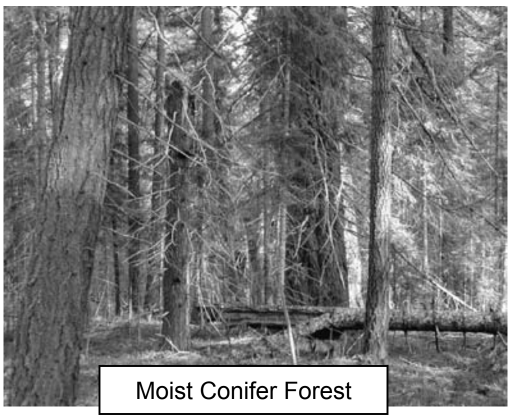


Clumpy Pine Forest

3. Open Conifer Forests - Mixed stands of pine and fir, higher densities, generally 2 or more canopy layers. Provides late-successional habitat for dispersal of spotted owl.



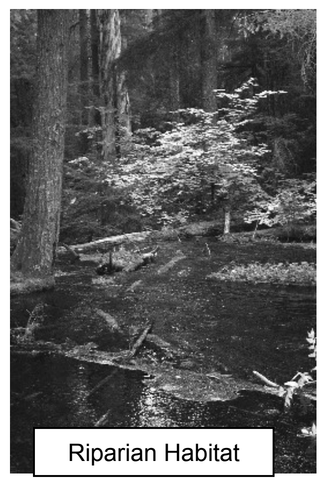
Open Conifer Forest



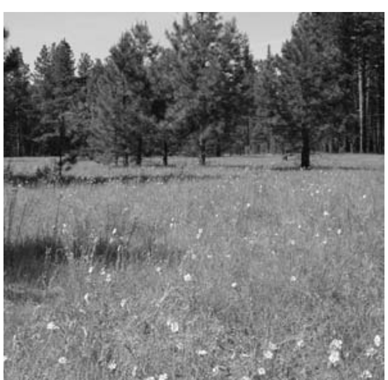
Moist Conifer Forest

4. Moist Conifer Forests – multiple canopy layers, overall high stand densities, a diversity of tree species and sizes. Provides late-successional habitat for spotted owl, and other species associated with dense forests.

5. Riparian areas – Shady, riparian forests, with high vegetative and structural diversity, and more dead wood. Provides habitat for bull trout and other riparian dependent species.



Riparian Habitat



Meadow Habitat

6. Meadows – Open with a few scattered large trees. Provides diversity, edge and foraging habitat for many late-successional species.

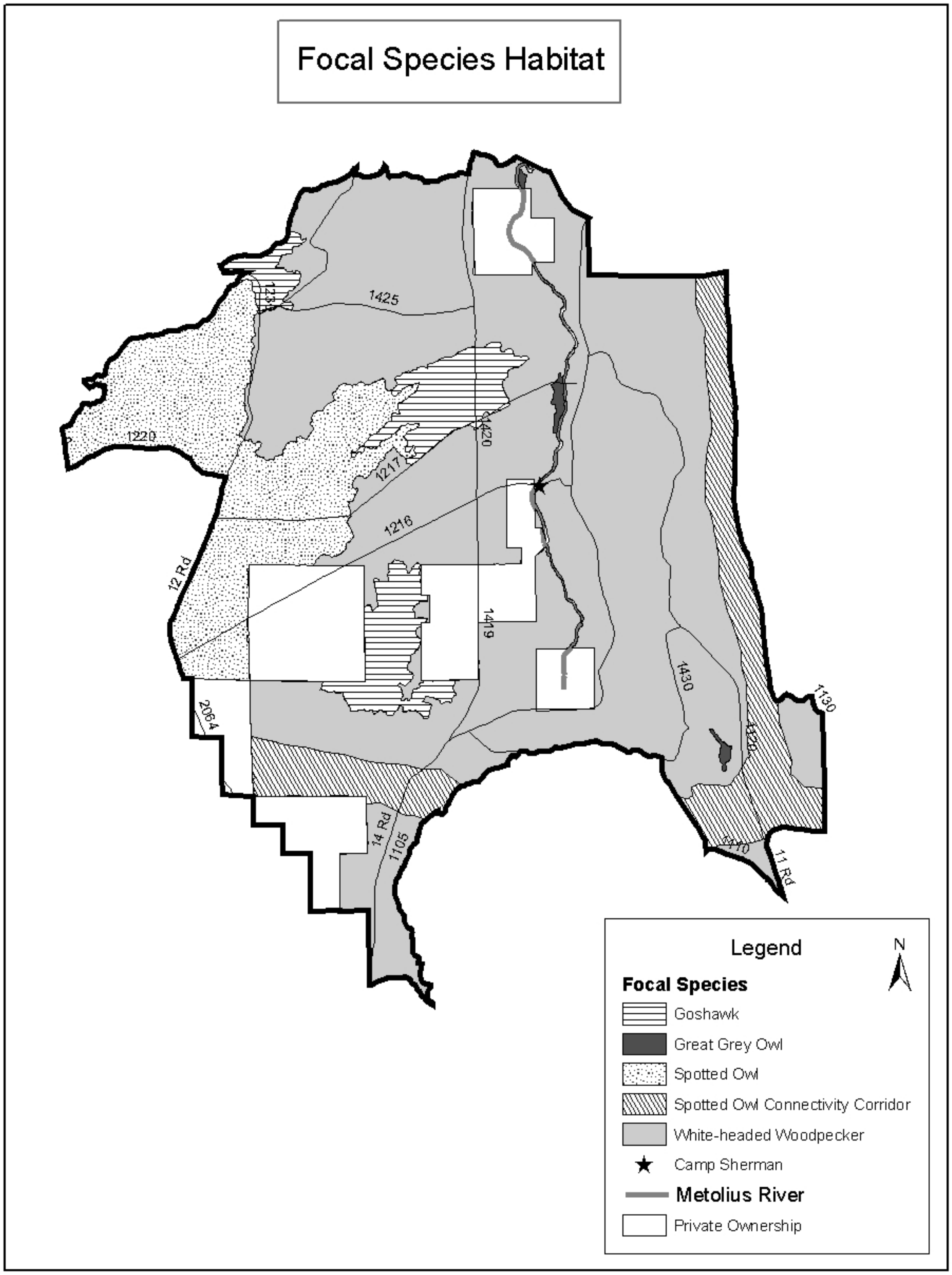


Figure 1-4. Focal Species Habitat – Desired Future Condition.

Decision Framework

The decisions to be made by the Deschutes Forest Supervisor through this analysis are:

- Should proposed vegetation and fuel management actions be implemented in the Metolius Basin Forest Management Project Area to reduce risk of high severity wildfire and improve forest health?
- If so, then what areas are to receive vegetation and fuel treatments, when are they to be treated, and what methods will be used?
- What roads should remain open within the project area to meet resource needs and public uses?
- Should a site-specific amendment to the Deschutes National Forest LRMP be made to allow some actions that may not meet visual quality standards and guidelines in the short-term?
- Should a site-specific amendment to the Deschutes National Forest Land and Resource Management Plan be made to allow fuelwood collection in the Metolius Heritage area as a tool for implementing the project?

Public Involvement

The Notice of Intent (NOI) to initiate this Environmental Impact Statement was published in the Federal Register on January 17, 2002, and requested public comments on the proposal. In addition, as part of the public involvement process, the agency held numerous meetings in the local community, a meeting with the Confederated Tribes of Warm Springs; consulted with the US Fish and Wildlife, National Marine Fisheries Service, and Oregon State Historic Preservation Office; worked closely with a federally appointed advisory committee representing a wide range of local interests, conducted five field trips for the public and several for specific interest groups, and met and conversed with numerous individuals regarding the project. All people concerned about the project were invited to visit the site with members of the planning team (though not many of these people chose to come visit). Information about the project was also provided for the public through letters and newsletters from the Sisters District, a website dedicated to the project, and through numerous articles in the local newspaper.

In addition, the Sisters Ranger District coordinated with a local conservation organization, Friends of Metolius, to plan, design and implement a small-scale demonstration project in the Metolius Basin to demonstrate forest management techniques that may be used in the larger project area. The objective of this project was to provide an educational opportunity easily accessible to visitors and residents. The Friends of Metolius conducted weekly field tours for the public of the demonstration area throughout the summer.

Table 1-1. Public Participation.

Contact	Date	Number of Individual/Groups Contacted
Letter – announcing Open House to be held in Camp Sherman to discuss short and long-term options for addressing fire risk and forest health	August 1, 2000	450 letters sent
Newspaper Brief - The Bulletin - announcing Open House in Metolius Basin	August 11, 2000	Newspaper circulation in Central Oregon (with website)
Open House: Metolius Basin Forest Health – Meet with residents of Camp Sherman to discuss short and long-term options for addressing fire risk and forest health	August 12, 2000	45 people attended
Letter –Summarizing comments heard and discussion at the Open House.	August 23, 2000	450 letters sent
Public Meeting – Friends of Metolius annual meeting; present the Sisters Ranger District proposal to address forest health and fire risk at a landscape level in the Metolius Basin	May 26, 2001	70 people attended
Newspaper Article - The Nugget – “Forest Service Plans Metolius Thinning”	August 29, 2001	Newspaper circulation in Sisters area (with website)
Public Meeting – Residents of Camp Sherman; provide an update on the progress toward address forest health and fire risk at a landscape level in the Metolius Basin	September 1, 2001	65 people attended
Letter – Inviting comments on the proposed Metolius Basin Forest Management Project	October 10, 2001	500 letters sent
Meeting – Field visit and briefing with Governor Kitzhaber	November 01, 2001	20 people attended
Meeting- Friends of the Metolius and the Forest Service discuss public involvement ideas and partnership opportunities	November 19, 2001	5 people attended
Newspaper Article - The Nugget – Article about the Metolius Basin planning process	November 28, 2001	Newspaper circulation in Sisters area (with website)
Meeting – Cultural and Heritage committee of the Confederated Tribes of Warm Springs	December 5, 2001	15 committee members attended
Meeting – Briefing with Senator Wyden’s Metolius Committee and Deschutes Provincial Advisory Committee	December 17, 2001	16 people attended

Contact	Date	Number of Individual/Groups Contacted
Meeting – Update Friends of Metolius Board and discuss partnership opportunities	January 16, 2002	10 people attended
Notice Of Intent to Prepare an Environmental Impact Statement – Federal Register	January 17, 2002	Circulation of Federal Register
Newsletter – discussing the progress of the Environmental Impact Statement, and purpose and need and key issues	February 2002	500 newsletters sent
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	February 11, 2002	18 people attended
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	March 11, 2002	16 people attended
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	April 8, 2002	15 people attended
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	May 13, 2002	12 people attended
Public Meeting – Friends of Metolius annual meeting; provide progress on the Metolius Basin Environmental Impact Statement	May 25, 2002	65 people attended
Public Field Trip – Review of the Metolius Basin project area, particularly as it relates to sensitive plant habitat	June 29, 2002	10 people attended
Newspaper Article – The Nugget - Review of the Metolius Basin project, and of the June 29 Field Trip	July 3, 2002	Newspaper circulation in Sisters area (with website)
Public Meeting – Metolius River Forest Homeowners annual meeting; provide progress on the Metolius Basin Environmental Impact Statement with a focus on defensible space and homeowners role	July 6, 2002	50 people attended
Public Field Trip – Review of the Metolius Basin project area, particularly as it relates to *Defensible Space*	August 31, 2002	15 people attended
Newspaper Article – The Nugget - Review of the Metolius Basin project, and of the August 31	September 11, 2002	Newspaper circulation in Sisters area (with website)

Contact	Date	Number of Individual/Groups Contacted
Field Trip		
Public Field Trip – Review of the Metolius Basin project area, particularly as it relates to the *Art Of Silviculture*	September 14, 2002	10 people attended
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	September 16, 2002	23 people attended
Newspaper Article – The Nugget - Review of the Metolius Basin project, and of the August 31 Field Trip	September 17, 2002	Newspaper circulation in Sisters area (with website)
Public Field Trip – Review of the Metolius Basin project area, particularly as it relates to *Fish Habitat*	September 28, 2002	30 people attended
Newspaper Article – The Nugget - Review of the Metolius Basin project, and of the August 31 Field Trip	October 2, 2002	Newspaper circulation in Sisters area (with website)
Meeting- Metolius Multiparty Stewardship Monitoring Group. Update and discussion	October 4, 2002	11 people attended
Website – Project specific website launched	October 23, 2002	Internet users looking for information on Forest Service, Deschutes National Forest, Fire Management, or Metolius Basin
Newspaper Briefs – The Nugget and The Bulletin – announcing the Metolius Basin website	October 30, 2002	Newspaper circulation in Sisters area and in Central Oregon (with websites)
Meeting- Provincial Advisory Committee Metolius Working Group. Update and issues discussion	November 18, 2002	19 people attended
Meeting- Metolius Multiparty Stewardship Monitoring Group. Update and discussion	November 28, 2002	10 people attended
Draft Environmental Impact Statement – Release of the Draft for Public Review	December, 2002	500 DEIS summaries sent; posted on website

Using the comments from the public, other agencies, and the Confederated Tribes of Warm Springs, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into two groups: significant and non-significant. Significant, or "key" issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) National Environmental Policy Act regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the record at the Sisters Ranger District, Sisters, Oregon.

The Forest Service identified the following issues as key during scoping:

1. Management of Vegetation in Late-Successional Reserves

Though the use of vegetation management in a Late-Successional Reserves is authorized under the Northwest Forest Plan, there is debate about the type and amount of management that should be done.

Late-Successional Reserves were designated as areas primarily intended to protect spotted owl and other late-successional species habitat. The focus of these designations was within the moist, dense forests on the western slope of the Cascade Mountains, where the fire regime is of infrequent, mixed and high intensity fires. The Late-Successional Reserves that were designated on the drier, fire-adapted ecosystems of the east slope of the Cascade Mountains did not historically provide stable or resilient dense forest habitat suitable for the spotted owl or other late-successional species with similar requirements. However, many decades of fire suppression has created atypical dense forest conditions, and spotted owls have moved in to occupy the denser sites. Unfortunately, these dense forest conditions can not be sustained over the long-term in these dry forests, since these sites are not able to support as many trees in a resilient of healthy condition as in moist, high-productivity sites typical of western Cascade forests. As such, the current health of vegetation in these over-dense stands is declining, resulting in an increasing risk of losing these late-successional habitats to wildfire, insects or disease. In addition, due to the extensive accumulation of fuels, above historically typical amounts, there is a higher risk of losing the well-established old-growth ponderosa pine, which are resilient to low-intensity fires but can be lost in high intensity burns, or from competition with numerous smaller trees. In order to improve forest health and reduce the risk of losing the fire-adapted late-successional habitat, actions proposed under this project would reduce stand densities across much of the landscape, though some dense pockets would be maintained around spotted owl nest sites and in suitable habitat.

The Northwest Forest Plan clearly directs forest managers to take actions that will prevent the loss of late-successional habitat from catastrophic wildfire, insect or disease events. Local community members are anxious for the Forest Service to follow this direction in order to protect both the forest resources and their homes and properties. However, a few members of the public (primarily members of environmental organizations who reside outside of the local area) have interpreted that the intent of a Late-Successional Reserve was to maintain maximum amounts of dense, interior forest conditions for spotted owls, regardless of where the Late-Successional Reserve is located and what historic conditions were. In addition, some people feel that in order to meet this goal, vegetation treatments should be restricted (either not occur at all, be limited to burning only, or be limited to removing only small trees).

Though there is also some concern from both local residents and regional and national environmental organizations about the use of commercial timber sales as a vegetation management tool in Late-Successional Reserves and in National Forests in general, this action is authorized by agency policy, and therefore not addressed as a significant issue (see non-significant issues for a discussion on this issue). However, to address this concern, the Forest Service applied and was approved for a pilot project under the new Stewardship Authority, which allows some non-traditional tools to be used to implement the proposed actions (see Appendix B for a discussion on Stewardship Authority).

<u>Methods to Measure Change in this Issue</u>:

- Acres of late-successional and possible old-growth stands treated, and method of treatment
- Acres of pole-sized trees that remain at high stand densities (relates to the ability for these trees to develop into future large-tree structure)
- Acres of nesting, roosting, and foraging habitat for spotted owl affected by proposed treatments

2. Size of Trees Removed

What is the socially acceptable diameter limit of trees which can be cut and removed to meet project objectives, and what is the ecologically optimal range of tree size and structure to leave in forest stands to reduce the risk of catastrophic loss and move toward or meet the needs of late-successional species?

An important structural element in this late-successional forest is the large ponderosa pine trees. Highly valued, both socially and ecologically, there is concern about the potential loss of large trees across the project area. Proposed actions intend to improve the ability for existing large trees to survive, and to create conditions more favorable for the development of future large trees. One of the proposed actions is to thin dense forest stands to both reduce the competition stress on remaining large trees, and to reduce the high fuel levels and ladder fuels. However, there is disagreement about the maximum size of trees that should be removed to meet project objectives. Some local Camp Sherman residents and members from both local and regional environmental groups have stated that 12” diameter trees are the largest that should be removed. Some other local organization members and residents have expressed that trees removed should be no larger than 16” diameter. Still other people, including residents with some experience in forest management, and forestry professionals, feel that the focus should be on the type of forest conditions that remain after treatment, and not place a limit on the size of trees that could be removed to meet forest health and fuel reduction goals. The debate is between the social definition of a "large" tree, and the science of growing and maintaining large trees.

There is general agreement among interested publics that large trees should *not* be removed in the Metolius Basin, even to meet project objectives. However, what defines a large tree is subjective, and perceptions are affected by prevailing conditions of the surrounding stands. For example, in a stand where most trees are greater than 20" diameter, trees larger than 25" diameter may be perceived as large. In a stand where most trees are 10" diameter, a tree greater than 14" diameter may be perceived as large. The Sisters Ranger District has referred to trees 21" diameter or greater as "medium to large" tree structure in local area assessments, based on this description from the Draft old-growth guidelines (Hopkins et al., 1992) and the Eastside Screens. The Deschutes National Forest Land and Resource Management Plan refers to trees 24" diameter + as large. However, there is still disagreement about the definition of a large tree.

Some people are more concerned about the age of the trees than their size. For example, some people feel that trees that are over 80 years old, regardless of size, should be preserved because they are a legacy of an older forest, and may be important old-growth components. The Northwest Forest Plan also defines younger forests as those less than 80 years old (ROD, pg.). In stands with particularly poor growing conditions, 80-year old pine trees may be less than 10" diameter.

The average basal area or tree density can be an important element in the type of stand that develops. There is a threshold density in any stand, below which would result in more resilience to insect, disease, and wildfire, and more vigorous growth in remaining trees. The majority of the basal area in a stand commonly resides in the largest trees. In a stand with very high densities of smaller trees, removal of these trees can move the stand toward or more healthy density. However, in a stand with a mixture of small and large trees, or high densities of larger trees, only removing small trees may not provide any significant reduction in density, and the stand may remain at risk to insects, disease, and wildfire. There are stands above the threshold density in the project area that are providing important habitat for late-successional species, and these would likely be left alone. However, there are many stands above the threshold density that are not supporting late-successional habitat (commonly because high densities have either stagnated the stand or they are too dense even for many interior forest late-successional species such as spotted owls). These are the stands that would be under debate regarding whether larger trees should be removed to improve stand health. If high densities are not reduced there is an increased risk that the remaining large trees may not survive as long as they would in a less dense stand and they would remain at higher risk to wildfires, insects and disease. In other words, the large trees may be lost anyway.

See the inserts "What Size of Trees Would be Removed" in Chapter 2, and "Forest Stand Densities: What is the Upper Management Zone" in Chapter 3 for additional details on this issue.

<u>Methods to Measure Change in this Issue</u>

- Upper limit on the size of Trees removed
- Predicted effects on the ability to meet goals of risk reduction and forest health improvement

3. Fire/Fuels Management

Prescribed fire can be an effective tool for reducing fuel levels and risk of high intensity wildfires. The issue is will residents and visitors to the Metolius Basin accept short-term impacts from fire, such as smoke and blackened trees, and the possibility of an escape fire, produced by controlled burning to meet risk reduction and forest health objectives?

Fire has historically played an important role in maintaining the health of the Metolius Basin ecosystem, and most of the local flora and fauna have evolved and are adapted to this fire regime. Creating conditions for low-intensity fire to be effectively reintroduced into the ecosystem is a goal across many western forests. However, it is predicted that if a wildfire burned through the project area in now, that it would burn at moderate to high severity across over 90% of the project area due to dense forest stand conditions. This hazard is predicted to increase if fuel levels are not reduced. Fuel management strategies can increase the ability to successfully control wildfires once an unplanned ignition occurs, and can reduce the risk of extensive impacts to late-successional habitat, important natural resources, and to people living near or visiting the project area.

Controlled burning and reintroduction of fire into the ecosystem can help meet the purpose and need of the project. Broad-scale prescribed burning, in combination with thinning and mowing, can help reduce fuel levels across large portions of the landscape. Though efforts would be made to minimize the extent and duration of impacts on people in the basin, all burning activity will produce smoke. Though it is generally understood by residents and visitors that smoke from a wildfire is worse than smoke from controlled burns (the timing, intensity and dissipation of smoke from wildfires can not be controlled), many local communities object to smoke from controlled burns as well. Smoke can negatively affect residents and visitors by irritating eyes and airways, and exacerbating any health problems related to air pollution. Smoke can also reduce visibility for short periods, detracting from the scenic quality of the Basin.

Fuels can be reduced by methods other than burning, such as mowing shrubs and thinning trees. However, reliance on these methods alone is more expensive, and does not treat the fuels as completely as burning (though mechanical treatments are often used in combination with burning). On the other hand, some members of the public support the use of prescribed fire almost exclusively as a way to reduce/consume fuels because it minimizes the removal of trees (see Issue #1). The tradeoff, particularly when fire is not combined with a pretreatment of removing some of the fuels through thinning and mowing, is greater amounts of smoke and more acres of blackened trees (some of the advocates for burning as an substitute for thinning do not live in the local area).

<u>Methods to Measure Change in this Issue</u>

- Acres at risk of moderate and high severity fire effects
- Acres prescribed burned
- Amount of smoke or tons of particulate matter

4. Water Quality and Soil Health

Tree harvest to reduce fuel levels and improve forest health can have impacts on soil and water. What are the best ways to mitigate these impacts?

An important consideration in restoring forest health is the health of soils and water quality, which support other forest resources and processes. Very high water quality is one of the outstandingly remarkable values in the Metolius Wild and Scenic River, and the river and its tributaries currently support robust populations of native fish, including bull trout (a federally listed threatened species) and redband trout (a State of Oregon sensitive species). This uncommonly high water quality is a valued resource by many people.

Because the river system is primarily spring-fed, the system does not commonly have extreme seasonal fluctuations in flow. Though this tends to maintain higher water quality, it also means that the natural "flushing" energy of high flows is not available to clean out accumulations of sediment. Sediment is detrimental to the spawning beds of native fish and can negatively affect the populations. As such, it is important to prevent/minimize sedimentation into the system.

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities directly affect soil properties, which may adversely change the natural capability of soils and their potential responses to use and management. A detrimental soil condition often occurs where heavy equipment or logs displace soil surface layers or reduce soil porosity through compaction. Indirect effects from these impacts include increased runoff and accelerated soil erosion. Detrimental disturbances reduce the soils ability to supply nutrients, moisture, and air that support soil microorganisms and the growth of vegetation. The biological productivity of soils relates to the amount of surface organic matter and coarse woody debris retained or removed from affected sites. Questions that summarize the concerns over water quality and soil health are:

- Would proposed vegetation treatments, result in detrimental soil and water quality impacts (e.g. soil compaction, displacement, and increased water yield) exceeding standards and guidelines?
- Would no action result in higher intensity burns and reduced soil and water quality (excessive loss of soil organic matter and nutrients, accelerated soil erosion, and reduced water quality resulting from sedimentation)?

Methods to Measure Change in this Issue

- The extent of detrimental soil disturbance within individual harvest units or other activity areas, such as prescribed burn areas
- The amount of coarse woody debris that would be retained to provide ground cover protection and a long-term source of nutrients on treated sites
- The probable success in project design and implementation of mitigation measures that would be applied to minimize adverse impacts to soil productivity
- Acres at risk of high severity fire effects
- Do proposed actions meet Aquatic Conservation Strategy objectives
- Cumulative watershed effects

5. Road Access

Reducing miles of roads can help reduce resource impacts and mitigate effects from vegetation management, particularly sedimentation in the river system, but also reduces public access to certain sites in the project area. What is the best network of roads to maintain for public use, while protecting forest resources?

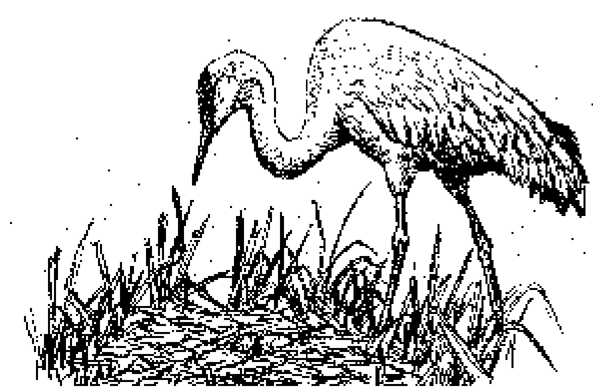
Road densities in the project area are higher than the 2.5 miles/sq mile recommended by the Forest Plan. High road densities in watersheds can be a major source of sediment into streams, decreasing water quality, and subsequently fish habitat. Roads and road use can also contribute to fragmentation of wildlife habitat and facilitate vehicle access to some potentially sensitive resource areas, such as along rivers. Vehicle use can result in soil compaction and displacement. Vehicles on roads not regularly maintained can result in surface erosion and sedimentation. In addition, roads act as vectors that aid the spread of noxious weeds. A reduction of road miles can mitigate these impacts, and impacts that may result from vegetation management under this project.

Public roads also strongly influence the type, amount and location of recreation use. A reduction in road miles would reduce the acres of the project area that are accessible to the public by vehicles. Some visitors to National Forest lands prefer to have the maximum amount of roaded access maintained for public use. This is particularly relevant to visitors who may not be able to access these areas by non-motorized means due to mobility impairments. Other residents and visitors would like the road density reduced so that the sights and sounds of vehicle use are reduced, and the opportunities for unroaded recreation experiences are increased.

A project objective is to analyze roads in the project areas and propose changes as needed to create more economical and environmentally sensitive road network, move toward Forest Plan Guidelines, and help mitigate potential impacts from vegetation management actions.

<u>Methods to Measure Change in this Issue</u>

- Change in miles and density of open roads in the project area
- Location of where roads are closed (i.e. within riparian areas, deer winter range)



CHAPTER 2. ALTERNATIVES CONSIDERED

This chapter describes and compares the alternatives considered for the Metolius Basin Forest Management Project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

DESCRIPTION OF POSSIBLE TECHNIQUES

The range of possible vegetation, fuel and road management actions was developed to help meet forest health[2] and risk reduction goals, and to address the habitat goals for late-successional species within the project area (see Figure 1-4 for a map of desired focal species habitat). These actions are based on effectiveness research of management actions, and management experience applying different techniques.

Defensible Space Strategy

Under each of the Action Alternatives (2-5), there will be a contiguous (though still with variety in tree size, species spacing) corridor of reduced fuels approximately 600’ on either side of the main routes into the Basin (Forest Roads 12, 14, 1419, 1420, 1120, 1216), and approximately 1200’ on either side of the residential areas and other areas of high use (campgrounds, resorts) (Figure 3-5). Fuel reduction activities in this defensible space corridor would generally be planned as part of the landscape-level thinning. However, in areas where there normally would not be stand-level fuel reduction (usually to protect special habitats, such as for spotted owl or along riparian areas) fuels would be reduced within this defensible space corridor.

Reducing Risk of Wildfire at 3 Levels

Wildfire risk would be managed with 3 different, though interrelated strategies:

1. Landscape Level – Risk of high severity wildfire would be reduced across the project area through broad-scale thinning, burning and mowing.
2. Defensible Space in the Wildland/Urban Interface – Focused fuel reduction zones adjacent to residential and high use areas, and along evacuation route roads.
3. Around Homes – the responsibility of homeowners to manage fuel on their property. (see www.firefree.org for tips on creating safety zones around your home).

[2] *Forest Health* is defined as the “condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity to provide for specified human needs and values” (pg. 2-60, ICBEMP Draft EIS, 2000). Ecosystem health refers to the “condition where the parts and functions of an ecosystem are sustained over time and where the system’s capacity for self-repair is maintained, such that the goals for uses, values, and services of the ecosystem are met” (pg. 1-2, ICBEMP Draft EIS, 2000).

Defensible Space corridors may look like this stand

Actions in the defensible space would primarily be thinning from below, focusing on leaving long-lived, fire resistant ponderosa pine, larch and Douglas-fir. These activities would be combined with mowing and underburning as needed, hand piling and some pruning-up of limbs. Where thinning would occur as part of a broader landscape-scale treatment, the largest trees that would be removed would depend on the Alternative scenario (see Alternative Description, this Chapter). Where healthy stand conditions or sensitive resources would not need or benefit from thinning, then trees 8" diameter or less would be removed within the Defensible Space corridor to assure continuity of reduced ground fuels adjacent to roads and homes. The defensible space would look more open, with shorter brush heights and fewer small trees. Most of the large trees would remain.

The defensible space corridors would be areas where fire intensity is reduced so that firefighters can more safely make a stand to suppress wildfire that is moving toward main travel routes or high use areas. The corridor of reduced fuel, in combination with landscape-level treatments, would provide a better chance for fires to stay low to the ground, and burn at a lower intensity. These are the types of fires that can be most successfully suppressed, tend to do the least damage to forest resources, and can be beneficial to a fire-adapted ecosystem like the Metolius Basin.

Silvicultural Prescriptions

<u>No Silvicultural Treatment:</u> Forest stands that are functioning well and not at high risk of severe wildfire, insects or disease; or stands that may be at risk but are currently providing important habitat for focal late-successional species, would not be treated at this time. *(See Metolius Heritage Demonstration Units 9-11 – "control" units)*

<u>Aspen Restoration:</u> Removal of most of the small and midsized conifers, and regeneration of aspen by hand or mechanical cutting. The objective is

> ***What Will the Forest Look Like?***
>
> Many of these management techniques have been applied on a small-scale in the Metolius Heritage Demonstration project area, located near Camp Sherman at the corner of Forest Roads 1419 and 1216. Techniques proposed for this project that were used in the Demonstration project are identified, along with the plot in which it was used. This allows people to see what the forest may look like after the technique is applied. In addition, more photographs and descriptions of vegetation management techniques can be found on the website for this project at: http://www.fs.fed.us/r6/centraloregon/index-metolius

to improve growing conditions for a few declining stands of aspen, so this rare habitat is maintained in the project area for diversity (LRMP M19-14).

Meadow Enhancement: Restoration and maintenance of natural meadows through removing small (12" diameter or less) conifers. The objective is to reduce the number of trees growing into and closing-up the meadow openings.

Mowing: Mowing to reduce brush height and density in order to reduce ladder fuels. This treatment would be used primarily in conjunction with prescribed underburning, either where underburning is a primary treatment or where it would be done to reduce fuels created by tree cutting prescriptions (clean up "activity fuels"). *(See Metolius Heritage Demonstration Unit 6 (mow and burn) and 8 (mow only).)*

Thinning trees up to 8 inches diameter: Removal of trees 8 inches diameter or less through thinning from below[3], either in existing "plantations" (stands that have been replanted after harvest) or in stands that have not received regeneration harvest but have high densities of small trees. Early seral species (i.e. ponderosa pine and larch) would be retained. The objective is to reduce competition and improve the health and vigor of remaining trees, and reduce fire hazard. The trees cut would be mostly saplings (≤ 5 in. diameter), so these treatments represent an investment in the stand (up front costs) with little in the way of recoverable products with market value (depending on market conditions). *(See Metolius Heritage Demonstration Unit 3 and 5).*

Thinning trees up to 12 inch diameter: Same as above, but would involve thinning trees up to 12 inches diameter. These stands may have some recoverable products with market value (small sawlogs, chip logs), but these treatments would still primarily represent an up-front cost.

Thinning trees up to larger diameters (Higher Residual Density): This treatment would involve *thinning from below* potentially up to the diameter limit for the Alternative, which varies (see the description of Alternatives 3, 4 and 5, this Chapter). The objectives are to reduce stand densities and to modify fuel amounts and arrangements (though limits on tree size does affect the ability to meet desired densities). The desired density would be approximately 120-140 square feet basal area, depending on site productivity and stand structure objectives (see insert on following page for a description of "basal area"). The healthiest and largest trees would remain, and a focus would be on retaining healthy ponderosa pine, western larch, white pine, and Douglas-fir. This treatment could benefit habitat conditions for late-successional species that are associated with open, mature stands, but with a slightly more closed canopy than the "lower residual density" thinning (see next treatment description).

Tree Size Limit. *It is important to understand that an upper limit on the size of trees that could be removed does not mean that **all** trees within these size limits would be removed. See the insert on "What Size Trees would be Removed", on the following page for further discussion.*

[3] Thinning "from below" entails removal of trees, beginning with the smallest and moving toward larger trees, until the desired/prescribed basal area (density) is met for the stand. If the desired density can be met by removing only smaller trees, then mid-sized and larger trees would not need to be removed.

Basal Area

A healthy forest grows with the inputs of sunlight, water and nutrients. If forests do not get the right mix or amount of these inputs (due to limited availability from competition or external factors), then the forest may not grow well, or in some cases, may not grow at all (stands will stagnate). The Sisters Ranger District wants to create conditions for a healthy forest; one that can provide late-successional habitat, and can be resilient to disturbances. The proposed vegetation and fuel management actions are expected to help reduce the intensity and severity of disturbances, and help grow a healthy, resilient forest.

Basal area is the surface area of the cross-section of a tree at 4.5' from the ground. When the basal area of trees in a stand are added together,it tells us about the density of trees in the area. Basal area is one measure of the amount of tree biomass. If basal area is very high for a particular area in the forest (too much biomass – too much competition), then the forest would not grow as well, remain as healthy, or be as resilient to disturbance.

Science can tell us what type of forest conditions will develop under high or low basal areas. People's values tell us what forest conditions are desired. For example, In certain areas it may be desirable to manage forests at high basal areas (higher than optimal for growth or resiliency to wildfire, insects or disease), such as where we need to maintain dense forest conditions for rare old-growth species, or where people want dense forests to provide screening. However, these choices involve tradeoffs. If we choose to maintain high basal areas, the forest stand may be at higher risk to catastrophic disturbances, and there is a greater risk of losing much of the forest features that we wanted to save. If we choose to maintain forest stands at lower basal areas, we would not be providing habitat for species that need dense forest conditions (though these conditions were not historically very common in the Metolius Basin ponderosa pine forests) and we would lose some effect of vegetative screening. However, this lower basal area would result in a forest condition that is more resilient to catastrophic disturbance, and therefore, likely to be sustained for a longer period than the dense forests, and can provide late-successional habitat for species that prefer open, mature stands.

An important goal of this project is to reduce stand densities, so that we can have more resilient, healthy forests.

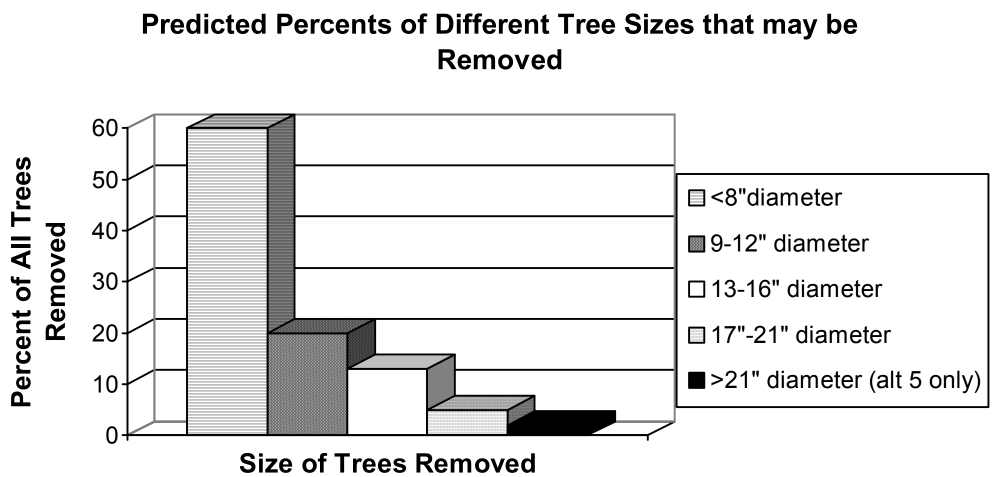
The 4 different objectives, depending on stand conditions and where the stand is located, would be to:

- Maintain or move stand conditions toward goshawk foraging habitat
- Move overly dense or stagnated stands toward spotted owl nesting, roosting, and foraging habitat
- Maintain or move stand conditions toward spotted owl dispersal habitat
- Maintain the health and protect stands within the spotted owl connectivity corridor

See the picture of "Open Pine Stand" under Desired Future Condition, Chapter 1 for an idea of what this treatment may look like.

What Size of Trees would be Removed?

Each of the Action Alternatives proposes a different upper limit on the size of trees that could be removed from the forest, because this was expressed as an important issue from the public. However, since all thinning would remove the smallest trees first ("thinning from below"), and since the majority of the trees on the landscape are under 8 to 12" diameter, then the majority of trees that would be removed would be less than 12" diameter, under any of the Alternatives.



The graph displays a general concept for the landscape. The actual percent of trees of different sizes removed from each stand would vary depending on stand conditions and the number of trees of different sizes within the stand.

Thinning trees up to larger diameters (Lower Residual Density): This treatment would involve *thinning from below* potentially up to the diameter limit for the Alternative, which varies (see the description of Alternatives 3, 4 and 5, this Chapter). The objectives are to reduce stand densities and to modify fuel amounts and arrangements (though limits on tree size does affect the ability to meet desired densities). The desired density would be approximately 80-110 square feet basal area (depending on site productivity and stand structure objectives). The healthiest and largest trees would remain, and a focus would be on retaining healthy ponderosa pine, western larch, white pine, and Douglas-fir. This treatment could benefit habitat conditions for late-successional species that are associated with lower density, more open stand conditions (see *Metolius Heritage Demonstration Unit 7).* The 3 different objectives, depending on stand conditions and where the stand is located, would be to:

- Maintain or create suitable white-headed woodpecker habitat
- Reduce fire hazard
- Move stand conditions toward spotted owl nesting, roosting, and foraging habitat in mixed-conifer dry plant association in the long-term (grow large tree component (pine, Douglas-fir, larch) first).

Dwarf Mistletoe Control: Pruning mistletoe-infected branches of lightly to moderately infected trees, to improve the health and longevity of the tree. This treatment would also involve killing (to create snags) moderately to heavily infected overstory trees when these trees are infecting young trees in the understory, preventing stand development. Stands with dwarf mistletoe would also be thinned to reduce competition stress within the stand. *(See Metolius Heritage Demonstration Unit 1a)*

Prescribed Underburning: Underburning in stands with a fire-resistant overstory. Underburning may be a stand-alone treatment or may be combined with incidental removal of smaller (8-inch diameter or less) trees and mowing as needed to reduce concentrations of fuel and help prepare a resilient stand when burning is later applied. *(See Metolius Heritage Demonstration Units 1a, 1b, 2a, 2b, 4, 5, 6 and 7. Unit 4 is a burn only unit, and unit 6 would combine mowing and burning. On each of the other units underburning would be a follow-up treatment after tree removal).*

Shelterwood: The objective of this treatment would be to regenerate or re-grow healthy trees in stands that are in poor condition due to past spruce budworm activity, root diseases, or dwarf mistletoe. These stands are generally mixed-conifer with white fir as the dominant species (approximately less than 25% of the stand would be made up of ponderosa pine, Douglas-fir or larch). The primary species removed would be white fir. All ponderosa pine (free of dwarf mistletoe) 21 inches diameter or greater and additional healthy trees (where present) would be left to achieve a residual spacing of approximately 40 to 75 feet (average of 7-25 trees per acre), with a basal area of approximately 20 to 50 square feet per acre.

Thinning trees up to larger diameters in conjunction with Shelterwood Harvest: The objective of this treatment would be to thin from below the healthy portions of stands described under Shelterwood above, and to retain green trees in a stand where they exist, while still creating conditions favorable for re-growth of long-lived, fire-resistant seral species (ponderosa pine and western larch). These portions of the stands would generally have greater than 25% healthy ponderosa pine, Douglas-fir or larch.

Larch Restoration: The objective of this treatment would be to restore or re-grow declining larch stands, which provide important habitat and visual diversity in the predominately pine forest, and would meet Land and Resource Management Plan guidelines for the Metolius Heritage Area (pg. 4-165). Trees would be thinned in conjunction with group openings (removing the majority of trees except for healthy larch) from ¼ to 3 acres in patches of western larch. This prescription would be applied to larch stands that are moderately to heavily infected with larch dwarf mistletoe. There is widespread decline of larch due to mistletoe and competition from pine, white fir, and Douglas-fir. As many healthy larch as possible would be retained by pruning off the mistletoe infected branches. Removal of the most heavily infected trees would prevent further spread of mistletoe and would open up the stand creating conditions favorable for establishment and growth of natural regeneration and planted larch. The resulting stand would appear much more open than a thinned stand. *(See Metolius Heritage Demonstration Unit 1a).*

Fuel Prescriptions

Many of the fuel treatments described below would be used in combination with other fuel and silvicultural treatments

Hand Piling: This treatment would involve piling slash (limbs and tree tops) by hand and would mainly be applied when thinning trees up to 8 to 12 inches in diameter. It would also be used on sensitive soils and within riparian reserves in other vegetation treatments in order to minimize soil disturbance and compaction. *(See Metolius Heritage Demonstration Unit 3).*

Machine Piling: Piling slash by means of small crawler tractors, small backhoes with a grapple arm, and other low ground-pressure machines would be applied on about 70 percent of *mixed-conifer* treatments where existing fuel loads are heavy and slash would be high. This treatment is predicted to affect up to 60 percent of the unit acres (i.e. if a unit is 100 acres, up to 60 acres may be affected by the machine used to pile the slash), and would only be used where machine piling on trails could not be employed (see the next fuel prescription). Machine piling would be applied primarily in stands where trees larger than 12 inches diameter are removed. Machines would not be used in riparian reserves or on sensitive soil or steep slopes (greater than 25%).

Machine Piling on Skid Trails: This fuel treatment involves piling slash concentrations on skid trails by machine and would be applied when thinning to 12 inches in diameter and where a harvester/forwarder system (cut-to-length) is used in 12-21” diameter thinning. This treatment is predicted to affect up to 20 percent of the unit acres (i.e. if a unit is 100 acres, up to 20 acres may be affected by the machine used to pile the slash), and would be employed instead of machine piling wherever possible.

Underburning: Burning, under controlled conditions, most or all of the area of a treatment unit. This would be applied in about 70 percent of the ponderosa pine stands where trees thinned are greater than 12 inches diameter, and where existing fuels are lower and species composition is predominantly ponderosa pine and/or western larch. *(See Metolius Heritage Demonstration Units 1a, 1b, 2a, 2b, 4, 5, 6 and 7. Unit 4 is a burn only unit, and unit 6 would combine mowing and burning. On each of the other units underburning would be a follow-up treatment after tree removal).*

Mowing/Underburning: Same as underburning, except that mowing would be done prior to underburning to reduce flame lengths and achieve a more controlled burn. *(See Metolius Heritage Demonstration Unit 6)*

Mowing with Hand Piling or Machine Piling: Mowing to reduce brush height and density. This may be applied with other slash piling techniques to reduce wildfire risk.

Road Actions

Inactivation - Blocking (either with a gate, boulders or logs) vehicles from using the road temporarily. Roads that are inactivated from public use may be needed for routine administrative or service access (i.e. for power line maintenance), or for future access for forest management, so are not completely removed from the road system through decommissioning (see next definition).

Decommission - Rehabilitation of a road segment that is not needed currently or in the foreseeable future. Depending on the condition of the road bed, there are a variety of methods that could be used to decommission a road. If vegetation is already growing into the road bed from the surrounding forest, then very little action may be needed to decommission the road. Other actions may include obliteration or subsoiling (tilling) of parts of the road bed and reseeding or replanting the openings. All decommissioned road beds would be stabilized to mitigate erosion, and road structures (culverts) would be removed.

Actions within Riparian Reserves

Treatments in riparian reserves are focused on under burning in Alternative 2 with a total of 315 acres, and thinning in Alternatives 3, 4 and 5 (252 acres, 252 acres and 176 acres respectively) (Table 2-1). Thinning trees 8" diameter and less in the defensible space corridor would be common to all action alternatives (253 acres).

Underburning would be focused in Alternative 2 along the intermittent streams of the First Creek watershed. Thinning would be primarily focused on First and Suttle Lake subwatersheds along intermittent tributaries or the uplands of large riparian reserves. Thinning trees 12" diameter and less would be concentrated along the Metolius River, and Lake Creek (Table 2-1).

Thinning treatments vary by alternative in the diameter of trees removed from the riparian reserve. Alternative 2 would have a 12" diameter limit on all riparian treatments. Alternative 3 would have a 16" diameter limit. Alternative 4 would have a 16" diameter limit on riparian reserves of Jack Creek, First Creek, Metolius River and Lake Creek. Trees potentially up to 21" diameter that don't contribute to shade or in-stream wood could be removed from other riparian reserves in Alternative 4. Alternative 5 would have a 12" limit on Jack Creek, First Creek and Lake Creek, with 16 inch limit on Metolius River. It is assumed that most of the basal area reduction prescribed by thinning would be accomplished by removing trees within the 12 to 16 inch diameter range. Alternative 5 would have no specified limit on tree size removed from the riparian reserves except along Jack Creek, First Creek, Metolius River and Lake Creek, where the limit of 12 inches was imposed to protect connectivity for Spotted Owls.

Table 2-1. Proposed vegetation treatments and fuel treatments within riparian reserves by subwatershed and alternatives.

Treatment	Alt	Cache	First	Jack	Scarp	Suttle Lake	Total
No Treatment	2		372	169	27	119	688
	3/4		371	169	27	119	687
	5		371	169	27	119	687
Aspen Restoration	2	5				5	10
	3/4	5				5	10
	5	5				5	10
Thinning trees 8” diameter and less in defensible space corridor	2		70	39	108	36	253
	3/4		70	39	108	36	253
	5		70	39	108	36	253
Thinning trees up to larger diameters[4]	2						
	3/4	9	214		4	23	250
	5	11	138		4	23	176
Larch Restoration (thinning only, no group openings)	2						
	3/4						
	5		76				76
Meadow Enhancement	2				17		17
	3/4				17		17
	5				17		17
Thinning trees 12” diameter and less (includes plantations)	2	55	115	36	222	166	594
	3/4	55	130	36	222	162	605
	5	55	130	36	222	162	605
Underburn	2	11	228	2	41	34	315
	3/4			2	37	15	54
	5			2	37	15	54

All of the treatments proposed in the Cache subwatershed are along intermittent streams. Treatments in the First Creek subwatershed are dominated by thinning (primarily small trees) along First Creek and the intermittent streams that parallel First Creek. Few treatments are prescribed along the Jack Creek riparian reserve other than small tree thinning by hand. Adjacent to the Metolius River, all of the treatments proposed are small tree thinning by hand. Riparian treatments proposed in the Suttle Lake subwatershed include small tree thinning, some aspen regeneration and a minor amount of thinning trees 12” diameter and less (Table 2-2).

[4] Thinning under Alternative 3 would remove trees potentially up to 16” diameter (except up to 21” diameter white fir), thinning under Alternative 4 would remove trees potentially up to 21” diameter (except up to 25” diameter white fir), and Alternative 5 would not have set diameter limit, but removal of trees over 21” diameter would be an exception.

Table 2-2. Acres of treatment in riparian reserves as proposed in the alternatives by stream type.

Treatment	Alt	Perennial with fish	Perennial without fish	Ephemeral	Intermittent with fish	Intermittent without fish	Total
No Treatment	2	327			159	202	688
	3/4	326			159	202	687
	5	326			159	202	687
Aspen Restoration	2	7				3	10
	3/4	7				3	10
	5	7				3	10
Thinning trees 8" diameter and less	2	147	5		54	47	253
in defensible space	3/4	147	5		54	47	253
corridor	5	147	5		54	47	253
Thinning up to	2						
larger diameters	3/4	4		52	91	105	252
(Alternatives 3-5)	5	4		52	91	29	176
Larch Restoration	2						
(thinning only, no	3/4						
group openings)	5					76	76
Meadow Enhancement	2	17					17
	3/4	17					17
	5	17					17
Small Tree Thinning <12	2	250			24	320	593
inches	3/4	242			24	338	604
	5	242			24	338	604
Underburn	2	43		52	91	129	315
	3/4	47				6	54
	5	47				6	54

Trees up to 12 inches would be removed with small machinery (similar to an all-terrain vehicle quad), pulling trees to the skid trail, or similar low impact technique. Fuel treatments would consist of hand piling and pile burning. Alternative fuel treatments may include leaving slash on trails and jackpot burning. Thinning of larger material may be done by whole tree yarding, by pulling line or limited trails on the outer edge of the riparian reserve.

Under Alternative 2, underburning would be done on as many as 315 acres within riparian reserves, depending on natural fuel break and road layout for fire line. In Alternatives 3-5, there would be less underburning (54 acres). The majority of post-tree removal fuel treatments would be done as hand piling. Hand piles would be outside of riparian vegetation and a safe distance from the streambank.

Alternatives Considered in Detail

The Forest Service developed 5 alternatives, including the No Action and Proposed Action alternatives, for reducing the risk of catastrophic wildfire, insect or disease, and improving forest health in the Metolius Basin. Each alternative may have different effects on other forest resources and on social concerns (such as concerns about smoke produced from prescribed burns). The alternatives were based on ideas and comments from the public, advice from the Metolius Basin Working Group of the Provincial Advisory Committee (PAC), on legal requirements we must comply with (i.e. Endangered Species Act, National Forest Management Act, etc…) and the capability of the resources.

The 4 action Alternatives propose vegetation and fuel treatments on many of the same areas, and at first glance may appear the same. In fact, Alternative 3 and 4 are very similar, with the only difference being the potential upper limit of trees removed. After considerable discussion, Alternative 3 was added, so that a full range of effects relating to tree size (a key issue) could be analyzed. The other two action Alternatives, 2 and 5, propose much different types of treatments (though, again some of it relates to the size of trees removed) and are expected to have different results in the ability to reduce the risk of high severity wildfire and improve forest health. The Proposed Action, Alternative 4, is a mix of vegetation and fuel treatments that are expected to help make the forest more resilient to catastrophic disturbances. These actions are based on the assumptions that reducing stand densities, and moving toward lower basal areas in many stands, can be very effective in meeting project goals.

The option of removing a range of tree sizes can help design treatments that address unique conditions in each stand. For example, where a very high amount of the stand biomass resides in trees larger than 16" diameter, and there are few smaller trees present, removal of a few of the 16"+ diameter trees can be effective in reaching the desired basal area for the more open late-successional habitats. Each of the Alternatives are expected to have a different effectiveness in reaching desired basal area.

Alternatives that only addressed the wildland urban interface, or only addressed prescribed burning without removing trees, were considered, but not fully analyzed. For a rationale, see the section on *Alternatives Considered but Not Fully Analyzed* in the later part of this Chapter.

For a display of the different types of activities by Alternative see Table 2-3, and for a summary of outputs and consequences, see Table 2-4. For a detailed list of treatments by alternative, at a stand level, see Appendix A.

Alternative 1

No Action

Objective: Under the No Action alternative existing processes and habitat cycles in the project area would continue largely without intervention. Current management of fire suppression, hazard trees, standard road maintenance and re-closure of breached roads would continue. However, no actions would be taken to reduce risk at a landscape scale, or to actively develop a defensible space around residential areas, high public use areas and roads. This alternative will be evaluated as the baseline condition.

Vegetation and Fuel Treatments. No vegetation or fuel treatments would be implemented beyond activities that are approved by the Deschutes National Forest Land and Resource Management Plan, such as standard maintenance of hazard trees along open roads and in recreation areas, weed control, and thinning in the existing plantations (approved under previous decisions).

Defensible space: No defensible space strategy would be implemented either adjacent to high use areas or roads. There is an currently a limited opportunity for residents to collect down wood and dead or dying trees 8” diameter or smaller on National Forest Lands within 300 feet of their property to help reduce down fuel levels.

Tree Size: No trees would be removed to address reducing the risk of catastrophic wildfire, insect or disease, and improving forest health. Thinning trees 8 inch diameter or less would still occur in plantations.

Late-Successional Habitat: There would be no direct management actions that would alter the existing late-successional habitat features and conditions. This Alternative would not be inconsistent with the Metolius Late-Successional Reserve Assessment goals and objectives, but would not help move the habitat toward desired conditions.

Soil and Water Quality: There would be no direct actions that would affect water quality or soil productivity. Indirect affects from road use are expected to continue. This alternative would also have the greatest number of acres at risk of impacts from severe wildfire. This Alternative would not be inconsistent with the Metolius Watershed Analysis goals and objectives, but would not help move the habitat toward desired conditions.

Roads: Within the entire project area, there are 96 miles of open road, with an open road density of 3.6 miles of roads per square mile. There would be no reduction in road miles.

Alternative 2

Objective: The objective of this Alternative is to reduce short-term risk of catastrophic wildfire, insect and disease while also minimizing short-term watershed and resource effects that can be associated with tree harvest, and to address the key issues of limiting tree harvest in a Late-Successional Reserve, and limiting the size of trees removed. This Alternative would reduce surface and some ladder fuels, but would not effectively reduce stand or crown densities extensively enough to improve forest health. 71 percent of the total project area (approximately 12,135 acres) would be treated by proposed actions, mostly through burning and small tree (12” diameter or less) thinning (Figure 2-1).

Vegetation and Fuel Treatments. There is a combination of vegetation and fuel treatments proposed (see Table 2-3). In addition, there would be annual review and removal of hazard trees (which are often larger than 12” diameter) as needed to protect public safety. See Table 2-3 for details on the type of vegetation and fuel treatments by each Alternative.

Defensible Space. The defensible space strategy (see description under Description of Possible Techniques, in this Chapter) would still be implemented to increase public safety, though only trees 12" diameter or less would be removed. The majority of the areas within the 600-1200 foot zone would receive fuel reduction efforts through landscape level actions of burning or thinning.

Tree Size. There would be a limit of up to 12" diameter on the size of trees that would be removed (though not *all* trees within this size limit would be removed).

Late-Successional Habitat. This Alternative will focus on minimizing direct disturbances in dense, interior forest habitats for late-successional species. Habitat for species associated with fire adapted late-successional habitat will receive primarily underburning for short-term habitat improvements. See Table 2-4 for details on actions within spotted owl, goshawk, white-headed woodpecker and Peck's penstemon habitat.

This Alternative would help move toward the desired future conditions identified in the Metolius Late-Successional Reserve Assessment.

Soil and Water Quality: A maximum of 1,121 acres would be affected by a ground-based logging system, and approximately 514 acres would be affected by machine piling. Mitigation and soil restoration measures (see Mitigation in the next section of this Chapter) would be used to reduce cumulative soil impacts to within Land and Resource Management Plan Standards. Road inactivation, decommissioning and maintenance would benefit soils and water quality in the long term (see Roads below).

Hand thinning and underburning would be the primary activities within 1188 acres of the riparian reserves. About one percent of riparian reserve acres would be affected by ground-based machine thinning, but this would only occur in the drier, upland soils within the riparian reserves. The objective of thinning would be to restore vegetative diversity, reduce risk of catastrophic wildfire, insect or disease, and reduce stand densities in riparian areas.

This Alternative would help move toward the desired future conditions identified in the Metolius Watershed Analysis.

Roads: Approximately 20 miles of roads would be inactivated or decommissioned**.** Of those that would be closed, 6 miles were previously open roads. This would leave approximately 90 miles of open road, with an average density of 3.4 miles of open road per square mile within the project area. See Table 2-5 for a list of roads status changes by Alternative, and Figure 2-4 at the end of this Chapter.

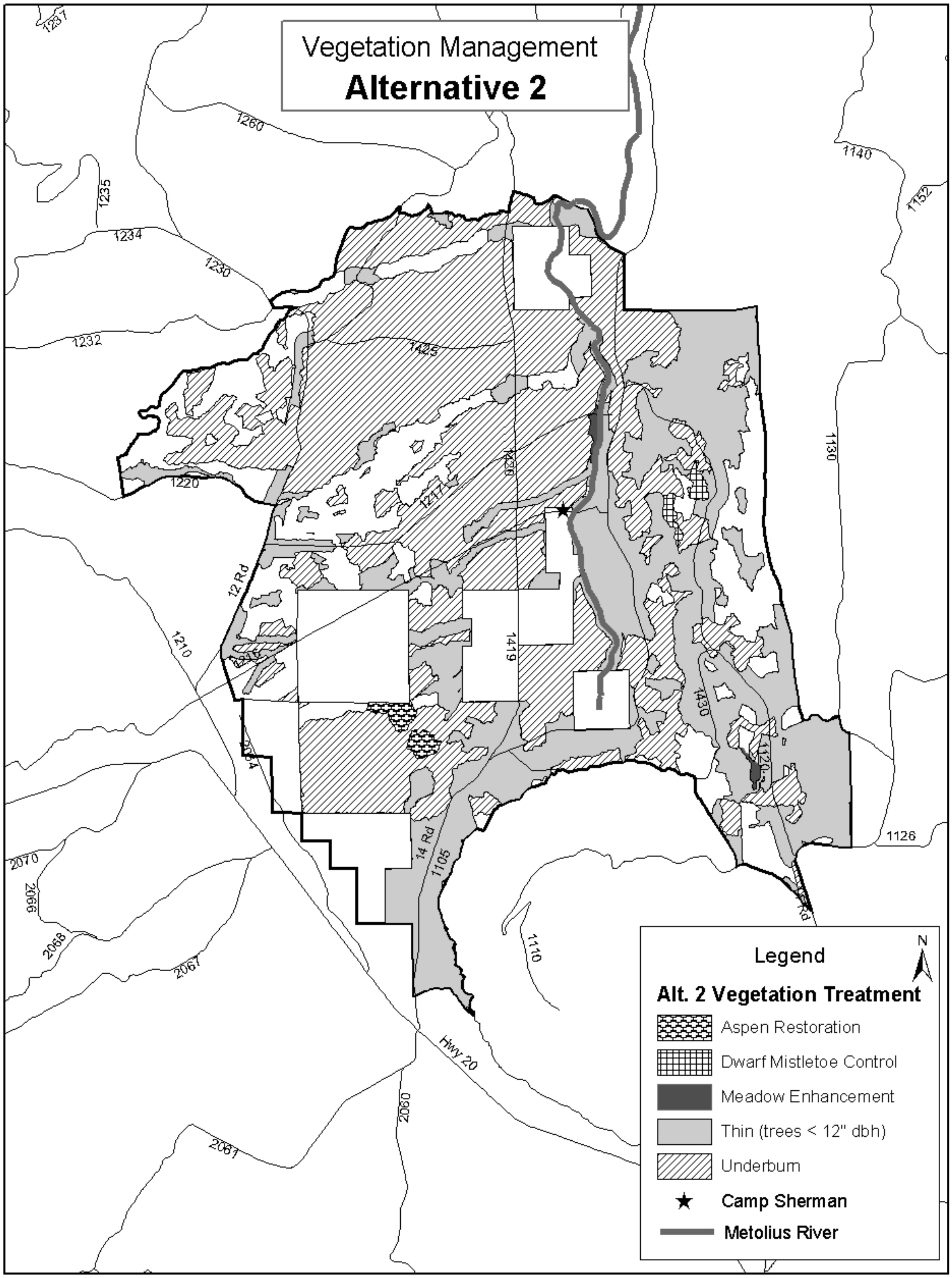


Figure 2-1. Vegetation Management Treatments under Alternative 2 .

Alternatives 3 and 4

Proposed Action – Alternative 4

Objective: These Alternatives are the same, except for variations on the key issue of size of trees that could be removed, so they are described together. Alternative 3 has a lower limit on the size of trees that could be removed than Alternative 4 (see Tree Size below). These alternatives focus on balancing the goals of improving forest health, reducing the risk of wildfire, insect and disease, and of providing safety for people, property, late-successional habitat and forest resources, while maintaining adequate late-successional habitat for a diversity of species. Alternative 4 is the *proposed action*.

74 percent (12,648 acres) of the total project area would be treated by vegetation and fuel management actions (Figure 2-2).

Vegetation and Fuel Treatments: There would be a variety of vegetation and fuel treatments proposed (see Table 2-3). Actions to restore meadows and aspen stands, to manage dwarf mistletoe, and to address hazard trees are the same as under Alternative 2. Variations on other vegetation management actions include the acres and size of trees thinned and the acres of underburning.

Defensible Space: The defensible space strategy (see description under Description of Possible Techniques, in this Chapter) would be implemented though trees 16” diameter or less could be removed under Alternative 3, and 21” diameter or less under Alternative 4. The majority of the areas within the 600-1200 foot zone would receive fuel reduction efforts through landscape level actions of burning or thinning.

Tree Size: Under Alternative 3, there would be an upper limit of 16” diameter trees that could be removed for ponderosa pine, Douglas-fir and western larch. The upper limit for white fir would be 21” or less. Under Alternative 4, there would be a limit on the size of trees that would be removed to 21” diameter or less for ponderosa pine, Douglas-fir and western larch. The limit for white fir would be 25” or less.

Late-successional Habitat: There will be an emphasis on creating resilient late-successional habitat conditions over the long term, and suitable late-successional habitat for fire-climax species, while short-term habitat for late-successional species associated with dense, interior forests are still maintained. See Table 2-4 for details on actions within spotted owl, goshawk, white-headed woodpecker and Peck’s penstemon habitat.

This Alternative would help move toward the desired future conditions identified in the Metolius Late-Successional Reserve Assessment.

Soil and Water Quality: A maximum of 7,332 acres would be affected by a ground-based logging system, and approximately 2078 acres would be affected by machine piling. Mitigation and soil restoration measures (see Mitigation in the next section of this Chapter) would be used to reduce cumulative soil impacts to within Forest Standards. Road inactivation, decommissioning and maintenance would benefit soils and water quality in the long-term (see Roads below).

Vegetation and fuel reduction actions would occur within approximately 1,190 acres of riparian reserves; 80% of these riparian reserve acres being affected by either hand thinning or underburning. Twenty percent of these acres would be affected by ground-based machine thinning, but this would only occur in the drier, upland soils within the riparian reserves. The objective would be to restore vegetative diversity, reduce risk of catastrophic wildfire, insect or disease, reduce stand densities, and develop large tree structure in riparian areas.

This Alternative would help move toward the desired future conditions identified in the Metolius Watershed Analysis.

Roads: Approximately 50 miles of roads would be inactivated or decommissioned**.** Of those that would be closed, 13 miles were previously open roads. This would leave approximately 83 miles of open road, with an average density of 3.1 miles of open road per square mile within the project area. See Table 2-5 for a list of roads status changes by Alternative, and Figure 2-5 at the end of this Chapter.

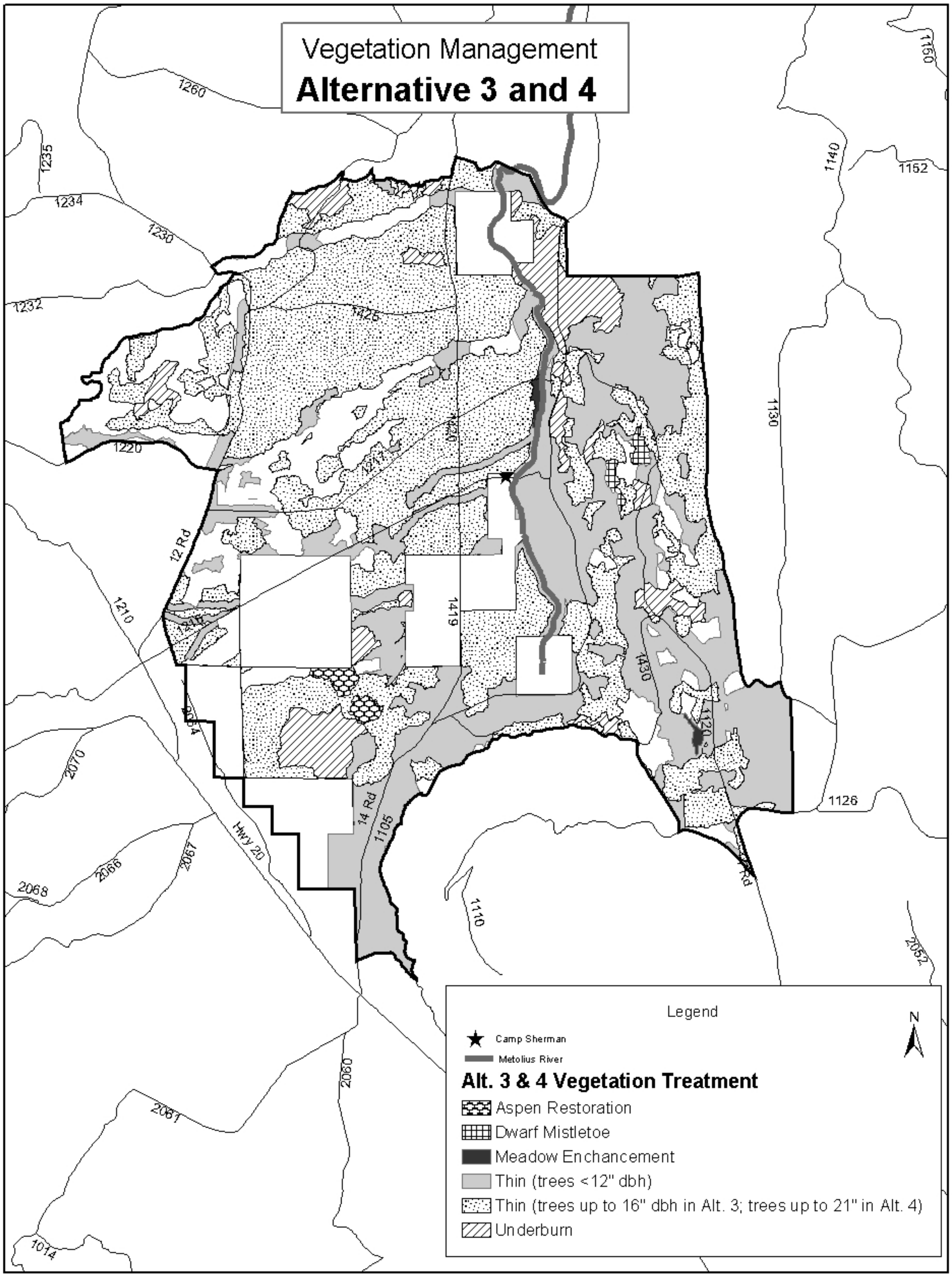


Figure 2-2. Vegetation Management Treatments under Alternatives 3 and 4.

Alternative 5

Objective: This Alternative focused of this Alternative is to maximize reduction of catastrophic wildfire, insects and disease, across the landscape. There would be less emphasis on providing habitat for species associated with dense, interior forest conditions than under the previous alternatives. However, known habitat areas for threatened or endangered species would still be protected. Approximately 75 percent (12,914 acres) of the total project area would be treated by proposed actions (Figure 2-3).

Vegetation and Fuel Treatments: There is a combination of vegetation and fuel treatments proposed (see Table 2-3). Actions to restore meadows and aspen stands, to manage dwarf mistletoe, and to address hazard trees are the same as under Alternative 2. Variations on other vegetation management actions include the acres and size of trees thinned, the acres of underburning, the addition of 296 acres of regeneration of declining stands, and restoration of pockets of western larch.

Defensible Space. The defensible space strategy (see description of defensible space under Description of Possible Techniques, in this Chapter) will be fully implemented. The majority of the areas within the 600-1200 foot zone would receive fuel reduction efforts through landscape level actions of burning or thinning.

Tree Size: There would not be a diameter limit on trees which could be removed; however, removal of ponderosa pine, Douglas-fir, and larch trees larger than 21" diameter would be an exception, and only occur the following conditions.

The recommended exceptions, under which 21" or greater diameter trees would be removed include:

- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access road

Late-Successional Habitat: This Alternative will have the greatest emphasis on creating resilient late-successional habitat conditions over the long-term, and suitable late-successional habitat for fire-climax species. See Table 2-4 for details on actions within spotted owl, goshawk, white-headed woodpecker and Peck's penstemon habitat.

This Alternative would help move toward the desired future conditions identified in the Metolius Late-Successional Reserve Assessment.

Soil and Water Quality: A maximum of 7,720 acres would be affected by a ground-based logging system, and approximately 2413 acres may be affected by machine piling. Mitigation and soil restoration measures (see Mitigation in the next Section of this Chapter) would be used to reduce cumulative soil impacts to within Land and Resource Management Plan Standards. Road inactivation, decommissioning and maintenance would benefit soils and water quality in the long-term (see Roads below).

Proposed actions would occur within approximately 1190 acres of riparian reserves; 80% of these riparian reserve acres being affected by either hand thinning or underburning. Twenty percent of these acres would be affected by ground-based machine thinning, but this would only occur in the drier, upland soils within the riparian reserves. The objective would be to restore vegetative diversity, reduce risk of catastrophic wildfire, insect or disease, reduce stand densities, and develop large tree structure in riparian areas.

This Alternative would help move toward the desired future conditions identified in the Metolius Watershed Analysis.

Roads: Approximately 60 miles of roads would be inactivated or decommissioned**.** Of those that would be closed, 18 miles were previously open roads. This would leave approximately 78 miles of open road, with an average density of 2.9 miles of open road per square mile of the project area. See Table 2-5 for a list of roads status changes by Alternative, and Figure 2-6 at the end of this Chapter.

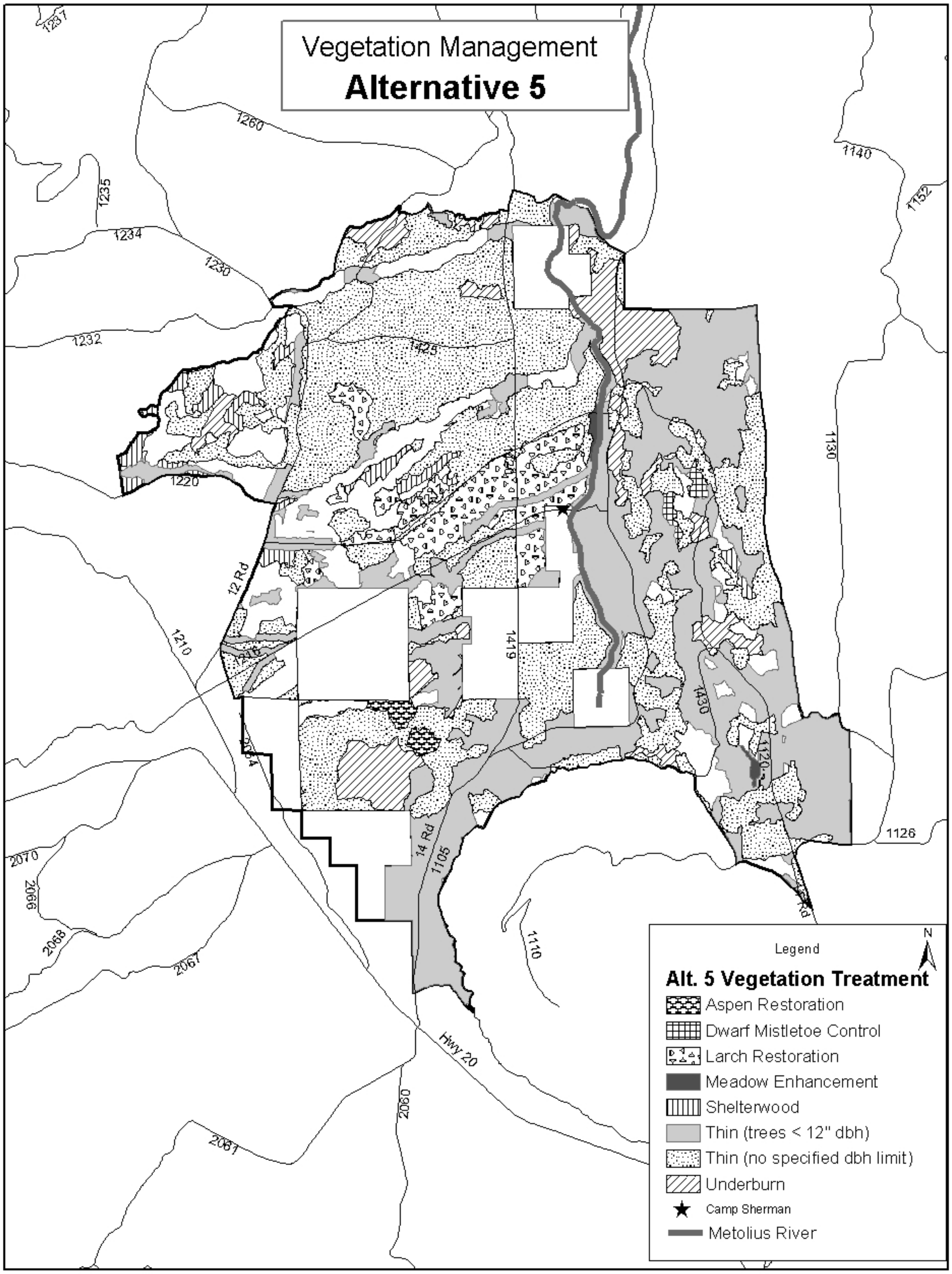


Figure 2-3. Vegetation Management Treatments under Alternative 5.

Table 2-3. Summary of Vegetation and Fuel Treatments under the Action Alternatives.

TREATMENTS	ALTERNATIVE 2	ALTERNATIVES 3 AND 4	ALTERNATIVE 5
Type of Vegetation Treatment	Acres of stands in which the action would occur		
Thinning trees 12" diameter or less - Thin stands in which removal of primarily smaller trees (12" diameter) can meet forest health and risk reduction objectives (includes 1276 acres of thinning in plantations)	4835	4638	4719
Thinning up to larger diameters - Thin stands in which benefits can be achieved by removing trees up to the potential tree size limit of 16" diameter under Alternative 3, 21" diameter under Alternative 4, and no specified limit under Alternative 5 (though removal of trees larger than 21" diameter would only occur under certain conditions[5]). Trees under 12" diameter would also be thinned in these stands.	0	6758	5836
Shelterwood – Removing dead and declining trees in stands affected by root disease, dwarf mistletoe and spruce budworm. Also includes thinning healthier portions of the stands.	0	0	296 (includes 172 acres of shelterwood only, and 124 acres of shelterwood combined with thinning)

[5] The recommended exceptions, under which 21" or greater diameter trees would be removed include:

- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees. Consider the canopy contribution of the white fir to be removed.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access roads.

TREATMENTS	ALTERNATIVE 2	ALTERNATIVES 3 AND 4	ALTERNATIVE 5
Larch Restoration - small group openings and thinning in stands where it objectives is to open up stands so existing larch component (which is declining in the project area) can be restored	0	0	735
Underburning - including mowing	7058 (includes approximately 5200 acres of mowing)	1009 (includes approximately 834 acres of mowing)	1009 (includes approximately 834 acres of mowing)
Meadow Enhancement	35	35	35
Aspen Restoration	10	10	10
Dwarf Mistletoe Control- Prune infected trees and thin stands	130	130	130
TOTAL ACRES TREATED	12,068	12,580	12,770
Type of Post-Activity Fuel Treatment	Alternative 2	Alternatives 3 and 4	Alternative 5
Hand Piling	2145	2408	2408
Machine Piling (affects up to 60% of the unit acres)	655 unit acres (up to 393 acres affected)	2266 unit acres (up to 1360 acres affected)	2973 unit acres (up to 1784 acres affected)
Machine Piling on Skid Trails (affects up to 20% of the unit acres)	604 unit acres (up to 121 acres affected)	3589 unit acres (up to 718 acres affected)	3145 unit acres (up to 629 acres affected)
Underburning	633	868	875
Mowing + Underburning	973	2440	2437
Mowing in units where hand or machine piling is used (these acres are included in the above hand and machine piling acres)	2451	5666	5692
Ground-based	1121	7332	7720
Helicopter	0	363	363

Mitigation Common to All Action Alternatives

The Forest Service developed the following mitigation measures to be used as part of all of the action alternatives.

All of the Alternatives would meet direction in relevant laws and policies, and the standards and guidelines in the Deschutes National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan, except in terms of site-specific visual quality standards and guidelines for which an amendment is proposed under this analysis (Chapter 4). In addition, the Alternatives either comply with the project design criteria for the Deschutes and Ochoco National Forests Programmatic Biological Assessment (2001-2003), or, if there are proposed deviations from the Biological Assessment, were reviewed by US Fish and Wildlife Service.

Mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). Mitigation of adverse effects would involve changing or modifying the actions described under the alternatives that may cause effects.

Recommendations. There are many actions that the Forest Service may apply to enhance project design, but may not be required to avoid or mitigate potentially significant impacts from implementing the selected Alternative. These optional project enhancements are listed in Appendix C, and would be considered during project implementation. These recommendations are similar to a menu of tools the Forest Service could use depending on site-specific conditions, funding, and availability of resources.

Rating. The rating criteria for effectiveness of mitigations measures is listed below:

- <u>Poor</u>: The action would have benefit, but would have a major conflict with other project objectives and goals.
- <u>Low</u>: The action would have benefit, but the benefit is difficult or expensive to achieve and of minor value, and may have conflicts with other objectives or goals.
- <u>Medium</u>: The action would have minor or major benefit, and conflicts with other objectives or goals are minor or none.
- <u>High</u>: The action would have major benefit, conflicts with other objectives or goals are minor or none. The action also helps meet other objectives or goals.

Air Quality

- All prescribed fire operations will adhere to the Oregon State Implementation Plan (SIP) for smoke management (also address Class I Airshed standards). *High effectiveness.*

Snags and down wood (snag requirements specific to individual species can be found under mitigation for the species)

Thinning trees 12" diameter and less – no requirement.

Thinning trees greater than 12" diameter and Larch Restoration

- No snags or down wood would be removed during harvest activities, but some material could be consumed during underburning. During burn operations, assure protection of at least 1 hard snag and 1 down log per acre, where available. These should be representative of the size and species contained in the stand. *High effectiveness*.
- In stands where thinning trees 16" + diameter –Leave 40-60 linear feet per acre of the largest available material. Down woody material left should be representative of the make-up of the stand. Whole logs should be left where possible. *High effectiveness, though many stands are not currently meeting standards (are deficient).*

Shelterwood units (Alternative 5 only)

- Where they exist, maintain 13 snags/acre in mixed conifer wet plant associations; 6.5 snags/acre mixed-conifer dry plant associations; 4 snags/acre in ponderosa pine wet stands with >30% canopy cover; and 2.5 snags/acre in dry ponderosa pine plant association. These need to be maintained during post harvest activities as well. *High effectiveness*, *though many stands are not currently meeting standards (are deficient), particularly in the 15" diameter + size classes.*
- Where they exist, maintain 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long should be retained. Decay class 1 and 2 logs can be counted toward this total (ROD C-40). Down logs retained on-site should reflect the species mix of the original stand. *High effectiveness, though many stands are not currently meeting standards (are deficient).*
- Leave 15% of the unit uncut for future recruitment of snags and down wood (green tree retention). *High effectiveness.*

Provide for 100% population potential of each species by providing sufficient numbers of green tree replacements. *High effectiveness*.

Wildlife

Bald Eagle

- Restrict disturbance activities within ¼ mile non-line-of-sight or ½ mile line-of-sight for any newly discovered bald eagle nests from January 1 through August 31. *High effectiveness.*
- Protect all existing bald eagle roost and perch trees along the Metolius River. *High effectiveness.*

Spotted Owl

- Disturbance activities (logging, post-sale activities, etc.) will be restricted within .25 miles of known spotted owl activity centers from March 1 through September 30 unless non-nesting is verified. Consult a Wildlife Biologist to determine what activities are restricted. Blasting and helicopter use may be restricted for up to 1 mile from known activity centers. *High effectiveness*.

Goshawk

- Implement seasonal restrictions from March 1 to August 31 around any known or discovered nest site. Establish a 30-acre no treatment area around newly discovered goshawk sites. *High effectiveness.*

Great Gray Owl

- No gopher baiting around meadow habitat to allow for a healthy prey population.

Marten

(addressed under Snag and Spotted Owl Mitigation)

Great Blue Heron

- Restrict disturbance activities within ¼ mile of known rookeries from March 1 through August 31. *High effectiveness.*

Osprey

- For newly discovered nest sites, provide a 300’ buffer around the nest site. *High effectiveness.*
- Restrict disturbance activities within ¼ mile of nest sites from April 1 through August 31. *High effectiveness.*

Flammulated Owl And White-headed Woodpecker

- If either species is found to be nesting during implementation, suspend activities until young have fledged. *High effectiveness.*
- Leave all snags >20” diameter within the White-headed Woodpecker focal habitat (see figure 1-4) (ROD C-46). *High effectiveness.*
- Provide for 100% population potential by providing sufficient numbers of green tree replacements in regeneration units (ROD C-46). This is additive to other woodpecker snag requirements. For white-headed woodpeckers, 0.60 conifer snags (ponderosa pine and Douglas-fir) per acre >15” dbh and in soft decay stages should be retained. *High effectiveness.*
- Within the White-headed Woodpecker focal habitat area, limit harvest activities to 2000 acres per year to minimize disturbance and adverse impacts during the nesting season (April 15 to July 31). *Moderate effectiveness (some disturbance would still occur for nesting birds).*

Big Game

Outside of Black Bark Pine Stands (stands about 50-80 years old) - Hiding areas must be present over at least 30% of National Forest lands and will be dispersed throughout the project area (LRMP, WL-54). Hiding cover must meet one of the following guidelines:

- Six acre or larger stand capable of hiding 90% of a standing adult deer from view of a human at a distance of 200 feet. *High effectiveness.*
- Six acre or larger stand with an average height of 6 feet and which has not been thinned in 15 years. *High effectiveness.*
- Residual clumps of one half acre or larger within units with advanced regeneration and at least 12 trees greater than 7 inch diameter per acre remaining after harvest. *High effectiveness*.

Within Black Bark Pine Stands - Approximately 10% of the treated stands should be in clumps that meet the following conditions:

- Cover patches must be at least ½ acre in size and must not have been thinned or harvested in the past 20 years. Small clumps will be suitable in dense stands but larger patches (4 to 5 acres) may be needed in more open stands. *High effectiveness.*
- Clumps must be dispersed throughout the unit so that visual screening is provided. *High effectiveness.*

Leave ½ to 5 acre clumps within the Lake Creek area where riparian inclusions are set away from the stream to provide for calving areas. *High effectiveness.*

Coopers and Sharp Shinned Hawks

- Restrict disturbance activities within ¼ mile of nest sites from April 15th through August 31. *High effectiveness.*

Red-tailed Hawks

- For newly discovered nest sites, provide a 300’ buffer around the nest site. *High effectiveness.*
- Restrict disturbance activities within ¼ mile of nest sites from March 1 through August 31. *High effectiveness*.

Crater Lake Tightcoil snail

At known sites (map of known sites located in Project Files at the Sisters Ranger District):

- Maintain existing canopy closure of trees and shading within 50’ of the stream’s edge to moderate fluctuations of temperature and humidity on the site. If riparian vegetation exceeds 50’, then a site-specific modification should be made to incorporate this area into the buffer zone. *High effectiveness.*

- Minimize disturbance of the forest floor litter, duff, and woody debris within the extent of the riparian vegetative habitat. *High effectiveness.*
- Maintain or enhance naturally occurring diversity of plant species in Habitat Areas. Maintain natural understory vegetation and a layer of uncompacted organic litter and debris on the ground within 50' of known sites. *High effectiveness*
- Maintain a component of riparian vegetation, including hardwood trees and shrubs where they exist, to provide a constant supply of logs, leaves, and leaf mold. *High effectiveness.*
- Avoid harvest activities (use of harvest machinery, skidding logs, locating skid trails) that would cause soil compaction within 50' of the stream edge along Lake and Jack Creeks and the Metolius River. *High effectiveness.*
- Maintain existing logs and other woody debris. *High effectiveness.*
- Avoid prescribed burning in Habitat Areas and protect them from wildfire by fuels management in adjacent areas. Utilize handpiling within 75' of the stream edge along Lake and Jack Creeks and the Metolius River. *High effectiveness.*

Plants

Peck's Penstemon and Tall Agoseris

Designate a population of Peck's penstemon in the First Creek area as "protected" to meet the recommendations of the Species Conservation Strategy. Protected populations are underrepresented in the First Creek drainage. *High effectiveness.*

Within "Managed" populations

- Avoid severe ground disturbance- landings, etc. in population concentrations. *High effectiveness.*
- Design ground based logging to limit skid trails to 20% or less of area. *Moderate effectiveness; some disturbance would still occur to plants within skid trails.*

Within "Protected" populations

- Use only known methods - ie. fire, thinning with little ground disturbance. *High effectiveness.*
- If machine thinning is required to protect resources in a protected population area, minimize ground disturbance by logging over snow. Use sufficient snow depth and firmness to prevent most ground disturbance. *High effectiveness.*

Rare truffle, Elaphomyces anthracinus

- Buffer known sites in Riverside Campground. *High effectiveness.*

Competing and Unwanted Vegetation.

Action	Effectiveness	Discussion
Prioritize and pretreat existing weed populations before ground disturbance	High	Action is approved under existing 1998 Deschutes Weed Control EA and is in progress
Survey and monitor areas disturbed by the project, especially landings. Document and handpull any new weeds found.	Medium	Not all areas can be surveyed due to time and funding constraints
Locate and use weed free project staging areas	Medium	Most staging areas can be located in weed free areas, exception is Rd 1216 St Johns Wort
Require clean equipment	High	This is a Region 6 requirement and part of all timber contracts. Ensure vehicles used in stewardship contracts, mowing, prescribed fire, and road maintenance/decommissioning are clean.
Evaluate options, including road closure to reduce flow of traffic on sites where desirable vegetation needs to be reestablished (ie. landings, temporary roads)	High	Rehab and close temporary roads and landings as soon as possible
In vegetation types with relatively closed canopy (Spotted owl nesting , roosting and foraging habitat, riparian areas) retain shade to the extent possible	High	This will be possible in these selected areas where retaining closed canopies for cover and shade is a habitat objective
Minimize soil disturbance to the extent practical	High	Follow Forest Plan standards for 20% or less detrimental soil impacts per treatment area. Prescribed fire objectives to retain some needle duff will also contribute
Where the project creates bare ground, revegetate disturbed soil	Medium	Use native seeds, when available, to revegetate landings in high-risk areas. Only use ephemeral non-natives to temporarily occupy the site (replaced by native plants over time) if natives are not available.
Improve effectiveness of prevention practices through weed awareness and education. Provide information and training and develop incentive programs for locating new invaders	Medium	This can be accomplished through general weed education and awareness, specific training of contract inspectors, and through community partnerships. Partners exist in the Metolius area that are working on this issue.
Minimize soil disturbance by over the snow logging and reuse skid trails	Medium	This is required mitigation for protected sensitive plant population areas.
Minimize soil disturbance in fuels treatments by treating fuels in place instead of piling, minimizing heat transfer to soil in burning, and minimizing fireline construction	Medium	Can be accomplished in many areas.
For long term restoration and weed suppression, and to reduce grass and sedge competition with reforested stands, recognize need for prompt reforestation	High	Most areas would not have created openings, except about 296 acres of shelterwood in declining white fir. These areas would be the first priority for reforestation r

Watershed and Soils

The management requirements listed for the soil resource are to be implemented during or after the project in order to meet the stated objectives. These requirements represent standard operating procedure for the protection of Forest resources, and the requirements are generally addressed in timber sale contract provisions or sale layout. The source for the requirements is typically standards and guidelines from the Forest Plan, but it can also be existing laws or regulations, or guidelines for practices required by extraordinary conditions.

Management Requirement: Apply appropriate Best Management Practices (BMPs) to all ground-disturbing management activities, as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes Forest Plan states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon (Forest Plan 4-69).

Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on soil and water resources are briefly described for this project proposal.

Mitigation Measures For Harvest and Burn Operations

- Protect Soils and Water during burn operations – Maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering surface water. Design management practices (including fuels management – both burning and mowing operations) so that no more than 20 percent of an activity area (i.e., harvest unit, fuels treatment unit, etc.) may have detrimentally disturbed soil (compaction, erosion, displacement or severely burned). A burn plan addressing compliance with all applicable Forest Plan standards and guidelines and Best Management Practices will be completed before the initiation of prescribed fire treatments in planned activity areas. Prescribed burn plans need to include soil moisture guidelines to minimize the risk of intense fire and adverse impacts to soil and water resources (LRMP SL-1 & SL-3; Timber BMP T-2, T-3 & T-13; Fuels Management BMP F-2, F-3). *Moderate-high effectiveness.*
- After treatment, if post harvest monitoring shows an activity area to have more than 20 percent detrimental soil conditions then appropriate rehabilitation efforts will be initiated within these activity areas to reduce detrimental conditions below 20 percent (LRMP SL-4; Watershed Restoration BMP W-1). *High effectiveness.*
- Use harvest methods designed to lessen impacts on the soil resource, including some or all of the following: 1) designate or use existing skid trails; 2) restrict skidders to trails and limit off trail travel of other harvest equipment; 3) limit use of ground-based mechanized equipment on slopes greater than 30 percent, longer than 200 feet and making up more than 10 percent of the unit. If larger areas with slopes greater than 30 percent occur, they will be evaluated with the soil scientist prior to harvest; 4) avoid harvest operations during times of the year when soils are extremely dry and subject to excessive soil displacement (Timber Management BMP T-5, T-9, T-12, T-13). *Moderate effectiveness.*

- In all units, skid trails would be designated prior to the logging operations. Designating yarding and transportation systems would ensure a minimum of 80 percent of an activity area would be left in a condition of acceptable productivity potential for trees. This includes system and temporary roads, landings, and spur roads and skid trails. Skid trails, landings and temporary roads would be rehabilitated/stabilized after the sale, and revegetate as needed. Maintain spacings of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings. Closer spacings due to complex terrain must be approved in advance by the Timber Sale Administrator. Main skid trails have typically been spaced 100 feet apart (11 % of the unit area) from 1994 to present. For the larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trials be increased to 150 feet to reduce the amount of detrimentally disturbed soil to 7 percent of the unit area (Froelich, 1981, Garland, 1983). This would reduce the amount of surface area where restoration treatments, such as subsoiling, would be required to mitigate impacts to achieve soil management objectives. (LRMP SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16). *Moderate effectiveness.*
- Use old landings and skidding networks whenever possible. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure erosion control structures are stabilized and working effectively (LRMP SL-1; Timber Management BMP T-16, T-18). *High effectiveness.*
- *Maintain duff layer:* - Strive to maintain fine organic matter (organic materials less than 3-inches in diameter; may be commonly referred to as the duff layer) over at least 65 percent of an activity area (pertains to both harvesting and post harvesting operations). The preference is for the fine organic matter to be undisturbed, but, if disturbed, it should be of sufficient quantity and quality to avoid detrimental nutrient cycle deficits (short term nutrient cycling). If the soil and potential natural plant community (i.e., site) are not capable of producing fine organic matter over 65 percent of the area, adjust minimum amounts to reflect potential soil and vegetation capabilities (LRMP SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate effectiveness.*
- *Coarse Woody Debris/Down Wood* - Assure that on Ponderosa Pine sites, a minimum of 3 to 5 tons per acre of large woody debris (greater than 3-inches in diameter) is retained within activity areas for long-term site productivity (LRMP SL-1). Assure that on Mixed Conifer sites, a minimum of 5 to 10 tons per acre of large woody debris (greater than 3-inches in diameter) is retained within activity areas for long-term site productivity (LRMP SL-1). *Moderate effectiveness.*
- Use sale area maps for designating soil and water protections needs (Timber Management BMP T-4). *Moderate effectiveness.*

Soil and Water Mitigation Measures for Roads and Landings:

- All temporary roads and landings will be located outside riparian and stream areas. *High effectiveness.*

- All temporary roads will be rehabilitated by ripping and/or tilling, have water bars installed where necessary, and be closed immediately following harvest operations to restore hydrologic function. *High effectiveness.*
- Surface Drainage – minimized erosive effects of concentrated water and the degradation of water quality through the proper design and construction of temporary roads (Road BMP R-7). *Moderate effectiveness*
- Maintenance – conduct regular preventive maintenance to avoid deterioration of the road surface and minimize the effects of erosion and sedimentation (Road BMP R-18, R-19). *Moderate-high effectiveness.*

Unit Specific Mitigation for Soils and Water

- Restrict mechanical disturbance in potentially wet areas that contain high water tables. Confine equipment impacts to designated areas that can be mitigated following harvest and post-harvest activities.

  Portions of the following 87 proposed harvest units contain sensitive soils with seasonally high water tables:

  Units 57507, 57515, 57516, 57533, 57958, 57959, 57963 to 57970, 57974 to 57976, 57979, 57981 to 57983, 57985 to 57993, 57995 to 57998, 58000, 58003 to 58009, 58015, 58022, 58357, 58362, 58363, 58367, 58372, 58372, 58374, 58377, 58378, 58380, 58381, 58384, 58386, 58387 to 58393, 58396, 58402, 58404, 58409, 58410, 58417, 58419, 58420, 58422, 58719. 58730, 58731, 58735, 58742 to 58744, 58760, 58761, 58764 to 58766, and 58772 to 58774.

  Locate designated skid trails and log landings on well-drained sites, upslope from potentially wet areas. Restrict equipment operations to roads and designated logging facilities at all times. Exceptions would be subject to Forest Service approval.

  Note: Harvest unit numbers (listed above) are for Alternative 5 (maximum treatment using mechanized equipment for thinning treatments and/or piling operations off designated logging facilities). Some of these units do not apply to harvest activities proposed for Alternatives 2, 3, and 4.

  Objective: Protect or maintain the quality of soil properties and shallow rooted vegetation by controlling equipment operations to locations and conditions that are less susceptible to soil puddling and compaction damage. Confine equipment impacts to designated areas that can be mitigated following harvest and post-harvest activities.

- Restrict mechanical disturbance on slopes greater than 30 percent to designated areas (i.e., roads, landings, designated skid trails) at all times and require operators to winch logs to skidders. Exceptions for areas that make up less than 10 percent of an activity area would be subject to Forest Service approval. Hand felled trees shall be directionally felled toward pre-approved skid trails, and the leading end of logs shall be suspended while skidding. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Machine piling of slash would not be authorized off designated areas in activity areas that contain slopes over 30 percent.

Portions of the following 35 units proposed for mechanical treatment contain slopes greater than 30 percent:

Units 11590, 58719, 58735, 58737, 58753, 58767, 58769, 58773, 58777, 58779, 59135, 59137, 59146, 59148 to 59150, 59154 to 59156, 59165, 59167, 59173 59174, 59177, 59183, 59187 to 59189, 59191, 59195, 59200, 59205, 59209, 59214, and 59217.

Note: Harvest unit numbers (listed above) are for Alternative 5 (maximum treatment using mechanized equipment for thinning and/or piling fuel reduction treatments). Some of these units do not apply to harvest activities proposed for Alternatives 2, 3, and 4.

Objective: Reduce displacement and compaction damage to soils by limiting equipment operations to specified areas and ground conditions.

- Reclaim temporary roads, log landings and primary skid trails by applying appropriate rehabilitation treatments in activity areas where detrimental soil conditions are expected to exceed 20 percent of the unit area. Decommission (obliterate) logging facilities that will not be needed for future management. Options for mitigating the effects of project activities include the use of subsoiling treatments to loosen compacted soils, redistributing humus-enriched topsoil in areas of soil displacement damage, recontouring cut-and-fill slopes on excavated skid trails, and pulling available slash and woody materials over the treated surface to establish effective ground cover protection.

- Reclaim portions of the following 213 activity areas, ranging in size from 3 to 221 acres, which are expected to exceed the 20 percent limit in detrimental soil conditions following the mechanical treatments proposed with this project.

Units: 1 to 5, 7, 16, 17, 11098, 11588, 11590, 11600, 57014, 57015, 57025, 57027, 57028, 57031, 57033, 57035, 57036, 57040, 57058, 57148, 57507, 57509, 57513, 57515 to 57518, 57522, 57523, 57525, 57527 to 57530, 57532 to 57534, 57538, 57549 to 57551, 57565, 57570, 57575 to 57577, 57615, 57620, 57621, 57955, 57958, 57959, 57963 to 57976, 57979, 57982, 57983, 57985, 57987, 57988, 57990 to 57993, 57995 to 57998, 58000, 58003 to 58009, 58015 to 58017, 58019 to 58023, 58025, 58027, 58034, 58041 to 58043, 58357, 58361 to 58363, 58367 to 58372, 58374, 58377 to 58381, 58384, 58386 to 58393, 58396, 58402, 58409, 58410, 58417, 58419, 58420, 58422 to 58425, 58430, 58431, 58719, 58730, 58731, 58733, 58738, 58742 to 58744, 58750, 58757, 58765 to 58767, 58769, 58773, 58777, 58779, 58781, 58783, 58786, 58788, 59127 to 59129, 59135, 59137, 59139, 59141, 59144 to 59146, 59148, 59149, 59154 to 59156, 59158, 59162, 59164, 59165, 59170, 59173, 59177 to 59179, 59181, 59183, 59186 to 59189, 59191, 59195, 59198, 59200, 59202 to 59205, 59209, 59214, 59217, 59219 to 59222, 59229, 59232, and 59234.

Note: Harvest unit numbers (listed above) apply to all action alternatives. The majority of these units pertain to Alternative 5 (maximum treatment using mechanized equipment for thinning and/or piling slash and natural fuels). Therefore, some of these units would not apply to treatments proposed for Alternatives 2, 3, and 4.

Objectives: Reduce the extent of detrimentally disturbed soil to meet management objectives. Restore and stabilize detrimentally disturbed soils prior to seasonal runoff events. Prevent concentration of overland flow and reduce the risk of accelerated erosion and sedimentation.

In activity areas where less than 20 percent detrimental soil impacts exist from previous management, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following implementation of project activities.

In activity areas where more than 20 percent detrimental soil conditions exist from previous management, the amount of detrimentally disturbed soil must not exceed the conditions prior to the planned activity and rehabilitation efforts should move conditions toward a net improvement in soil quality.

Riparian Reserves and Fish

Widths for the riparian reserves are based on local riparian conditions and the recommendations in the Metolius Watershed Analysis: *High effectiveness.*

- 160 feet for lakes and natural ponds, seasonally flowing or intermittent streams, and wetlands less than 1 acre.
- 320 feet for streams, constructed ponds and reservoirs, and wetland greater than 1 acre.

Management actions within riparian reserves must be compatible with Aquatic Conservation Strategy Objectives.

- No ground based mechanized equipment in Riparian Areas, *except* where specified to promote Aquatic Conservation Strategy Objectives (see Riparian Reserve Treatments described at the beginning of this Chapter). *High effectiveness.*
- Silt fences, straw wattles, and/or erosion cloth will be incorporated as needed, and will be used to protect bare slopes. *High effectiveness.*
- Small Tree Hand Thinning <8 inch: Fuel treatments would consist of hand piling and pile burning. Hand piles would be outside of riparian vegetation and a safe distance from the streambank (generally 60 ft). Small tree hand thinning is restricted from areas within 30ft from all stream channels. *High effectiveness.*
- Small Tree Thinning >12 inch: Treatments up to 12 inch material would be cut with small machinery (i.e. 4X4 All Terrain Vehicle, All Surface Vehicle), pulling line from outer edge of the reserve or similar low impact technique. Use of light equipment may be approved in frozen ground or frozen snow conditions by the hydrologist, soil scientist or fisheries biologist. Trails would be minimized to achieve 100 to 150 ft spacing were possible, near the outer edge of the riparian reserve. Landings, large piles or refueling sites will be located outside of the riparian reserve. Fuel treatments would consist of hand piling and pile burning. *High effectiveness.*
- Maintain shade along Lake Creek, First Creek, Metolius River, and Jack Creek. *High effectiveness.*
- Alternative 4 will have a restriction of cutting only trees less than 16 inch diameter in riparian reserves. This measure will protect connectivity of forest structure for riparian

dependant species and promote large tree recruitment to channels of the riparian reserves. *High effectiveness.*

- Prescribed fire will use existing fuel breaks and roads for control lines within riparian reserves. Spring burns will generally give best retention of down wood. Hand line or watered control line (wet line) will be used when natural fuel breaks are insufficient. *High effectiveness.*
- Lake Creek Riparian Reserves In lieu of designating an expanded riparian reserve width along the entire channels, protect and maintain habitat connectivity between the forks of Lake Creek by restricting the use of machinery and protecting clumps of unique habitats of diverse vegetation. *High effectiveness, particularly in conjunction with the proposed riparian reserve widths.*
- Larch Restoration will not include created small group openings in riparian reserves (76 ac in Alt 5). *High effectiveness.*
- Stream crossings or fords through intermittent channels will not be used in thinning operations when flowing water is present. *High effectiveness*.

Roads /Transportation

To mitigate actions proposed under the action Alternatives, reductions in road miles are proposed. Alternative 2 proposes reducing about 20 miles of roads in First and Suttle subwatershed. This meets the objectives of this Alternative to minimized watershed effects in these 2 watershed that have been showing signs cumulative impacts. Alternatives 3 and 4 propose reducing about 50 miles of roads in First and Suttle subwatershed, and in deer winter range. Alternative 5 proposes to reduce about 60 miles of roads in First and Suttle subwatershed, deer winter range, and other sensitive resource sites in the project area. See Figures 2-4 through 2-6 for maps of proposed changes in road status. See Table 2-6 for detailed a list of roads proposed for improvements, decommissioning (stabilizing and rehabilitating unneeded roads) and inactivation (blocking vehicles from using a road), by Alternative. *Moderate effectiveness; roads can be a major source of sediment*

Recreation / Social Concerns

- The visual objective of "retention" should be maintained for 1/8 mile each side of the Metolius-Windigo Trail, the Butte Loops Trail and East and West Metolius Trails. *Moderate effectiveness.*
- Restrict transport of wood material as needed to reduce conflicts with recreation activities (LRMP M19-29). When restrictions are not practical, short-term closure of public access may be necessary. *High effectiveness*.

Heritage Resources

- Exclude heritage resource sites from mechanical harvest units (o.k. to have harvest by hand within heritage sites). Unit boundaries may need to be modified or the resource site may be designated as a "no treatment/leave area". No landings, skid trails or temporary roads will be located to include any portion of known heritage resource areas. *High effectiveness.*
    - In units that need protection, and during post-sale operations (including road decommissioning) mark sites on the ground for avoidance prior to layout. Archaeologist will monitor.
- Mowing operations will be conducted to minimize ground disturbance from equipment and should avoid historic or prehistoric properties. *Moderate effectiveness.*
- Burning operations will not include any pile burning or containment line construction in heritage resource areas. Avoid historic resource areas that contain combustible historic materials during underburning. *Moderate effectiveness.*
    - Burn plans will be reviewed by the archaeologist
- Avoid ground disturbance within known heritage resource locations (i.e. subsoiling). Road decommissioning should avoid subsoiling, waterbarring, or other ground disturbance within site areas. These locations can be decommissioned by placing or spreading trees, rocks, slash or other debris over the road surface without anchoring or installing any of these elements. Road inactivation by closing the entrance will need to avoid effects to any historic properties in the closure areas in a similar manner as decommissioning. *High effectiveness*.

Where sites need to be avoided by any treatment, an archaeologist will mark the area to be avoided prior to any needed implementation layout or design. Avoidance areas will be marked in any contractor files or maps as "areas to be avoided" and not as archaeological sites. All areas to be avoided or otherwise within treatment areas should be monitored by an archaeologist once during implementation and after implementation has been concluded to confirm that avoidance measures were implemented and effective. *High effectiveness.*

Scenic Quality

The proposed management activities may affect scenic resources (and their integrities) within the Foreground and Middleground landscape as seen from a travel corridor and a sensitive viewer location. The mitigation measures are designed to help reduced impact on Scenic Resources and meet Land and Resource Management Plan's standards and guidelines.

- A Landscape Architect shall work closely with Metolius Basin Forest Management planning team on treatment prescriptions and marking guides, specifically in area where proposed treatment areas fall within Foreground scenic view allocation areas. *High effectiveness.*
- Flush cut stump (6" or less) within immediate Foreground landscape (0-300 feet) in proximity of residential area, recreation site, and road and trail corridor that falls within

the Foreground Scenic View landscape and other sensitive viewing areas. *High effectiveness.*

- Small hand pile and then burn is desirable within the immediate Foreground landscape (0-300 feet) in proximity of residential area, recreation site, and road and trail corridor that fall within the Foreground Scenic View landscape areas. *High effectiveness.*

Monitoring

Monitoring is recommended to evaluate either 1) the effectiveness of mitigation measures and alternative actions, 2) to ensure that decisions are carried out as described in this environmental analysis, or 3) to review analytical assumptions and predictive tools used during planning to determine if they are appropriate for evaluating a specific resource under specific conditions.

White-headed Woodpecker - Prepare a monitoring strategy of proposed units to document use by white-headed woodpeckers.

Watershed and Fisheries

- Fine sediment in spawning habitats Jack Creek and Lake Creek and the Metolius River should continue to determine if that is true.
- Stream temperature in Lake Creek due to the stream being on the ODEQ 303 (d) list.
- Water quality in the Metolius River and Lake Creek, primarily nitrogen and phosphorous.
- Redd counts of bull trout in Jack Creek and redband trout in the Metolius River.
- Implementation monitoring of riparian reserve treatments with light equipment should be conducted by site inspections by a hydrologist, soil scientist or fishery biologist.
- Within the project area, monitoring stations have been established to measure water quality on the Metolius River and Lake Creek (in addition to flow measurements). Additional monitoring is proposed for Watershed Improvement Needs Inventories (WINIs) within watersheds that presently exceed 25% hydrologic disturbance.
- To maintain watershed health and validate ECA assumptions, the waterbodies within the analyzed subwatersheds should continue to be observed/monitored to determine if increased sedimentation may be occurring due to higher peak flows, longer peak flow durations and/or longer bankfull stages that might be contributing to channel alterations (e.g., bank scour).
- Watershed improvement activities should also be conducted within subwatersheds that presently exceed 25% hydrologic disturbance to rehabilitate these subwatersheds back to below 25% (e.g., road decommission projects).

Noxious Weeds

- Monitor known sites and use appropriate methods to eradicate or control the weeds in those sites before, during and after harvest, fuel and road operations. The sites are covered under the 1998 Deschutes National Forest Weed Control EA.
- Survey and monitor areas disturbed by activities associated with the project, document and map any newly discovered sites, and use appropriate methods to eradicate or control the weeds on those sites.

Scenic Quality

The Deschutes National Forest Land and Resource Management Plan required the maintenance of minimum (Retention within the Foreground and Middleground landscape) Scenic Quality Standards within the Metolius Basin Forest Management project area.

The monitoring threshold is limited to Scenic View allocation areas, including Foreground and Middleground landscape. Site monitoring would be directed at the following:

- The compliance of Scenic Quality Standards during and following the implementation of the proposed treatment activities.
- The compliance of mitigation measures and/or implementation guidelines designed to help mitigate any potential adverse impact on scenic resources.

Target for monitoring includes the proposed treatment areas along the Foreground scenic corridor route, such as Road 14 and Metolius Wild and Scenic River corridor. Additionally, the monitoring of specific Middleground landscape areas, to measure effect on landscape character brought on by proposed treatment activities, area is required. Monitoring is to be completed by a Landscape Architect within one year following the completion of the proposed treatment activities.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the Purpose and Need. Some of these alternatives may have been outside the scope of improving forest health and reducing risk, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below

Implement Only Defensible Space, or Fuel-Breaks

Alternatives were considered that would only implement the Defensible Space strategy adjacent to evacuation route roads, residential areas and high public use or recreation developments; or a combination of defensible space and fuel-breaks. These Alternatives would have provided a wider range of actions to evaluate, and could have addressed concerns by some people that want to minimize tree harvest in Late-Successional Reserves, or focus fuel reduction activities only adjacent to communities and not across broader landscapes in the general forest. However, the interdisciplinary team did not feel that these Alternatives would adequately address the high risk of catastrophic fire to local residents and visitors, or adequately address forest health concerns in the Metolius Basin. While this strategic zone is intended to create a space where wildfires would burn less intensely and allow firefighters to control the wildfire before burning into protected areas, it does not address other important risk factors:

- The risk of very intense wildfires *outside* the Defensible Space, but still within ¼ mile to several miles of homes, would still be moderate to high across much of the project area. Intense wildfires can spread very quickly (the Eyerly Fire, 5 miles from the project area, was observed spreading up to 4 miles within a day). A rapidly advancing wildfire, particularly if it is a crown fire, decreases the time available for firefighters to activate control and suppression measures (i.e. backburning) in the defensible space, and increases the risk of wildfire traveling through the defensible space, or spotting over it.
- Associated with the conditions of an intense fire described above, is the increased risk of "spotting" (live windborne embers traveling outside of the main wildfire). Spotting can ignite wildfires up to several miles outside of the main wildfire, and the risk of spotting into the community and high use areas would remain high.
- Also, this Alternative would not address the second objective for the project, to improve forest health within the Metolius Basin project area. The majority of the forest would remain at moderate to high risk of catastrophic wildfire, insect or disease, continuing to jeopardize late-successional habitat, large tree character of the forest, and other forest values. The Metolius Late-Successional Reserve Assessment and Metolius Watershed Analysis identified both a high risk of impacts to these values from current forest conditions, and a need to actively protect the values. An objective of the Metolius Basin project is to continue implementation of the district-wide forest health and fuel management strategy that the Sisters Ranger District has been implementing over the last decade (see Purpose and Need, Chapter 1).

Burn only, no Tree Harvest

The Alternative of using prescribed burning as the only tool for reducing forest fuels was considered. This Alternative would again address the concern by some people to minimize tree harvest on public lands. It was determined that many stands in the project area could be burned without extensive pre-treatments, and this is proposed under Alternative 2 (over 7,000 acres proposed for underburning). However, these acres were not always located strategically against high human use areas that need fuel reduction activities, and which need protection from catastrophic wildfires. In addition, current fuel densities and arrangements on the remaining project area would make it very difficult to control a prescribed fire or to get desired results of a low intensity ground fire (dense stands of trees, dense thickets of shrubs, and ample ladder fuels would be expected to burn very intensely, and increase the risk of a crown fire, which would be very difficult to control) (Graham et al., 1999).

No Commercial Products from Tree Removal

In response to some concerns about using timber sales, or the sale of products from forest health and fuel reduction activities, an Alternative, which would not permit the use of these tools, was considered. There is some negative public perception and distrust about commercial timber harvest, regardless of the goal of the harvest. This may be based on the perceived impacts from extensive harvest activities in the 1970s and 80s that altered the appearance and function of large areas of National Forest lands.

There are a variety of tools that can be used to achieve the desired goals for the Late-Successional Reserve including burning, mowing, and mechanical removal of trees (e.g. thinning). These tools may or may not yield a commercial product, depending on variables such as value and markets for materials.

The greatest difficulty with implementing a Late-Successional Reserve restoration program is funding the work. Traditionally, Congress has funded commercial timber harvest activities well, while many of the other forest resources have received relatively less funding. While there are opportunities to use commercial harvest to achieve Late-Successional Reserve goals, the value of much of the material that would be harvested in the Metolius Basin project area is relatively low and consists of small-diameter trees, and only may be suitable for the chip and pulp market. Receipts from commercial products can help fund other restoration activities.

Since commercial timber sales are authorized on National Forest System lands and can be an effective tool in meeting forest health and risk reduction goals, this Alternative was not considered in detail. However, to address public concerns, and so that the Forest Service could try additional tools for implementing the project, the Sisters Ranger District applied for and was selected as a pilot under the new Stewardship Pilot Authority. See Appendix B for a discussion about the new tools available.

Analyze Long-term Recreation Management

Recreation is a major activity in the project area, and there are several issues regarding long-term recreation management that the Sisters Ranger District and local community would like to deal with. Including recreation management within this analysis was considered so that a holistic analysis to managing resources and uses in the project area could be addressed at one time. However, CEQ regulations require that the purpose and need for an environmental analysis stay narrow and focused. Since the recreation management issues were not directly related to forest health and wildfire risk reduction, the Forest Service decided not to include these issue with this analysis.

Comparison of Alternatives

This section (table 2-4 on the following page) provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. See Table 2-3 in this Chapter for a comparison of vegetation and fuel management by Alternatives.

Table 2-4. Comparison of Alternative Features, Outputs and Effects.

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
FIRE HAZARD (Purpose and Need)					
Burn Severity - percent of acres that are predicted to burn at low, mixed and high severity[6]					
Low Severity (non-lethal)	3% (357 acres)	6% (880 acres)	33% (4842 acres)	48% (7,043 acres)	53% (7,777 acres)
Mixed severity (from 30%-80% mortality)	45% (6663 acres)	83% (12,189 acres)	59% (8,657 acres)	45% (6,603 acres)	41% (6,106 acres)
High Severity (stand replacement)	52% (7653 acres)	11% (1,614 acres)	8% (1,174 acres)	8% (1,174 acres)	6% (880 acres)
Defensible Space – includes thinning, mowing, burning, and pruning	Not fully implemented. Some small dead and down trees can be removed by homeowners w/in 300' of private lots	Implemented on 4,936 acres. Focus on ground fuels and small ladder fuels. Trees larger than 12" diameter are not removed so no reduction in crown density	Implemented on 4,936 acres. Potentially removes trees potentially up to 16, so ladder fuels treated, but limited effect on crown density	Implemented on 4,936 acres. Potentially removes trees potentially up to 21" diameter. Both ladder fuels and crown density reduced.	

[6] *Low fire severity* is generally not lethal to the forest stand. These are the most beneficial types of burns because they help clean out fuels on the ground without killing the trees. *Mixed fire severity* means it burns somewhere between low severity and very hot, and can kill from 30%-80% of the forest vegetation, depending on stand structure and conditions. *High fire severity* would generally kill most of the forest vegetation (considered as a "stand replacement" event).

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
TREE SIZE (Key Issue)					
Tree Size Upper diameter of trees that could be removed, with the exception of removing hazard trees to address public safety. Larger trees may be *treated* (but not removed) for dwarf mistletoe by pruning, girdling, or topping	N/A	12” diameter – All tree species	− 16” diameter – ponderosa pine, Douglas-fir, larch − 21” diameter – white fir	− 21” diameter – ponderosa pine, Douglas-fir, larch − 25” diameter – white fir	Not restricted; however, removal of ponderosa pine, Douglas-fir, larch trees larger than 21” diameter would be an exception, and only occur under certain conditions[7]

[7] The recommended exceptions, under which 21” or greater diameter trees would be removed include:
- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access roads.

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
LATE-SUCCESSIONAL FOREST VEGETATION MANAGEMENT (Purpose and Need, and Key Issue)					
Old Growth[8] - Possible Old Growth stands treated - Old Growth stands which remain at high densities[9] (measured as exceeding upper management zone) - Can trees > 21" diameter be removed?	0 acres treated 5338 acres (94%) at high density - N/A	4412 acres treated 4837 acres (86%) at high density - No	4546 acres treated 4207 acres (75%) at high density - No	4546 acres treated 3263 acres (58%) at high density - Yes, white fir only	4625 acres treated 3153 acres (56%) at high density - Yes, primarily white fir
Stand Density - % of project acres with densities over the upper management zone (UMZ). This relates to the % of area considered to be at **greater risk** of severe insect or disease effects - % of NF lands Treated	82% of stands (12032 acres) exceed UMZ N/A	62% of stands (9106 acres) exceed UMZ 83% treated	42% of stands (6169 acres) exceed UMZ 86% treated	36% of stands (5287 acres) exceed UMZ 86% treated	34% of stands (4994 acres) exceed UMZ 88% treated
Spotted Owl *nesting, roosting, and foraging habitat* - acres in which proposed treatment may *degrade* habitat quality in the short-term	N/A	Approximately 17% (about **165** acres) of existing nesting, roosting, and foraging habitat may be degraded by thinning trees 12" diameter or less, primarily within defensible space			

[8] There are approximately 5565 acres of possible old growth stands
[9] Relates to risk of impacts from wildfire, insects and disease

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Spotted Owl *dispersal habitat*[10] - acres in which proposed treatment may *degrade* habitat quality in the short-term	N/A	Less than 1% of dispersal habitat may be degraded	Approximately 53% (about 4812 acres) of habitat suitable for dispersal may be degraded by reducing canopy and midstory density	Approximately 62% (about 5687 acres) of habitat suitable for dispersal may be degraded by reducing canopy and midstory density	
Spotted Owl nesting, roosting, and foraging habitat – ***acres at risk of high severity fire****.*	797 acres at risk of high severity fire	627 acres at risk of high severity fire			
White-headed woodpecker – acres of habitat in which proposed treatment may *enhance* habitat	N/A	8878 acres habitat enhanced (removes some midstory, though not as effectively as the other Action Alternatives. Maintains thickets for foraging)	9004 acres habitat enhanced (more effective than Alternative 2 at removing midstory canopy, while still maintaining thickets for foraging)		8384 acres habitat enhanced (removes more thickets, which can be important for foraging, than the other Action Alternatives)
Goshawk – acres of habitat treated	N/A	875 acres treated (short-term potential negative effect by removing some habitat elements, but long-term beneficial effect by improving the health of the stands, and accelerating development of large tree structure)	887 acres treated (short-term potential negative effect by removing some habitat elements, but long-term beneficial effect by improving the health of the stands, and accelerating development of large tree structure)		

[10] The amount of dispersal habitat for northern spotted owl was determined by the acres of forests that have canopy cover greater than 30%. However, these acres may not all be well connected, and did not consider the quality or functionality of the dispersal acres. Also, many of the acres that qualified as dispersal are across ponderosa pine plant associations, which do not generally provide long-term dispersal habitat.

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Peck's Penstemon - acres of beneficial treatments from meadow & aspen restoration - acres on which individual plants may be damaged due to trampling from harvest activities	N/A	1087 acres beneficial treatments from meadow restoration and underburning 84 acres with potential risk of impacts to individual plants, though predicted long-term benefits to habitat by opening up stands	52 acres beneficial treatments from meadow restoration and underburning 289 acres with potential risk of impacts to individual plants, though predicted long-term benefits to habitat by opening up stands		52 acres beneficial treatments from meadow restoration and underburning 279 acres with potential risk of impacts to individual plants, though predicted long-term benefits to habitat by opening up stands
Meadow Enhancement and Aspen Restoration	None	− Thin conifers in meadows potentially up to 12" diameter (about 35 acres) − Burn meadows if soils and vegetation can benefit − Thin aspen as needed to stimulate groves (about 10 acres)			
WATER QUALITY (Purpose and Need, Key Issue)					

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Riparian Reserve – Type of treatments proposed − Within defensible space	N/A	− Thin 12" or less, primarily by hand. - Burn where suitable − Thin 8" or less, by hand	− Thin, potentially up to 16" diameter. Mitigate impacts by logging over frozen ground, when possible. Pull material to skid roads. - Burn where suitable − Thin 8" or less, by hand		− Thin 12" or less in Jack, First and Lake Creek (since they will be used as owl dispersal corridors). Actions in other riparian reserves, follow Alternative 4 − Thin 8" or less, by hand
Riparian Acres treated by hand (no machinery)	N/A	**1175** acres	**906** acres		
Riparian Acres treated by low impact machinery	N/A	13 acres	**284** acres		
Riparian Reserve[11] - Acres of riparian reserve stands treated	N/A	1188acres	1190 acres		
SOIL HEALTH (Purpose and Need and Key issue)					
Detrimental Soil impacts from proposed actions	N/A	Least potential impacts. Will meet LRMP standards after mitigation	Greater potential impacts than under Alternative 2, but less than Alternative 5. Will meet LRMP standards after mitigation		Greatest potential impacts. Will meet LRMP standards after mitigation
ROADS (Proposed Action and Key Issue)					

[11] Actions indicated would only occur within stands where needed to meet forest health and risk reduction objectives

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Roads	− Continue to re-close breached roads. − No new roads developed	− Focus road closures in riparian areas and in First and Suttle sub-watersheds. - Close (inactivate and decommission) total of 20 road miles − No new roads developed. − 0.25 miles of temporary roads for removing trees proposed (will be decommissioned after trees removed)	− Focus road closures in riparian areas and in First and Suttle sub-watersheds *and* in deer winter range. - Close (inactivate and decommission) total of 50 road miles − No new roads developed. − 1.65 miles of temporary roads for removing trees proposed (will be decommissioned after trees removed)		− Focus road closures in riparian areas and in First and Suttle sub-watersheds *and* in deer winter range, *and* across other sensitive resource areas. - Close (inactivate and decommission) total of 60 road miles − No new roads developed. − 1.8 miles of temporary roads for removing trees proposed (will be decommissioned after trees removed)
MISCELLANEOUS					
Scenic View enhancements	None	Scenery quality enhanced under each of the action Alternatives. Viewers would be able to see further into the ponderosa pine stands under Alternatives 3, 4, and 5 than under Alternative 2. Short-term (1-3 years) visual quality impacts associated with harvest activities and burning would be greatest under Alternative 5 and the least under Alternative 2. Site-specific, short-term amendment of forest plan visual quality standards and guidelines recommended.			
Urban Interface (treatments around private property and summer home lots)	N/A	− Implement defensible space treatments (maintain screening where possible – coordinate with lot owners)			

Element of Purpose and Need, or Key Issues	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Economics					
Estimated Volume - saw logs - pulp/chip	N/A	0 0	21,702 MBF 11,210 tons	28,944 MBF 11,370 tons	40,732 MBF 11,370 tons
Cost of logging trees greater than 12" diameter, including transportation to the mill		$0	$6,658,000	$8,452,000	$11,821,000
Cost of thinning small trees, prescribed burning and mowing		$2,901,000	$1,697,000	$1,696,500	$1,711,000
Cost of cleaning up fuels from logging and other vegetation treatments		$1,721,000	$2,992,000	$2,992,000	$3,034,000
Total Costs		**$4,622,000**	**$11,347,000**	**$13,140,500**	**$16,566,000**
Total Product Values		**$395,800**	**$6,248,300**	**$8,967,400**	**$13,114,800**
Net Value		**- ($4,224,2000)**	**- ($5,098700)**	**- ($4,173,100)**	**- ($3,451,200)**
Road Work Estimated costs of closures (both inactivation and decommissioning)	N/A	$49,710	$114,330		$132,030

Table 2-6. Proposed changes in Road Status by Alternative.

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1120020	Indian Ford	0.12	MBB	O	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor, deer winter range.
1120020	Scarp	0.18	MBB	O	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor, deer winter range.
1120052	Scarp	0.50	MBB	I	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor , in home range, deer winter range.
1120053	Scarp	0.50	MBB	I	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor, in home range, deer winter range.
1120055	Scarp	0.85	MBB	O	D		Y	Y	Minor erosion/dry draw crossing. Spotted owl dispersal, deer winter range, near vernal pool. Peck's penstemon present.
1120057	Scarp	0.15	MHE	I	D		Y	Y	Spotted owl dispersal, deer winter range
1120090	Indian Ford	0.20	MBB	I	D		Y	Y	Spotted owl connectivity corridor, deer winter range
1120100	Scarp	0.31	MBB	I / B	I		Y	Y	Deer winter range, spotted owl dispersal, spotted owl connectivity corridor , in saddle
1120100	Indian Ford	1.29	MBB	I / B			Y	Y	Deer winter range, spotted owl dispersal, spotted owl connectivity corridor
1120110	Scarp	1.00	MHE	I / B	D		Y	Y	Spotted owl dispersal and connectivity corridor, deer winter range
1120120	Indian Ford	0.28	MBB	O	D		Y	Y	Spotted owl connectivity corridor, deer winter range
1120120	Scarp	0.02	MBB	O	D		Y	Y	Spotted owl connectivity corridor, deer winter range
1120130	Indian Ford	0.07	MHE	O	D		Y	Y	Deer winter range
1120150	Scarp	0.15	MHE	O	D		Y	Y	Sensitive meadow habitat (OHV use occurring).
1120180	Indian F rd	0.20	MHE	O	D		Y	Y	Spotted owl dispersal, deer winter range
1120185	Indian Ford	0.06	MHE	O	D		Y	Y	Spotted owl dispersal, deer winter range
1120185	Scarp	0.04	MHE	O	D		Y	Y	Spotted owl dispersal, deer winter range

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1120200	Scarp	2.00	MHE	I / B	I		Y	Y	Goshawk habitat, spotted owl nesting, roosting, foraging and dispersal habitat, and connectivity corridor , deer winter range. Peck's penstemon present
1120205	Scarp	0.40	MHE	I / B	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor, deer winter range. Peck's penstemon present
1120206	Scarp	0.20	MHE	I / B	D		Y	Y	Spotted owl dispersal, spotted owl connectivity corridor , deer winter range
1120210	Scarp	0.49	MHE	I	D		Y	Y	Spotted owl dispersal, deer winter range
1120220	Scarp	0.38	MHE	I / B	I		Y	Y	Spotted owl dispersal, deer winter range
1120230	Scarp	0.20	MHE	I / B	D		Y	Y	Spotted owl dispersal, deer winter range
1120240	Scarp	0.15	MHE	I / B	D		Y	Y	Spotted owl connectivity corridor, and dispersal, deer winter range
1120250	Scarp	0.27	MHE	I / B	I			Y	Spotted owl connectivity corridor
1120260	Scarp	0.30	MHE	I / B	D			Y	Spotted owl connectivity corridor
1120295	Scarp	0.45	MHE	I	D			Y	Goshawk foraging, spotted owl dispersal
1120300	Scarp	0.80	MHE	I	D		Y	Y	Spotted owl dispersal, deer winter range Peck's penstemon present
1120310	Scarp	0.35	MHE	I	D		Y	Y	spotted owl dispersal, deer winter range Peck's penstemon present
1120400	Scarp	0.60	MHE	O	D		Y	Y	deer winter range
1120400	Scarp	0.10	MHE	O	I		Y	Y	deer winter range
1120410	Scarp	0.20	MHE	O	D		Y	Y	deer winter range
1120460	Scarp	0.40	MHE	I	D		Y	Y	spotted owl nesting, roosting, foraging and dispersal habitat, spotted owl connectivity corridor
1120500	Scarp	0.60	MHE	O	I		Y	Y	goshawk foraging, spotted owl dispersal, spotted owl connectivity corridor
1120550	Scarp	0.60	MHE	I	D			Y	goshawk foraging, spotted owl dispersal,
1120600	Scarp	0.80	MHE	O	D		Y	Y	Spotted owl dispersal habitat, goshawk foraging

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1120800	Scarp	1.60	MHE	I / B	I		Y	Y	deer winter range, heavily fragmented, connector road. Peck's penstemon present, wet meadow. mod/heavy surface erosion; needs waterbars.
1120810	Scarp	0.30	MHE	I	D		Y	Y	deer winter range, eastside dispersal, heavily fragmented peck's penstemon present, wet meadow.
1120812	Scarp	0.10	MHE	I / B	D		Y	Y	deer winter range, heavily fragmented
1120820	Scarp	0.90	MHE	I / B	D		Y	Y	eastside owl dispersal, deer winter range, heavily fragmented
1120825	Scarp	0.80	MHE	I / B	D		Y	Y	Spotted owl nesting, roosting, foraging and dispersal habitat, deer winter range, heavily fragmented
1120880	Scarp	0.30	MHE	I	D		Y	Y	deer winter range
1120887	Scarp	0.11	MHE	O	D		Y	Y	deer winter range, spotted owl dispersal
1120887	Scarp	0.25	MHE	O	D		Y	Y	deer winter range, spotted owl dispersal
1120888	Scarp	0.19	MHE	O	D		Y	Y	deer winter range, borders Research Natural Area,. Peck's penstemon present.
1120888	Scarp	0.03	MHE	O	D		Y	Y	deer winter range, borders RNA. Peck's penstemon present.
1200120	First	0.20	MHE	I	D	Y	Y	Y	crosses riparian reserve, owl core, TR, nesting, roosting, foraging and dispersal habitat .
1200130	First	0.40	MHE	O	D	Y	Y	Y	Adjacent to riparian reserve, spotted owl core, and nesting, roosting, and foraging habitat .
1200140	First	0.40	MHE	I	D	Y	Y	Y	Spotted owl core and dispersal, crosses riparian reserve. Peck's penstemon present.
1200150	First	0.20	MHE	I	D	Y	Y	Y	spotted owl dispersal and nesting habitat. Peck's penstemon present.
1200180	First	0.60	MHE	I / B	D	Y	Y	Y	Spotted owl habitat Peck's penstemon and tall agoseris present.
1200210	First	0.57	MHE	I / B	D	Y	Y	Y	Parallels First Creek, spotted owl dispersal. Peck's penstemon present
1200220	First	0.20	MHE	I	D	Y	Y	Y	Leads to First Creek, spotted owl dispersal. Peck's penstemon present

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1200230	First	0.20	MHE	I / B	D	Y	Y	Y	Parallels riparian reserve, edge of spotted owl nesting, roosting, and foraging habitat; goshawk habitat, deer winter range. Peck's penstemon present
1200231	First	0.10	MHE	I / B	D	Y	Y	Y	Peck's penstemon present
1200255	First	0.20	MHE	I	D	Y	Y	Y	Spotted owl dispersal, deer winter range
1200257	First	0.20	MHE	I	D	Y	Y	Y	Spotted owl dispersal, deer winter range. Peck's penstemon present
1200280	First	0.76	MHE	O	D	Y	Y	Y	spotted owl dispersal.
1200280	First	0.55	MHE	I / B	D	Y	Y	Y	in goshawk fledge area, in owl circle.
1200282	Jack	0.21	MHE	O	I			Y	parallels 1220 road, spotted owl habitat, contributes to fragmentation.
1200282	First	0.59	MSF	O	I	Y	Y	Y	parallels 1220 road, in spotted owl habitat, contributes to fragmentation.
1200285	Jack	0.25	MHE	O	I			Y	Spotted owl dispersal
1200285	Jack	0.20	MHE	O	I			Y	Spotted owl dispersal
1200285	First	0.55	MSF	I	I	Y	Y	Y	Spotted owl dispersal
1200297	Scarp	0.20	MHE	O	D		Y	Y	Tall agoseris
1200299	Jack	0.20	MHE	O	D		Y	Y	Tall agoseris
1200320	Jack	0.30	MHE	O	D		Y	Y	Parallels Jack Creek. tall agoseris
1200350	Jack	0.84	MHE	I / B	I		Y	Y	tall agoseris, peck's penstemon present. deer winter range
1200350	Jack	0.56	MHE	I / B	D		Y	Y	tall agoseris, peck's penstemon present. deer winter range
1200359	Jack	0.60	MHE	I / B	D		Y	Y	tall agoseris Crosses Jack Creek, deer winter range,
1200360	Jack	0.80	MHE	I / B	D		Y	Y	Erosion.
1216180	Scarp	0.27	MHE	O	D		Y	Y	Spotted owl nesting, roosting, and foraging habitat , goshawk fledge area, deer winter range
1216185	Suttle Lake	0.10	MHE	O	D	Y	Y	Y	crosses riparian reserve, goshawk area, spotted owl dispersal, deer winter range.

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1216191	Scarp	0.10	MHE	O	D		Y	Y	Leads to pvt ownership deer winter range
1216200	Suttle Lake	0.20	MHE	O	D	Y		Y	Spotted owl dispersal habitat in home range
1216300	First	0.45	MHE	O	I	Y		Y	crosses riparian reserve, spotted owl nesting, roosting, and foraging habitat in owl circle.
1216300	Suttle Lake	0.05	MHE	O	I	Y		Y	crosses riparian, spotted owl nesting, roosting, and foraging habitat in owl circle.
1216310	First	0.20	MHE	O	D	Y		Y	crosses riparian, spotted owl nesting, roosting, and foraging habitat in owl circle
1216700	First	0.48	MHE	I / B	D	Y		Y	Peck's penstemon present. crosses riparian, leads to spotted owl nesting, roosting, and foraging habitat in owl circle
1216700	Scarp	0.02	MHE	I / B	D			Y	Peck's penstemon present. crosses riparian, leads to spotted owl nesting, roosting, and foraging habitat in owl circle
1216760	First	0.10	MHE	I / B	D	Y	Y	Y	Spotted owl dispersal, deer winter range
1217200	First	0.50	MHE	O	D	Y	Y	Y	Peck's penstemon present parallel stream, Spotted owl nesting, roosting, and foraging habitat owl circle, deer winter range
1217233	First	0.20	MHE	I / B	D	Y		Y	crosses stream, spotted owl nesting, roosting, and foraging habitat
1217234	First	0.97	MHE	I / B	D	Y	Y	Y	Peck's penstemon present crosses stream, near nesting, roosting, and foraging habitat and White-headed Woodpecker habitat, goshawk fledge habitat, deer winter range
1217235	First	0.38	MHE	I	D	Y	Y	Y	Crosses stream, goshawk fledge area, deer winter range, spotted owl dispersal. Peck's penstemon and tall agoseris present
1217239	First	0.20	MHE	I	D	Y	Y	Y	Peck's penstemon and tall agoseris present, parallel to stream, goshawk fledge area, deer winter range
1217350	First	0.20	MHE	O	D	Y	Y	Y	crosses creek, spotted owl dispersal, deer winter range. noxious weeds present
1217620	First	0.40	MHE	I / B	I	Y	Y	Y	Peck's penstemon present

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative 2	3/4	5	Comments/Rationale for Change
									crosses creek, spotted owl dispersal, deer winter range
1217630	First	0.30	MHE	O	D	Y	Y	Y	between 2 riparian reserve, spotted owl dispersal, deer winter range
1217800	First	0.24	WS4	I	D	Y	Y	Y	summer home tract, crosses creek, White-headed Woodpecker habitat, deer winter range
1217825	First	0.36	WS4	I	D	Y	Y	Y	summer home tract, near riparian area, White-headed Woodpecker habitat, deer winter range
1220420	Jack	1.00	MSF	O	I			Y	goshawk habitat, spotted owl dispersal
1230010	First	0.10	MSF	I	D	Y		Y	goshawk fledge area, spotted owl circle and dispersal
1230108	Jack	0.04	MSF	I / B	D			Y	White-headed Woodpecker habitat, spotted owl dispersal
1230108	Jack	0.46	MSF	I / B	D			Y	White-headed Woodpecker habitat, spotted owl dispersal
1230110	Jack	0.20	MSF	O	I			Y	Spotted owl nesting, roosting, and foraging habitat , near Jack Creek
1230110	Jack	0.90	MSF	I	I			Y	Spotted owl nesting, roosting, and foraging habitat , near Jack Creek
1230240	Jack	0.20	MHE	I / B	D		Y	Y	Near Jack Creek, deer winter range, goshawk fledge area
1400049	Cache	0.34	MBB	O	I			Y	Goshawk habitat, spotted owl connectivity corridor and dispersal Noxious weeds
1400052	Cache	0.40	MBB	O	D			Y	Noxious weeds. White-headed Woodpecker habitat, spotted owl connectivity corridor and dispersal habitat
1400053	Scarp	0.61	MBB	O	D			Y	White-headed Woodpecker, Spotted owl connectivity corridor and dispersal, Noxious weeds
1400053	Cache	0.15	MBB	O	D			Y	Noxious weeds White-headed Woodpecker, Spotted owl connectivity corridor and dispersal,
1400054	Scarp	0.34	MBB	O	D			Y	Goshawk habitat, spotted owl nesting, roosting, and foraging habitat, White-headed Woodpecker, spotted owl connectivity corridor and dispersal Noxious weeds
1400055	Scarp	0.20	MBB	O	D			Y	Noxious weeds.

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative 2	3/4	5	Comments/Rationale for Change
									White-headed Woodpecker, spotted owl connectivity corridor in owl home range
1400120	Cache	1.17	MBB	O	I			Y	Crosses creek, parallels main road, White-headed Woodpecker, spotted owl connectivity corridor. Noxious weeds
1400120	Cache	0.62	MBB	I	I			Y	Noxious weeds. Crosses creek, parallels main road, White-headed Woodpecker, spotted owl connectivity corridor.
1400120	Scarp	0.14	MBB	I	I			Y	Noxious weeds. Crosses creek, parallels main road, White-headed Woodpecker, spotted owl connectivity corridor.
1400123	Cache	0.35	MBB	O	D			Y	Noxious weeds. Crosses creek, spotted owl dispersal
1400150	Scarp	0.80	MHE	I	D		Y	Y	Spotted owl dispersal, deer winter range, parallels 14 rd. Peck’s penstemon present
1400210	Scarp	0.60	MHE	I	D		Y	Y	Spotted owl dispersal, deer winter range
1419050	Scarp	0.20	MHE	O	D		Y	Y	Parallels 1419 rd, deer winter range
1419050	Suttle Lake	0.18	MHE	O	D	Y	Y	Y	Parallels 1419 rd, deer winter range
1419055	Scarp	0.10	MHE	O	D		Y	Y	Deer winter range
1419100	Suttle Lake	0.16	MBB	I	D	Y	Y	Y	Crosses Lake Cr, spotted owl nesting, roosting, and foraging habitat in owl circle; goshawk fledge area
1419106	Cache	0.11	MBB	I	D		Y	Y	deer winter range, in goshawk fledge area
1419106	Suttle Lake	0.09	MBB	I	D	Y	Y	Y	deer winter range, in goshawk fledge area
1419113	Cache	0.10	MBB	I	D			Y	Deer transition range
1419115	Cache	0.20	MBB	I	D			Y	Spotted owl connectivity corridor and dispersal
1419130	Suttle Lake	0.60	MBB	O	I	Y	Y	Y	Between creeks, goshawk fledge area, spotted owl nesting, roosting, and foraging habitat, deer winter range. Tall agoseris
1419131	Suttle Lake	0.10	MHE	I	D	Y	Y	Y	Tall agoseris. Between creeks, goshawk fledge area, spotted owl nesting, roosting, and foraging habitat, deer winter range
1419205	Scarp	0.29	MHE	O	D		Y	Y	Leads to riparian area, deer winter range, White-headed

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative 2	3/4	5	Comments/Rationale for Change
									Woodpecker, leads to head of Metolius. Peck's penstemon present
1419205	Scarp	0.03	MHE	O	D		Y	Y	Peck's penstemon present. Leads to riparian area, deer winter range, White-headed Woodpecker, leads to head of Metolius
1419205	Suttle Lake	0.44	MHE	O	D	Y	Y	Y	Peck's penstemon present. Leads to riparian area, deer winter range, White-headed Woodpecker, leads to head of Metolius
1419206	Scarp	0.18	MHE	O	D		Y	Y	Peck's penstemon present. Leads to riparian area, deer winter range, White-headed Woodpecker, leads to head of Metolius
1419206	Suttle Lake	0.02	WS4	O	D	Y	Y	Y	Peck's penstemon present. Leads to riparian area, deer winter range, White-headed Woodpecker, leads to head of Metolius
1419210	Suttle Lake	0.03	MHE	O	I	Y	Y	Y	Peck's penstemon present. Spotted owl dispersal, deer winter range, next to pvt
1419210	Suttle Lake	0.19	MHE	O	I	Y	Y	Y	Peck's penstemon present. Spotted owl dispersal, deer winter range, next to pvt
1419560	Scarp	0.23	MHE	I	D		Y	Y	Deer winter range Tall agoseris
1419801	Scarp	0.20	MHE	I / B	D		Y	Y	deer winter range
1419803	Scarp	0.15	WS4	I	D		Y	Y	deer winter range
1419804	Scarp	0.10	WS4	I	D		Y	Y	deer winter range
1420040	First	0.36	MHE	I	D	Y	Y	Y	Leads to riparian area, goshawk foraging, White-headed Woodpecker, deer winter range. Peck's penstemon present
1420100	First	1.50	MHE	I / B	D	Y	Y	Y	Peck's penstemon present. Parallels 1425 road. Spotted owl dispersal, deer winter range
1420110	First	0.02	MHE	I / B	D	Y	Y	Y	Deer winter range, spotted owl dispersal
1420115	First	0.15	MHE	I / B	D	Y	Y	Y	Deer winter range, spotted owl dispersal
1420125	Scarp	0.75	MHE	I / B	D		Y	Y	Deer winter range, White-headed Woodpecker Leads to House on Metolius.

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative 2	3/4	5	Comments/Rationale for Change
									Peck's penstemon present
1420126	Scarp	0.06	MHE	I	D		Y	Y	Peck's penstemon present. Deer winter range, White-headed Woodpecker Leads to House on Metolius
1420126	First	0.15	MHE	I	D	Y	Y	Y	Peck's penstemon present. Deer winter range, White-headed Woodpecker Leads to House on Metolius
1420130	First	0.20	MHE	I	D	Y	Y	Y	Tall agoseris. Deer winter range, White-headed Woodpecker
1420153	First	0.10	MHE	I	D	Y	Y	Y	Crosses First Creek twice, deer winter range, White-headed Woodpecker. tall agoseris, peck's penstemon present
1420160	First	0.60	MHE	I	D	Y	Y	Y	Peck's penstemon present Deer winter range Road runs along bottom of draw
1420170	First	0.42	MHE	I	I	Y	Y	Y	Deer winter range, spotted owl dispersal Peck's penstemon present
1420180	First	0.50	MHE	I	D	Y	Y	Y	Peck's penstemon present, tall agoseris. Deer winter range, Spotted owl dispersal
1420183	Scarp	0.02	MHE	I	D		Y	Y	Deer winter range, spotted owl dispersal
1420183	First	0.18	MHE	I	D	Y	Y	Y	Deer winter range, spotted owl dispersal
1420187	First	0.10	MHE	I	D	Y	Y	Y	Deer winter range, spotted owl dispersal
1420220	Scarp	0.80	MHE	I	D		Y	Y	Tall agoseris, peck's penstemon present. Crosses ditch, deer winter range, spotted owl dispersal, White-headed Woodpecker
1420240	Jack	0.40	MHE	I / B	D		Y	Y	Deer winter range, spotted owl dispersal Peck's penstemon present
1420360	Scarp	0.22	WS4	O	I		Y	Y	Leads to pvt, spotted owl dispersal, deer winter range, Adjacent to meadow. Close beyond campsite
1425600	First	0.41	MHE	O	I	Y	Y	Y	Deer winter range, White-headed Woodpecker Peck's penstemon present pop.
1425600	Scarp	0.19	MHE	O	I		Y	Y	Near Peck's penstemon population. Deer winter range, White-headed Woodpecker

Road	Watershed	Segment Length	Management Allocation	Current Status	Proposed Change	Change Recommended in Alternative			Comments/Rationale for Change
						2	3/4	5	
1425700	First	0.19	MHE	I	D	Y	Y	Y	Spotted owl dispersal
1425810	First	0.30	MHE	I / B	D	Y	Y	Y	Peck's penstemon present
1425811	First	0.20	MHE	I	D	Y	Y	Y	Deer range transition range
1425812	First	0.10	MHE	I	D	Y	Y	Y	Peck's penstemon present
1425820	First	0.40	MHE	I / B	D	Y	Y	Y	Spotted owl dispersal Peck's penstemon present
1425830	First	0.30	MHE	I / B	D	Y	Y	Y	Peck's penstemon present Spotted owl dispersal
1425840	First	0.45	MHE	I	D	Y	Y	Y	Peck's penstemon present Spotted owl dispersal
2064560	Cache	0.38	MBB	I	D			Y	Crosses riparian area
2064815	Suttle Lake	0.23	MBB	I	D	Y	Y	Y	Tall agoseris White-headed Woodpecker
2064820	Suttle Lake	0.07	MBB	O	D			Y	Crosses riparian area, in owl home range Tall agoseris

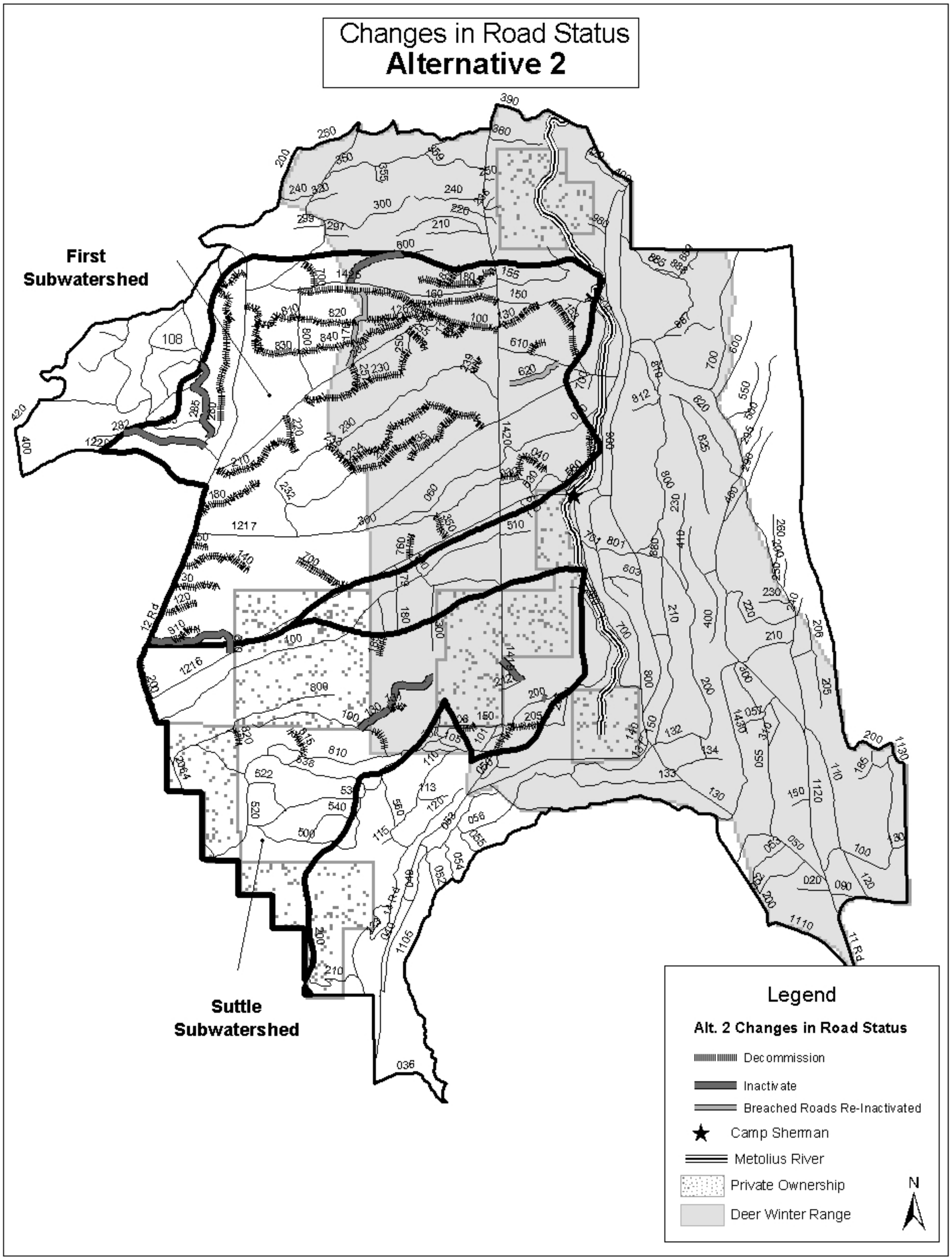


Figure 2-4. Proposed changes in road status under Alternative 2.

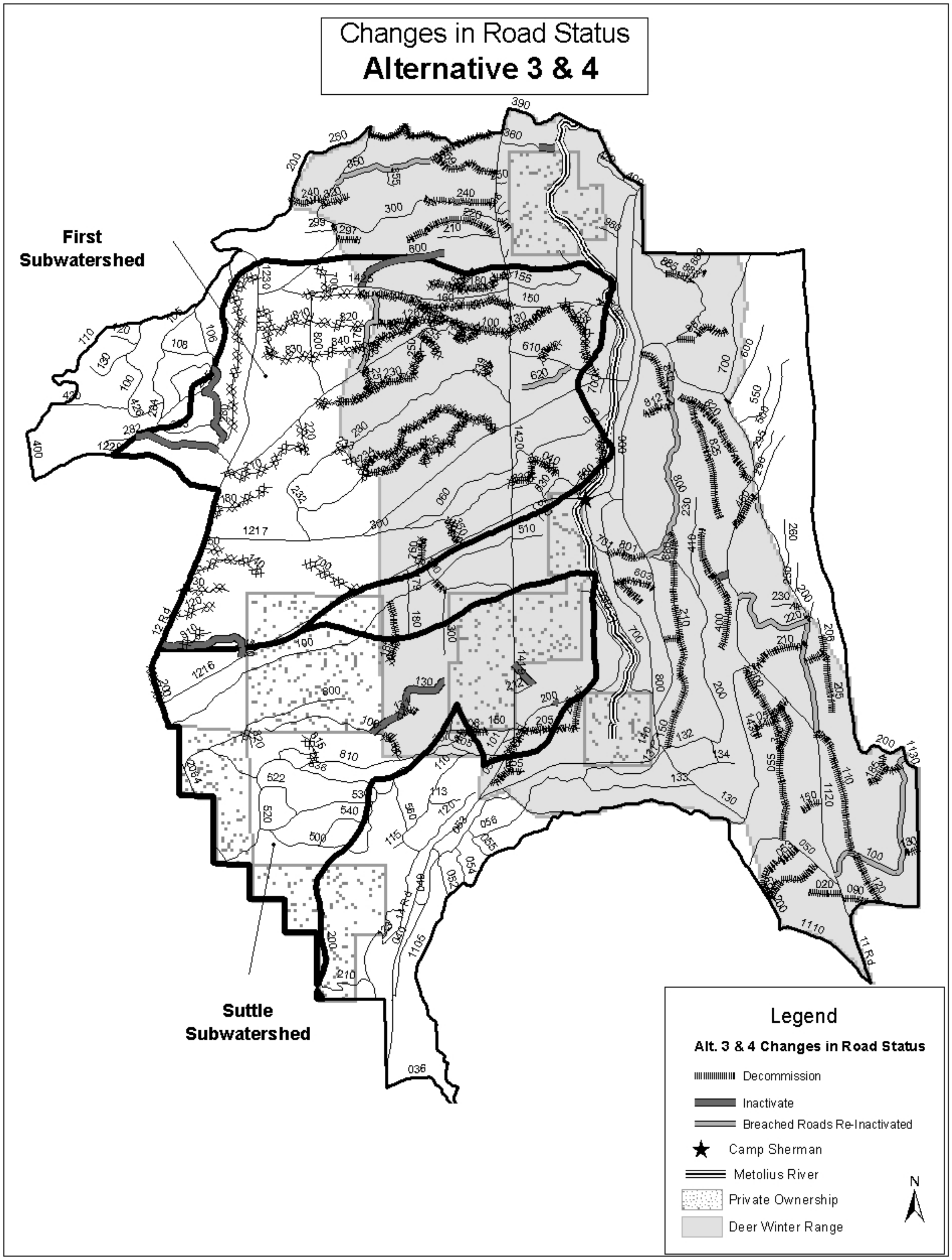


Figure 2-5. Proposed changes in road status under Alternatives 3 and 4.

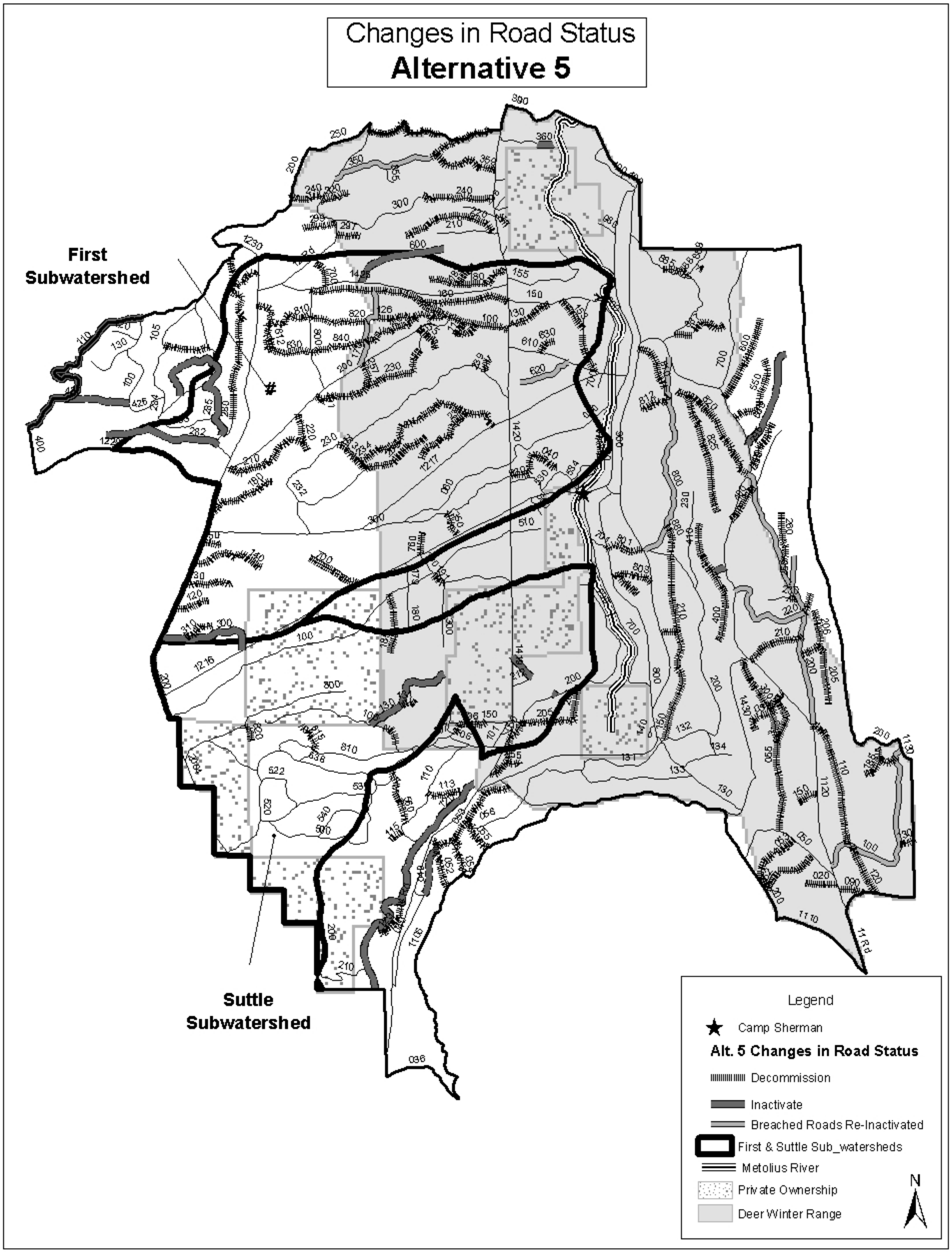


Figure 2-6. Proposed changes in road status under Alternative 5.

CHAPTER 3. AFFECTED ENVIRONMENT

This Chapter summarizes the physical, biological, and social environments of the project area. The discussion of existing conditions is organized by forest resources. Those descriptions that provide additional background relating to the Key Issues are identified.

Forest Vegetation and Late-Successional Habitat

This section provides background information for Issue #1, Managing Vegetation In Late-Successional Reserves, and Issue #2, Size of Trees Removed.

TYPES OF FOREST VEGETATION

This section describes the historic and current vegetation in the Metolius Basin Planning Area, disturbance events that have influenced vegetation, and the late-successional habitat condition (including a discussion of potential old-growth). There is also a discussion about the concept of "Range of Variability" and sustainable conditions.

How a forest ecosystem is structured and functions within the landscape depends on the type of vegetation the landscape can support over the long-term. This is based, in part, on productive capabilities of the soil, precipitation, aspect and slope. The type of vegetation is categorized into plant association groups. Plant associations were determined through field mapping of the potential natural vegetation using the protocol established by Volland (1988), with input from the Area IV Ecologist and other Forest Specialists including silviculturists, ecologists, botanists and stand exam personnel. The associations and series were then grouped by their climax species, site potential, and temperature and moisture similarities into Plant Association Groups, using the categories listed in the Deschutes WEAVE document (v.1.12) and are displayed in Table 3-1 and Figure 3-1.

Table 3-1 - Plant Association Groups.

Plant Association Group	Acres*	Percent
Mixed Conifer Wet	1717	12%
Mixed Conifer Dry	3941	27%
Ponderosa Pine (wet and dry)	8721	59%
Meadow and Riparian	219	>2%
TOTAL[12]	14,598	100%

[12] The planning area = 14,693 acres of National Forest lands; 21 acres are in mapping units <1.5 acres and are not considered in this discussion. 75 additional acres were listed as cinder, rock or water.

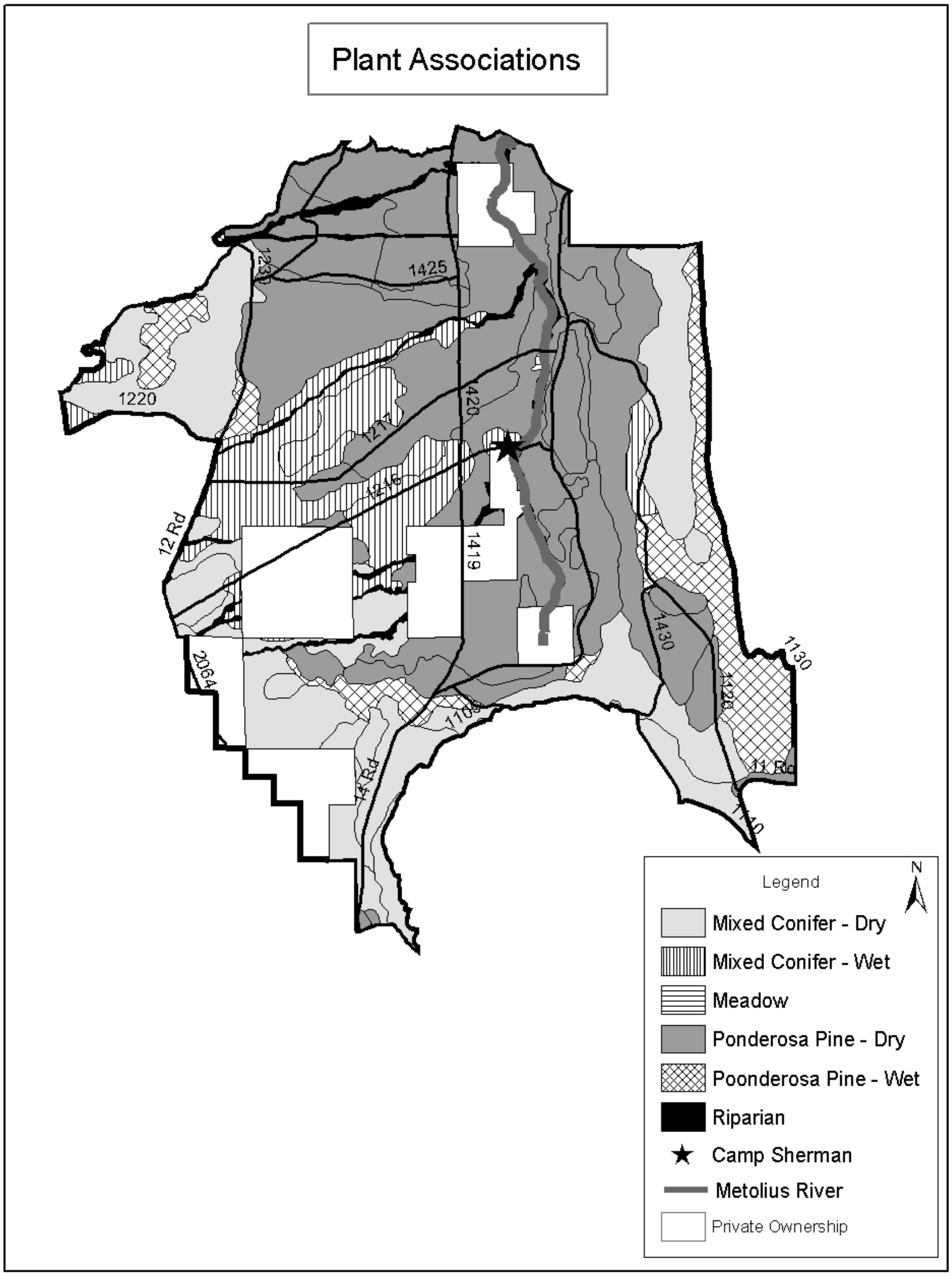


Figure 3-1. Plant Associations in the Project Area.

Ponderosa pine. Ponderosa pine (wet and dry) plant associations are found over the majority of the planning area on flat to rolling ground, on steep slopes at lower elevations, and on the upper slopes of Green Ridge. In this plant association group, ponderosa pine is the main seral and climax species, growing in small, even-age groups. Minor amounts of white fir and Douglas-fir may be present particularly in the ecotones within the mixed conifer plant associations. Ponderosa pine is the dominant species, but fir is increasing adjacent to the mixed conifer plant association due to adjacent seed sources and absence of fire.

Mixed Conifer (Wet and Dry). Mixed Conifer plant associations, where the dominant climax species are grand fir/white fir and Douglas fir, comprise 39 percent of the Metolius Basin Planning Area. In these areas, ponderosa pine, western larch, and lodgepole pine (and in some cases Douglas-fir) should be the dominant early seral species, but throughout much of the area they are now dominated by true firs.

> *Mixed-conifer dry* plant associations are found on the lower third of slopes of Green Ridge, the north-facing lower slopes of Black Butte, and the higher elevations on the west side of the planning area. Generally these areas have moderate to high productivity. Current tree vegetation consists of ponderosa pine, white fir, western larch, Douglas fir, incense cedar, and small amounts of other species.
>
> *Mixed-conifer wet* plant associations are found primarily in the higher elevations on the west side of the planning area, and between the North Fork and South Fork of Lake Creek. In mixed-conifer wet, the productivity is generally higher than in the mixed-conifer dry plant associations. Current vegetation consists of Douglas-fir, white fir, ponderosa pine, western larch, and lodgepole pine. Spruce can be found in the wetter riparian areas.

Riparian This type is found on approximately 3% of the project area and is found in the interface between terrestrial and aquatic ecosystems. On public lands within the project area, this interface is primarily associated with streams and rivers. These are the plant associations were plants that are dependent on a year-round or nearly year-round source of water are found, consequently, vegetation in these plant associations can be very diverse.

HISTORIC AND CURRENT CONDITION OF METOLIUS BASIN HABITAT AND VEGETATION

The historic conditions derived from the 1870 Surveyor Notes indicate that fire played a significant role in creating open fire climax forests in the Metolius Basin planning area. The notes described the Ponderosa Pine plant association as large even-aged stands of pure, large diameter ponderosa pine with grass understories. Mid elevation mixed conifer stands were described as heavy yellow pine (ponderosa pine) with open understories. The higher elevation mixed conifer was described as dense understories of pine, fir, willow and chinquapin. The forests as a whole were described as being fairly contiguous stands of large diameter ponderosa pine (Metolius Watershed Analaysis 1996).

Aerial Photo Interpretation from 1953 photos indicate conditions similar to the 1870 surveyor's notes, though the presence of denser stand conditions was increasing at higher elevations and in sites with more moisture, due largely to the suppression of fire. The forests were still dominated by large diameter ponderosa pine, with relatively open understories, but both ponderosa pine and some white-fir understories were more common due to the suppression of fires.

Over the past 100 years, dramatic changes (fire exclusion, timber harvesting, road construction) have occurred in the Metolius Basin project area (Metolius Watershed Analysis, 1996). Perhaps the greatest single impact on ecosystem stability has been the exclusion of fire. Historically, the mixed conifer and ponderosa pine forests were strongly influenced by frequent fire disturbances that maintained open under stories and a dominance of long-lived, fire adapted species such as ponderosa pine and Douglas-fir. All of these processes, in turn, helped reduce competition for water and nutrients, prevented extreme effects from insect and disease cycles, and maintained tree vigor in the dominant species.

Typical density in many stands in the project area

Currently, the forest is composed of stands that are either multi-layered old trees, dense to moderately dense second-growth pine where most of the older trees were removed, or plantations resulting from clearcutting and shelterwood harvesting in the late 20th century. The multi-layered conditions that have developed in many stands favor some late-successional species, such as the spotted owl and goshawk, while having a negative effect on other species, such as the white headed woodpecker and Peck's penstemon.

Stand Density and Forest Structure

Different environments can support different levels of tree density (e.g. wetter, richer soils tend to be able to support more trees per acre). The maximum bimoass that a plant association can sustain, before growth is suppressed and trees begin to decline in health, is the "upper management zone" (Cochran et al. 1994, Eglitis, 1997; and Maffei, 1997). Approximately 82 % of the area has high stand densities, or are above the upper management zone (Figure 3-2). High stand densities tend to increase stress and reduce vigor among all size classes, and increase the likelihood of mortality from insects and diseases, especially during droughts.

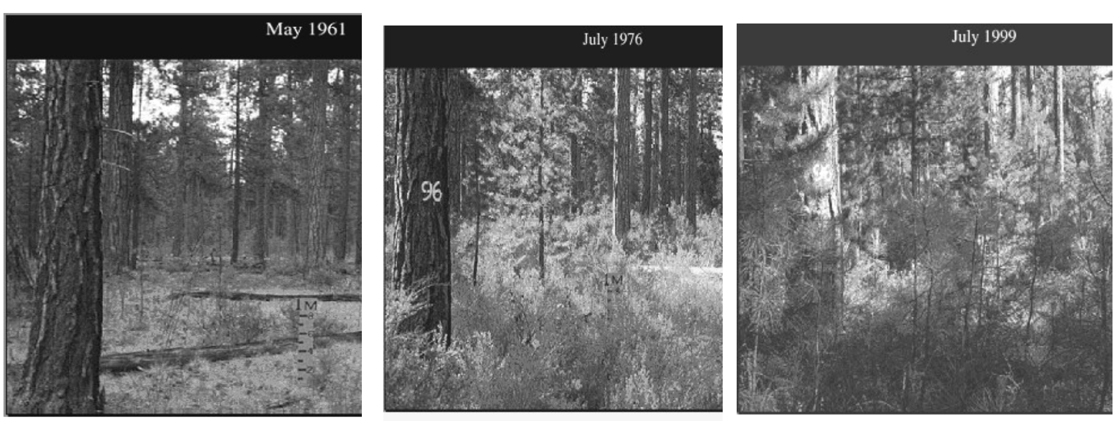


Photo points on the Sisters Ranger District that demonstrate the rate of understory growth over 38 years

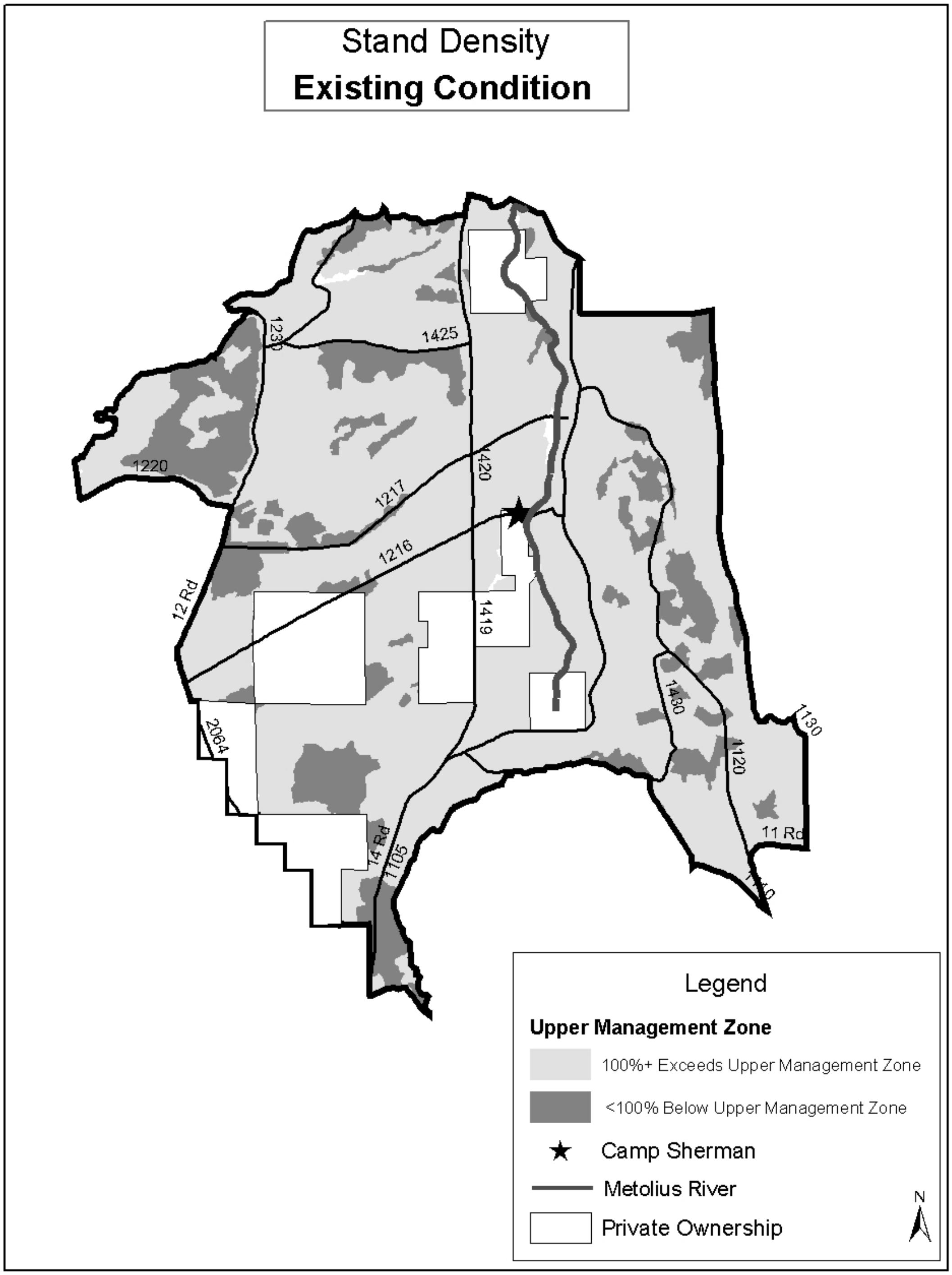


Figure 3-2. Existing Stand Densities, using the measure Upper Management Zone.

Forest Stand Densities: What is the "Upper Management Zone"?

The *upper management zone* is a concept described by Cochran and others (1994) and is one way to describe and analyze the density of forest stands. It is defined as a threshold density level at which a suppressed class of trees begin to develop in a stand. This is the point at which trees begin to come under stress because they are intensely competing for growing space (Oliver and Larson, 1996). Growing space is the aggregate of all the factors necessary for the growth of plants. These factors include, but are not limited to, the following: sunlight, water, mineral nutrients, suitable temperature, oxygen, carbon dioxide and physical space. Because plants have unique anatomies they need to grow to survive. The growth of plants can become limited when any one of the growth factors becomes limited. The higher stand densities are above the upper management zone, the more the growing space becomes limited and the greater the risk is of losing trees in the stand.

What is the upper management zone based on? There are certain biological limits to growing vegetation. For example, if you were to plant 1,000 carrots in a 5-gallon bucket, you would expect many of them never to survive. Of those that survived, there would be such competition for food, water and light that you would not expect the carrots to grow very well. In addition, physical space would play a factor in limiting how large the carrots could grow. However, if you were to try planting 20 carrots in the 5-gallon bucket, you could expect much less competition for food and water, much less mortality, and much larger and healthier carrots.

The forest operates on the same principles that dictate what happens in the 5-gallon bucket. The forest is limited in space, water, nutrients and light available for plant growth. These factors, along with other climate and site factors help set the limits of the type, size, and amount of forest vegetation that can be grown on a given site. If we want healthy forests with large trees, then it is important to help control how dense the forest is growing.

Scientific studies have determined certain "normal" density limits for conifer species. The upper management zone is the density level that is approximately 75% of the density of the "normally" stocked stand.

Trees per Acre versus Basal Area: There are numerous ways to characterize stand density. Two of the most common ways are trees per acre and basal area. Basal area is the surface area, in square feet, of the cross-section of the bole of a tree at 4.5 feet above ground level. When you relate the amount of basal area or trees per acre to some unit of land, an acre for example, then that tells you something about the density of trees on that acre. Trees per acre and basal area are related in that small trees have very little basal area and large trees have a relatively high amount of basal area. For example, a 5" tree contains 0.14 square feet of basal area and a 30" tree contains 4.9 square feet of basal area. Consequently, it takes about 36 5" trees to make the same basal area of one 30" tree.

Density management, regardless of the measure used (e.g., basal area, trees per acre, etc.), helps managers consider not only the quantity of trees a site can support, but also the quality, or types of trees we want to grow. If you want to grow poles for the wood products market, it may be okay to grow many more trees on an acre, than if you want to grow large trees with large limbs and well-developed crowns (the type of forest structure so important to many old-growth species).

The upper management zone relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. With information about any forest stand, an upper management zone for that site can be calculated. The upper management zone is the density level at which trees begin to come under significant stress and can become susceptible to bark beetles and perhaps other insects and diseases.

Maintaining stand densities at sustainable levels is essential for promoting forest health and maintaining or creating large trees and habitats in dry areas. The upper management zone is a site-specific threshold density, above which forest health conditions and large tree health are likely to deteriorate. The primary cause is that, on any given piece of ground, there are limits to growing space or the resources available for plant growth. When these limits are reached, loss of plant growth and/or mortality can become common elements of the stand. In addition, due to stress on the existing stands, they may be at a high risk of impacts from wildfire, insects or disease.

Canopy Cover

Though high stand densities can reduce the longevity of a forest stand, some plant and animal species, including the spotted owl, depend on high forest densities and closed canopies. However, within the ponderosa pine dominated forest in this project area, less than 3% of the stands provide 60% or greater canopy cover (relatively closed, and a density used by spotted owls). These stands are generally not sustainable for the long-term in the Metolius Basin.

There are no historical records of canopy cover, but we can estimate that with lower densities maintained by frequent underburns in much of the Metolius Basin Planning Area, canopy cover was lower historically than it is at present. Table 3-2 shows the percent of acres by percent canopy cover class within each plant association group.

Table 3-2. Distribution of Acres by Canopy Cover Class within Plant Association Groups.

PLANT ASSOCIATION	Percent of Metolius Basin Project Acres					TOTAL
	<19	20-29	30-39	40-59	60+	
Mixed Conifer Dry	3.3%	1.3%	7.2%	15.8%	0.6%	**28.0%**
Mixed Conifer Wet	1.7%	1.8%	1.4%	5.3%	1.5%	**11.7%**
Ponderosa Pine Dry	5.0%	16.8%	19.2%	9.4%	0.0%	**50.4%**
Ponderosa Pine Wet	1.2%	0.3%	2.0%	4.4%	0.0%	**7.9%**
Riparian Vegetation	0.8%	0.2%	0.1%	0.2%	0.6%	**1.9%**
Totals	**12.0%**	**20.4%**	**29.9%**	**35.1%**	**2.7%**	**100%**

Tree Size

There are fewer large trees on the landscape than over the last century. The largest trees remaining in the project area initially grew under low-density conditions, with plenty of resources (light, water, nutrients, and space) available for plant growth. In fact, there has been a dramatic shift in tree sizes over the last half century. Since 1953, the number of acres within the project area that were dominated by trees 21 inches diameter and greater have decreased from 100% to only 27% today (Forest Vegetation Specialist Report).

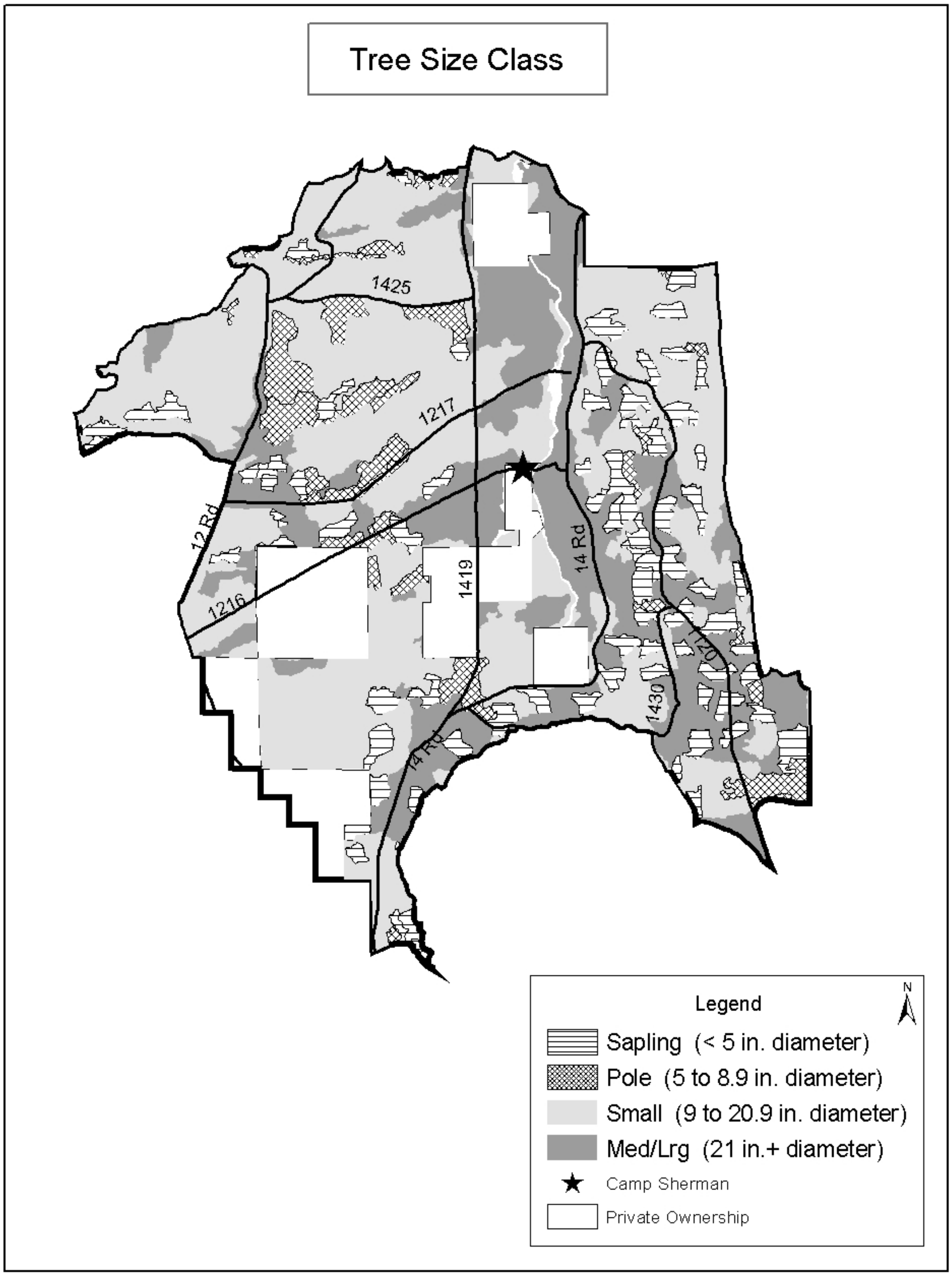


Figure 3-3. Tree Size Classes.

While the dominant size class across the project area has shifted from med/large (i.e., 21"+) to the smaller size classes, medium/large trees (21"+ dbh) are still common across the project area. Across the project area (including regeneration harvest units) it is estimated that medium/large trees (21"+ dbh) average approximately 11.3 trees/acre with a range from <1 tree/acre to 47.9 trees/acre. As a comparison, consider that recent stand exams across 4 stands (395 acres) within the Metolius RNA, an area that was established in 1931 and consequently has had no active management except for fire suppression and within the last 10 years the reintroduction of fire (prescribed). Across these 4 stands, the average trees/acre 21"+ dbh is 16.5 with a range of 15.2 to 17.3.

Social Values related to Tree Size. See a description of social values as they relate to tree size under Issue #2, Chapter 1.

Species Composition

The most dramatic change in species composition is the difference between dominance of ponderosa pine versus white fir over the last 50 years. The acres dominated by ponderosa pine have decreased by about 1800 acres while the acres dominated by white fir have increased by about the same amount (USDA Forest Service, Metolius LSRA, 1996). Fir is intolerant of drought and fire.

In general, these dramatic shifts in species composition have occurred primarily in the mixed conifer plant association. In dry ecosystems with historically frequent fire regimes, ponderosa pine may not be succeeded by fir for 300 to 400 years, but, with the exclusion of fire, it has occurred in some locations of the arid west in only 40 years (Harvey et al., 1994; Graham et al., 1999).

DISTURBANCE SIZE AND INTENSITY

Disturbances are an important process in continuing the cycle of renewal in most ecosystems, and some amount of mortality from disturbances is desirable, particularly for those species such as black-backed woodpeckers that are associated with large disturbance events (USDA Forest Service, Metolius LSRA, 1996). However, there has been an important change in the type of disturbances that are now affecting this ecosystem. The primary historic disturbance was frequent, low-intensity fire, which helped maintain stable ecosystem functions and late-successional characteristics in the ponderosa pine and mixed-conifer dry plant associations. Disturbances caused mortality from single trees or small groups to large patches. This resulted in the important, though minor, structural elements of diseased, dead, damaged and down trees. Many species (wildlife, plant, insect, fungi, microorganisms, etc.) have evolved with the historic cycles and scales of disturbance and successional patterns.

The primary types of disturbances on the Sisters Ranger District are now insect and disease, and intense fires. This change may result in fluctuations in habitat conditions more extreme than historic levels for this forest, with potential loss of important late-successional elements, such as larger long-lived trees, canopy cover, large snags and down wood (Graham et al., 1999). In addition, there may be a trend of slower recovery of the system, partly due to the effect of high intensity wildfires on soil productivity. The result is a greater impact on those species, such as the spotted owl, which have adapted to dense habitat conditions, while it may benefit some early seral species, which can tolerate extreme disturbances.

Mortality across the Metolius Basin Planning Area is generally low, although there are stands with higher mortality in the mixed conifer areas in the western and central portion. These higher levels of mortality are due to the effects of a spruce budworm epidemic in the late 1980s and early 1990s. The budworm defoliation predisposed stands containing mostly white fir and Douglas-fir to mortality from bark beetles and root diseases.

Mortality in a Mixed-Conifer Stand

Although ponderosa pine is found in much of the area, large ponderosa pines are declining and may eventually become rare (personal communication, Bill Hopkins, Zone Ecologist). Mortality of large ponderosa pine averages about 8 percent or more across the planning area (Sisters Ranger District, stand exam data). The effects of the drought of the 1980's and early 1990's caused many of these old (250-350 years) trees to succumb to armillaria root disease and western pine beetle. However, this mortality has had the positive effect of restoring the historic snag component, much of which was removed in harvest activities over the last 50 years. However, it is also indicative of stand conditions that are placing stress on the overstory, and when drought conditions return another wave of mortality would be expected.

Insects and Disease

The roles of insects and diseases as disturbance agents in the forest are very closely tied to vegetation patterns. Factors such as species composition, size structure, and density of forest stands are all very important in determining which agents are likely to be present in the forest, their abundance, and how profound their effect is likely to be on that vegetation. By their actions, forest insects and diseases sometimes alter the vegetative patterns that provided them with suitable habitat, and set the stage for new processes to occur.

The primary insects within the project area include the Douglas-fir beetle, fir engraver, western pine beetle, mountain pine beetle, pine engraver beetle, and western spruce budworm. Bark beetles prefer old trees in dense stands with low vigor (USDA, 2000) so may present an additional risk to large trees in the project area. Acres above the upper management zone for density are considered imminently susceptible to bark beetles.

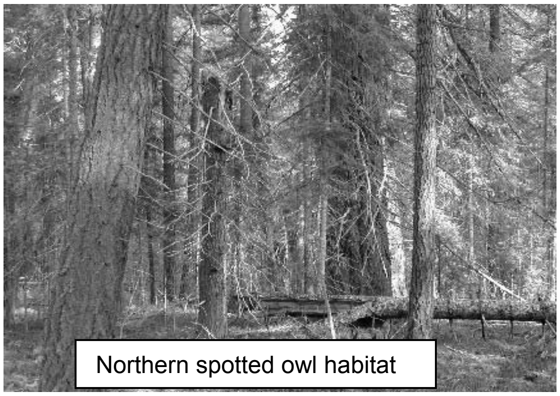
The primary diseases include various dwarf mistletoes, and root diseases. One or more of these agents affects all of the conifer species. The key associates include dwarf mistletoe, armillaria root disease, and annosus root disease. Dwarf mistletoe is widespread across Central Oregon, and a study (DeMars, 1980) on the Deschutes National Forest showed that the parasite could be found in approximately 45% of the ponderosa pine stands, with about 24% of the trees in these stands exhibiting some level of infection. Based on field surveys, an estimated 1175 acres of ponderosa pine, 2600 acres of larch, and 215 acres of Douglas-fir in the project area are moderately to heavily infected by dwarf mistletoe. Root disease levels were found to be present but low on 2068 acres, at moderate levels on 780 acres and at high levels on 920 acres.

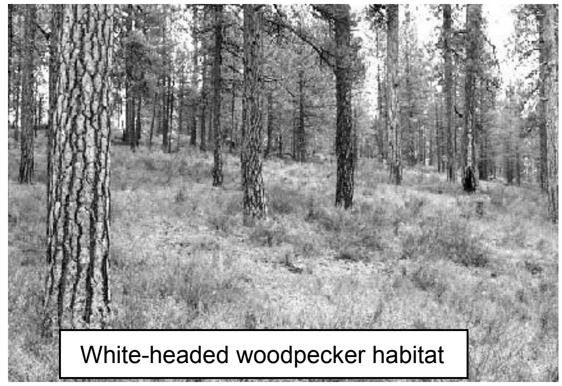
Moving forest densities, structure and fuels to resemble conditions within the natural range of variability is expected to reduce the risk of severe stand-replacing wildfires and widespread insect and disease outbreaks, and intensity of effects when disturbances occur (Brookes et al., 1987). These actions could also help maintain old-growth ponderosa pine longer. The remaining old trees may have genetically inherent survival traits that make their gene pool important and rare. They have survived centuries of droughts, fires, insect/disease outbreaks, and human impacts but are reaching the end of their lifecycle which could be extended by reducing competition, stress, and bark beetle susceptibility (Wickman, 1992).

LATE-SUCCESSIONAL RESERVES AND RISK OF LOSING LATE-SUCCESSIONAL HABITAT

Maintaining and enhancing late-successional reserve habitat (primary by reducing the risk of wildfire, insect and disease) is an important objective in this project, and is recommended in the Metolius Late-Successional Reserve Assessment. Late-Successional Reserves were established under the Northwest Forest Plan to protect and enhance conditions of old-growth forest ecosystems, which serve as habitat for old-growth related species, including the northern spotted owl. The Metolius Late-Successional Reserve boundaries were designated primarily based on the presence of nesting spotted owl pairs during analysis for the Northwest Forest Plan (early 1992-1994). There are two types of old-growth habitat in this Late-Successional Reserve, fire climax (a mature, stable community of dry-site vegetation) and climatic-climax (mature moist forest habitat).

The majority of the ponderosa pine and mixed-conifer dry plant associations are fire-climax systems. These plant associations, which are the most common in the project area, are not well suited to support species like spotted owls that require dense, multi-layered forests. However, there are late-successional species that prefer these open, mature pine forests, such as white-headed woodpeckers, and these are the habitats that the Forest Service is focusing on improving and protecting in much of the fire climax forests (see Figure 1-4, Chapter 1, for portions of the project which will be managed for white-headed woodpeckers and spotted owl habitat). Habitat needs for white-headed woodpeckers are very different from those for spotted owl (open, single layered stands versus dense, multi-layered stands - see photos). Both types of habitat in the project area are at risk of losing important habitat elements due to high fuel loads and dense stands.





The Northwest Forest Plan (1994), Draft Spotted Owl Recovery Plan (1992), and Metolius Late-Successional Reserve Assessment (1996) recognize the increased risk of fire, insect and disease on the east slope of the Cascade Mountains. These guiding documents for management of areas such as the Metolius Basin project area indicate that to address this high risk, it may be necessary to implement management actions beyond typical guidelines for Late-Successional Reserves. The Northwest Forest Plan states that "silviculture aimed at reducing the risk of stand-replacing fires may be appropriate", and that density reduction in mid-level canopy layers by thinning may reduce the probability of crown fires (ROD, B-7).

The Draft Northern Spotted Owl Recovery Plan addresses the potential for significant loss of habitat on the Deschutes National Forest. In fact, several hundred acres of spotted owl dispersal habitat and some nesting, roosting, and foraging habitat has been recently lost in wildfires on the Sisters Ranger District in 2002 in addition to the thousands of acres lost at a result of the western spruce budworm outbreak of the late 1980's and early 1990's. The Draft Plan recommends that to reduce the risk of loss from insect and diseases, land managers focus on stand density control to reduce stocking and stress on existing stands.

The Draft Plan further states:

> There are no forest protection options to maintain owl habitat at its current level in the East Cascades sub-region. As noted, the current extensive habitat is likely a result of an historical anomaly: successful fire protection. The structure resulting from this anomaly is inherently unstable, subject to increased fire, wind, disease, and insect damage. Any stand manipulation which will significantly increase resistance to these disturbance factors apparently will result in decreased owl habitat (Forest Protection Guidelines, pg 471).
>
> Forest ecosystems are dynamic. They change with or without active management. . . A recommendation to implement a strategy that in fact reduces optimum owl habitat may seem a paradox. We believe that such implementation will in the long run better protect owl habitat than a shortsighted attempt to continue total protection. . . . Active management of habitat in the East Cascades sub-region, through protection strategies designed to prevent large-scale catastrophic events, is the most rational management direction (Conclusions, pg 472).

Old Growth Stands

While silvicultural treatments can accelerate some stand development processes, such as tree growth to promote larger trees, other stand development processes, such as tree crown maturation, bark thickening, and tree bole decay, may not readily accelerated by silvicultural treatments (ROD B-45). Providing habitat for late successional species and conserving late-successional species diversity are part of the primary purpose of Late-Successional Reserves (ROD B-4,5).

Thirty-six percent of the Metolius Watershed has late-successional and old growth stands (the Northwest Forest Plan requires a minimum of 15% old growth in 5th field watersheds for vegetation management activities to be permitted).

Current late-successional conditions were analyzed from 2000/2001 stand exam data, and indicate that there are approximately 9662 acres of stands with late-successional elements. Stands with late-successional elements were considered to be those having 7 or more trees per acre >= 21" diameter and having 2 or more canopy layers, and/or stands having late-seral species composition. Within these stands, approximately 5599 acres were determined to be "possible old growth" (Table 3-3), based on the number of trees per acre 21 inches diameter and larger (1 of the 6 criteria used to determine old-growth stands; USDA Forest Service Region 6 interim old growth definition, 1993). The analysis identified stands with the appropriate tree species mix and overstory to be considered possible late-successional habitat (Figure 3-5).

Table 3-3. Possible Old Growth[13] by Plant Association Group.

Plant Association Group	Percent of Metolius Basin Planning Area that is Possible Old Growth based on Number of Large Trees per Acre
Ponderosa Pine	24.7
Mixed Conifer Dry	7.9
Mixed Conifer Wet	5.1
Riparian	0.6
TOTAL	**38.3**

Trends. Large old-growth trees are the key structural components of late-successional forests because of the time required for their development, their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. However, altered successional patterns are working against the long-term survival of these old-growth trees. All growing sites have a fixed quantity of resources and growing space, and as inter-tree competition increases it is usually the large trees that die first (Dolph et. al. 1995, In: Fitzergerald et. al. 2000). It is thought that we may have only a few decades to deal with this situation, or we risk losing the large trees (Fitzgerald, 2002. pers. comm.). Large trees would be lost at a faster

[13] Possible old growth for Ponderosa Pine = 13 or more live trees/acre ≥ 21" diameter, Mixed Conifer (dry and wet) = 15 or more live trees/acres ≥ 21" diameter

rate at higher stand densities than at lower stand densities.

Without action it is predicted that loss of the large tree structure would continue. Given the relatively low numbers of trees 21 inches diameter or larger per acre compared to smaller trees, this number could be considered substantial.

Range of Variability, and Suitable vs. Sustainable Late-Successional Forest Habitat

A goal in managing Late-Successional Reserves is to assure forest habitats develop into sustainable stands and systems over the long-term. These conditions would not generally occur if there has been extensive stress on the system, such as too many trees growing in one area, or total absence of periodic disturbance. This is with the understanding that all forest systems have a historic range of fluctuation or variation, due to disturbances (drought, fire, insect and diseases). But, over the long-term, this variation occurs within predictable parameters, and it is within this historic range of variation that the forest develops and species evolved.

The historic range of conditions (the conditions that prevailed in a forest over the past few hundred years) is often considered "sustainable" since it is based on the assumption that a forest is most likely to maintain native species and processes if it somewhat resembles the conditions under which those species evolved (USDA Forest Service, Metolius Late-Successional Reserve Assessment, 1996).

Sustainable, or stable, forest conditions can provide suitable habitat for species *over the long-term*, even though there would still be variation in successional stages. However, alteration of a part of the system, including alteration of historic disturbance processes, can result in a catastrophic change in the system, or an *unsustainable or unstable* condition. The result could be widespread loss of historic habitats and the species that depend on them. It also may result in relatively slow recovery of the system, particularly if soil productivity is severely impacted, such as from intense wildfire. The current condition of much of the old-growth habitat in the Metolius Basin project area is not stable, due in part to a long absence of low intensity fires.

Forest habitats that are not sustainable can still provide adequate, or suitable habitat for certain species in the *short-term*. For instance, the high tree density and closed canopy in portions of the mixed conifer forest areas in Metolius Basin are now providing suitable habitat for the spotted owls to nest, roost and forage. However, overcrowded conditions, recent droughts, and subsequent epidemics of insect and disease have put tremendous stress on these forest stands, and some are now rapidly declining. Thus, these stands would not provide suitable long-term habitat for spotted owl.

Fire/Fuels/Air Quality

Fire is a key issue in this analysis because the current decline in forest health in the project area is, in part, due to a prolonged exclusion of fire from the system. Fire is a disturbance process that historically played an important role in shaping the landscape of the Metolius Basin project area Metolius Late-Successional Reserve Assessment 1996). Under current conditions, fuel loads are high and there is a moderate to high risk of large-scale, high-severity wildfire. As stands become denser, and trees die from competition stress, fuel levels and fire hazards are predicted to increase over more of the project area. The likelihood of fire is high within the project area because it lies in a lightning prone portion of the district. Important values that are at risk include private property and human safety, late-successional habitat, soil productivity, and scenic quality.

HISTORIC ROLE OF FIRE

Fires have historically been a major influence in shaping these landscapes. Fredrick Colville's 1898 report, "Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon", reveals that forest composition was quite different a century ago. He described the general forest as "the yellow pine forest, …[in which] the principal species is …pinus ponderosa. The individual trees stand well apart, and there is plenty of sunshine between them." Colville also recognized the role of fire. "The scant grass and underbrush do not make a destructive burn".

Fire Regimes

Fire regimes are based upon our understanding of historic conditions and description of the role fire played in an ecosystem (Agee, 1993). There has been some debate about the accuracy of these historic descriptions and Tiedemann and colleagues (2000) argue that "open park-like" conditions may not have been as pervasive in eastern Oregon pine stands as assumed based on the historic descriptions. However, though many of the descriptions of forest conditions and fire behavior were anecdotal, the numerous historical records documented remarkably similar conditions in the Metolius Basin.

> *Under normal conditions of forest and rangeland health, fires play a vital role in removing excess fuels and maintaining normal plant composition and density. These fires tend to burn at ground levels, generating low temperatures and moving relatively slowly. When burning through forested areas, these fires remove underbrush and dead growth while healthy, mature trees survive. Without active management of forests and rangelands, large, expensive and damaging wildfires will occur more frequently, causing greater damage to people, property and ecosystems. Intelligent, active land management that minimizes the risk of severe fires is needed to protect forest and rangeland ecosystems.* (Healthy Forest Initiative, pg 4)

The fire regime identifies potential fire effects and historic size, frequency, and intensity of fires within the vegetation types. The suppression of fires in the 20th century, combined with timber harvest, has changed the composition of the forest a great deal, and estimating those fire regimes can be difficult. However, the historic fire regime of the Metolius Basin Planning can be described as low severity, with an average frequency of 8-12 years (Bork, 1985, In: Cochran and Hopkins, 1990).

Ponderosa Pine. Historically, fires were of low intensity, rarely scorching the crowns of the mature trees. This can be inferred from the pattern of scarring found on residual trees and from early accounts of wildfires in the ponderosa pine.

"Ordinarily, a fire in yellow-pine woods is comparatively easy to check. Its advance under usual conditions may be stopped by a patrolman on a fire line a foot or so wide, either with or without backfiring. The open character of the woods makes the construction of fire lines relatively easy, and in many cases horses may be used to plow them" (Munger, 1917).

"Frequent underburns killed most of the small under story trees which colonized the sites during brief fire-free intervals, maintaining an open, park-like appearance" (Agee, 1992; Wickman, 1992). This allowed bunchgrasses and most forbs to recover rapidly, so the herbaceous vegetation dominated the understory. The natural landscape pattern was seemingly unbroken parkland of widely spaced tree clumps. Of all the Eastside forest vegetation types, the pine was the most stable in landscape pattern (Agee, 1992). Agee (1993) also notes that frequent underburning probably consumed much of the down wood.

Currently, fires in ponderosa pine are often facilitated by events such as insect mortality, diseases, wind events, or drought, and many more acres are burning at higher intensities. All of these conditions have been exacerbated by the exclusion of natural fire. This has allowed an accumulation of ladder fuels that increase the risk of crown fires over a large area or to generate sufficient intensity and duration to reach inside bark temperatures capable of killing a normally fire resistant mature tree (WEAVE, 1994).

Mixed Conifer (Wet and Dry). Historically, the mixed conifer forests also had fairly frequent fire activity, though not as frequent as in ponderosa pine forests. Wet mixed conifer plant associations have wetter, more productive site conditions that allow vegetation to grow rapidly but also retards the effects of fires. The wetter soils and fuel conditions reduce the spread and intensity of fires on these sites. These conditions increase the length of time between fires, thereby increasing the fire return interval (Agee, 1992).

Fire return intervals for mixed conifer plant associations are quite variable and depend upon many other site-specific conditions, but have been found to range from 9 to 50 years depending on the elevation gradient. The average fire size for low intensity fires ranged from 50 to 150 acres and stand replacement fires were 100 to 1,000 acres in size (Bork, 1985; Hopkins, 1995; McNeil and Zobel, 1980).

RECENT FIRES

There have been several large (over 100 acres) wildfires on and adjacent to the Sisters Ranger District in the last several years (Cache Creek, Bald Peter, Cache Mountain, Marion Mountain, Eyerly). The fires burned in several different types of fuel types and forest conditions, but each one showed extreme, and unexpected fire behavior. This extreme fire behavior was observed across the west in the summers of 2000 and 2002. Fire behavior specialists indicate that the recent trend toward more extreme fires is due in part to the significantly higher fuel loads, from high densities of small trees, than historically occurred (Omi, 1997). Many veteran firefighters reported that they had never seen such extreme fire behavior in the 20-30 years that they had been working in fire suppression (personal conversation, Rapp; personal conversation, Sandman).

Eyerly Fire on the Sisters Ranger District, July 2002

Forest conditions that reduced extreme fire behavior was also observed on local wildfire in 2002. Most notable was the change from a rapidly advancing crown fire during the Cache Mountain Fire, to a less intensive ground fire against the Black Butte Subdivision in a recently thinned stand (personal observation and personal conversation, Cache Mountain Fire Fighters, The Bulletin, Cache Mountain close-out report, 2002). In recent studies (Omi 1997, Graham et al., 1999, Omi and Martinson 2002) thinning has been demonstrated to be an effective tool in reducing wildfire intensity and severity.

Management Direction

The goals and objectives for fire management from the Metolius Late-Successional Reserve Assessment (1996, Appendix 1) are to:

- Protect and sustain late-successional habitat.
- Reduce the current risk of loss of late-successional habitat from large-scale, high intensity wildfires.
- Begin the process of reintroducing fire into fire-adapted ecosystems to improve, sustain and develop late-successional habitat in the long term.
- Develop fire suppression strategies that protect human life and property while protecting and sustaining late-successional habitats and components.

The Sisters Ranger District is continuing to implement a long-term strategic fuel reduction and forest health plan across the District. The District plan has involved vegetation and fuel management both at the landscape-scale and in focused, strategic zones (i.e. cross-District fuel breaks and defensible space around communities). Improving forest health and reducing the risk of catastrophic loss from wildfire, insects or disease is well supported by direction in the Deschutes National Forest Land and Resource Management Plan and recommendations from the Metolius Late-Successional Reserve Assessment and Watershed Assessment.

VALUES AT RISK, AND FIRE RISK/SEVERITY ANALYSIS

Metolius Basin at Risk

The threat of wildfire is a national, regional and local concern. The Integrated Natural Fuels Management Strategy (USDA 1998) stated that 31% of the Deschutes National Forest was at "abnormally high risk from large stand replacement insects, disease outbreaks and wildfires", predominately in the ponderosa pine, and dry mixed conifer dry forests, and that "fire behavior has become increasingly unpredictable within plant associations that historically had periodic, low intensity fires." The Central Oregon Partnerships for Wildfire Risk Reduction (2002) found that, in Central Oregon, wildfires threaten people and property, timber resources, ecosystem and forest health objectives, tourism and recreation areas, and critical plant and wildfire habitats, and that vegetation conditions in many Central Oregon forests are not natural.

Wildfire Risk

Not all risk of wildfire can be eliminated, and some level of risk must be accepted. But where values are high and risk ca not be sufficiently reduced, then the hazard or severity of wildfire must be reduced.

(Omi, 1997, "Fuels Modification to Reduce Large Fire Probability")

Local resource management agencies have developed a "condition class" map for Central Oregon (USDI, BLM, 2001). "Condition class" measures the degree of departure from the historical fire regimes that a site has experienced. Condition class 1 is applied to areas at or near expected conditions (areas that are consistent with inherent fire regimes). Condition class 2 describes areas that have missed 1 to 2 fire cycles, and condition class 3 areas have missed 3 or more fire cycles or have species or structural characteristics that are significantly different from their historical range. Forests in the project area were within the Condition Class 3, which indicates a potential extreme accumulation of fuels, leading to an increased risk that normal surface fires would become catastrophic stand-replacing wildfires (Central Oregon Intergovernmental Council, 2002)

In August of 2001, the US Department of Agriculture and Department of Interior published a list of communities in the vicinity of federal lands that are considered to be "at high risk from wildfire." Camp Sherman, within the project area, appears on this list (Federal Register, August 2001).

Values at Risk

There are numerous values at risk to impacts from wildfire in the project area, including residents and homes in the Camp Sherman area, summer homes, resort properties, developed recreation sites and numerous dispersed recreation sites. There are also several large private commercial timberland parcels within or adjacent to the project area. Wildfires in the summer of 2002 on the Sisters Ranger District have demonstrated the high risk to communities and residences in forested areas, with 20 homes burned in the Three Rivers subdivision during the Eyerly Fire and 2 homes burned in Black Butte Ranch during the Cache Mountain Fire. In addition, 1,000's of acres of private forest land was burned (Files for the Eyerly and Cache Mtn. Fires, Sisters Ranger District).

Habitat for late-successional species is also at risk from severe wildfire. Both the Northwest Forest Plan (1994) and the Draft Spotted Owl Recovery Plan (1992) recognized the increased risk of fire in this part of Oregon, and the subsequent risk of losing habitat. "The potential for large-scale loss of owl habitat from fire is higher here than for any other Oregon province, and is considered a severe threat (pg. 149, Draft Recovery Plan for the Northern Spotted Owl, 1992). In the Eyerly, Cache Mountain, and Cache Creek fires approximately 6,200 acres of Late Successional Reserves burned. Much of these acres lost habitat that was suitable for late-successional species associated with dense, interior forest conditions, and approximately 25% of these acres burned at such a high severity that left little suitable habitat for late-successional species, expect those which can survive in early seral conditions and highly disturbed areas (e.g black backed woodpeckers)

Other natural resources at risk from wildfire impacts include soil productivity, water quality, scenic values, heritage and recreation resources.

Fire Risk/ Severity Analysis

A hazard risk analysis is an evaluation of the potential for a wildfire occurrence and the risk of the fire affecting resources, human safety and property. The analysis evaluates numerous factors, including *hazards* (fuel loadings, current stand conditions and mortality), *risks* (recreational use, private property location, plantation locations, lightning fire trends, and human-caused fire trends), and fire *intensity* (fuel loadings and stand conditions, weather conditions, presence of ladder fuels and their potential to move the fire from the ground into the crowns of the trees, and presence and species of brush).

Wildfires occur when environmental conditions (weather, topography, and fuels) are favorable for the spread of fire following an ignition. These factors affect fire intensity and duration, effects on resources, and difficulty of wildfire suppression. Of the three components of the fire environment, only fuel loading and arrangement can be changed through management actions.

The Metolius Late Successional Reserve Assessment (1996) determined the majority of the project area to have a moderate to high risk of fire due to the high fuel levels and the high amount of human use (pgs. 100-112). The only area found to have a low risk of fire was along the scarp of Green Ridge, due to less human use. Late-successional forests in the project area are currently at risk from stand-replacing crown fires, events that would have been rare under the historic low-severity fire regime. Forest structure can be managed to reduce the severity of fire events (Agee, 1996, Omi 1997, Graham et al., 1999, Omi and Martinson 2002).

Three categories were used to rate stands within the planning area for expected fire severity under the most probable burning conditions (Table 3-4):

- **Non-lethal:** Less than 30 percent of the basal area or less than 10 percent of the canopy cover would be killed by the fire.
- **Mixed:** Between 30 and 80 percent of the basal area or between 10 and 90 percent of the canopy cover would be killed by the fire.

Non lethal burn through a thinned stand, Cache Mtn Fire, 2002

Surveying the effects of a stand replacement fire on the Sisters Ranger District, 2002

- **Stand Replacement:** Greater than 80 percent of the basal area or greater than 90 percent of the canopy cover would be killed by the fire.

These classes were determined using the following data: stand structure (number of layers), species composition (early-, mid-, or late-seral), dominant size class of trees, tree canopy cover, percent slope, and brush cover. The Ochoco Viable Ecosystems Model (USDA Ochoco National Forest, 1994) was used to make an initial classification of the severity class. Then, canopy cover was considered by making a requirement that to fall into the Stand Replacement category a stand must have at least 30 percent canopy cover. Slopes over 30 percent moved a stand from Mixed Severity to Stand Replacement classification. Finally, brush cover was examined on a site by site basis to see what effect it would have on classification.

Table 3-4. Number of Acres and Percent of Planning Area by Fire Severity Class.

Fire Severity Class	Acres of Project Area	Percent of Area
Non-Lethal	472	3
Mixed Severity	6732	46
Stand Replacement	7468	51
TOTAL	**14672**	**100**

Figure 3-4 shows the distribution of the fire severity classes over the planning area. This map indicates that there are several contiguous areas with a risk of Stand Replacement fire- one in the central portion (including Camp Sherman), one in the northern portion, and one in the eastern portion. Areas rated as Mixed Severity connect these areas.

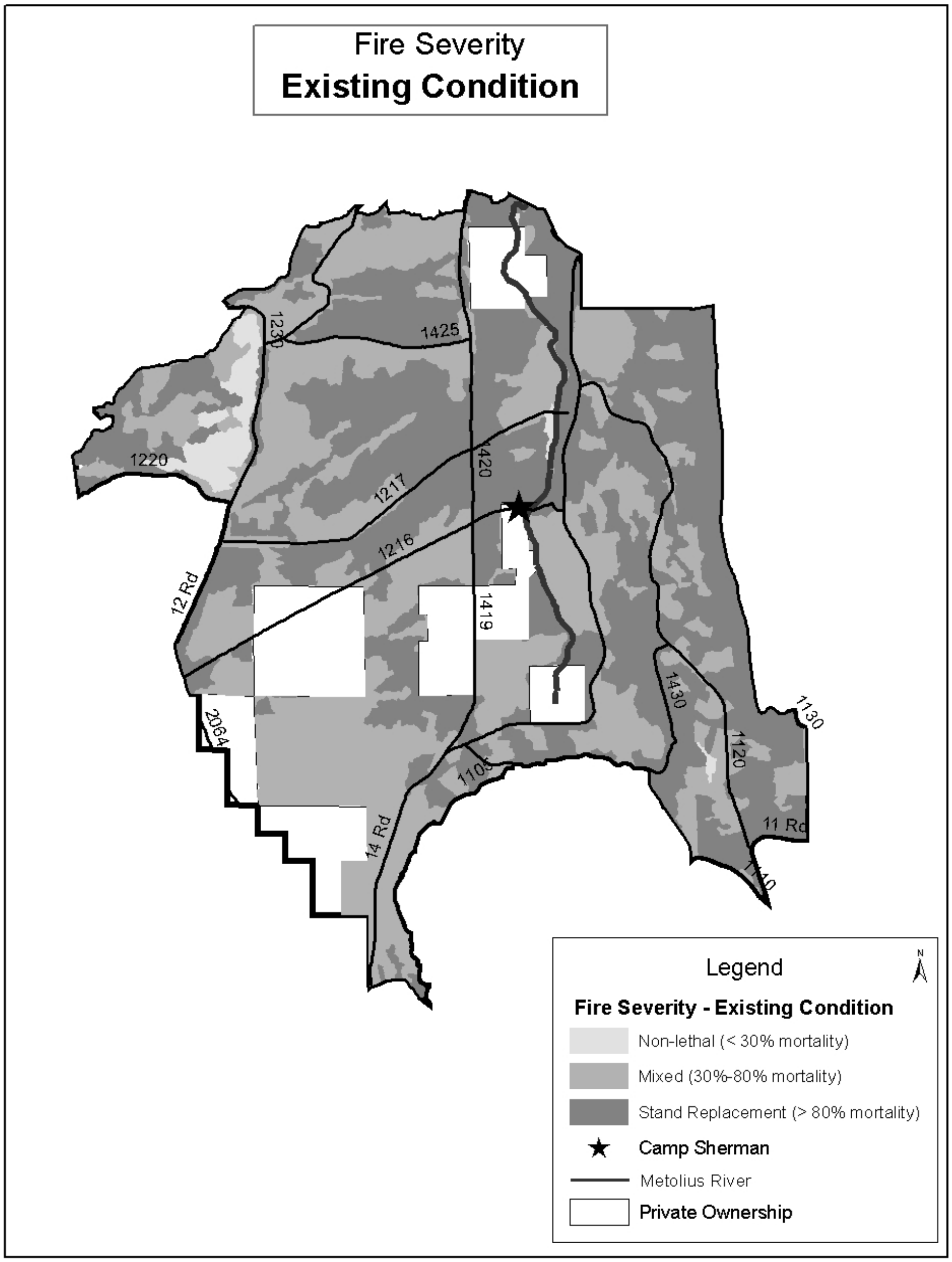


Figure 3-4. Existing Predicted Risk of Wildfire at High, Mixed and Low Severity.

Defensible Space and Wildland Urban Interface

Fire in the wildland urban interface is a major concern in this project area. High fuel levels (brush, dense stands of small trees, and snow-damaged trees) surround the community of Camp Sherman and can increase the risk of severe wildfire effects. Hazards are compounded by the proximity of homes and recreational sites visited by the thousands during the summer (the peak fire season).

Proposed treatments would aid in reducing hazards by creating "defensible space" corridors of reduced fuels for approximately 1200 feet around high human use areas (residential areas , campgrounds, recreational attractions), and for approximately 600 feet along the main routes into the Basin (figure 3-5). The defensible space corridors are intended to be an area where fire intensity is reduced and can more safely be suppressed. The corridor of reduced fuel, in combination with landscape-level treatments, will provide a better chance for fires to stay low to the ground, and burn at a lower intensity. These are the types of fires that can be most successfully suppressed, tend to do the least damage to forest resources, and can be beneficial to a fire-adapted ecosystem like the Metolius Basin.

Fuel reduction activities in this defensible space corridor would generally be planned as part of the landscape level thinning in the remainder of the project area. However, in areas where landscape-level or stand level fuel reduction are not planned (usually to protect special habitats, such as for spotted owl or along riparian areas) fuels would still be reduced in this defensible space corridor, except within a few sections along Forest Road 1217 due to sensitive spotted owl habitat.

House adjacent to National Forest lands in Metolius Basin

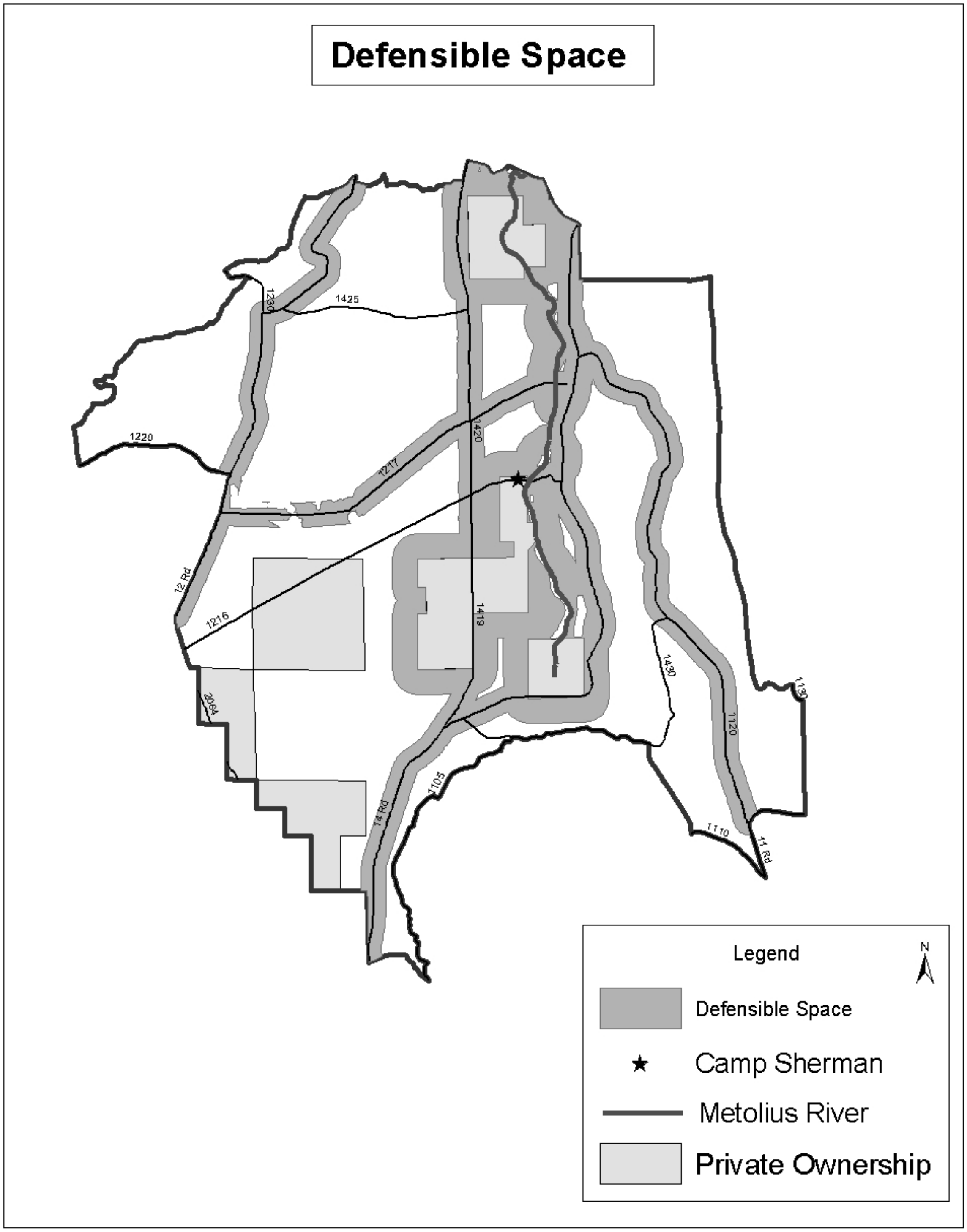


Figure 3-5. Location of Defensible Space Zones.

AIR QUALITY

Standards

The Clean Air Act is intended to protect and enhance air quality while ensuring the protection of public health and welfare. The Act established National Ambient Air Quality Standards, which must be met by state and federal agencies, and private industry. The Act designated several classes of airsheds. Class 1 airsheds are given the most protection from human caused air pollution in order to protect their pristine character. The Mt. Jefferson Wilderness, to the west of the project area about 3-4 miles, has a Class I Airshed. Prescribed fire plans may be written so that smoke intrusions into Class I airsheds would be mitigated, either by avoidance or through dispersion. However, since the predominate wind pattern is from the west toward the east, there is low risk of smoke from prescribed fire in the project area significantly affecting the Mt. Jefferson Wilderness. In the case of wildland fire, no control over smoke direction or dispersion would be possible and the volume could be much greater than that from prescribed burning (Huff et al. 1995).

Prescribed burning operations on the Deschutes National Forest are in compliance with the Oregon State Implementation Plan for Visibility Protection (SIP). The SIP restricts burning activities between July 1 and September 15 adjacent to the Mt. Jefferson Wilderness.

Potential Health Effects

Smoke, the principle impact from burning (whether by prescribed fire or wildfire), relates to temporary visibility reductions and effects on human health. Smoke releases particulates into the atmosphere, potentially affecting the health of forest workers, visitors and nearby residents. According to Clean Air Act of 1977 and 1990, Federal Land Managers will attempt to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare". The critical pollutant thought to effect human health is particulate matter emitted in smoke that is less than 10 microns (PM10). Due to their very small size and weight, PM10 can remain airborne for weeks. Over ninety percent of smoke particle are less than 10 microns.

Wood smoke has been documented to be mutagenic, which can be a precursor for cancer (Boutcher, 1992). Exposure to PM10s aggravates chronic respiratory diseases such as asthma, bronchitis and emphysema. Burning debris will release carbon dioxide and water, criteria pollutants (those pollutants regulated by the EPA under the Clean Air Act), and hazardous air pollutants or "air toxins". Some air toxins are known to be carcinogenic.

Potential health effects may be more acute for persons with respiratory or cardiovascular disease who are unable to tolerate the additional stress imposed on their respiratory systems by exposure to smoke.

There have been concerns expressed on a regional scale (not in regards to this project) about increased CO2 in the atmosphere, particularly if prescribed fire were to be applied on a landscape-scale (USDI-USDA, 1995).

The Deschutes Basin currently meets EPA standards for PM10 levels. This means that in a 24-hour period the concentration of PM10s does not exceed 150 micrograms per cubic meter more than once per year. The Deschutes Basin has approached these levels, but primarily during November through February due to home heating with wood stoves.

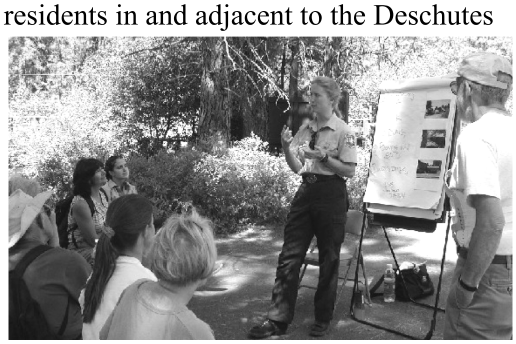
Visibility

Another impact from smoke is reduced visibility, which can negatively affect scenic quality within the Metolius Basin and Camp Sherman. Reduced visibility from prescribed fire is generally a short-term impact and does not occur for more than 1-3 days. Smoke from wildfires is much less predictable, but recent experience from the Eyerly and Cache Mountain fires during the summer of 2002 found light to heavy smoke in the communities of Central Oregon for more than three weeks. Several communities near larger western fires in 2002, including the Biscuit fire in southern Oregon that burned over 500,000 acres, experienced smoke for over a month.

CURRENT EFFORTS TO ADDRESS FIRE RISK

Fuelwood Collection. Fuelwood collection is permitted for residents in the project area on National Forest lands within 300 feet of their summer home or private lots. The objective was to reduce some of the dead and down fuels adjacent to residences, while utilizing the material. This activity is limited to collection by hand only (no vehicle use).

Education. Resource management agencies and protection services in Central Oregon have provided a variety of educational information to residents in and adjacent to the Deschutes National Forest. On the Sisters Ranger District, a Fire Prevention Technician has been available to coordinate with local communities, including Camp Sherman, on methods to protect private lands from wildfires.



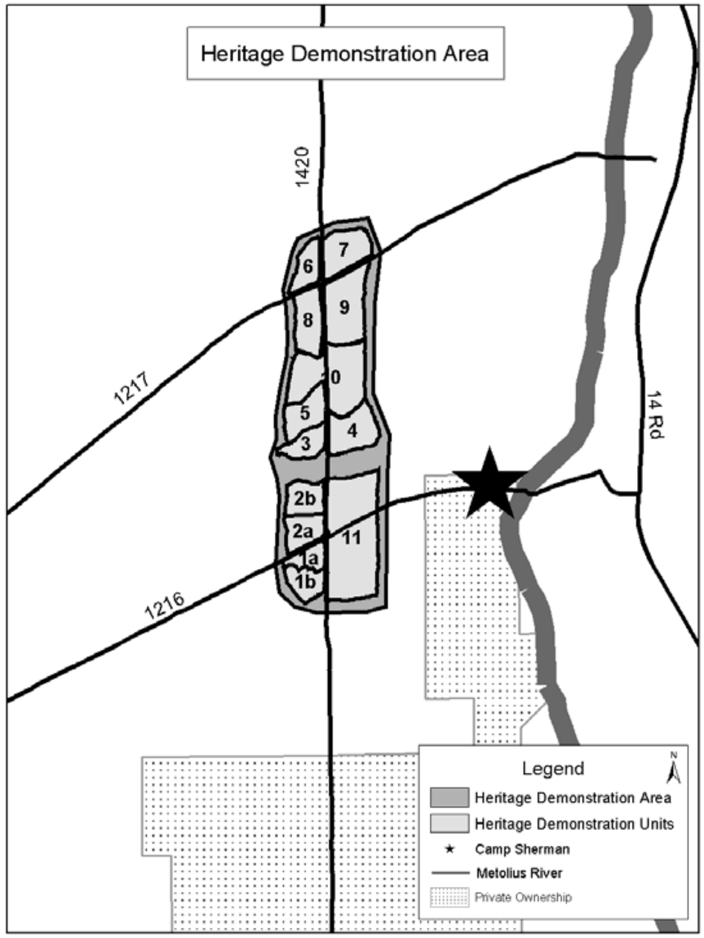


Figure 3-6. Metolius Heritage Demonstration Project map.

Metolius Heritage Demonstration Project. To address local concerns about the need to deal with forest health and wildfire safety, a community group, the Friends of Metolius, approached the Sisters Ranger District and asked us to participate in a unique partnership to demonstrate forest management techniques on a small scale in a highly visible location in Camp Sherman. The objective of the Metolius Heritage Demonstration Project was to increase local awareness and understanding about the methods used in controlling stand densities and fuels, and to show people what the outcomes look like. There are several plots in the 120 acre project area, some not treated so that they act as a control, and several treated with a variety of fuel reduction methods, including tree harvest, small tree thinning, mowing, pruning and burning. Implementation of this demonstration project began in the spring of 2002.

Wildlife

FOCAL SPECIES

The Metolius Late-Successional Reserve Assessment (1996) recommended management of late-successional habitat in the project area focus on the several “focal” species, including the *northern spotted owl, northern goshawk*, *whiteheaded woodpecker, Peck’s penstemon, and bull trout*. Discussions on these species are found under the following sections.

This project area covers a small portion of the Metolius Late-Successional Reserve. The interdisciplinary team identified that late-successional habitat in the project area could best support the late-successional species listed above. The portions of the project area that were identified with the best existing and potential habitat for each of these species is shown on Figure

1-4, in Chapter 1. This helped to guide proposed actions to meet project goals. The majority of the area is in the ponderosa pine plant association and was identified as habitat for White-headed Woodpecker. Mixed conifer stands along the west boundary were identified as spotted owl nesting, roosting, and foraging habitat, and a dispersal habitat for spotted owl was identified along a connectivity corridor on the south and east boundary. Three parcels of habitat were identified for goshawk. Peck's penstemon habitat is primarily coincident with White-headed Woodpecker habitat, and bull trout habitat is along the stream system.

The Metolius Wild and Scenic River Resource Assessment (1997) identified wildlife as an outstandingly remarkable value for the river corridor, based on the presence of threatened, endangered and sensitive species, the presence of a diversity of other species, and the importance as a travel corridor for big game.

THREATENED, ENDANGERED AND SENSITIVE SPECIES

Species, which have potential habitat within the project area, are discussed in this section. All threatened, endangered or sensitive animal species that are either known to occur or may potentially occur on the Sisters Ranger District are listed in Table 3-5. Other species are listed and discussed in the Biological Evaluation for Wildlife, located in the Project Record.

Table 3-5. Threatened, endangered or sensitive animal species that are either known to occur or may potentially occur on the Sisters Ranger District.

Common Name	Federal Listing	Potential Habitat in Project Area
American Perigrine Falcon	S	
Northern Bald Eagle	T	Y
Northern Spotted Owl	T	Y
Horned Grebe	S	
Red-necked Grebe	S	Y
Bufflehead	S	Y
Harlequin Duck	S	
Yellow Rail	S	
Tricolored Blackbird	S	
Western Sage Grouse	S, SOC	
Canada Lynx	T	Y
California Wolverine	S, SOC	Y
Pacific Fisher	S	Y
Pygmy Rabbit	SOC	
Oregon Spotted Frog	PT	Y

E= Endangered, T= Threatened, S= USFS Region 6 Sensitive, C= USFWS candidate species, SOC=USFWS Species of Concern, PT= Proposed threatened.

Northern Spotted Owl

Status: Threatened (both federal and state), Management Indicator Species (Deschutes National Forest)

Nesting, roosting, and foraging habitat Habitat: The northern spotted owl is a Late-Successional Reserve focal species within the project area, and typically lives primarily in old growth and mature forests. Studies on spotted owls on the west side of the Cascade Mountains (where the majority of the population lives) found that typical characteristics of a suitable owl habitat includes abundant dead and down woody material, a medium to high closure of the forest canopy, multiple layers in the forest overstory, and mature trees (generally 200 years or older) or greater than 32 inches diameter (Interagency Science Committee Report 1990). However, spotted owl habitat in forests east of the Cascade Mountains contain habitat that may not typically fit the above definition. Suitable nesting, roosting, and foraging habitat on the Deschutes National Forest occurs in forest stands (regardless of plant association) that have a total canopy cover greater than or equal to 40% and a canopy cover of at least 5% among trees >21″ diameter. This definition assumes that the stand is multi-storied and contains some large trees. An analysis of stand exam and photo interpretation data, and field verification determined that approximately 7% of the Metolius Basin project area meets the definition of spotted owl nesting, roosting, and foraging habitat. Nesting, roosting, and foraging habitat occurs in the mixed conifer and riparian plant associations (but not ponderosa pine). A more detailed description of the nesting, roosting, and foraging habitat definition can be found in the FY2001-2003 Biological Assessment, Appendix A (USDA 2001).

The Metolius Basin project area encompasses portions of four known spotted owl home ranges. Only one “activity center” (the core area in which the owls reside, and is usually centered around a nest tree) out of four is actually located within the project area boundary, along the northwest side. There is no designated Critical Habitat Unit within the project boundary.

Tables 3-6 and 3-7 summarize the existing nesting, roosting, and foraging habitat within each home range, and the amount of habitat (both nesting and dispersal) within the project area. Information about the current nesting, roosting, and foraging habitat was determined by first reviewing the habitat identified through aerial photo-interpretation and documented in the Deschutes National Forest geographic information database (GIS). The information was updated through the use of site-specific stand exams and field reconnaissance. The acres of habitat for each of the owl pairs is below what is recommended for suitable nesting habitat within their home ranges (40% of the home range or 1182 acres is recommended to be nesting, roosting, and foraging habitat) (USFWS 1994).

Figure 3-7. Existing spotted owl nesting, roosting, and foraging habitat.

Table 3-6. Current nesting, roosting, and foraging habitat within each Spotted Owl Home Range.

Owl Pair	1.2 Mile Home Range Radius (2,955 acres)	
	Nesting, roosting, and foraging habitat acres	% of Home Range with Suitable nesting, roosting, and foraging habitat[14]
Canyon Creek	760	26%
Davis Creek	833	28%
Obsidian	1044	35%
Suttle 96	901	30%

[14] The minimum recommended acres of nesting, roosting, and foraging habitat within a home range is 40% of the home range acres

Table 3-7. Acres of Habitat throughout the Metolius Planning Area.

	Total Planning Area Acres[15]	Total Nesting, roosting, and foraging acres	Dispersal Habitat Acres w/ 40% + canopy cover	Dispersal Habitat Acres w/ 30-39% canopy cover
Metolius Basin Project area	14,694	1,059	5,123	3,990

Field Reconnaissance: The Metolius Basin project area was surveyed for spotted owl to protocol (USDA 1993) during 2001 and 2002.

Dispersal Habitat and Connectivity. Currently, 9113 acres (62%) of the project area provides habitat conditions suitable for dispersal of spotted owls, based on the acres of stands with an average canopy cover greater than 30% in the stands with an average size of 11" diameter or greater trees. Approximately 5,123 acres (35%) of these acres have an average stand canopy cover of 40% or greater (typical of forest conditions west of the Cascade Mountains), and approximately 3,990 acres (27%) of these acres have an average stand canopy cover of 30-39% (the density of habitat conditions more sustainable in forests east of the Cascade Mountains).

Connectivity is addressed in the Programmatic Biological Assessment as an important constituent element of habitat where habitats are protected from disturbances or are representative of the historical, geographical, and ecological distributions of the species it is designed for. Functional connectivity, according to Noss and Cooperrider (1994) is measured according to the potential for movement and population interchange of the target species. For spotted owls, connectivity is affected more by the suitability of the overall landscape than by the presence or absence of discrete corridors, because spotted owls disperse randomly (USDA 1990). Corridors have become an important tactic for preserving biological diversity however. Rosenberg et al. (1997) defined corridors as "a linear landscape element that provides for movement between habitat patches, but not necessarily for reproduction". Thus, not all life history requirements of a species may be met in a corridor."

Much of the interior of the project area is ponderosa pine. The ponderosa forest does not provide ideal habitat for spotted owls because of the lower stand densities (and thus canopy covers). U.S. Fish and Wildlife Service and other agency biologists agree that attempting to maintain or develop high stand densities and canopy cover for spotted owls in this plant association may not benefit the owls or forest health. The Sisters Ranger District biologist recommended that these areas be managed to provide habitat for late-successional species that require open-mature forests, and that habitat for spotted owls be managed in the mixed conifer plant associations and along riparian reserves.

At the beginning of the planning process for this project a connectivity corridor, suitable for spotted owl dispersal, was recommended by the District Biologist. The corridor is located through primarily mixed-conifer plant associations and forest stands with the best ability to sustain dispersal habitat characteristics over time. The corridor is also located to provide a

[15] Excludes private lands

connection from the spotted owl activity areas north and west toward the bulk of the Metolius Late-Successional Reserve and the Mt. Jefferson Wilderness (Figure 3-8).

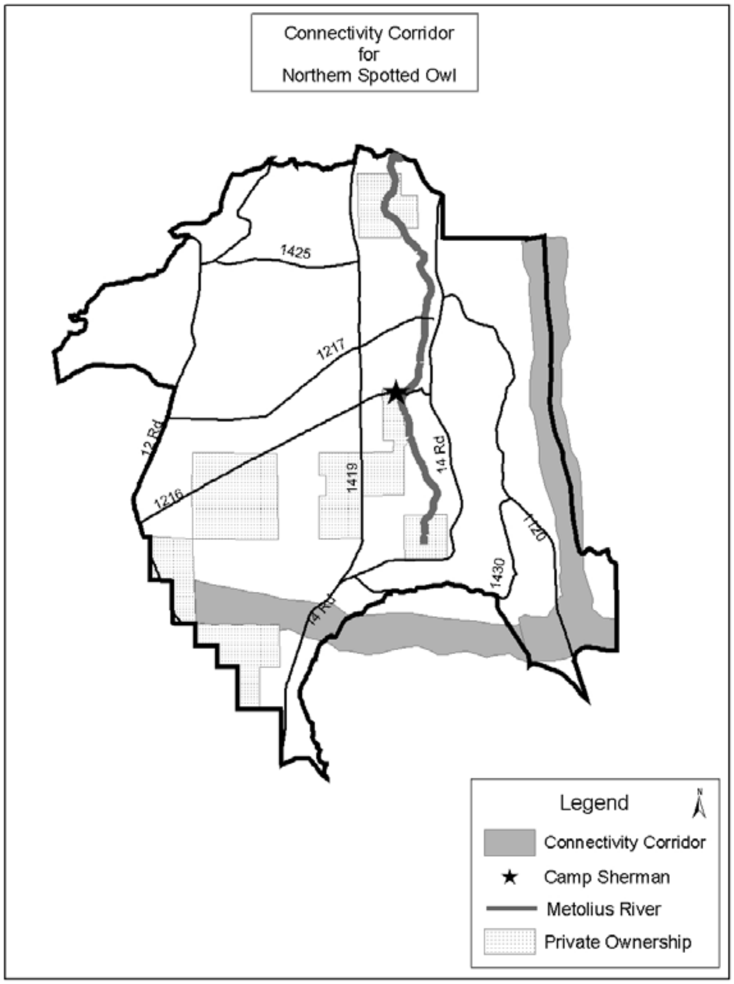


Figure 3-8. Location of Connectivity Corridor for Spotted Owl Dispersal.

To maintain the corridor as dispersal habitat it is recommended that a minimum of 30% canopy closure be maintained to facilitate movement of owls from the Cascades to Green Ridge. The corridor extends outside the project boundary to the top of the Green Ridge along the steeper slopes. Actions that reduce fuel concentrations along the toe of the slope may help reduce the risk of severe effects from wildfire on this habitat, which could result in barriers to dispersal. In addition to the connectivity corridor, suitable dispersal habitat is available for spotted owl and other interior forest species along the riparian reserves (most running east/west, except for the along the Metolius River which runs north-south).

There is an increased risk of losing the remaining suitable habitat by a stand replacing fire event or further degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material (though some snags and down woody material would be created with these events). This may lead to reduced numbers of spotted owl pairs occupying the Late-Successional Reserve due to less available suitable habitat.

Northern Bald Eagle

Status: Threatened (federal and state), Management Indicator Species (Deschutes National Forest)

Habitat. Bald eagles are permanent residents of Oregon. Essential habitat elements for the recovery and eventual de-listing of the northern bald eagle are nest sites, communal night roosts, foraging areas, and perch sites. On the Deschutes National Forest, ponderosa pine and Douglas-fir trees averaging 32 inch+ diameter with large, open limb structure are preferred for nesting. Nests are typically constructed within one mile of rivers and large lakes. Ideal perches are large trees and snags within 330 ft. (100 m) of water (Anthony et al., 1995). Prey items include fish, waterfowl and other birds, small mammals, and carrion (Stalmaster, 1987). Most of the large lakes, reservoirs, and rivers on the Sisters Ranger District provide suitable habitat for bald eagles.

Bald eagle use has been documented within the planning area (district files). One known nest site lies just outside the northern project boundary approximately 1.5 miles. This pair uses the Metolius River as their primary foraging area year round. The project area lies within the High Cascades Bald Eagle Recovery Zone 11 (McAllister and Anderson, 1990).

Surveys have not yet been conducted to determine extensive use of the river and associated uplands. However, incidental sightings have occurred along the Metolius River from the headwaters to the edge of the project boundary. There are no other suitable nesting areas, other than the Metolius River, located within the project area. Foraging is primarily limited to the river due to the small size of the creeks within the project boundary.

Trends/Concerns. Large snag habitat outside of designated areas is very important to retain since most large snag habitat may be lost within the recreation sites.

Canada Lynx

Status: Threatened (federal)

Habitat. The lynx , and its primary prey the snowshoe hare, require a mix of habitat, including dense, multi-layered, early successional stands as a forage base (Layne, 1954; Obbard, 1987; Klenner and Krebs, 1991) and old or mature stands with high canopy closure and large accumulations of down woody material for denning. Travel between denning and forage areas and between other suitable areas is usually located on prominent ridges, through saddles, and along riparian areas. Consistent snow depths are also required for lynx. The majority of lynx occurrences and use occurs above the 4500′ elevation in the Oregon Cascades.

No lynx have been detected in Oregon, and the Metolius Basin planning area does not occur within a designated Lynx Management Unit or Key Linkage Area. One unconfirmed sighting has been recorded just outside the project area in 1986 near the 12 Road near Lake Creek. Another unconfirmed sighting was reported in 1996 approximately 10 miles south (district files). No other occurrences have been reported to date.

The project area consists primarily of ponderosa pine plant associations, which do not provide suitable lynx habitat. The project area does provide some dispersal habitat and opportunistic foraging could occur along riparian reserves and special habitats where forage quality and quantity is increased (Jack and Lake Creeks). However, most riparian areas in the project area do not contain riparian vegetation and are most likely unsuitable.

Bufflehead

Status: Sensitive (USFS Region 6)

Habitat: Buffleheads nest near mountain lakes surrounded by open woodlands containing snags. In many areas, the preferred nest trees are aspen but they will use ponderosa pine and Douglas-fir snags. In Oregon, most nest in artificial nest boxes. This duck eats both animal and plant material. Bufflehead population numbers are generally low in Oregon, perhaps due to a shortage of natural cavities (Csuti et al., 1997).

No bufflehead sightings have been documented in the project area, though surveys have not been conducted for this species. Buffleheads have been sited at Wizard Falls fish hatchery just north of the project area (district files). Potential habitat exists along the Metolius River, especially in open slack water. It is also possible that portions of Jack and Lake Creeks could provide potential habitat.

As with the bald eagle, loss of snag habitat in and adjacent to recreation areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat. Snag habitat along the river in between campgrounds and summer home tracts is important to retain due to the loss of this habitat component elsewhere.

Harlequin Duck

Status: Sensitive (USFS Region 6)

Habitat: Harlequin ducks use rivers, streams, and creeks as feeding habitat and commonly nest in bank cavities and along stream edges. Shrubby riparian vegetation, lack of human disturbance, and loafing sites are important factors for harlequin ducks (Cassirer and Groves, 1989). Harlequins feed primarily on aquatic insects and their larvae (Csuti et al., 1997).

Surveys for harlequin ducks were conducted along the Metolius in 1998, from Jack Creek to Lake Billy Chinook. No ducks were detected during these surveys (Concannon, 1998). Two harlequins were sited near the Wizard Falls fish hatchery bridge during the fall of 2001 (district files). It appears that the Metolius River may be an important stopover during migration.

The Metolius River receives high human use along most of the lower reaches, which may deter use by harlequins for nesting. Currently, there is a hiking trail located along a portion of the river, which has removed vegetation and increased the disturbance potential. The upper river, within the project area, is dominated by gravel and sand, which may decrease foraging success. The Metolius River also lacks abundant loafing sites, which may also deter use. Without adequate loafing sites within the river, the ducks would need to access the banks more frequently. And because human use levels are high, this may lead to limited use along most of the river within the project area.

Oregon Spotted Frog

Status: Proposed Threatened (federal)

Habitat: Spotted frogs generally inhabit warm (>20ºC) perennial marshes, lakes, ponds, or slow moving waters with abundant aquatic vegetation (Corkran and Thoms, 1996). This species is most often associated with non-woody wetland plant communities with sedges, rushes, and grasses (Leonard et al. 1993). They require very shallow water for breeding, and often use flooded meadows or water trapped in flattened vegetation at the edges of ponds. Populations have been reduced throughout much of their range due to wetland reclamation and introduction of non-native amphibian and fish species (Leonard et al., 1993; Corkran and Thoms, 1996).

The project area contains streamside riparian habitat along Lake, First, and Jack Creeks and the Metolius River along with other riparian habitats like springs found in Allingham meadow. However, suitable habitat for spotted frogs is minimal in the project area. Water temperatures are generally too cold and emergent wetland vegetation is absent except in isolated areas. There are no known occurrences of spotted frogs on the Sisters Ranger District.

Few surveys have been conducted in the project area, mostly along Jack Creek. No spotted frogs were found.

California Wolverine

Status: Sensitive (USFS Region 6), Species of Concern (USF&W Service), and Threatened (State of Oregon), Management Indicator Species (Deschutes National Forest)

Habitat. Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. Habitat use is probably dictated largely by food availability; wolverines are primarily scavengers, but also depend on a variety of prey items. High elevation wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. In winter, they tend to den in the ground under snow or in rocky ledges or talus slopes (Ingram 1973; Banci 1994). Wolverines make little use of young, thick timber and clear-cuts (Hornocker and Hash 1981).

Wolverines appear to be extremely wide-ranging and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. For these reasons, Hornocker and Hash (1981) concluded that wolverine populations should be treated as regional rather than local.

No wolverine studies have been conducted in the Central Cascades. Several historic sitings have been documented in and around the project area. One siting occurred just outside the project area near Suttle Lake, while the remainder of nearby sitings occurred within the Mt. Jefferson and Mt. Washington wilderness areas. A potential den site was located south of the project area during the 1998 flight, but nothing was detected during a 1999 flight, and wolverine were not detected when an infrared camera was used near the wilderness boundary. No other surveys were conducted for this species.

Much of the project area may not be suitable for wolverine use due to habitat fragmentation from roads, low elevation ponderosa pine forests, and heavy recreation use.

Pacific Fisher

Status: Species of Concern (USF&W Service), Sensitive (USFS Region 6)

Habitat. Fisher populations are considered to be extremely low in Oregon, Washington, and parts of the Rocky Mountains. On the eastside of the Cascades, fisher occur at higher elevations in association with true firs and mixed conifer forests. They tend to prefer areas with high canopy closure and late-successional forests with relatively low snow accumulations. Critical features of fisher habitat include physical structure of the forest and prey associated with forest structure. Structure includes vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, down woody material, and layers of overhead cover.

Habitat quality inside the project area may not be ideal but habitat does exist. Nesting, roosting, and foraging habitat for spotted owl also provides suitable habitat for fisher. Existing suitable habitat is minor in the project area and fragmented. Most of the existing nesting, roosting, and foraging habitat is found in the mixed-conifer wet plant association between First and Davis Creeks. There are scattered patches along Green Ridge and the base of Black Butte but these are small in size and isolated. These patches are dominated by ponderosa pine that may not be suitable for fisher. Vertical and horizontal structure complexity may not occur to the level preferred by fishers. Snow accumulations also tend to be fairly deep in this area and may deter use by fisher. Field reconnaissance has not been conducted for this species.

MANAGEMENT INDICATOR SPECIES

Table 3-8. Management Indicator Species and Species of Concern.

BIRDS		MAMMALS	
Species	**Status**	**Species**	**Status**
Northern Goshawk*	MIS, SOC	Bats*	SOC/MIS
Coopers Hawk*	MIS	Elk*	MIS
Sharp-shinned Hawk*	MIS	Marten*	MIS
Great Gray Owl*	MIS	Mule Deer*	MIS
Great Blue Heron*	MIS		
Cavity Nesters*	MIS		
Waterfowl*	MIS	**MOLLUSKS**	
Red-tailed Hawk*	MIS	**Species**	**Status**
Osprey*	MIS	Crater Lake Tightcoil*	Survey and Manage
White-headed Woodpecker*	MIS		
Flammulated Owl*	MIS		
Neo-tropical Migrants*	MIS		

MIS = Management Indicator Species, Deschutes National Forest LRMP
SOC = USFWS Species of Concern
* = Occurs or potentially occurs in project area.

Goshawk

The northern goshawk is a focal species within the project area, and within the Late-Successional Reserve. The goshawk is also listed as a state species of concern.

Habitat: This species is associated with mature and old growth forests. All mature and late-successional habitats are considered potential *nesting* habitat and all other forested seral stages are considered potential *foraging* habitat. Moist mixed conifer and moist ponderosa pine late-successional areas are preferred habitats. Preferred nest stands have a minimum of 40% canopy cover. Nest sites within these stands typically have greater than 60% canopy closure (Reynolds et al., 1991).

Potential nesting habitat coincides with spotted owl nesting, roosting, and foraging habitat which is located primarily along the scarp of Green Ridge and in the western portion of the project area. However, managing for goshawk and spotted owl habitat in or near each other is not recommended because goshawk will prey on the spotted owl. Additional goshawk nesting habitat occurs outside spotted owl nesting, roosting, and foraging habitat, primarily in the mixed conifer wet and dry plant association and along riparian reserves.

Three areas were identified within the project area to be managed for goshawk habitat (Figure 1-4, Chapter 1). Area 1 lies near Jack Creek and Forest Road 12. Area 2 is centered around current nesting habitat near First Creek, and Area 3 is located between private lands along Lake Creek. Each of these three areas represents a home range for one pair (Table 3-8). Only part of Area 1 home range lies within the project boundary.

Table 3-9. Goshawk Areas and Associated Acres.

Area	Name	Acres w/in the Project Area
Area 1	Jack Creek	184 acres
Area 2	First Creek	431 acres
Area 3	Lake Creek	413 acres

There is one known nest site located in the project area in Section 9. It is suspected that this site has not been active since 1995, though there were no surveys conducted to verify this until 2001. Three additional nest sites are located just outside the project boundary in Sections 30, 31 and Section 7 (district files). Protection of core nest sites (that have been active within the last 5 years) is required (Draft Interim R6 Goshawk Management Direction). It is recommended that a 30-acre core area along with 2 alternative nest areas be identified for each site, as well as a 390-acre post-fledgling area. Therefore, the sites located outside the project area may have part of their post-fledgling area designated within the project boundary.

Table 3-10. Goshawk Habitat in the Metolius Basin planning area.

Habitat Type	Foraging Habitat	Nesting Habitat
Acres	1888 acres	337 acres

The planning area was surveyed in 2001 and 2002 to protocol (USDA 1992). No goshawks were detected on the survey.

Trends. It is recommended that management actions be designed to promote future nesting and foraging habitat for goshawks. Nesting and foraging habitat are not static and in the short term (less than 50 years), may be reduced in quality or lost due to environmental factors such as insects, disease or wildfires. Much of the existing habitat has an increasing amount of white fir, is overstocked, and in some areas, has a high occurrence of disease. It is predicted that mixed conifer stands may continue to lose large ponderosa pine, and Douglas-fir trees would be replaced by white fir. Canopy closure of these stands may be sufficient for goshawks, however large structure would be sparse over the landscape and may reduce potential nesting habitat.

White-headed Woodpecker and Flammulated Owl

The white-headed woodpecker is a focal species in this project area, and was identified as a focal species for both the Metolius Basin Watershed Analysis and the Metolius Late-Successional Reserve Assessment. Goals for both documents (Landscape Area 2 in the Metolius Watershed Assessment and Strategy Area G in the Late-Successional Reserve Assessment) are to manage for late-successional habitat that is primarily fire-climax ponderosa pine. Another goal is to manage to provide stands dominated by large pine with open understories. These goals are consistent with managing for suitable white-headed woodpecker habitat.

Both the white-headed woodpecker and flammulated owl are discussed together because they have many of the same habitat requirements.

Habitat. The flammulated owl and white-headed woodpecker live in ponderosa pine and mixed conifer dry habitats. Their preferred habitat is typically a mosaic of open forests containing mature and old growth ponderosa pine and Douglas-fir trees, interspersed with dense patches of younger trees that provide roosting areas for the flammulated owl. All stands with a significant component of mature and old growth trees are considered potential habitats. This owl nests in medium to large snags (12″ to 25″ diameter) in cavities created by flickers or pileated woodpeckers. It forages primarily on arthropods and other insects (USDA(b) 1994). The white-headed woodpecker nests in large diameter snags (>1/ac 25″ diameter or greater) with moderate to extensive decayed wood. It relies heavily on seeds of conifers (primarily ponderosa pine) to supplement their diet of insects from tree bark and lichens (Dixon, 1995; Frenzel, 1999). Open pine forests are becoming limited within the project area due to high stand densities. Currently there are 2,294 acres of suitable habitat available within the planning area.

A white-headed woodpecker study was initiated in 1993 through 1995 by Rita Dixon (1995) to determine important habitat characteristics for this species. The Metolius Basin was one of her study sites. It was later followed up (1998-2001) by the Nature Conservancy (Richard Frenzel). Multiple nests were located in the Basin from these efforts, most between the Forest Roads 1419/1420 and just east of the Metolius River to the base of Black Butte. However, white-headed woodpeckers may be using marginal habitat according study results.

Within the Metolius Basin project area white-headed woodpecker was determined by looking primarily at four factors: percent canopy closure, size class of existing trees, number of canopy layers, and the number of large trees over both 21” and 32” diameter. This information was gathered from stand exam data where available. If it was not available from stand exams, photo interpretation data was used. White-headed woodpecker habitat was considered to exist in the ponderosa pine dry, ponderosa pine wet, mixed conifer dry, and mixed conifer wet plant associations where species composition must be early or mid seral for the mixed conifer dry and mixed conifer wet plant associations. Table 3-11 shows the stand parameters that were used to delineate white-headed woodpecker habitat.

Table 3-11. Parameters used to delineate white-headed woodpecker habitat.

Percent Canopy Cover	Size Class	No. of Canopy Layers	No. of medium to large trees
20-30%	> 8” diameter	1 or 2	Minimum of 10 trees > 21” diameter, or 2 trees/acres > 32” diameter

No flammulated owl sightings have occurred inside the project area. However, two sightings were detected in 2001 just outside the project boundary, and the likelihood of additional detections is high (district files).

Continued fire suppression, which has resulted in denser and taller shrubs, has resulted in unsuitable conditions for both species. This limits the available forage base for the owl by decreasing the diversity of forest floor plants, which may discourage some arthropods and other insects from occupying these sites. It also hinders foraging attempts due to the somewhat limited maneuverability of flammulated owls (USDA(b) 1994). Increased shrub layers may also lead to an increase in small mammal densities which could lead to increased predation on white-headed woodpeckers (Frenzel, 1999).

Trends/Concerns. Increased stand densities perpetuate loss of large tree structure over time, which both species require for nesting and foraging. It also reduces available nest sites, which could result in more competition for existing sites between species and may lead to greater predation risks. Increased stand densities may also increase the risk of loss from fire. Both species require snags for nesting and both utilize softer snags (moderate decay). These structures would be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

Big Game

*Winter Range***.** Most (60%) of the project area is identified as biological deer winter range in the Deschutes National Forest Integrated Fuels Strategy (1998), though it is not located in a deer land management allocation under the Deschutes National Forest LRMP. The Oregon Department of Fish and Wildlife consider this area important habitat for mule deer. Table 3-10 shows the acres of deer habitat in the project area. There are no Key Elk Habitat Areas within the project area, though elk are commonly observed wintering here. Water, an important habitat element for big game, is not limited in the project area except on the scarp of Green Ridge.

Table 3-12. Deer habitat acres.

Deer Habitat Type	Acres of Habitat
Winter Range	10,155 acres
Summer Range	2,209 acres
Transition Range	4,651 acres
Management Area 7 (LRMP allocation)	0 acres

Ecological Types and Site Potentials. An evaluation of suitable deer habitat (primarily bitterbrush and other browse plants) was completed by determining the different ecological types (ecotypes) in the project area. Ecotypes were mapped using information on soil types and the "potential natural vegetation" (the climax vegetation that would occur on a site when natural disturbance events are allowed to occur), site productivity, fire risks, expected shrub recovery times and seral stages, and conversion potential to less desirable species.

Of the 4 ecotypes identified for the Metolius Basin project area, only ponderosa pine sites show the potential to produce bitterbrush in the amounts needed for winter range requirements. However, only about 60% of the identified winter range is located in this ecotype. The other 40%

of winter range consists of the mixed conifer moist ecotype. Bitterbrush is not considered potential natural vegetation for this ecotype, though snowberry, which is present in minor amounts in the mixed conifer ecotype, may offer similar palatability for deer. The mixed conifer ecotypes also are located along the urban interface in the project area where there is high human use. As such, the urban interface is used less by big game than other areas. Due to the limitations of the mixed conifer ecotype, the planning team recommended focusing management of deer winter range within the ponderosa pine ecotype (approximately 10,200 acres). For more information on the ecotypes, see the discussion under Soils, and Appendix D.

In years of light snowfall, many deer and elk will stay in the lower elevations. In heavy snow years, most deer and elk move out of the Metolius Basin to the Crooked River National Grasslands and private lands, and north to the Warm Springs Reservation.

Transition and Summer Range. The remainder of the project area is suitable transition and summer range. The transition range is a narrow strip along the western portion of the project area. Observations by District biologists and local residents indicate very little use of the "transition" range by either deer or elk.

Hiding Cover. The Deschutes National Forest Land and Resource Management Plan (1990) states that hiding areas must be present over at least 30% of National Forest land and will be dispersed throughout areas where management actions occur (see specific guidelines about hiding cover under Mitigation Measures, Chapter II). The amount of hiding cover in the Metolius Basin project area was determined using stands with 30% canopy closure or greater. Approximately 10,175 acres, or 69% of the stands within the project area meet that definition. Hiding cover is present in dense forest stands, ponderosa pine thickets, and along riparian reserves. Due to increased stand densities, even ponderosa pine stand contain hiding cover from the abundant amount of small trees. These provide hiding cover until the bottom limbs disappear leaving only the boles. However, even the boles break up visual continuity and provide some hiding cover. Patch size varies but most stands contain a mosaic of small tree thickets and larger trees. Therefore, hiding cover is abundant within the project area. Mixed conifer stands provide both hiding and thermal cover.

Management of Deer Habitat in a Late Successional Reserve. The project area lies within the Metolius Late-Successional Reserve. Management direction in a Late-Successional Reserve is to manage for species associated with late-successional forest conditions. The Northwest Forest Plan states that, when in conflict, the Late Successional Reserve standards and guidelines will take precedent over LRMP standards and guidelines. Big game (deer and elk) can use late-successional habitat, but do not require late-successional conditions. Further, managing forest conditions in the Metolius Basin project area to fully meet the Deschutes National Forest LRMP standards and guidelines for deer habitat (particularly hiding cover) may be contrary to managing for certain late-successional species (particularly white-headed woodpecker) and to reducing the risk of loss of habitat to insects, disease or wildfire. It is felt the standards and guidelines can be met for big game, but it would not be an emphasis when site-specific conflict may occur between habitat for big game and habitat for late-successional species.

Calving and Fawning Habitat. The Metolius Watershed Analysis (1996) recommended that riparian reserves that are important calving and fawning habitat be increased to 1000-2000 feet wide to provide adequate cover. The Watershed Analysis also recommends designating wider riparian reserves to maintain or develop big game cover. Lake Creek, a known calving area, is made up of a complex of riparian reserves from a series of winding channels. Mitigation in this project would protect clumps of dense vegetation between the Lake Creek channels to provide habitat. Since the riparian reserves merge in this area to provide a riparian area up to 1,000 feet wide or more, this project analysis does not recommend increasing this width. Reducing fuel levels in the drier uplands of the riparian areas can help sustain the long-term habitat suitability of the riparian reserve, but it is recommended that changes not be continuous (unless they are low intensity, such as small tree thinning) but provide a diverse mosaic of vegetation throughout the reserve.

Trends/Concerns. There is risk to available forage and cover for big game from a landscape level wildfire due to increased stand densities and suppression of fire. Other concerns about big game habitat are increasing pressures from recreation use, disturbances to animals from increasing Off Road Vehicle use, high road densities and habitat fragmentation. Winter use of the area is also increasing which results in increased stress levels in animals during critical periods.

Road density is another key element that can affect big game habitat and use. Though the Deschutes National Forest Land and Resource Management Plan indicates a guideline road density of 2.5 miles/sq. mile, actual road densities are considerably higher with 3.6 miles of open roads.

Cooper's Hawk

Habitat. Cooper’s hawks will occasionally prey on small mammals, and are generally found in densely wooded coniferous forests and, to a lesser degree, in deciduous woods. They select nest sites in dense second growth of mixed conifer and ponderosa pine stands usually near water (Jackman and Scott, 1975).

Forest stands with 9 to 21″ diameter trees have the greatest potential as suitable habitat. No nests have been located to date inside the project area. However, one was located in 2001 just outside the project area in Section 26 (district files).

Trends/Concerns. Habitat conditions are expected to remain the same for the short-term. Increasing stand densities may increase the potential habitat over time. However, the highest density stands are at the greatest risk of loss due to competition stress and high fuel loads. Loss of these dense stands would result in reduced availability of suitable habitat in the project area.

Sharp-shinned Hawk

Habitat: Suitable habitat usually includes thickets in mixed conifer and deciduous woods. It routinely uses dense cover to escape detection by predators or from being harassed (Jackman and Scott, 1975).

Nesting habitat has been grouped into 3 types (Reynolds, 1976): young, even-aged conifer stands with single-layered canopies; mature, old-growth stands of mixed conifer with multi-layered canopies; and dense stands of aspen. Nests are usually located in cool, moist, well-shaded stands with little (<10%) ground cover. Sharp-shinneds usually place their nests in the densest portion of the canopy.

Forest stands with 9 to 21″ diameter trees have the greatest potential as suitable habitat. No known nests have been located to date. However, an alarm call was detected along the scarp of Green Ridge (district files). This area has the potential to be a nest core area. Further surveys are needed to determine if a nest is present or not.

Trends/Concerns. Habitat conditions are expected to remain the same for the short-term. Stand densities would continue to increase due to white fir encroachment. This would increase the potential habitat over time. However, the highest density stands are at the greatest risk of loss due to competition stress and high fuel loads. Loss of these dense stands would result in reduced availability of suitable habitat in the project area.

Red-tailed Hawk

Habitat. The red-tailed hawk inhabits mixed country of open areas interspersed with woods. They roost in thick conifers and nest in large conifer snags often in the tallest tree on the edge of the timber. They feed mainly on small rodents (mice, squirrels) but eat larger mammals (skunks, rabbits), birds, reptiles, and insects (Jackman and Scott, 1975).

Past harvest activities have produced habitat conditions favorable for red-tailed hawks by openning stands adjacent to mature and late-successional stands. This has provided open areas for foraging adjacent to potential roosting and nesting habitat. No known nests have been located within the project area.

Trends/Concerns. Suitable habitat may decrease as stands become more dense, reducing foraging opportunities and increasing the risk of a large scale fire event occurring, which may result in a loss of large snags and structure. This would reduce both existing and future nesting habitat.

Great Gray Owl

Habitat: The great gray owl is usually associated with meadows in conjunction with late-successional habitats. Mixed conifer/lodgepole pine/mountain hemlock communities associated with meadows are considered habitat for this species. Recent studies in the Blue Mountains (Bull and Henjum, 1990; Bull et al., 1988) have shown that owls will inhabit openings created by timber harvest activities, especially those that mimic natural gaps. Allingham meadow and meadows existing on private lands provide the best potential habitat. However, areas where late-successional habitat abuts created openings can provide suitable habitat as well. Some mature and late-successional ponderosa pine stands may provide habitat, especially if they possess dense inclusions with open understories.

Surveys according to the Regional protocol (USDA 1995) were conducted in 2001 and 2002. No great gray owls were found in the project area, though there has been an unconfirmed siting , and one new nest site found just outside the project area.

Trends/Concerns. Increasing stand densities can benefit the owls by increasing canopy cover and canopy layers. However, the trend in losing large trees may decrease suitability for great grays by decreasing potential nesting structure. Where high stand densities exist, there is an increased risk of fire. Increased fire intensities could destroy critical habitat elements like snags. This would prolong the development of suitable great gray habitat in the Metolius Basin area.

Great Blue Heron

Habitat: Great blue herons nest in colonies in large deciduous and conifer trees adjacent to water. They forage in shallow water or open fields for fish, crustaceans, insects, rodents, amphibians, and reptiles. They are very sensitive to disturbance, especially during the nesting season (Jackman and Scott, 1975).

Riparian reserves along the Metolius River, Jack Creek and Lake Creek, as well as meadows in the project area and on private lands, provide marginally suitable habitat within the project area boundary. Scarcity of prey may limit use in the project area. A historic rookery was located in 1981 in Section 10, and it was active until 1994.

Trends/Concerns. Increased stand densities, canopy cover, down woody debris and snags can benefit great blue herons, though conifer encroachment into the meadows may limit available foraging habitat. The trend in loss of large, long-lived trees may limit future nesting structure. Increased stand densities may also lead to smaller limb structure, which would limit nesting habitat.

Osprey

Habitat. Osprey nest near lakes and rivers in the tops of large snags or on artificial platforms. Their main prey are slow-moving fish that swim near the surface. However, they may also take other vertebrate species (birds, reptiles, and small mammals) (Csuti et al., 1997). The Metolius River provides suitable habitat for ospreys for both nesting and foraging, only one nest has been documented in the project area.

Trends/Concerns. Loss of large snag habitat within campgrounds and summer home tracts is a concern due to the limited amount of snags available. Competition for nesting structure occurs between osprey and other raptors so retention of snag habitat is important, especially outside campgrounds and summer home tracts. Increased human use along the river is also a concern due to the high amount of use currently. Disturbance to nesting osprey may negatively affect successful reproduction.

American Marten

Habitat: The American marten is associated with mixed conifer and high elevation hemlock/lodgepole pine late-successional habitats, and is associated with climatic climax habitats. Marten habitat is generally dense-canopied (greater than 40% canopy cover) and supports significant amounts of large down logs and snags greater than 20″ diameter. Especially significant are riparian areas, ridgetops, and areas where high concentrations of down logs and snags occur (USDA(a) 1994).

The project area contains minimal suitable habitat for marten, focused in the mixed conifer wet stands and along the riparian reserves for Jack, First and Lake Creeks. Marten are likely to avoid open ponderosa pine and mixed conifer dry plant associations, which lack complex horizontal structure typically found in more moist forest conditions and along riparian reserves. However, they may use the area for dispersal from the slopes of the Cascades to Green Ridge or Black Butte. Systematic surveys have not been completed for the area.

Trends/Concerns. Denser canopy cover could increase the potential use by marten, may also result in increased amounts of snags and down woody material. However due to the open nature of the majority of the project area, complex horizontal structure may never be generated. Over time, large structure may be lost due to white fir encroachment. With increased stand densities, there is an increased risk of loss from a disturbance event, reducing canopy cover habitat quality. A stand replacing fire event would remove most of the structure, which would prolong the development of habitat for several decades.

Neotropical Migratory Birds

In the past few years, there has been increased attention on the downward population trends of many bird species. Neotropical migratory birds are of particular concern. While reasons for the declines are complex, factors believed to be responsible include habitat loss and fragmentation on both wintering and breeding grounds, predation, cowbird parasitism, and pesticide use. The Deschutes National Forest is following guidelines from the "Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington" (Altman, 2000) which outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades, and the focal species associated for each habitat type. Table 3-11 displays specific habitat types highlighted in the document, habitat features needing conservation, and the focal bird species.

Table 3-13. Priority habitat features and associated focal species for Central Oregon.

Habitat	Habitat Feature	Focal Species for Central Oregon
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker
	Large trees	Pygmy nuthatch
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis' woodpecker
Mixed Conifer (Late-	Large trees	Brown creeper
	Large snags	Williamson's sapsucker

Habitat	Habitat Feature	Focal Species for Central Oregon
Successional)	Interspersion grassy openings and dense thickets	Flammulated owl
	Multi-layered/dense canopy	Hermit thrush
	Edges and openings created by wildfire	Olive-sided flycatcher
Lodgepole Pine	Old growth	Black-backed woodpecker
Meadows	Wet/dry	Sandhill Crane
Aspen	Large trees with regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue grouse

Features of the current and desired future habitat for certain neotropical migratory birds include large patches of old ponderosa pine forests, large trees and snags, open understories, wet meadows, aspen stands (though these are limited), and fire created openings. Most meadows are on private lands and are used for grazing and other uses. Risks to suitable habitat include lack of low intensity wildfire to maintain open understories, fragmentation, loss of large tree habitat to wildfire due to increased stand densities, wildfire, safety concerns, and brush control.

Surveys were not conducted for neotropical migrant bird species. However, incidental sightings have been made by district personnel during other field outings. Species detected can be found in Appendix A of the Wildlife Report (project files).

Trends/Concerns. Habitat for species that are more dependent on closed canopies and dense understories (i.e. Townsend's warbler, hermit thrush and red-breasted nuthatch) is expected to continue to increase over time. Loss of ponderosa pine and Douglas-fir results in fewer foraging opportunities for species like the white-headed woodpecker and brown creeper who need large diameter trees. Increased stand densities and brush densities increase the risk of loss that could further reduce the availability of habitat in the area for most late-successional species.

Waterfowl

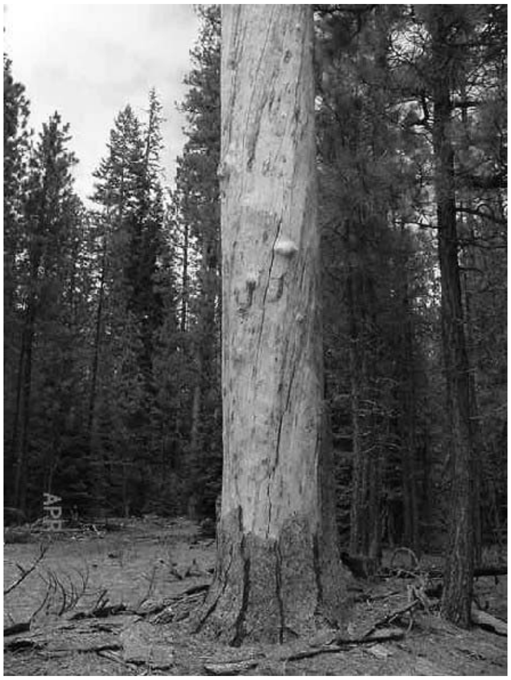
Habitat. Open lakes, ponds, streams, rivers, and wet/dry meadows provide foraging habitat for most waterfowl species. Some species utilize large snags for nesting, while others utilize open grassy areas near the water's edge. Most waterfowl diets consist primarily of vegetation although some animal matter (caddisflies, crustaceans, and mollusks) may be consumed (Csuti et al., 1997).

Four waterfowl species have been documented in the project area (mallard, canvasback, common merganser, Canada goose). Most sightings have occurred along Lake Creek, the Metolius River, and the meadows associated with Lake Creek and the Head of the Metolius (district files). Potential habitat exists primarily along the Metolius River, Lake Creek, and Jack Creek. Allingham meadow may provide habitat as well. However, much of the suitable meadow habitat occurs on private land.

Trends/Concerns. Loss of snags in and adjacent to recreation and residential developments is a concern because nesting structures are currently limited. However, high use recreation areas are not preferred nest sites due to the increased disturbance levels. Snag habitat along the river in between campgrounds and summer home tracts is important to retain due to the loss of this habitat component elsewhere. Much of the suitable meadow habitat associated with riparian areas occurs on private lands.

Snag/Down Woody Material/Green Tree Replacements

Snags are an important structural component in forest communities. Studies have shown that snags are used by nearly 60 species in eastern Oregon, many of which are cavity nesters. Dead and down woody material is also an important habitat component. This material serves as sites for feeding, reproducing, cover, and resting for many wildlife species (USDA 1985).



Primary cavity excavators include pileated woodpecker, black-backed woodpecker, northern flicker, hairy woodpecker, Williamson's sapsucker, three-toed woodpecker, and Lewis' woodpecker, white-headed woodpecker and flammulated owl. Primary cavity excavators depend on snags and logs for nesting, roosting, and foraging. Most of these species are associated with late-successional habitats. Black-backed and three-toed woodpeckers are associated with lodgepole pine, while Lewis' woodpeckers prefer ponderosa pine associations. Pileated woodpeckers and Williamson's sapsuckers prefer mature and late-successional habitats in mixed conifer plant associations while northern flickers and hairy woodpeckers are found in a mix of habitats, especially those associated with edges.

Many aspects of snags and down woody material have been noted in recent studies to be of more importance for associated species. Hollow trees and logs are important structural components across the landscape and should be retained wherever possible. This habitat component is used by many species for night roosts, denning, resting, nesting, cover, and foraging habitat.

Preferred snag species for cavity excavators include ponderosa pine, western larch, and aspen, and occasionally Douglas-fir snags where larch and aspen are limited. Larger diameter snags (>20″ diameter) are also preferred. These tend to stand the longest, can accommodate cavities of any woodpecker species, and provide the most stable microclimate because of wood thickness. Taller snags can also provide a wider range of nesting and roosting structure across the landscape. Some woodpecker species may stratify snag use where snags are limited. Decay class is important as well. Most recent dead snags, those that still have their bark and limbs and have little decay, are used primarily for foraging. However, Class 3 snags are used by secondary cavity excavators and primary cavity excavators that prefer softer wood. Green tree replacements are important components to leave also. They allow for future recruitment and provide foraging substrate now.

Logs are an important component on the landscape. They provide organic and inorganic nutrients in soil development, contribute to water economy, provide microhabitats for invertebrates, plants amphibians, and other small vertebrates, and provide structure for riparian associated species in streams and ponds. It has been shown that size, distribution, and orientation many be more important than tonnage or volume (Bull, Parks, and Torgersen, 1997). In the drier ponderosa pine and mixed conifer plant associations which had frequent fires, the historic amount of downed logs was assumed to be quite low (Agee 1993).

Management Direction. Snag and green tree retention levels were developed during the Metolius Watershed analysis (see Wildlife Report, Project Records for standards). Additional snag guidelines are addressed in the Northwest Forest Plan, pages C-41 and 42 (general) and pages C-46 and 47 (white-headed woodpecker). Down woody material standards are addressed in the Northwest Forest Plan pages C-40 and 41. For eastern Oregon, a minimum of 120 linear feet of logs per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained. Decay class 1 and 2 logs can be counted towards these totals. Down logs should reflect the species mix of the original stand. In areas of partial harvest, standards and guidelines should be applied, but they should be modified to reflect the timing of stand development cycles.

Existing Conditions. Approximately 2/3 of the project area was sampled for snags and down woody material. Snag and down log averages on the Deschutes National Forest are highly variable and dependent on several factors including water availability, soil fertility, stand condition and density, and fire history.

Snags. Table 3-14 summarizes existing snag levels by size class and plant association. Density for snags >15" diameter is below recommended levels in all plant associations except riparian (Table 3-15).

Table 3-14. Existing snag levels per acre (average and range) by size class and plant association for the Metolius Basin project area.

Size Class	Mixed conifer Dry	Mixed conifer Wet	Ponderosa pine dry	Ponderosa pine wet	Riparian
	Average snag levels (and range of snags found) per acres				
<10" diameter (range not included)	3.3	3.9	1.8	2.0	6.6
10-14" diameter	3.8 (0-23)	3.9 (0-16)	2.0 (0-8)	1.1 (0-2)	4.8 (0-7)
15-24" diameter	1.9 (0-9)	3.2 (0-9)	1.4 (0-3)	1.3 (0-2)	3.7 (0-5)
25"+ diameter	1.6 (0-3)	1.4 (0-2)	0.8 (0-5)	1.2 (0-2)	2.9 (0-3)

Snags/acre based on weighted average.

Table 3-15. Comparison of stands (by %) against standards and guidelines for snags by plant association for the Metolius Basin project area.

Size Class	Mixed conifer dry		Mixed conifer wet		Ponderosa pine dry		Ponderosa pine wet	
	Snag Levels below or meet/exceed standards							
	Below	Meets or exceeds	Below	Meets or exceeds	Below	Meets or exceeds	Below	Meets of exceeds
10-14”	43%	57%	28%	72%	0%	100%	75%	25%
15-24”	77%	24%	83%	17%	72%	28%	100%	0%
25+	96%	4%	100%	0%	85%	15%	69%	31%

Analysis shows that Mixed Conifer and Ponderosa Pine Dry plant associations meet or exceed recommended snag levels for small size class (10-14.9” diameter), but snags are not proportionally distributed throughout the project area. However, the recommended retention level for this size class within the Ponderosa Pine Dry association is zero.

Snags are below recommended levels for both mid (15-25” diameter) and large (25+” diameter) size classes in most plant associations. There is variability and some stands meet or exceed recommended levels but these are the exception.

Down Wood. Though existing levels of down wood are assumed to be higher than historic levels, log size tends to be smaller. Down wood >16” diameter is lacking in all plant associations and does not meet current standards and guidelines (Table 3-16).

Table 3-16. Existing down wood levels per acres by size class and plant association for the Metolius Basin project area.

Size Class	Mixed conifer dry	Mixed conifer wet	Ponderosa pine dry	Ponderosa pine wet	Riparian
	Lineal Feet/Acre				
8-15” diameter	233.9	489.9	135.4	242.3	156.3
≥16” diameter	60.6	94.1	46.9	65.9	113.0

Down wood/acre based on weighted average.

Table 3-17 compares existing levels of diameter down woody material ≥16” diameter with standards and guidelines for the project. There is currently no standard for down woody material less than 16” diameter.

Table 3-17. Comparison of stands (by %) against standards and guidelines for down woody material by plant association for the Metolius Basin project area.

Size Class	Mixed conifer dry		Mixed conifer wet		Ponderosa pine dry		Ponderosa pine wet	
	Below	**Meet or exceed**	**Below**	**Meet or exceed**	**Below**	**Meet or exceed**	**Below**	**Meet or exceed**
>16" diameter	90%	10%	71%	29%	95%	5%	100%	0%
>16" diameter ranges (linear ft./ acres)	0-302		0-307		0-184		0-113 l	
8-15" diameter ranges (linear ft./ acres)	0-1792		67-1097		0-465		60-693	

Standards and Guidelines suggest that down wood retention levels be designed for specific vegetative treatments and reflect the timing of stand development cycles.

Thinning is the most frequently prescribed treatment in the project area. Since most stands across the project area are mid-seral and lack material >16" diameter the only size class for which there are current standards), prescribed levels were modified to provide 33-50% of the recommended down-wood density, but allow natural recruitment for the life of the stand.

Rationale for this prescription includes several factors: 1) the stand remaining after harvest will continue to grow and provide a source for larger diameter down wood over time, 2) no removal of down wood is proposed, but impacts may result from prescribed burning; and 3) the average diameter of trees remaining in each stand under alternatives 4 and 5 would be larger, providing larger diameter down wood over time.

Trends/Concerns. In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris and snags. However, there would be a shift in species composition with a decrease in ponderosa pine and Douglas-fir, which cavity nesters prefer, and an increase in white fir. There is the potential for snag/log creation from disturbance events (insects, disease, and wildfire). However, snags and logs created by wildfire may be heavily charred and unusable for a longer period of time leaving less available habitat

SURVEY AND MANAGE SPECIES

Mollusks

Only one survey and manage wildlife species has habitat in the project area; the Crater Lake Tightcoil (*Pristiloma arcticum crateris*) (Survey and Manage Final Supplemental Environmental Impact Statement 2000). The SEIS directed that strategic surveys be conducted and all known sites be managed until further notice. This species is considered to be rare and identification of specimens is difficult because of its small size and cryptic habits. Expert identification is required.

Habitat. Habitat related to this species is defined in broad terms since little information is known. Mosses and other vegetation near wetlands in conifer forests generally above 2000′ and east of Interstate 5 defines habitat for the Crater Lake Tightcoil. Other habitat components include uncompacted soils, litter, logs, and other woody debris in a site where the ground is shaded or otherwise protected from excessive fluctuations in temperature and humidity (Burke et al., 1999).

Threats to the species include activities that compact soils, reduce litter and/or vegetative cover, or impact potential food sources (i.e. livestock grazing, heavy equipment use, Off Highway Vehicles, and camping on occupied habitats). Fluctuations from removal of ground vegetation on ground temperature and humidity may be less extreme at higher elevations and on wetter sites, but no studies have been conducted to evaluate such a theory. These snails appear to occur on wetter sites than general forest conditions, so activities that would lower the water table or reduce soil moisture may degrade habitat (Burke et al., 1999).

Intense fire that burns through the litter and duff layers is devastating to most gastropods, and even light burns during seasons when these animals are active can be expected to have more serious impacts than burns during their dormant periods (winter or summer). Snowmobiling or skiing could impact these snails if snow over their occupied habitats were compacted, losing its insulative properties and allowing the litter or ground to freeze (Burke et al., 1999).

Surveys. Surveys were completed during 2001-2002 along all known riparian areas (excluding human-made irrigation ditches). *Pristiloma* species were found at 41 locations throughout the project area. They have been sent to the taxa expert for positive identification. The largest concentrations of sites were found along the North Fork of Jack Creek. However, specimens were collected from the North, Middle and South Forks of Lake Creek, along the Metolius River, and from a wetland along the South Fork of Jack Creek. The locations of these sites have been recorded using the Global Positioning System.

All but one *Pristiloma* were located along perennial streams. The one *Pristiloma* that was not found on a perennial stream was located in a wet meadow in a patch of sedges. Several streams within the Metolius Basin planning area do not contain suitable habitat for mollusk species due to the intermittent nature of the stream, lack of riparian vegetation, and low moisture content (Metolius Creek, Davis Creek, portions of First Creek, and stretches along the Metolius River). The remaining riparian areas vary but most have a narrow band of riparian vegetation, averaging 10-30′ wide and most occur within the ponderosa pine plant association.

Bats

Habitat: Most bat species are associated with foraging within forested and riparian areas. See Table 3-18 for the potential bat species that could be found in the Metolius Basin project area and their habitat characteristics (Csuti et al., 1997).

Table 3-18. Potential bat species and habitat requirements for the Metolius Basin.

Species	Forage Substrate	Roost Site	Main Prey Species	Comments	Found in Project Area
California Myotis	Forest edges and over water	Cliff faces, tree crevices, caves and structures	Butterflies and small flies		No
Western Small-footed bat	Ponderosa pine and mixed conifer forests	Rock crevices, under boulders, and beneath bark	Small insects	Will also forage over rocks	Yes
Yuma Myotis	Riparian, moist woodlands, and open forests	Buildings, caves, and bridges	Moths, midges, flies, and termites	Closely associated with water and very sensitive to disturbance	No
Little Brown Myotis	Moist forests and riparian areas		Flying insects	Closely associated with water	Yes
Long-legged Myotis	Coniferous forests and riparian areas	Crevices, buildings, and caves	Moths	Closely associated with forests	Yes
Long-eared Myotis	Forested habitats and forested edges		Moths		Yes
Silver-haired bat	Forested areas and over ponds and streams	Under bark	Soft-bodied prey	Deforestation and loss of snags is a threat	Yes
Big Brown Bat	More common in deciduous versus coniferous forests	Structures	Beetles	Forages over open areas and uses hollow trees	Yes
Hoary Bat	Riparian and brushy areas	Trees	Moths	Solitary forest dwelling	Yes
Pallid Bat	Arid regions and open forest types	Cliff faces, caves, and buildings	Flightless arthropods	Forages on ground and very intolerant to disturbance	No
Western big-eared Bat		Buildings, caves, and bridges	Moths	Presence of roost sites more important than veg type; very sensitive to disturbance	No

Three known surveys have occurred in or near the project area, and the species that had been found are listed in Table 3-13. It was noted in a 1997 survey that the high number of species found at First Creek indicated that the forest stands around this area offered a variety of day roost options that fulfilled the needs of a broad spectrum of bat species. Also noted in this study is that even though there was a high number of different species found, the number of individual bats captured was low compared to other places on the forest. Potential habitat exists across the project area varying in quality.

Primary risks to habitat include fire suppression, which can result in increased stand densities and loss of large tree structure. Increased stand densities may intensify a wildfire event resulting in the loss of large trees, large snags, and important special habitat components like hollow trees. Continued hazard tree removal also limits the availability of snag habitat, especially near the Metolius River and other riparian areas. Increased human use of the project area can also lead to increased disturbance of day and night roosts, maternity sites, and winter hibernaculum.

OTHER WILDLIFE INFORMATION

Metolius Wildlife Refuge

The Metolius Wildlife Refuge was established in 1993 as a cooperative contract between Oregon Department of Fish and Wildlife and the U.S. Forest Service. The purpose of the contract was to establish a no hunting area around Camp Sherman and provide a refuge for watchable wildlife. Many wildlife species in the area had become acclimated to humans and were vulnerable to hunting, road-kill, and poaching. The refuge was originally established in 1956 and incorporates approximately 2200 acres. It is bordered by Canyon Creek and the Metolius River to the north, the 14 road on the south, the 1419 and 1420 roads on the west, and the 14 road on the east.

The area is considered deer winter range and is composed primarily of ponderosa pine. Private parcels include House on the Metolius, part of Camp Sherman, and the Head of the Metolius. Several summer home tracts, campgrounds, and trails are also found within the boundaries. No formal watchable wildlife projects have been developed for this area and no surveys have occurred specifically within the refuge.

Aspen

In the past 100 to 150 years, there has been a dramatic decline in aspen forests due to a change in fire intervals (Bartos and Shepperd, 1999). The absence of fire has allowed late successional plant species to move into aspen stands and out compete the aspen. Bartos and Shepperd (1999) stated that most aspen will eventually be replaced by other communities like conifers, sagebrush, and other tall shrubs without some type of disturbance.

There are only three known locations of aspen in the project area, totaling about 10 acres. All locations are associated with riparian areas, and are enclosures (not intermixed throughout the stand).

Aspen stands are declining on these 10 acres due to conifer encroachment and the lack of regeneration and disturbance. The Deschutes National Forest Land and Resource Management Plan supports the restoration of aspen in the Metolius Heritage area for habitat and visual diversity (pg. 4-166).

Fish

SPECIES

Bull Trout

Status: Threatened (Federal)

The Upper Metolius river population of bull trout has been increasing, from a spawning count of 26 redds in 1986 to 760 redds in 2001. This increase is attributed to recent fishing restrictions in the Metolius tributaries and in Lake Billy Chinook. The population is considered a healthy population because of the increasing trend and the presence of three life history forms: resident, fluvial (river) and adfluvial (lake) (Buchanan et al. 1997). The recovery plan for the species in the Deschutes River Recovery Unit is in draft form and critical habitat will be designated by 2003.

Within the project area, bull trout are known to spawn in 5 miles of Jack Creek, ½ mile of Heising Spring, ½ mile of Spring Creek (isolated report) and in about 1 mile of the Metolius River, near Heising Spring. In the project area, the rearing habitats include the spawning streams and 5 miles of the Metolius River. Primary habitats for bull trout are cold water streams for spawning and early rearing (less than 10 degrees Celsius). Juvenile and adult habitat is focused on pools and side channels with overhead cover such as undercut banks and wood. After age three, most juvenile bull trout move to Lake Billy Chinook to rear to adults at age five. A few sub adult fish may remain in the Metolius River and return to spawn to Jack Creek.

Bull Trout are also listed as a Late Successional Reserve focal species because they are linked to large tree forest conditions for shade, water quality, low fine sediment and large wood for cover, and which supports cold water habitat for spawning and rearing habitat for bull trout, (USFS 1996). Mature forests have more stable flow regimes, clean gravel for spawning habitat, and large trees that provide large in stream wood, creating pools and overhead cover for bull trout habitat.

The Metolius Late Successional Reserve Assessment also identified Cascades Apatania Caddisfly and Tailed Frogs as focal species within the larger area. Habitat concerns for these species would be addressed by habitat for Bull Trout.

Redband Trout

Status: Sensitive (US Forest Service, Region 6, and Oregon State)

The Metolius River population has increased five fold since 1995, when annual spawning surveys were initiated. This increase may be because hatchery rainbow trout have not been stocked into the Metolius River since 1995. Spawning areas are primarily in the upper Metolius River upstream of Camp Sherman Bridge and in Lake Creek and Abbot Creek. Rearing habitat includes virtually all of the perennial streams in the project area. The upper Metolius River is primary habitat for spawning because of the relatively moderate winter temperature and abundant gravel.

Spring Chinook Salmon

Status: Currently extirpated, but streams in the project area are listed as Essential Fish Habitat (Federal)

Spring Chinook Salmon were native to the Metolius River but were eliminated due to failed juvenile passage at Pelton Round Butte Dams in the late 1960s. Reintroduction into the Metolius River is currently under study. The Metolius Basin is listed as Essential Fish Habitat under the Maguson Stevens Act, which requires consultation with National Marine Fisheries Service for habitat disturbing activities. Primary habitat is pools or pool like habitats. Pool habitats can be created with large wood in the Metolius River.

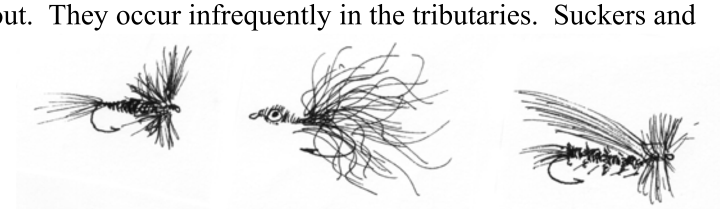
Other Fish Species

Brown Trout are a European species introduced probably from Suttle Lake. They are found throughout the entire river, and provide a fishery in Lake Creek and Suttle Lake. *Brook trout* have been introduced from eastern North America and are found in the Metolius River, Spring Creek and area around springs. Brook trout are also found in the upper reaches of First Creek.

Kokanee and sockeye salmon are two different life history forms of the same species. Kokanee are the lake resident form that remains in the lake as they grow into adults. Kokanee are native to Suttle Lake and spawn in Link Creek in the fall. Kokanee have established a population in Lake Billy Chinook and spawn in the upper Metolius River and the lower portions of the tributaries.

Sockeye migrate from the lake to the ocean at age 1.5. When they are four to five years old, they return from the ocean as adults and swim up the river in summer to spawn. Native sockeye were extirpated prior to the 1940s as a result of a small dam at the outlet of Suttle Lake, which was believed to have prevented the juveniles from exiting the lake. There was a hatchery operation for out planting sockeye in the late 1940s and early 1950s but the operation was discontinued in the mid 1950's. Sockeye salmon are currently being proposed for possible reintroduction above Pelton Round Butte Dams.

Other fish in the Metolius River include *mountain whitefish*, *bridge lip* and *large-scale sucker, longnose dace* and three species of *sculpin*. Whitefish is the dominant species of fish in the Metolius River, far out numbering trout. They occur infrequently in the tributaries. Suckers and longnose dace are primarily found in the Metolius and Lake Creek. Sculpins are found in most streams in the basin.



HABITAT

There are several important fish habitats located within the project area. The Metolius River is a highly revered fishery for redband trout and bull trout. The Metolius River provides cool temperatures in the summer and moderate temperatures in the winter. Several tributaries join the Metolius River within the project area including Lake Creek, Spring Creek, First Creek, Jack

Creek and Heising Spring. These streams and other springs or intermittent channels dissect the project area from west to east. The tributaries make up the majority of the streams in the project and have a great influence on the Metolius River habitats. There are almost 60 miles of streams in the project area, over 75% of those miles provide habitat for fish.

Shade and Water Temperature

At the headwater springs, the Metolius River rises at 48 F and is cooled by spring fed streams as it flows downstream (Riehle 1993). Because of the unique high water quality of the Metolius River, the Wild and Scenic River Plan has guidelines for maintenance of the existing baseline water quality, which is stricter than state standards (USFS 1997). The spring fed tributaries such as Jack Creek provide spawning habitat for bull trout because of their cold water (Riehle 1993, USFS 1995). Side channels, backwater pools, and the overhanging vegetation along these features provide important habitat for fry rearing.

Lake Creek is on the ODEQ 303(d) list for water quality limited streams because its 7-day average daily maximum water temperature exceeds 64 F. Lake Creek is fed by Suttle Lake, which has warm surface water in late summer (Houslet 1999).

Dense stand of trees along First Creek provide shade to keep water temperatures cool

Within the project area, riparian stands of trees are generally dominated by ponderosa pine stands, which typically provide 20% to 40% canopy cover. Riparian areas in mixed conifer stands are generally denser. Actual stream shade would vary depending on the width of stream, tree height and stream orientation to the sun. Thinning understory trees is not expected to impact shade significantly. However, the actions taken to reduce wildfire risk must balance stream bank protection while reducing the risk of crown fires in riparian reserves with dry brush and dense, small trees. The maintenance of shade trees along the streams of the project is essential to protect the habitat for bull trout and redband trout (USFS 1995).

Fine Sediment

Spawning and rearing habitat require clean gravel and cobble free of sand and silt. Sources of fine sediment include the roads and the naturally sparsely vegetated stream banks of intermittent streams. Due to the unique character of the loose volcanic sandy soils and the lack of flushing flows in the spring-fed streams, there is a risk of accumulating fine sediment in spawning and rearing habitats within the project area, (though a large flood event in 1996 did flush fine sediment from local streams (Houslet and Riehle 1998)). The Metolius River and its many tributaries and springs are very stable (Riehle 1993), except for First and Davis Creeks, which can be flashy. The more flashy flows of the intermittent streams can move fine sediment into perennial streams during flood events. Most of the actively eroding stream banks in the project area are along intermittent, higher gradient streams along the western portion of project area. Protection of stream bank vegetation is important to protect spawning habitat. Streamside vegetation can also serve to filter fine sediments from road runoff.

Riparian road densities are high in several subwatersheds, and along the Metolius River, Cache Creek and First Creek. There area 31 road/stream crossing in the project area within the First Creek subwatershed that could be direct sources of road born sediments into the stream network (Table 3-19). Most floodplains have not been altered in the project area except at road crossings, and where Forest Road 900 cuts along steep slopes adjacent to the Metolius River. These areas are a source of sediment. Floodplain roads occasionally reroute flood waters down roads.

Table 3-19. Number of miles of road per square mile within Riparian Reserves within the project boundary. Also included is the number of stream crossings by roads, including bridges, culverts, wet fords and dry fords.

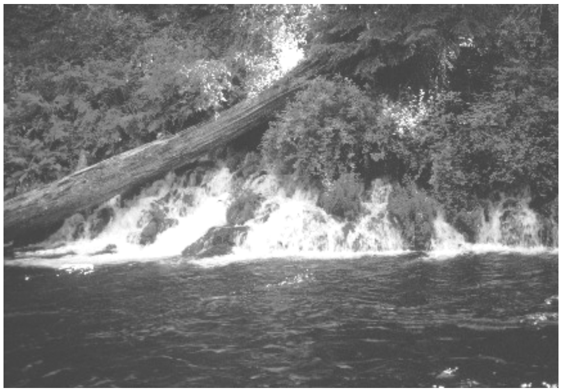
Subwatershed Name	Miles of road/ mile^2	Number of stream crossings
Cache	5.0	4
First	4.4	31
Jack	3.4	5
Scarp	6.1	10
Suttle Lake	2.0	14

Though road densities throughout the subwatershed of the project area are relatively high, (Table 3-20), there is a lower risk of watershed scale effects from the road network in this project area because of the generally flat topography (except along the steep slopes of Green Ridge). Road densities can be exaggerated when calculated on small portions of a watershed such as Canyon Creek and Indian Ford Creek. Those subwatersheds have little area within the project boundary.

Table 3-20. Road densities within the subwatersheds of the project area.

Subwatershed	Alternative 1 Riparian Road Density - miles/miles^2	Action Alternatives Riparian Road Density Miles/miles^2
Cache	5.0	2.9
First	4.4	2.6
Jack	3.4	2.3
Scarp	6.1	5.8
Suttle Lake	2.0	1.7
Total	**3.9**	**3.1**

Large Wood and Pools



Bull trout use wood for cover (Goetz 1994) and wood can create pools important to bull trout and chinook salmon. The reduction in the amount of wood in the Metolius River was identified as a red flag in the Metolius Watershed Analysis (USFS 1996). Although recovering, the Metolius River had wood removed in the past for erosion control, salvage and boating safety. Recent wood placements have been allowed to start to reverse the trend. Stream habitat surveys of the river have rated the Metolius River as still having low densities of wood and pools per mile (USFS 1995).

The tributaries have had recent influx of wood as a result of high tree mortality in the riparian area. This process is important in the western side of the project area, were mixed conifer stands are more prevalent. These streams have been rated in the watershed analysis as having moderate to high densities of wood per mile but low frequency of pool habitat, compared to regional standards (USFS 1995).

Nutrients

Concern for increases in the nutrients supplied to the Metolius River gave rise to a nutrient monitoring program in the Wild and Scenic River Plan. This monitoring program is being implemented each year, partly funded by the Friends of the Metolius. Much of the nutrients supplied to the Metolius River come from springs (Cotter and Riehle 2002). Lake Creek does not significantly increase the nitrogen or phosphorous in the River but the nutrient levels tend to decrease as the water travels downstream, being tied up in algal growth and bacteria uptake. Suttle Lake, upstream of the project area, has naturally high levels of phosphorous (Aquatic Analysts 1990).

Invertebrates are numerous and diverse in the Metolius River and Jack Creek. The spring- fed streams of the project have a variety of clean water taxa, indicating good water quality conditions (Riehle 1993). Lake Creek has showed signs of habitat limitations for aquatic invertebrates, primarily from temperature and fine sediment. This sampling was done prior to the 1996 flood.

Ditches

There are several irrigation ditches associated with Lake Creek between the private timberland and the Metolius Meadows residential area. Only a few of these ditches have been mapped and a few of them are under special use permit. Several of these diversions need fish screens. The riparian vegetation associated with these diversions should be protected and maintained.

Management Direction

The Metolius Wild and Scenic River Plan provides direction for protecting outstanding remarkable values, including fisheries and hydrology. The Northwest Forest Plan identified the Metolius watershed (excluding Cache Creek subwatershed) as a Key Watershed based on the contribution of water quality to the Deschutes River and the health of the bull trout population.

The Deschutes Land and Resource Management Plan identifies riparian areas to be managed for riparian dependent species. The area of riparian protection was generally 100ft or as defined by riparian plant associations. Watershed protection was based on the use of best management practices to protect water quality and water related resources.

Plants

This section summarizes Protected, Threatened, Endangered and Sensitive (TES), and Survey and Manage (S&M) plants, competing and unwanted vegetation, and noxious weeds related to the Metolius Basin project area. For further information, refer to the Botany Report and Biological Evaluation in the Project Record.

Approximately 36% of the project area was surveyed in 2001, focusing on habitats for rare plants (see Plant Biological Evaluation). Information from earlier surveys was also examined, and the Interagency Species Management System (ISMS) database which tracks Survey and Manage species was queried.

HABITATS

Regional Ecological Significance for Plants

The Interior Columbia Ecosystem Management Project (ICBEMP) identified the Metolius Basin as within one of nine “hotspots of species rarity and endemism” in eastern Oregon. The Oregon Biodiversity Project, which identified the Metolius Basin as an area to address biodiversity conservation, mentions the need to conserve more large high quality blocks ponderosa pine habitats in this East Cascades Ecoregion, based on historical abundance and biological significance. The report also states that growth in the Sisters area and heavy recreational use pose some long term threats but that “this area’s high visibility could make it a showcase for biodiversity management strategies on public lands”. The Oregon Biodiversity Project also identifies at-risk species including, Peck’s penstemon and tall agoseris.

The Metolius Wild and Scenic River Resource Assessment (1992) identified ecological values as an “outstandingly remarkable value” in the river corridor, partly due to the presence of Peck’s penstemon.

Late-Successional Habitats

Late-successional forests in the project area are dominated by ponderosa pine fire-climax plant associations, which historically have been characterized by fairly open stands with limited shrub cover. As such, associated plants are those that tolerate sun, dry conditions, and frequent, low-intensity fire. There are also moist, dense forests located along the western portions of the project area, along the north side of Black Butte, on Green Ridge, and along riparian areas. The late-successional habitats are somewhat fragmented by roads, past harvest activities, and private lands. Non-forested areas (grasslands, riparian areas) are uncommon but contribute significantly to habitat and species diversity (Metolius Watershed Analysis, 1996).

Landscape Level Connectivity. The Metolius Late Successional Reserve is a part of a regional network of Late Successional Reserves designed to maintain habitat and viability for late successional species. Located on the eastside of the Cascade Mountain crest, the Metolius Late Successional Reserve is one of several on the Sisters Ranger District that represents an important eastern edge of range for both owls and other late successional species. Edge populations are believed to be particularly important to long term species viability from a genetic aspect.

The Metolius Late Successional Reserve is fragmented and existing late successional habitats are poorly connected (Metolius Late Successional Reserve Assessment, 1996, pg 66). An overall objective for the reserve is to design treatments to reduce fragmentation and provide well-connected late successional habitats (Metolius Late Successional Reserve Assessment, 1996, pg 66).

FOCAL PLANT SPECIES

The Metolius Late Successional Reserve Assessment (1996) identified several focal plant species, which are those species associated with late-successional conditions, and are guild representatives. For example, providing habitat for a specific guild (of focal species) will provide habitat for a number of species that have similar habitat requirements (Why-chus Watershed Assessment, pg. 101). All of these species have *potential* habitat within the project area, and several have been found in the area. However, the most notable plant is Peck's penstemon, which has numerous populations within the project area, and is the focal plant species within the project area. Peck's penstemon is also a listed sensitive species.

THREATENED, ENDANGERED AND SENSITIVE PLANT SPECIES

Prefield review identified potential habitat for 5 sensitive species that were recommended for survey. These species are:

- Tall Agoseris- *Agoseris elata*
- Peck's penstemon -*Penstemon peckii*
- Porcupine sedge -*Carex hystericina*
- Water lobelia -*Lobelia dortmanna*
- Scheuchzeria- *Scheuchzeria palutris ssp. americana*

Only Peck's penstemon and tall agoseris were found during surveys, and are the focus of the following discussion. There are no *threatened* or *endangered* plants known or suspected to occur.

Peck's penstemon

Peck's penstemon is a rare endemic wildflower found only in the Sisters area. It is identified in the Metolius Late Successional Reserve Assessment as a focal species in pine and mixed conifer forests in seasonally moist microsites. The plant is known to benefit from low intensity fire and needs open sunny habitats to insure flower and seed production. The Metolius Basin project area is an important central core of the plants global population.

Botanists reported Peck's penstemon in the Metolius Basin area as early as 1928 (Oregon Heritage Data Base Records). Several survey efforts for Peck's penstemon were done in the 1970's and 80's. Systematic Forest Service plant surveys for rare plants in the project area began in 1990 and found many new populations. Surveys in 2001 located 21 populations of Peck's penstemon in the project area.


Peck's penstemon

Approximately 25 populations are classified by the Conservation Strategy as "*Protected*". This means that management actions must benefit the plant (i.e., prescribed fire, mowing). Some loss of plants is allowed, but should be minimal. Approximately 33% of the populations in the project area are protected.

Other populations are classified by as "*Managed*". This means they can be experimented on with tools likely to benefit the plant (i.e. thinning without severe ground disturbance). Loss of plants can be up to 20% of population over 500 individuals in size. Approximately 67% of the population in the project area are managed.

Light ground disturbance can create new habitat areas but severe ground disturbance can uproot plants and destroy populations (Vrilakas,1989). Field observations support that selective harvest and thinning that employs light ground disturbance can benefit the plant. Pecks penstemon is often observed in skid trails and some large populations have been found in clearcut areas. The Conservation Strategy for Peck's penstemon (O'Neil 1992) states that, without mitigation, timber harvest can be a threat to the populations. Mitigation could include minimizing soil disturbance in known populations, cleaning up slash (to leave open ground for germination), considering the condition of the population and plant phenology, and preserving the majority of individual plants during the treatment.

There has been one formal study which evaluated the effects of timber harvest on Peck's penstemon (Ingersoll 1993). Plots were established in the Lake Creek Timber sale in the

Metolius Basin in 1980 and reread in 1992. Although flowering frequency was observed to be greater in 1992 than in 1980, Ingersoll found that harvest treatments had reduced plant cover and species diversity at the study sites in relation to the degree of soil disturbance.

Other concerns to Peck's penstemon, specific to this project area include closed canopies depress which flowering and sexual reproduction, deep needle duff preventing germination, noxious weeds occupy available habitat, and invading nonnative grass (*Agropyron intermedium).* This non-native grass was seeded along roadsides and landings in the past, and displaced Peck's penstemon populations.

Tall Agoseris

Tall agoseris was reported within the project area in 1937 (Oregon Heritage Data Base Records). Surveys in 2001 located additional populations of Tall Agoseris.

This rare wildflower is a regional endemic but difficult to identify. Historically, it is known from the length of the Cascades from Washington to California. Its habitat is the dry edges of moist ecotones, including meadows and open woods. The variety of Tall Agoseris found in Sisters is orange and may be genetically different than the yellow Tall Agoseris found elsewhere in Oregon and Washington (personal communication, Kenton Chambers 2002).

Tall Agoseris occurs in areas with little to no canopy cover, leading to the assumption that the species is shade-intolerant. Fires have probably played a role in maintaining some of the open, meadow habitats in which the species occurs (Washington Natural Heritage Program, 2001). There are less than 50 occurrences in Washington and most populations are small. Threats include grazing, competition with non-native species, recreational trampling, and closed canopies. Historic lowland occurrences may have been lost to conversion of habitat.

Other concerns to tall agoseris are the same as discussed for Peck's penstemon.

<u>Management Opportunities.</u> Opportunities for plant restoration and protection are discussed in the Metolius Watershed Analysis (pg. 152), including use of prescribed fire when possible to benefit plants which have evolved with fire, such as Peck's penstemon, and tall agoseris; restoring Allingham Meadow to benefit Peck's penstemon and tall agoseris, and public education focus on role of fire in forested ecosystem.

SURVEY AND MANAGE SPECIES

There is potential habitat for 8 Survey and Manage species, 7 of which require surveys before ground disturbance. These species are:

Vascular plants
- Mingan moonwort -*Botrychium minganense* - A
- Mountain grapefern -*Botrychium monatum* - A
- Mountain lady's slipper -*Cypripedium montanum* - C

Bryophytes
- Luminous cave Moss *Schistostega pennata* - A

- Ant spearmoss -*Tetraphis geniculata* - A

Lichens

- *Pseudocyphellaria raineriensis* - A

Fungi

- Noble polypore -*Bridgeporous nobilissimus* – A
- Rare truffle - *(Elaphomyces anthracinus)* –B

Potential habitats were surveyed according to existing protocols. Category A are …, Category B are …, while category C are….Additional survey effort was accomplished for the Ant spear moss, Tetraphis genicultata, though none was found.

Rare Truffle

The only Survey and Manage species known to exist in the project area is the rare truffle *(Elaphomyces anthracinus)*. Its status is Survey and Manage Category B (manage all known sites). This rare truffle is known from only 2 sites in Oregon, both are in the project area near Riverside Campground. It was identified as a Focal Species because it represents habitat requirements for fungi species that are ectomycorrhizal associates in mature pine forests. There is no survey requirement.

The species is believed to be at high risk of extripation under the Northwest Forest plan because of its rarity and its dependent mycorrhizal association with old growth ponderosa pine.

Relatively little is known about the ecology of this truffle. It is presumed to form ectomyorrhizal connections to its host old growth pine and therefore disturbance that affects the host will potentially affect this taxa. Fire is considered a potential threat, as are actions that damage host trees and disturb the soil occupied by host tree roots. This includes logging that removes host trees, and other actions that disturb the soil (Castellano and O'Dell 1997).

Recommended management of this species includes managing an area large enough to maintain habitat and microclimate of the population, maintaining dominance of host trees, minimizing disruption of soil, and managing tree diseases to minimize loss of host trees. The Regional expert on this species was consulted for management recommendations.

COMPETING AND UNWANTED VEGETATION

There are two considerations for competing and unwanted vegetation relevant to this project: noxious weeds, and grass and sedges that may compete with reforestation. Shrubs and dense stands of small trees were not considered in this analysis because amounts of these two components that are within the historic range of variability are desirable and important habitat elements. Proposed actions are expected to allow fire to be reintroduced into the project area as a natural control of shrubs and small trees.

There is high probability habitat for undiscovered weeds sites, in old harvest units, in the private timberland interface, and along major road corridors. Approximately 36% of the project area was surveyed in 2001 and major roads within the area were surveyed for noxious weeds and individual plants were handpulled in 2002.

Spotted and Diffuse Knapweed- These two knapweed species are the noxious weeds of greatest concern in the project area. Knapweeds are aggressive invaders but have a passive seed dispersal mechanism requiring seed transport, such as by water along intermittent waterways or more often by vehicle tires along roadways. Treatment priority for knapweeds is very high because of the risk of transport by logging equipment.

Dalmation Toadflax - Dalmation Toadflax has been rare in the area but is also of concern because of its increasing presence outside the project area in Sisters and Central Oregon.

Scotch Broom – This noxious shrub has been increasing in moist areas of the Metolius Basin and is of particular concern because of the longevity of seed, which may last decades after a plant is removed.

St Johns Wort – This noxious weed species has been a lower treatment priority because it does not appear to be as aggressive as other weeds species but may become a greater problem if extensive ground disturbance occurs adjacent to larger populations. It may be very persistent once established because of its ability to spread by rhizomes.

Table 3-21 and Figure 3-**9** show the known weed sites within and adjacent to the project area.

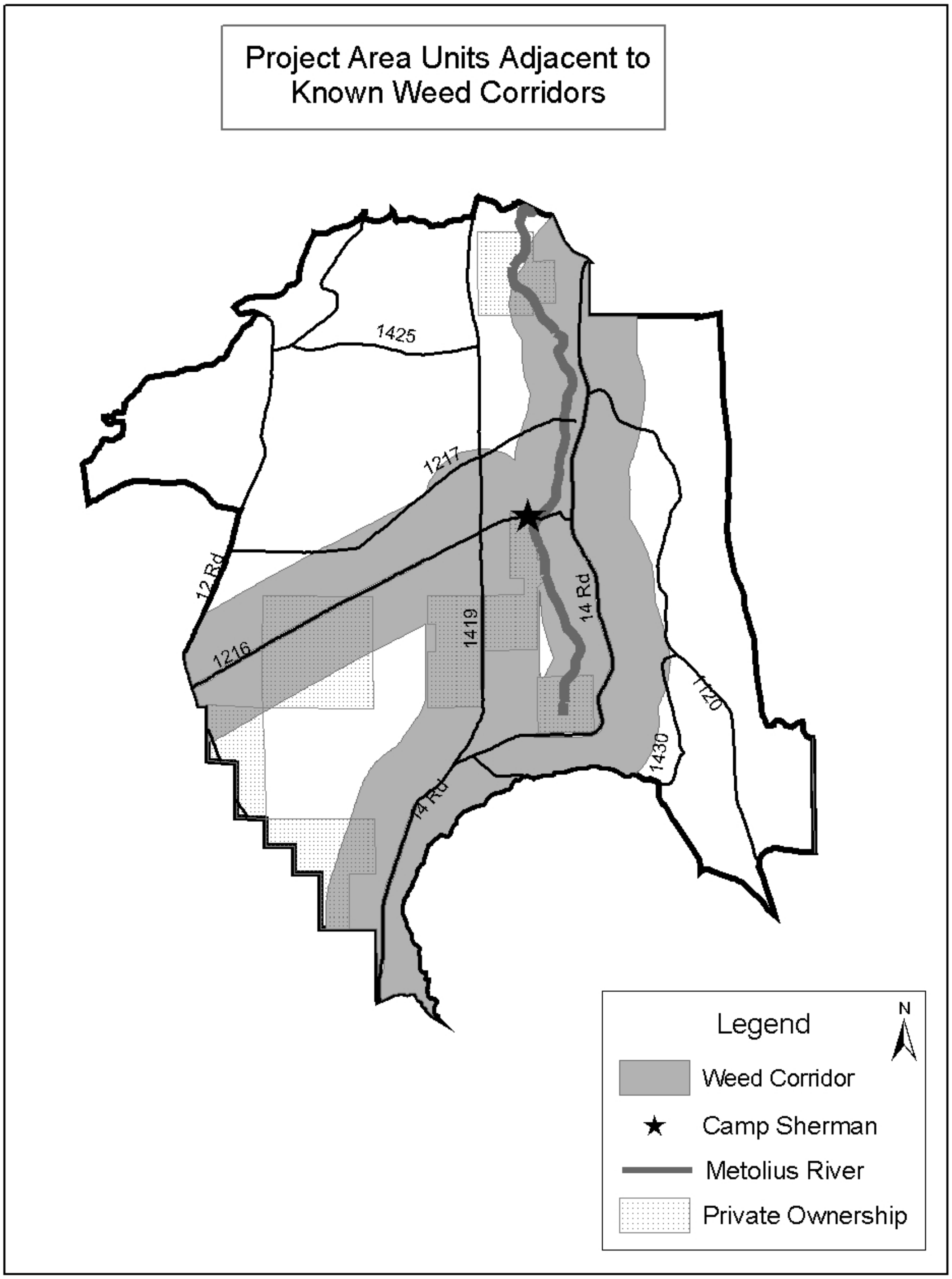


Figure 3-9. Locations of known Noxious Weeds along primary roads.

Table 3-21. Known Noxious Weed Sites.

Location	Noxious Weed Species Present	Intensity of infestation And area	Treatment History
Forest Rd 11 from Hwy 20	Diffuse knapweed Spotted knapweed	Scattered plants along 2 miles in project area	Herbicide, handpulling, & biological control
Forest Rd 14	Diffuse knapweed Spotted knapweed Dalmation Toadflax Scotch Broom	Scattered plants along 10 miles in project area	Hand pulling Biocontrol
Forest Rd 14/900	St Johns Wort Diffuse knapweed Spotted knapweed Dalmation Toadflax	Point location less than 1 acre within project area	Handpulling
Hwy 20	Diffuse knapweed Spotted knapweed	Scattered plants along 17 miles outside but adjacent to project area	Herbicide, handpulling, & biological control
Forest Rd 1419/1420	Scotch Broom	Scattered plants along 1 mile within project area	Handpulling
Forest Rd 1216	St Johns Wort	Scattered plants along 3 miles within project area	Biocontrol

Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats.

Risk Ranking

There is a high risk for the introduction or spread of noxious weeds into the project area, based on the combination of the following three factors:

1. There are known weeds in/adjacent to project area on Highway 20 and the Forest Road 14
2. 5 out of 8 possible vectors[16] are present
3. Project operation in/adjacent to weed population

The 5 vectors that may increase the risk of weed introduction include the potential use of heavy equipment in the project area, the presence of some Off-Highway Vehicles in the area, some pack

[16] Vectors that can lead to the risk of weed introduction include: 1) heavy equipment, 2) importing soil/cinders, 3) Off-Highway Vehicle use, 4) grazing, 5) pack animals, 6) plant restoration, 7) recreationists (hikers, mountain bikers), and 8) Forest Service or other vehicles

animals visit the area, plant restoration may be planned, recreationists are present, and frequent vehicle use.

Soil

This topic provides background addressing Key Issue number 4, water quality and soil health

Landscape Characteristics

The Metolius Basin project area is located within the volcanic Cascade Range of Oregon, where essentially all landforms, rocks, and soil are products of volcanism, glaciation, and major earth movements. The landscape of the project area is characterized by gently sloping plains of glacial outwash which are surrounded by hills and ridges of lava that rise above the outwash plains (Metolius Watershed Analysis, 1995). Elevation ranges from about 2,950 feet in the northeastern portion along the northern boundary to about 4,100 feet on lower slopes of Green Ridge along the eastern boundary. The eastern portion contains moderately sloping to steep slopes (20 to 70 percent) of volcanic materials that resulted from faulting which formed the Green Ridge escarpment. Glaciers did not affect this landform, and rock outcrop is common on the steeper slopes. The gently sloping plains (0 to 10 percent slopes) in the basin contain glacial outwash as the major underlying soil parent material. Glacial till also occurs on the higher elevation landforms to the west, but dominant overlaying soils have developed from a number of pumice and ash deposits, including Mazama Ash (Crater Lake deposit), Blue Lake cinders, Sand Mountain ash, Mt Washington ash, as well as other volcanic deposits (Craigg, 2002). Most soil materials have been reworked by running water and deposited over the landscape ranging in thickness from 20 to greater than 40 inches. Dominant soils consist of sand sized and smaller particles resulting in sandy loam soil textures. On the west side of the planning area, limited areas with Blue Lake cinder deposits have soils with coarser gravel sized cinders.

Water is transmitted rapidly through these soil materials, and most water yielded from these lands is delivered to streams as deep seepage and subsurface flow. Surface runoff generally occurs only on localized areas of shallow and moderately deep soils (20 to 40 inches) associated with rock outcrop during high intensity storms or when the ground is frozen. Several perennial and intermittent streams occur within the project area (see Watershed/Riparian/Fish section).

The project area contains five Eco-types and 17 ecological landtype units based on similarities in landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation (Craigg, 2002). Similar landtypes were grouped to develop four major ecological types and one additional type of limited extent (Upper Deschutes Soil Survey, 1999). The biophysical characteristics of these ecological land units can be interpreted to identify hazards, suitabilities, and productivity potentials for natural resource planning and management. This basic information provides a context within which to assess existing conditions relative to the range of inherent variability and desired future condition.

Sensitive Soil Types

Criteria for identifying sensitive soils to management is listed in the (Deschutes LRMP, Appendix 14, Objective 5). These criteria include slopes over 30%, frost pockets, seasonal or year-long high water tables, extremely rocky areas, and soils that have high or extreme erosion hazard ratings. Sensitive soils within the project area include soils with seasonal high water tables, windthrow hazards, and soils on slopes greater than 30 percent. Approximately 39 percent (5,721 acres) of National Forest System lands within the project area contain sensitive soil areas (Table 3-22). Surface erosion is not a primary concern within the project area due to the extent of gently sloping to moderately steep landforms and the inherent porosity of representative soils. Sensitive soils that occur within proposed activity areas are discussed in the Soil Resource section of Chapter 4 (Environmental Consequences).

Table 3-22. Sensitive Soil Areas within the Metolius Basin project area (Natural Resources Conservation Service, Upper Deschutes Soil Survey, 1999).

Map Unit Symbol	Map Unit Name (soil series names and soil phases)	Type of Concern**	Acres
16E	Belrick-Douthit Complex, 30-50 % slope	2	396
29A	Cryaquolls, 0-3 % slope	1	153
143B	Suiloten-Circle Complex, 0-8 % slope	1	3,059
161E	Windego-Smiling Complex, 30-50 % slope	2	1,061
163E	Windego-Smiling-Rock Outcrop Complex, 30-70 % slope	2	829
164A	Wizard Sandy Loam, 0-3 % slope	1	223

**Management Concerns

(1) Perched water table, especially during spring runoff period.
Windthrow hazard due to shallow rooting depths in wet areas.

(2) Slopes greater than 30 percent limit ground-based equipment operations.

Management Direction

Forest Plan direction is to promote maintenance or enhancement of soil productivity. Alternative management practices will be developed and mitigating measures implemented when activities will result in detrimental soil impacts (Forest Plan page 4-70, SL-1). Standard and Guideline (Sl-3) requires that a minimum of 80 percent of an activity area be left in a condition of acceptable productivity potential for trees and other managed vegetation following land management activities. Standard and Guideline (SL-4) directs the use of rehabilitation measures when the cumulative impacts of management activities are expected to cause damage exceeding soil quality standards and guidelines on more than 20 percent of an activity area. Standard and Guideline (SL-5) limits the use of mechanical equipment in sensitive soil areas. Operations will be restricted to existing logging facilities (i.e., skid trails, landings) and roads, whenever feasible.

The Pacific Northwest Region developed soil quality standards and guidelines that limit detrimental soil disturbances associated with management activities (FSM 2520, R-6 Supplement No. 2500-96-2). This Regional guidance supplements Forest Plan standards and guidelines, which are designed to protect or maintain soil productivity. Detrimental soil impacts are those that meet the criteria described in the Soil Quality Standards listed below.

Detrimental Compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.

Detrimental Puddling occurs when the depth of ruts or imprints is six inches or more.

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.

Severely Burned soils are considered to be detrimentally disturbed when 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.

Severely burned soil – Eyerly Fire, Sisters Ranger District

Target Landscape Condition

The primary goal of soil management is to maintain or enhance soil conditions at acceptable levels without impairment of the productivity of the land. The extent of detrimental soil disturbances is minimized through the application of mitigation measures and conservation practices designed to meet management objectives. The land effectively takes in and distributes water, and erosion rates are controlled to near-natural levels. The biological productivity of soils is ensured by management prescriptions that retain adequate supplies of surface organic matter and coarse woody debris.

Scope of the Analysis

The soil resource may be directly, indirectly, and cumulatively affected within each of the 423 activity areas proposed within the project area. An activity area is defined as "the total area of ground impacted activity, and is a feasible unit for sampling and evaluating" (FSM 2520). For the Metolius Basin Forest Management Project, activity area boundaries are considered to be the smallest identified area where the effects of different management practices would occur. Thus, the discussion of soil effects and soil quality standards for the issue measures will be focused on units proposed for silvicultural treatment and fuel treatment areas where prescribed fire is planned.

The best available information about the proposed actions was used in conjunction with the location of activities to analyze the potential effects on the soil resource. Quantitative analyses and professional judgment were used to evaluate the issue measures. This analysis also considered the effectiveness and probable success of implementing the management requirements, mitigation measures and Best Management Practices (Mitigation, Chapter 2). Additional information about the effects of management activities on soils can be found in the Final Environmental Impact Statement for the Deschutes National Forest Land and Resource Management Plan.

Past Activities

Wild land Fire

Wildfires can cause intense burning of the forest floor that may completely consume the protective surface cover and cause soils to repel water, thereby increasing surface runoff and subsequent erosion. Although fire history data indicates that large fires (greater than 100 acres) have burned portions of the project area within the past 50 years (Metolius Watershed Analysis, Appendix 1, 1995), there is currently little evidence of severely burned soil because native vegetation has recovered and existing sources of ground cover have returned surface erosion rates to near natural levels. Therefore, extensive areas of severely burned soil do not exist within the project area. Any localized evidence of severely burned soil would likely be confined to small areas where individual logs or stumps were completely consumed by fire.

Fuel loadings in previously harvested areas have been reduced, but there is still a risk of intense fires in other portions of the project area due to existing stand conditions. The majority of the project area is facing a moderate to high fire hazard, and this hazard will increase if fuel levels are not reduced (see Fire/Fuels section).

Timber Harvest

Between 1968 and 1996, ground-based logging equipment disturbed soils in portions of 382 harvest units (13,825 acres) within the Metolius Basin project area. Based on harvest history, various silvicultural treatments have occurred within the project area prior to Forest Plan direction. Temporary roads, log landings, and primary skid trails were constructed and used to access harvest units. Varying degrees of soil compaction and displacement have been observed within these units (Craigg, 2002). The majority of past soil disturbances occurred on and adjacent to heavy-use areas such as primary skid trails and log landings. Some long-term, adverse effects to site productivity still exist where topsoil layers were displaced and/or several equipment passes caused deep compaction.

Past harvest history, field observations, Regional and Forest Plan guidance and various research references were used to estimate existing soil conditions within the activity areas planned for this project. Approximately 3,300 acres of soil is currently committed to existing roads and logging facilities within portions of the 423 activity areas proposed for this project. It was determined that 348 of these activity areas (about 80 percent) currently have detrimental soil conditions that exceed 20 percent of the unit area due to past ground disturbances from management activities.

Mechanical treatments (i.e., ground based harvest and/or machine piling) are proposed within 238 of these activity areas, and approximately 87 percent of these activity areas (208 units) currently have detrimental conditions that exceed 20 percent of the unit area. The amount of detrimentally disturbed soil ranged from 21 to 38 percent. All of these soil disturbances occurred prior to the establishment of Forest Plan standards and guidelines (1990) that limit the extent of detrimental soil disturbance to no more than 20 percent within individual activity areas, such as harvest units. Estimates of existing percentages of detrimental soil disturbances are displayed for each of the proposed activity areas in Table 4-1 (Environmental Consequences, Soil Resource Section).

Restoration treatments, such as subsoiling, have rehabilitated approximately 37 acres of disturbed soil on skid trails and landings in portions of 21 past harvest units that are now scheduled for re-entry with this project. These restoration acres were deducted in the calculated estimates of detrimentally disturbed soil for these activity areas. Soils committed to existing logging facilities in other activity areas will remain in a detrimental condition until reclamation activities are implemented to improve the hydrologic function and productivity on disturbed soils.

The effects of management activities on soil productivity also depend on the amount of coarse woody debris (CWD) retained or removed on affected sites. Care must be taken during slash disposal and fuels reduction treatments to retain enough logging slash and woody debris (greater than 3 inches in diameter) for long-term nutrient cycling. A minimum of 5 to 10 tons per acre of coarse woody debris should be retained on ponderosa pine sites and 10 to 15 tons per acre on mixed conifer sites to maintain soil productivity (Graham et al. 1991, Graham et al. 1994). A sufficient number of standing dead snags and live trees should also be retained for future recruitment of organic matter.

Fuel loadings in ponderosa pine stands generally range from 5 to 15 tons per acre and mixed conifer stands range from 15 to 45 tons per acre, depending upon past harvest history and stand conditions (Metolius Watershed Analysis, 1995). Prior to the establishment of Forest Plan standards and guidelines (1990), equipment operators were not directed to leave some of the logging slash and natural fuels in treatment areas. Most of these woody materials were concentrated into piles for burning, and current amounts of CWD may be deficient where these practices were used in some previously managed areas. However, even these sites are likely approaching the recommended level because tree mortality and windthrow have caused boles to fall to the ground over time.

Roads

The project area contains approximately 151 miles of existing roads on National Forest System lands (see Roads section). Approximately 125 miles (205 acres) of these existing roads occur within the 382 previously harvested areas that are now scheduled for re-entry with ground-based equipment. About 54 miles (92 acres) of road occur in activity areas proposed for mechanical treatments where previous logging has not occurred since 1968. It should be noted that road mile estimates within the planned activity areas also included about 35 miles of unclassified roads. The amount of detrimentally disturbed soil committed to existing roads is included in the percentages displayed in Table 4-30 (Chapter 4, Soil Resource Section).

Roads detrimentally disturb soil properties and convert the soil resource to a non-productive condition. Most of the precipitation that falls on compacted road surfaces is transmitted as surface runoff, and roads are primary sources of accelerated surface erosion. The greater the area cleared of surface cover, the greater the erosion potential.

Accelerated erosion and sediment delivery to streams can be reduced through proper maintenance or removal of roads that are no longer needed for future management. Road condition surveys were conducted on most roads within the project area to identify maintenance and reconstruction needs, as well as decommissioning opportunities. It was found that some lower use roads need maintenance to improve surface drainage and reduce erosion (see Roads section). Road maintenance and reconstruction activities will improve current problems on specific roads that will be used as haul routes for this project. The roads analysis also identified several road segments that are recommended for decommissioning treatments. Road obliteration treatments have beneficial effects to the soil resource by improving hydrologic function and productivity on disturbed sites.

Recreational Activities

The concentration of human activity in and around recreation sites can reduce vegetative cover, compact the soil surface, and accelerate erosion. Current recreational activities include developed and dispersed camping, hiking, mountain biking, horseback riding, and limited off-highway vehicle (OHV) use. Intensive recreation use has resulted in impacts to sensitive resources in the Metolius Basin, particularly along rivers and streams (see Recreation section). Since developed recreation sites are commonly located within and adjacent to riparian areas, eroded soil particles can enter streams and affect water quality. The Forest Service conducts annual maintenance of developed recreation sites to mitigate serious erosion problems and impacts to other resource values.

Impacts from dispersed recreation activities are usually found along existing roads and trails. Heavy use of popular dispersed recreation sites typically show substantial resource damage given a combination of overuse, improper camping techniques and insufficient control and maintenance. An inventory of dispersed campsites recorded 41 sites located near streams within the project area. The use of OHVs and horses has resulted in miles of user-created trails. Campfires usually consume available sources of down woody debris around recreation sites.

Soil Existing Conditions

Natural events and management disturbances have influenced the current condition of soils in the project area. Natural disturbance patterns (i.e., precipitation events, droughts, insect and disease epidemics, and wildfires) continue to influence erosional processes that give landforms their distinctive appearance and drainage patterns. Ground-disturbing management activities (i.e., timber harvest, road building and recreation use) directly affect soil properties, which in turn influence the productivity and hydrologic function of soils. The magnitude of effects is directly related to the quantity and quality of surface organic matter and soil porosity.

Summary Discussion Relevant to the Issue Measures

Detrimental Soil Disturbance

The primary sources of past detrimental soil disturbances are associated with existing roads and ground-based logging facilities which were used for timber management activities between 1968 and 1996. Of the 423 activity areas proposed within the project area, it was concluded that over 80 percent (348 units) currently have detrimental soil conditions that exceed 20 percent of the unit area. Of the 238 activity areas proposed for mechanical treatments (i.e., ground based harvest and/or machine piling), approximately 87 percent (208 units) currently have detrimental conditions that exceed 20 percent of the unit area. The amount of detrimentally disturbed soil ranged from 21 to 38 percent. All of these past soil disturbances occurred prior to the establishment of Forest Plan standards and guidelines in 1990. Forest Plan direction is to limit the extent of detrimental soil disturbance to no more than 20 percent within individual activity areas.

Although intensive recreation use has resulted in soil resource damage in localized portions of the project area, the overall extent of these soil disturbances are relatively minor in comparison to disturbed areas associated with the transportation system and timber management activities.

There is little evidence of severely burned soil from past wildfire events within the project area. This detrimental soil condition would likely be confined to small areas where individual logs or stumps were completely consumed by fire.

Coarse Woody Debris

Adequate amounts of coarse woody debris currently exist within the majority of activity areas to protect the soil surface and provide a long-term source of nutrients as these organic materials gradually decompose. In some portions of the project area, fire suppression has resulted in vegetation conditions that have fuel loadings in excess of historic pre-settlement conditions (Craigg, 2002). Other previously managed areas may have coarse woody debris amounts which are slightly deficient, but these sites have been improving towards optimum conditions as dead tree boles have fallen to the ground over time.

Project Design and Mitigation

Cumulative levels of existing and predicted amounts of new soil disturbance need to be considered to determine whether soil quality standards will be met. For activity areas that have already been impacted by previous management, project plans need to include options for avoiding, reducing, and mitigating adverse impacts from project activities to meet soil quality standards (Chapter 2, Mitigation Measures).

Water Quality

This topic provides background addressing Key Issue number 4, water quality and soil health

The subwatersheds in the Metolius Basin project area were evaluated using stream surveys, watershed analysis, field observations, engineering, silviculture, aerial photo interpretation, GIS, and Cumulative Watershed Effects analysis.

ANALYSIS AREA

The Metolius Basin project lies within the Upper Metolius and Why-chus 5th field Watersheds. The 17,000 acre project area includes part of seven 6th field subwatersheds Table 3-23, Figure 3-10). The project area is dissected to the east and west by the Metolius River.

Table 3-23. Watersheds, Subwatersheds, and Approximate Acreage Within the Metolius Basin Project Area.

5th FIELD WATERSHED	6th FIELD SUBWATERSHED	ACREAGE*	ACREAGE* WITHIN PROJECT AREA
Upper Metolius	Cache	11,900	1,150
	Suttle Lake	10,500	1,680
	Scarp	16,400	6,940
	Canyon	21,300	45
	First	5,550	4,480
	Jack	9,830	1,430
Why-chus	Indian Ford	23,200	340

* Acreage calculations are approximate values.

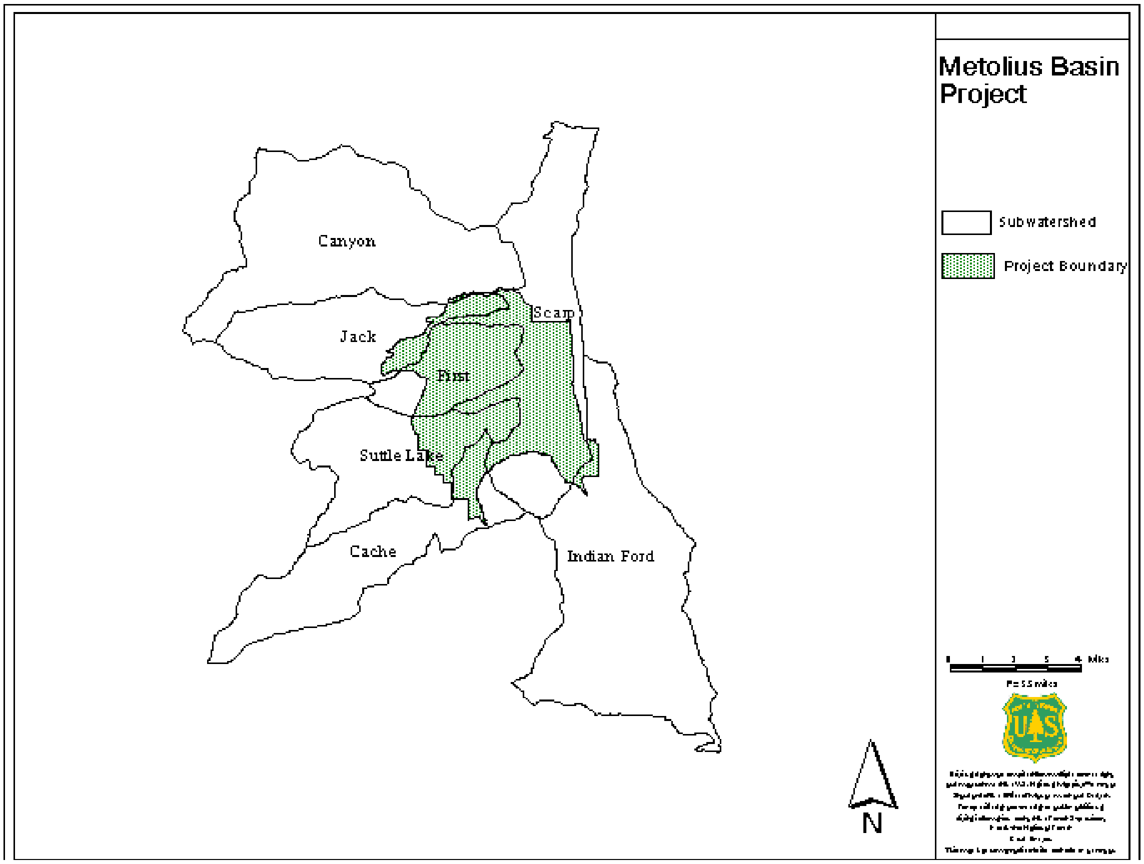


Figure 3-10. Subwatersheds in the Metolius Basin Project Area.

Mean annual precipitation in the area is estimated to be between 25 and 40 inches (Larsen, 1976). Several perennial streams occur within the project area including the Metolius River, Jack Creek, Lake Creek, and Spring Creek. Intermittent streams also occurring in the project area include First Creek and Davis Creek along with numerous other smaller intermittent streams that are not named (Metolius Watershed Analysis, 1996). Slopes range from 0-10% in the basin, and up to 70% on Green Ridge.

Drainage System

The Metolius Drainage is primarily a spring fed system that is periodically fed by many snowmelt driven, higher elevation ephemeral channels.

The headwaters of the Upper Metolius Watershed originate in the Cascade Mountains and flow east into the glacial outwash landscape with many streams meandering to the Metolius River. Throughout the course of the streams, groundwater inputs may influence flow and water quality.

East of the Metolius River is Green Ridge. Most of the streams are ephemeral and flow for a short distance down the steep escarpment. Most of these streams carry water only during storm events, as is the case in most subwatersheds within the project area (Metolius Watershed Analysis, 1996). The Upper Metolius 5th Field Watershed (excluding the Cache Creek Subwatershed) is a Tier 1 Key Watershed based on the presence of bull trout and its contribution to anadromous salmonid conservation. High water quality and its contribution to the Deschutes Basin is also an important feature of the watershed. Key watersheds serve as refugia which are the basis of most species conservation strategies. To meet Northwest Forest Plan direction, the Metolius Watershed Analysis was completed in 1996. The Northwest Forest Plan also directs that road mileage be reduced in Key Watersheds, which is an objective on this project.

Description of 6th Field Subwatersheds

Jack Subwatershed: This subwatershed is dissected to the north and south by Jack Creek. Jack Creek is a very stable stream system with seasonal fluctuations in flow due to irrigation withdrawals in the summer and seasonal intermittent flow from tributaries.

First Subwatershed: This subwatershed is dissected to the north and south by First Creek. First Creek is a relatively unstable stream system with a "flashy" flow response to storm events (i.e. response times in peak flow are shorter than normal in response to storm events). There is evidence of down-cutting and bank erosion within the First Creek Drainage.

Scarp Subwatershed: This subwatershed is dissected to the east and west by the Metolius River. The Metolius River is a very stable river for its size and has very consistent discharge patterns on an annual basis. It incorporates the west aspect of Green Ridge, which includes many ephemeral stream channels.

Suttle Lake Subwatershed: This subwatershed incorporates Suttle Lake and is dissected to the north and south by the 3.8 mile Lake Creek. Irrigation diversions, dams, and bridges exist within this section. Lake Creek is the first tributary to the Metolius River and can significantly influence water quality in the Metolius. Lake Creek is on Oregon's 303(d) list for exceeding summertime maximum stream temperatures. Flow in Lake Creek is delayed and somewhat regulated due to upstream water storage in wetlands, ponds, and Suttle Lake. Lake Creek water sources are from Blue Lake, Link Creek, Suttle Lake system, springs, and intermittent Cache Creek. South Fork Lake Creek is considered the mainstem stream and North Fork and Middle Forks of Lake Creek could be considered as irrigation diversion ditches.

Based on analysis during the Metolius Watershed Assessment, Suttle Lake Subwatershed is experiencing a moderate reduction in soil quality, and moderate to high increase in sediment delivery and flow regimes. A decrease in water quality and clarity is occurring in Link Creek and small lakes with the subwatershed (Houslett, 1998). Overall riparian condition within the watershed is fair. There are localized riparian areas that are in poor to extremely poor condition as a result of recreation, roads, and private land use.

Cache Subwatershed: This subwatershed is dissected to the north and south by Cache Creek. Cache Creek is a tributary to Lake Creek, yet only flows water into Lake Creek during large flood events or periods of high water table. Cache Creek flowed over highway 20 during the 1996 flood and reached Lake Creek for a period of weeks. Field observations on Cache Creek June 24, 1999 showed evidence of heavy bedload movement derived from spring runoff or flood events. The cause of excess sediment is not apparent at this time, but may be from Dry Creek, a short, perennial non-fish bearing stream outside of the project area.

<u>Indian Ford Subwatershed:</u> This subwatershed is dissected to the east and west by Indian Ford Creek. Unlike the other subwatersheds in the Metolius Basin project area, Indian Ford Subwatershed is in the Why-chus 5th Field Watershed. Indian Ford Creek is a low gradient spring-fed stream that is a tributary to Squaw Creek. Diversions have resulted in reduced flows, high water temperatures, and low dissolved oxygen levels. Nutrient enrichment and riparian camping have lowered water quality (Sisters/Why-chus Watershed Analysis, 1998).

<u>Canyon Subwatershed:</u> This subwatershed is dissected to the north and south by Canyon Creek, Brush Creek, Roaring Creek, and Bear Valley Creek. There are approximately 45 acres of proposed treatment within the subwatershed, of which will have no *measurable* adverse effects on the stream systems.

BENEFICIAL USES

Beneficial uses are documented according to criteria by the Oregon Department of Environmental Quality (ODEQ, 1998a). A beneficial use is a resource or activity that would be directly affected by a change in water quality or quantity.

The beneficial uses of water in the Metolius Basin Project Area include public and private domestic water supply, industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid fish rearing, salmonid fish spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality (Wild and Scenic River).

Water quality for beneficial uses is maintained and protected through the implementation of the Northwest Forest Plan Aquatic Conservation Strategies and Standards and Guidelines (1994), the Deschutes National Forest Plan Standards and Guidelines including Best Management Practices (BMPs), Metolius Watershed Analysis (1995), the Metolius Wild and Scenic River Management Plan (1996), the Metolius Late-Successional Reserve Assessment (1996), and the Why-chus Watershed Analysis (1998).

RIPARIAN RESERVES

Riparian Reserves are designed to best meet the Aquatic Conservation Strategy (ACS) objectives and to provide habitat connectivity for terrestrial and late-successional species. Riparian reserves recommended by the Metolius Watershed Analysis (USDA, 1996) are as follows:

- Permanent streams with fish, natural ponds and lakes are assigned 320 feet beyond the edge of water.

- Wetlands, intermittent streams, permanent streams without fish are assigned 160 feet beyond the edge of water.
- Created ponds and reservoirs are assigned 160 feet beyond the edge of water.

These widths are based on site-potential tree heights. The Metolius Watershed Analysis recommended considering expansion of riparian reserve boundaries to 400 feet on each side of permanent streams and 250 feet on intermittent streams in the Suttle Lake, Jack, First, and Cache Subwatersheds. This is primarily due to low stream densities and high fragmentation, and to provide habitat connectivity through aggregation of riparian reserves where possible (ex. Lake Creek) (Metolius Watershed Analysis, 1996, pp. 147-148). However, this project analysis determined that since riparian reserves were not highly fragmented in the project area, that riparian reserves widths listed above would be adequate.

There are approximately 1917 acres of riparian reserves within the project area. Riparian reserves are important areas to protect from catastrophic impacts to riparian vegetation and soils. Deciduous vegetation contributes organic matter and nutrients to streams, large wood and shade to streams, and help hold stream banks together in floods and filter road runoff from entering the streams. Some of the dense, diverse vegetation along stream corridors that make the streams more susceptible to crown fires are also the conditions that make for diverse floodplain habitats for fish and riparian associated species.

Riparian reserves are also important areas for recreationists, but heavy recreation use has been impacting soils and vegetation. Thinning trees in riparian reserves may open areas to vehicular traffic and increase dispersed trails and camping along the stream banks. Dispersed camping is in high demand and is especially high along Lake Creek and Jack Creek.

Perennial streams in the project area are at a lower risk of wildfire due to the increased humidity and relatively flat terrain. Even though the riparian vegetation may be dense, there is a diversity of plants that may hold moisture all summer and may not burn intensely. If upland conditions are brought into more natural fuel loads, the risk of catastrophic loss of riparian reserves will be reduced.

The distribution of riparian reserves along perennial or intermittent streams varies by subwatershed (Figure 3-11). Much of the riparian reserves of the First Creek subwatershed is comprised of intermittent stream without fish and First Creek itself. The Jack Creek, Suttle Lake and Scarp (Upper Metolius River) riparian reserves are mostly fish bearing.

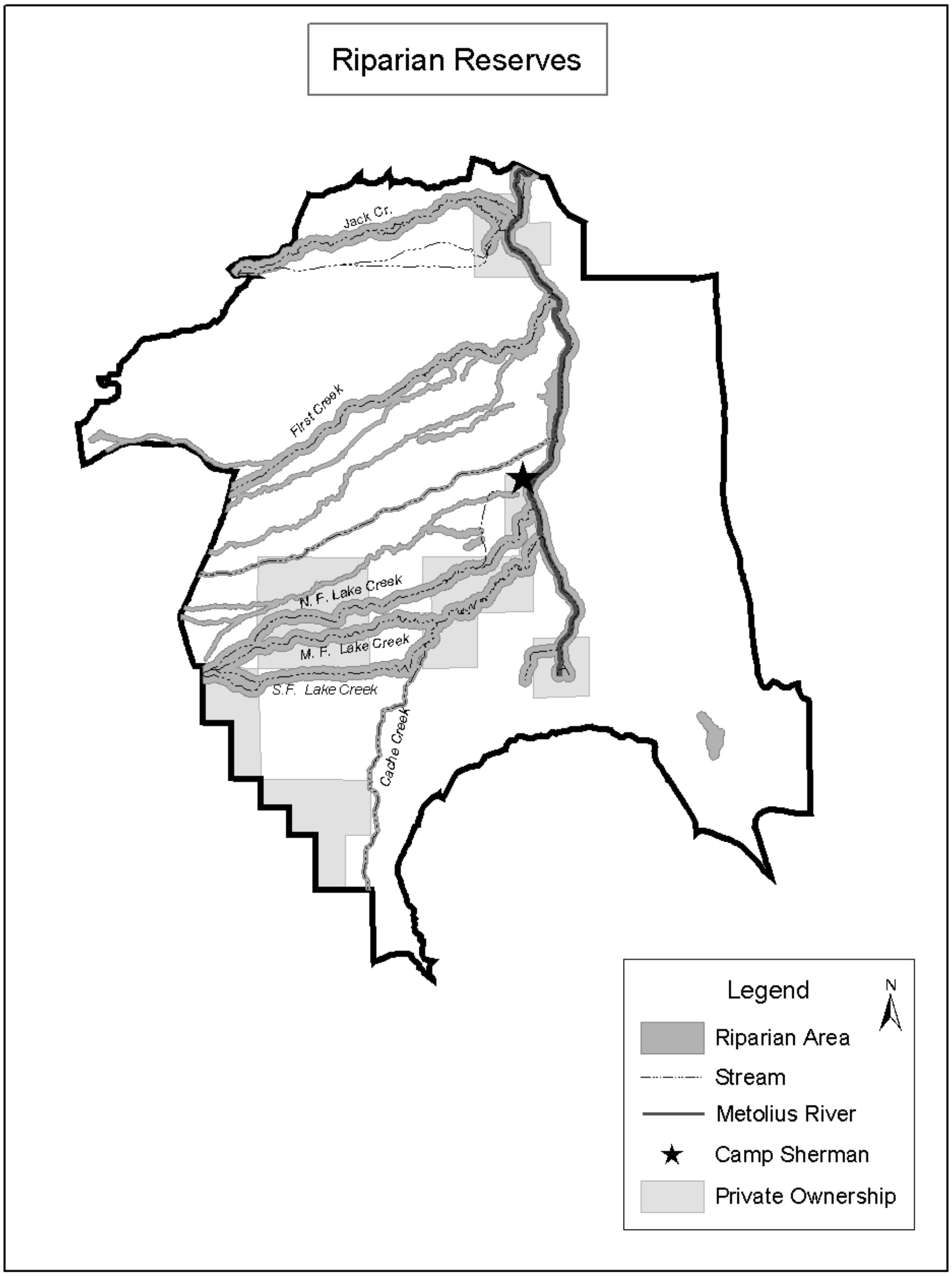


Figure 3-11. Map of riparian reserves of the project area.

Riparian vegetation along the riparian reserves is dominated by wet mixed conifer plant associations in the First Creek and Lake Creek subwatershed. The low broad flood plains extend the range of the mixed conifer to the east. The Metolius River and Jack Creek are dominated by dry ponderosa pine plant associations. All perennial streams have riparian plant associations dominated by mountain alder, serviceberry, wild rose, snowberry and sedge.

Stands of large trees are important to riparian reserves in providing a diversity of habitats in the floodplain and instream. Large tree forests provide increased shade and retain soil moisture later into the year. The majority of riparian stands along Lake Creek and the Metolius River are dominated by large trees (Table 3-24). Large tree dominated stands comprise nearly half of the area along First Creek and the intermittent streams in that watershed. Jack Creek has few acres that are dominated by large trees, although large trees are scattered throughout the riparian reserve.

Table 3-24. Acres in Riparian Reserves that meet the possible old growth definition, based on size of trees. The definition is 13 trees per acre over 21 inch DBH in ponderosa pine stands and 15 trees per acre over 21 inch DBH for mixed conifer.

Acres of Possible Old Growth by Subwatershed					
Cache	First	Jack	Scarp	Suttle Lake	Total
20	392	37	233	196	878

Over half of the riparian forest stands have densities above the upper management zone, based on average basal area, and nearly one quarter of the stands evaluated were over 200 ft^2 of basal area. It is predicted that, even though riparian areas typically have denser vegetation than upland forest stands, these dense conditions are outside of the historical range of variabiliy (Metolius Research Natural Area unpublished data).

Riparian stands are dominated by small trees in ponderosa pine in the First, Jack and Suttle subwatersheds. The riparian reserve along the Metolius River (Scarp) was dominated by stands with large ponderosa pine, with small tree stands less common. First Creek had a sizable proportion of the watershed in small to large trees in mid seral stages of mixed conifer stands

<u>Desired and Existing Condition.</u> The desired condition of riparian reserves is outlined in the Northwest Forest Plan Aquatic Conservation Strategy Objectives (Northwest Forest Plan ROD, B-11). Objectives include providing for travel and dispersal corridors for many terrestrial animals and plants and provide for greater connectivity within the watershed.

Riparian Reserves should provide large wood, stable and vegetated streambanks and flood prone areas, stream shade, a vegetative filter for runoff from roads, a diversity of vegetative conditions to which associated species have been adapted, and a network of uninterrupted habitats to serve as connectors for species that have reduced mobility.

Existing conditions of riparian reserves within the project area range from good to poor. Many riparian areas could benefit from a light to moderate reduction in tree densities to promote tree growth in remaining trees for stream shade, and reduce the risk of loss to wildfire. One such example is Lake Creek, where predominately down fuel loads and tree densities are very high. Water quality can be protected by reducing the hazard of catastrophic wildfire by thinning areas of high mortality and areas that are out of the range of natural variability. In other localized areas, roads, recreation and private land use have degraded riparian reserves. Prescribed fire could also be used as a tool to reduce the risk of catastrophic wildfire and protect water quality from sediment into streams and increased stream temperature from the loss over vegetative shade.

303(D) LISTED STREAMS:

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of all waters. A portion of the proposed project area is in a 6th field subwatershed with a stream on the 303(d) list. From the mouth to Suttle Lake, the North and South Forks of Lake Creek do not meet the standard for water temperature in salmonid rearing streams (64.0^{o}F) established by Oregon Department of Environmental Quality (1998 Database of Waterbodies considered for 303(d) Listing in Oregon). The North Fork Lake Creek data shows a 7-day average of daily maximum stream temperatures of 73^{o}F in 1990 and 1991. The South Fork Lake Creek shows 7-day average daily maximum stream temperatures of up to 80^{o}F in 1991 (USFS Sisters Ranger District data). However, it is predicted that higher stream temperatures in Lake Creek are due to the influence of the water temperature from Suttle Lake, the primary source of Lake Creek (Houslet, 1999). The large surface area (253 acres) and low velocity of Suttle Lake promote warming of surface water. Data from past Suttle Lake projects has been sent to DEQ in an attempt to remove Lake Creek from the 303(d) list. It is assumed that with the application of proposed mitigation measures outlined in Chapter 2, the proposed project will have no measurable adverse effects on the listed 303(d) parameters of Lake Creek.

METOLIUS WILD AND SCENIC RIVER

The Metolius River was designated as a part of the National Wild and Scenic system in 1988, and a River Management Plan was complete in 1997. This plan provides direction to protect and enhance the 8 outstandingly remarkable values of scenic quality, recreation, cultural resources, geology, water quality, fisheries, wildlife, and ecological values. The portions of the Metolius River that is within the project area is classified as “recreation”, and is to be managed to “protect and perpetuate a recreation experience in a historic setting amidst the beauty of the Metolius River and its surrounding ponderosa pine forest” (ROD:1). The Management Plan recognized that, in certain areas, the upland and riparian vegetation in the river corridor was outside the range of desired conditions. The plan provides direction on the use of vegetation management to move forest conditions toward healthy, open pine stands in the uplands, and large trees and denser shrubs in the riparian areas.

Roads

This topic provides background addressing Key Issue number 5, road access

EXISTING TRANSPORTATION SYSTEM

Within this project area there are 151.3 miles of road under Forest Service jurisdiction, including 55.3 miles of inactivated (closed) roads (though some have been breached or re-opened by the public). This leaves 96.0 miles of open road, for an open road density of 3.6 miles per square mile (see Table 3-25).

Table 3-25. Existing Road Miles and Densities within the Project Area.

Types of Road	Miles within the project area	Road density (miles/sq. mile)
Entire Project Area (including the Metolius Heritage Area)		
All Roads (open and closed)	151.3	5.7
Open Roads[17]	96.1	3.6
Baseline Roads ("primary" + "secondary" roads)	62.4	2.3
Primary	27.9	1.0
Secondary	34.5	1.3
Other Roads – (all roads, including inactivated roads, not included under baseline roads,)	88.9	3.3
County and Private Roads	9.9	0.4
Metolius Heritage Area Only		
All Roads (open and closed)	87.1	5.7
Open Roads in the Heritage Area[18]	47.8	3.1
Heritage Area Baseline Roads ("primary" + "secondary" roads)	31.3	2.1
Heritage Other Roads - all roads, including inactivated roads, not included under baseline roads)	55.8	3.7

The Land and Resource Management Plan lists density guidelines for the project area at 1.5 miles per square miles within the Metolius Heritage area and 2.5 miles per square mile elsewhere. However, in the Metolius Heritage area baseline road density alone is greater than the guidelines density, at 2.1 miles per square mile. It will require a close look with the local community to

[17] Total Project Area = 26.6 sq. miles
[18] The Metolius Heritage Area is approximately 9,734 acres or 15.2 square miles

determine which of the baseline roads, if any, the public is willing to close. These guideline densities will be used as thresholds for further evaluation. No baseline roads were proposed for closure under this project analysis.

Roads in the project area which are classified as Highway Safety Act roads include 11, 1110, 12, 1216, 1217, 14, 1419, 1420, 1400140, and 1400900.

Road condition surveys were conducted on most roads within the Metolius Basin project area to identify maintenance and reconstruction needs. The only maintenance concerns were found on lower use roads, and could be addressed with the addition of a few drain-dips with lead-out ditches to improve surface drainage and reduce erosion, and brushing and limbing where needed to improve sight distance and safety.

Roads Analysis

In 1997 the Sisters Ranger District identified baseline roads considered necessary for maintaining public and administrative access to National Forest lands. These roads were identified as either primary or secondary roads. Roads not selected as primary or secondary (those classified as "other" roads) include currently inactivated roads and open roads that need site specific analysis to determine whether they should be inactivated, decommissioned or returned to secondary status.

In 2001, The National Forest System Road Management Policy required a science-based transportation analysis be developed for every National Forest, consistent with changes in public demands and use of National Forest resources. This direction focuses on assuring that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; that unneeded roads are decommissioned and restoration of ecological processes are initiated; and that additions to the National Forest System road network are only those deemed essential for forest resource management and use. A Forest-wide road analysis is being completed on the Deschutes National Forest, assessing all main roads across the forest, including within the Metolius Basin Forest Management Project area. The project-level road analysis that was conducted for this project area incorporated assessment recommendations for the main roads from the Forest-wide road analysis, and information from the previous Sisters Ranger District road assessment, then focused on reviewing the remainder of all roads in the project area (a summary of findings from the Road Analysis can be found in Appendix E).

Through the recent road analysis, many road miles (particularly short road segments in or adjacent to riparian or other sensitive resource areas) within the Metolius Basin project area were recommended for inactivation or decommissioning by the planning team (including many user-created roads within riparian areas). Finding a balance that addresses both the need for public access and the risks associated with roads is essential. The proper balance will result in a more efficient and affordable road system with less risk to the environment and public safety than currently exists. In addition, reducing road miles can mitigate potential watershed effects from timber harvest activities used to reduce fuel loads. A range of road closures is analyzed under each of the Alternatives of this project (see Chapter 2, Tables 2-5).

The baseline road system, in general, is in good condition and will safely carry the expected administrative traffic. Some secondary roads, and open roads in the "other" category, will be further evaluated for maintenance needs when specific haul routes are identified for this project. The Sisters Ranger District coordinates with Friends of Metolius on an annual basis to re-close old roads in the basin which have been breached by off-highway vehicle use.

Economic and Social Values

Local Economy

Wood Products/Forestry. Timber sales from the Deschutes National Forest used to provide employment opportunities to local communities that were dependent on timber-harvest related employment. However, over the last several decades, all but one of the primary log processing mill and many of the secondary wood processing plants in Deschutes, Jefferson and Crook Counties have closed down due to limited supplies of material. The economy is much more diversified in these counties than it had been over the last 20 years, and are no longer primarily dependent on agricultural and forestry related business (Central Oregon Intergovernmental Council, 2002).

Markets for small diameter logs

Consistent supply is a primary factor, but other factors that can equally impact timber sales [of small diameter logs] include distance to log supply, efficiency of processing technology matched to smaller log size, and fluctuations in lumber/chip market prices. Each affects the price a buyer is willing to pay for logs. If the bid price a buyer is willing to pay meets or exceeds the minimum cost recovery price set by the Forest Service, a sale may proceed. If the bid price falls below the minimum, no sale occurs. All of these factors have contributed to decreasing the timber buying potential in the region.

Markets and Processing Options for Small Diameter Trees, Mater Engineering, 2002

The impact of this trend is the loss of skills, equipment and manufacturing capacity that can help implement forest restoration and fuel reduction projects. Currently, the wood material that comes off the Sisters Ranger District in the last few years has been transported to mills in Madras, Prairie City, Gilchrest, and in the Willamette Valley (Mater Engineering, 2002). In addition, more of the skilled labor and equipment to harvest wood products on the Deschutes National Forest have come from outside the local area. This adds to the net cost of restoration work.

Declines in timber harvests over the past several years, in response to changing social values, have subsequently contributed to significant declines in payment levels to communities. Historically, 25 percent of the gross receipts collected by the Forest Service from the use of National Forest System lands and resources (including timber sales) were returned to the States as a source of funding for schools and roads. Payments to counties were based on the amount of National Forest System land within a county and comprised an important element of local budgets.

In response to this decline, on October 30, 2000, (Public Law 106-393), H.R. 2389, the Secure Rural Schools and Community Self-Determination Act of 2000 (Act) was signed into law by President Clinton. Counties now have the option of continuing to receive payments under the 25 Percent Fund Act or electing to receive their share of the average of the three highest payments during the years from 1986 to 1999.

Other natural resources employment in and adjacent to the project area is related to the administration of the National Forest lands on the Sisters Ranger District, and coordination with other land and resource-based agencies which work in the area.

Leisure Services. Within the project area the primary employment is within the leisure services sector, in local lodges, resorts, and concessionaire-operated Forest Service campgrounds. The local Camp Sherman store provides supplies for visitors and residences.

Costs to Consider in this Analysis

The above discussion suggests that there may be potentially high costs for removing smaller diameter wood material from the forest, particularly if local markets and skills are not available. Other costs to consider under this analysis relate to full implementation of all restoration activities (mowing, burning, disposal of fuels related to thinning), and of road decommissioning and inactivation. Another consideration is the potential cost-savings for wildfire suppression under the action alternatives. Estimates of these values are discussed under the Economics Section in Chapter 4.

Stewardship Contracting

Due to declines in timber harvests from federal lands in the last several years, several initiatives have evolved to build broader linkages between watershed restoration and healthy communities. In 1999, section 347 of the Appropriations Bill was passed authorizing the Forest Service to enter into several dozen stewardship contract demonstration projects, which allow the Forest Service to combine procurement contracts and timber sale contracts to more efficiently accomplish ecosystem restoration. To address local concerns about the use of commercial timber sales to implement the Metolius Basin Forest Management Project, and Sisters Ranger District applied for and was selected as a demonstration site in 2002. See Appendix B for more information about Stewardship Contracting.

An objective of applying stewardship contracting to the Metolius Basin Forest Management Project is to provide opportunities to build and enhance local contractors skills and equipment through restoration work. Matching watershed restoration needs and contracting with residents and firms has been increasingly emphasized as an alternative to diversifying rural economies to benefit the economic and social well-being of local communities.

Social Values

Local residents are concerned about protecting and restoring the beautiful Metolius Basin and preserving values associated with enjoyment of the landscape. Management actions may affect people's value associated with ecosystems. The preamble to the Metolius Conservation Areas management standards and guidelines in the Deschutes National Forest Land and Resource Management Plan (pg. 4-164) clarify the importance of social values in the Metolius Basin.

> **Metolius Conservation Management Areas**
>
> *The upper Metolius Basin is an inspiring forest setting. For decades people have found the Metolius to be a special place where they are relieved from the stresses of everyday life amidst a unique natural beauty that exists in few other places. In many families, a tradition of recreation use and love of the Metolius has been handed down over several generations.*
>
> LRMP, pg. 4-164

Beliefs reflect what people think is true about something and can be a reason a person has one or more attitudes. They are subject to change based on new information, experiences or learning. Values reflect what people consider to be precious to them. They represent goals or standards of behavior that form the basis for their attitudes and beliefs. Values are deep-rooted and resistant to change. Core values influence people's perceptions about land management activities (Haynes and Horne 1997).

Understanding the beliefs and values of the various members of the public, and balancing management decisions among a variety of opinions and interest regarding ecosystem management has changed over time. Forests valued because of their utility to humans have traditionally led natural resource management policies. However, over the past decade, the view of preserving forests in their existing condition, without active management, has increased (Steel 1994).

People interested in the Metolius Basin Forest Management Project have wide ranging values, and there are some conflicting opinions about whether the forest should be actively managed to achieve outcomes people desire or passively managed by allowing nature to achieve its own course. Though a few people hold firm beliefs on either end of this spectrum of active or passive management, most people share a mix of values and perspectives.

Ecological values are associated with functions and services provided by the biophysical environment such as air quality, water quality, protection and maintenance of plant and animal species. Functions and services associated with desired conditions for the Metolius Basin Forest Management Project area include, water quality, and late-successional habitats that sustains viable fish and wildlife populations, and vegetation composition and structure and fire regimes within an expected range of variation depict the functions and services provided by the area.

Spiritual and aesthetic values include beliefs that the environment provides people with scenic quality, solitude and personal renewal, feelings of attachment to specific places, an intrinsic value of knowing that natural areas exist for their own sake, and the desire to leave a healthy environment for future generations (Bengston 1999). Sense of place or place attachment has a variety of interpretations mostly including emotional bonds that people form with geographic places; values, meanings or symbols that are strongly felt but hard to identify; qualities that are valued if they are threatened or lost; shared cultures or social practices and a set of place meanings; and awareness of cultural, historical and spatial contexts that form the basis of values and social interactions (Williams and Stewart 1998). Many locals and long-time visitors have very strong emotional bonds to the Metolius Basin (a more detailed description of Sense of Place can be reviewed in Chapter 1).

A survey of residents in Central Oregon (OSU 2002), on Fire Conditions on Public Forests and Rangelands, found that the majority of respondents felt it was very likely that a wildfire could break out in the forests near their homes within the next 5 years, and felt that wildfires could cause severe impacts to forest vegetation and water resources within burned areas. The majority of respondents also thought that prescribed fires, "mechanical removal of vegetation", and thinning were legitimate tools that resource managers should use to reduce the risk of wildfire impacts. This survey also found a high level of concern about smoke from prescribed fires, but many felt that smoke was a "necessary inconvenience" from the application of prescribed fires.

In a survey of Oregonians and national public about values regarding natural resources, respondents identified protecting resources for future generations as the most important factor. The three most important factors for eastside residents were a quality place to live, outdoor recreation and wildlife habitat. Factors most important to national interests were wildlife habitat, and ecological health (Brunson and others 1994). According to a recent survey commissioned by the Oregon Department of Forestry (Oregon Department of Forestry 2001) most Oregonians want the forestland of the state to be managed for a balance of social, economic and environmental benefits.

Scenic Values

High scenic quality is one of the outstanding natural qualities that attract people to the Metolius Basin. Stately old growth ponderosa pine, the clear blue water of the Metolius River and its tributaries, and glimpses of flower-filled meadows are defining features of the Metolius Basin. This beautiful scenery contributes significantly to the quality of life for the local Camp Sherman residents.

MANAGEMENT DIRECTION

This very special value is highlighted in management directions found in the Deschutes National Forest LRMP, and Metolius River Wild and Scenic River Plan. Of the 4 management allocations directing land management in the project area, 3 identify protection and enhancement of scenery as a primary objective. Scenic quality is also one of several outstandingly remarkable values for the Metolius Wild and Scenic River.

The Scenery Management System (SMS) will be used in conjunction with the Deschutes National Forest Land and Resource Management Plan (LRMP 1990) and the Northwest Forest Plan (1994) to describe and analyze scenic quality.

The main forest roads through the Metolius Basin, 1120, 12, and 14, and the Metolius Wild and Scenic River are the primary scenic view corridors found within this project area (LRMP, Alternative E map, 4-121 through 4-131, and 4-165 through 4-202). These one-half mile corridors are to be managed as natural appearing landscapes with high scenic integrity within the foreground. The majority of the area outside of these scenic routes, such as other road and river corridors, is visible from Black Butte as middle-ground (between ½ and 5 miles).

Visual Sensitive Areas. The interface between National Forest lands in the project area and private lands (particularly residential and resort properties), summerhome lots, and recreation developments, and the entire length of the scenic corridors in the project area are visually sensitive. Management activities within these areas would need to be carefully designed and implemented to minimize short-term impacts on the scenic resource.

A small portion (3%) of the project area is managed under the Metolius Special Forests allocation, where scenic quality standards are not as high as in the other parts of the project area, and scenery can be altered for longer, with a lower scenic integrity level during management activities.

Management Goals

Landscape Character and Scenic Integrity. The landscape character goal for ponderosa pine forests in the Metolius Basin is to achieve a natural-appearing landscape with open park-like stands. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags, and small openings, to highlight special features within the landscape, are desirable and encouraged. Where feasible, diversity in vegetation species, age and size classes would be encouraged (such as stands of younger trees), but the primary character would be vast stands of ponderosa pine, with strong elements of large yellow pines.

Along the west, south and east boundaries, mixed conifer stands in the foreground would create a views of extensive, continuous tree canopies, intermixed with a few natural-appearing openings. There would be more diversity in plant species and size in mixed conifer forests than ponderosa pine forests.

The Metolius Wild and Scenic River Resource Assessment (1992) identified scenery as an “outstandingly remarkable value” in the river corridor, partly due to the presence of mature ponserosa pine forests, and the visual prominence of the river.

Proposed Forest Plan Amendment

The current Land and Resource Management Plan standards and guidelines for maintaining visual quality restrict the activities that can be visible to the "causal observer" within certain areas, including scenic view zones of retention and partial retention in the Metolius Heritage, Metolius Black Butte, and Metolius Special Forest management allocations. It is expected that activities proposed under this project may not meet these standards, so a site-specific, short-term amendment to these standards and guidelines is proposed. See Chapter 4, under Forest Plan Amendments, for a description of the proposed changes and an analysis of effects.

EXISTING CONDITIONS

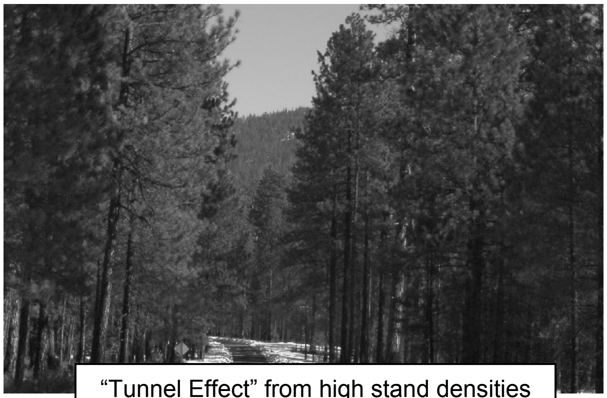

View of Mt. Jefferson over the Metolius River

Past natural openings and human-caused activities have affected the natural-appearing landscape character. Some dead and down trees resulting from natural processes (such as insects, diseases, wildfire, and high impacts from wind and snow damage) and past management activities (such as past timber harvest, wood cutting, and dispersed recreation development, access roads, and facility development) have degraded the area's scenic quality and integrity to some degree. The greatest impact occurs when these human-caused activities are highly visible from sensitive viewer locations. High tree stumps, dead and down logs, bent-over trees, and very dense thickets of small trees have contributed to negative deviations from a natural-appearing scenery which the public expects and values within the Metolius Basin.

In addition, one of the most highly valued scenic resources, large ponderosa pine trees, are slowly dying out due to competition with dense stands of young trees, and there are fewer replacement trees (large-limbed, large diameter pines). The historic larger-scale stand characteristic of an open park is also being lost to dense forests and denser canopies. These conditions have also led to a greater risk of high intensity fires, which may increase the potential loss of scenic quality in the future.

Of the popular travel corridors in the project area, Forest Road 14 is the most sensitive scenic corridor. This is the primary access into and out of numerous recreation sites, including the Metolius River, campgrounds, summer homes, resorts, and other destinations that make this area very special. Diverse vegetation stands and species, with various ages, size classes and health conditions, frame both sides of these travel routes. These stands provide strong lines, textural and color patterns broken up only by occasional filtered-view openings into the foreground and middleground landscape, and are considered to be unique scenic features (providing form and relief feature) within Central Oregon landscape characteristic

However, the scenic quality along these routes is becoming degraded due to high stand density and snow damage to small trees, resulting in a view that is restricted to mostly the immediate foreground ("tunnel effect"). Small trees are crowding out glimpses into the old-growth stands, and of distant wilderness peaks and Black Butte. In a sense, the travelers along these routes are not able to "see the forest through the trees" anymore.



"Tunnel Effect" from high stand densities along a road in the project area

Recreation and Lands

Management Direction

Recreation management objectives are specified under the 4 separate management allocations under the Deschutes National Forest Land and Resource Management Plan. Though there are variations in objectives, similarities in management direction focus on maintaining the beauty and naturalness of the Metolius Basin, managing visitor use and recreation activities to prevent degradation of the resources, and restricting Off-Highway Vehicle use (within the project area, Off-Highway Vehicle use is only permitted within the Metolius Special Forest area, and then only when compatible with other resource values). In addition, the Wild and Scenic River Plan (which identifies recreation as an outstandingly remarkable value) direction recommends developing vegetation management strategies for all developed recreation sites, closing roads with 200 feet of streams, and managing other areas for low-density camping.

Recreation Residences. Tract Objectives are to be used as guidelines for management of the recreation residences (summer homes) along the river. The specific guidelines regarding thinning and reforestation calls for the preservation of the stands of large ponderosa pines to be the major goal. Small trees may be thinned where necessary to give space for optimum growth of larger ones. Reforestation may also occur. Any vegetation treatment will be determined in advance in consultation between the USFS and the homeowner during the preparation of the Operation and Maintenance Plan.

Recreation Opportunity Spectrum. The Recreation Opportunity Spectrum is a tool for guiding management of recreation facilities and experiences that are compatible with surrounding forest settings. It is recommended that the majority of the project be managed as "Roaded Natural", where the environment is mostly natural appearing when viewed from sensitive roads and trails. Vegetation alterations would maintain the desired visual and recreation characteristics, and evidence of human activity would harmonizes with the natural environment. A small area between Road 1220 and The Head of Jack Creek (approx. 500 ac.) is classified as "Roaded Modified", which means it is acceptable if management actions are more visible, and access to recreation settings is easy (little risk of challenge). The immediate foreground of campsites should still appear relatively "natural".

Recreational Activities and Facilities

The Metolius Basin is the most popular area to recreate on the Sisters Ranger District. Current recreational activities include developed camping, dispersed camping, picnicking, hunting, fishing, hiking, mountain/road biking, horseback riding, nordic skiing, snow shoeing, snowmobiling, limited off-highway vehicle (OHV) use, sight-seeing, watching wildlife, driving for pleasure, participating in interpretive activities and non-motorized boating.

Recreational facilities include six fee campgrounds operated under permit by Hoo Doo Recreational Services. These campsites can accommodate a total of 650 people at one time when fully occupied. However, average occupancy is between 14% and 27% over the entire season (April to October). There are no comprehensive vegetation management plans for these campgrounds and the hazard trees are removed on an annual basis, as needed. Other developed sites include the Fish Viewing Platform, Head of the Metolius and the Allingham Dump Station (closed to the public in 2002). Total number of visitors to these facilities in 2000 was about 216,616. All of these facilities are located within the Metolius River corridor.

Trails within the project area include the East and West Metolius River Trails (hiking), the Metolius-Windigo Trail (horse/hiker), a portion of the Lower Butte Trail adjacent to Forest Road 14 (horse, hikers, mtn. biking), Segment H trail adjacent to Forest Road 1419, and a portion of the Green Ridge Trail (horse/hiker/mountain biking). These trails receive a moderate amount of use with the exception of the Green Ridge Trail, which receives low use. All trails are in fair to good condition with minor maintenance needs.

The Allingham Administrative Site is also located within the Metolius River corridor. This site is used for storage, provides a single residence for seasonal Forest Service employees, and is a designated fire Incident Command camp. Some vegetation management has been done on the site to remove hazard and snow bent trees.

Intensive recreation use has resulted in impacts to sensitive resources in the Metolius Basin, particularly along rivers and streams. A recent dispersed campsite inventory recorded 41 sites located near streams within the project area. It is estimated that there are an additional 10-20 dispersed sites not included in this inventory. The use of OHVs and horses/stock is often associated with dispersed camping and has resulted in miles of user-created trails. A recent inventory of these trails was conducted by Friends of Metolius, and the information was included in the area road analysis. Work by the Sisters Ranger District, with the Youth Conservation Corp, in 2002 helped restrict vehicle access from sensitive riparian areas adjacent to bull trout habitat. The District also coordinates with Friends of Metolius on an annual basis to re-close old roads in the basin which have been breached by off-highway vehicle use.

Recreation Activities under Special Use Permit

There are 108 summer homes located on National Forest lands along the Metolius River in six tracts (Tracts C, E, F, H, I, O). These homes are managed under special uses permits and received 27,000 visits in fiscal year 2001. Management direction, including maintaining lots in a fire-safe condition, is provided by the tract objectives (project files).

The Camp Sherman Store, also managed under a special use permit on National Forest lands, is at the hub of the community. It serves as a convenience store and provides for the basic needs of the locals and visiting public. It received 100,000 visits in fiscal year 2001.

As mentioned, there are six Developed campgrounds under special uses permit to HooDoo Recreational Services. These campgrounds are: Allingham, Camp Sherman, Gorge, Pine Rest, Riverside, and Smiling River. An annual operating plan provides management direction.

There are two outfitter guide permits for use of the Metolius River. These are institutional and are issued to Central Oregon Community College and Bend Parks and Recreation Department. Other institutions are permitted from time to time. Applications for commercial, non-developmental special uses must respond to both the “demonstrated need” and “negligible impact” criteria if they are within the Metolius Wild and Scenic River Corridor.

Non-recreational Activities Under Special Use Permits.

Non-recreation special use permits have been issued to allow for power lines, phone lines, irrigation ditches (off Lake and Jack Creeks), and some private driveways, like Tamarack Lane.

The Holzman Grazing Permit encompasses a 64-acre fenced pasture, and allows grazing for two horses.

The Black Butte School and the adjacent Camp Sherman Community Church are also under permit on National Forest Land. A land exchange is currently underway that will put these two facilities on private land

Heritage Resources

Prehistoric and historic values of the Metolius River are one of the outstandingly remarkable values of the Wild and Scenic River corridor.

Prehistoric Use. Evidence from initial surveys, which found artifacts beneath a layer of Mazama ash, indicates that the initial and primary occupations occurred more than 7,000 years ago. The Metolius River basin is known to have been an important travel route (the Klamath Trail) and occupation area for both Columbia Plateau and Great Basin cultures throughout pre-history.

Historic Use. Fur trappers and other Euro-American traders were the first non-native visitors to provide written descriptions of the Metolius River area. These explorers crossed the area in the early 1800’s over the Klamath Trail. Captain John Freemont of the Topographical Engineers, leading a government supported expedition, explored and mapped the Metolius River area in

1843. Lt Henry Abbot conducted surveys for Pacific Railroad Surveyors in 1855 in search of a railroad route across the Cascade Range.

The first documented non-native settlement of the Metolius River area began in approximately 1870 with the establishment of several homesteads (some of which remain in private ownership today). The community of Camp Sherman was established in 1890s and early 1900s. Primarily ranchers from Sherman and Morrow counties used the community as a retreat and vacation spot. Many of the 108 summer homes on the river within the project area were built between 1910 and 1920. A Civilian Conservation Corps (CCC) camp, which housed up to 400 men, was built at the current location of Riverside Campground in 1932.

Traditional Use. The Wasco, Warm Springs and Paiute people have used the river as a major source for harvesting fish (see Chapter 1, Background for further description of traditional uses and values). Members of the Sisters Ranger District met with the Cultural and Heritage Committee of the Confederated Tribes of Warm Springs to discuss this project. Committee members expressed a strong interest in protecting the Metolius River and its waters, and provided historic anecdotal information about visiting the project area to fish, hunt and on the way to collect berries. They remembered the landscape as much more open then it is today, with fewer trees and shrubs. The Metolius River is the only specified tribal interest resource identified in the project area. No significant populations of tribal use plants or locations of tribal traditional use are known. The Warm Springs and Wasco Tribes from The Confederated Tribes of Warm Springs Reservation of Oregon are the known tribes with historic associations to this area.

The project area is within lands ceded to the Federal Government by The Confederated Tribes of the Warm Springs Reservation of Oregon under treat in 1855 and ratified by Congress in 1859.

Recorded Heritage Resources

Approximately 7200 acres within the project area have been surveyed, most in relation to this project proposal, but numerous others surveys have also been conducted since 1981. The survey for this project covered all high probability areas and a sample of low probability areas. High probability in this project analysis area included the areas adjacent to the Metolius River and tributaries and several areas of fairly flat ground on Green Ridge. The remainder of the project is considered low probability for the presence of significant historic and prehistoric resources.

Through past and present surveys, 54 heritage sites and 12 isolates have been located and recorded. Sites have 10 or more artifacts or the presence of features such as cave, rock art, fire pit remains or structures. Isolates do not have any features and less than 10 artifacts. Of the 54 sites; 37 are prehistoric, 16 are significant and considered significant and eligible for inclusion on the National Register of Historic Places (ten pending State Historic Preservation Office consultation), 10 are considered not significant (7 pending State Historic Preservation Office consultation), and 28 remain unevaluated. The 12 isolates are considered not significant. Overall the density of sites is moderate to high compared to other areas of the Sisters Ranger District.

Most of these sites are found adjacent to rivers and streams. A number of these have been impacted by development in the area of Camp Sherman and recreation along rivers and streams. Other sites in the analysis area have been identified and damaged by roads established in historic and recent times. Overall, approximately 48 of the 54 known sites have existing disturbance from one or more of these sources.

Management direction for cultural resources is found in the Deschutes National Forest LRMP (C-2, 3 and 4), in the Forest Service Manual, 2360, in federal regulations 36CFR63, 36CFR800 and 43 CFR7, and in various federal laws including the National Historic Preservation Act, the National Environmental Policy Act, and the National Forest Management Act. Management direction asks the Forest to consider the effects on cultural resources when planning projects, to evaluate each resource for eligibility to the National Register of Historic Places (Register), and protect or mitigate effects to resources that are eligible.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

This Chapter summarizes the effects of implementing each alternative on the environment described in Chapter 3. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

Key Issues #1, Vegetation Management in Late Successional Reserves and #2, Size of Trees Removed

Important Interactions

The issue that relates to management of Late Successional Reserves is primarily one of social acceptability and debate over whether it is appropriate to harvest trees in a Late Successional Reserve, and how big those trees should be to meet goals. The information analyzed here does not answer those questions; they relate to choices and tradeoffs that will be addressed by the Forest Supervisor in the Record of Decision for this project. This analysis discloses the predicted effects of tree harvest on late-successional habitat and forest structure.

A question some people have raised is whether it is within the Forest Service's policy to harvest trees in a Late Successional Reserve, regardless of the objectives of tree harvest, and if so, is there an absolute limit on tree size. As addressed under the issues in Chapter I, the Northwest Forest Plan does allow silvicultural treatments inside Late Successional Reserves, providing the goals are to reduce risk and promote long-term maintenance of late-successional habitat (ROD, C-12,13). Most treatments proposed under this project were assessed, reviewed and approved by the Regional Ecosystem Office under the Metolius Basin Late Successional Reserve Assessment (1996). The action that was not assessed at that time, and would require additional review by the Regional Ecosystem Office is regeneration treatments in declining stands under Alternative 5. See the discussion on Late-Successional Reserve Assessment Consistency at the end of this section.

The factors that are analyzed, and that influence late-successional forest conditions are forest structure (stand densities and tree size), species composition, and disturbance processes. Actions that can affect these factors are the type and amount of vegetation management (e.g. tree harvest, aspen restoration, mowing and prescribed burning), and risk of extensive disturbances.

Direct and Indirect Effects

Forest Structure

Stand Density is a primary factor affecting growth and vigor of forest vegetation, and its resilience to disturbances. Different parts of the project area can support different stand densities, depending, in part, on available water, light and nutrients. For instance, forest stands on wetter, more productive sites can usually tolerate higher densities than stands on dry, low productivity sites. The Metolius Late-Successional Reserve Assessment (USDA 1996) states "maintaining stand densities at manageable levels is essential for promoting forest health and maintaining or creating large tree character and habitat in dry areas (pg. 16).

Ponderosa pine is more sensitive to high stand densities than other tree species in the project area. The longer a ponderosa pine remains in overcrowded conditions, the less it is likely to reach 21" or greater diameter. Stump analyses on the Sisters Ranger District revealed that large ponderosa pine trees initially had rapid growth rates (due to little competition) for the first 50 to 100 years and less growth over time as density increased.

The "upper management zone" is the stand density threshold above which forest conditions and large tree health are likely to deteriorate (Cochran et al, 1994). Stands that are far above the upper management zone (the point at which tree mortality begins to occur due to competition) are more susceptible to severe disturbances than stands less densely stocked (see insert of upper management zone, Chapter 3).

<u>Tree Size</u> (measured by the diameter of the trunk at 4.5 feet above the ground) is an indicator of the stage of development of old growth trees. An important structural element in the Metolius Basin late-successional forest is the large ponderosa pines. Highly valued, both socially and ecologically, there is concern about the potential loss of large trees across the project area. Proposed actions intend to improve the ability for existing large trees to survive, and to create conditions more favorable for the development of future large trees. One of the proposed actions is to thin dense forest stands to reduce the competition stress on remaining large trees, to improve the health and growth of smaller trees so that they may grow into the medium/large tree components sooner, and to reduce the high fuel levels and ladder fuels. Research shows (Tappenier et al. 1997, Hall 1998, and Hopkins 1998) that low densities are a requirement for development of large "old growth" trees with large branches. It appears that large branches (an important habitat component for several late-successional dependent species) can only develop if the tree's bole is exposed to ample light for most of the tree's life. If existing densities are not reduced, it is predicted there would be delayed development of future large trees and a loss of existing large trees due primarily to stress for competition, primarily in the ponderosa pine and mixed conifer dry plant associations.

Social Acceptability. The upper limit on the size of tree that can be removed is a Key Issue under this analysis. There is disagreement about the maximum size of trees that should be removed to meet project objectives. Some people feel that only "smaller" trees (under about 12" diameter) should be removed, due to concerns about the perceived limited amount of trees larger than 12" in the project area, and a concern about the loss of future old growth (they feel that most mid size trees must remain so that they can develop into the next generation of old growth). Other people who feel there should be a limit on the size of trees removed have a difficult time in defining what is the "right" limit. Common limits expressed are somewhere between 12" and 21" diameter. However, other people feel that defining a tree size limit is arbitrary, and that the focus should be on removing the correct trees from a stand to meet the objectives of reducing risk of severe loss from insects, disease or wildfire.

What defines a large tree is subjective, and perceptions are affected by prevailing conditions of the surrounding stands. For example, in a stand where most trees are greater than 20" diameter, trees larger than 25" diameter may be perceived as large. In a stand where most trees are 10" diameter, a tree greater than 14" diameter may be perceived as large. The Sisters Ranger District has referred to trees 21" diameter or greater as "large" tree structure in local area assessments, based on this description from the Draft old-growth guidelines (Hopkins et al., 1992) and the Eastside Screens. The Deschutes National Forest Land and Resource Management Plan refers to trees 24" diameter + as large. However, there is still disagreement about the definition of a large tree.

Average tree size in this stand is about 12-14" diameter

Each of the Action Alternatives analyzes the predicted effects of removing different sizes of trees.

Late-Successional And Old Growth Structure. Large old-growth trees are the key structural components of late-successional forests both for their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. Altered successional patterns are working against the long-term survival of these old-growth trees. All growing sites have a fixed quantity of resources and growing space, and as inter-tree competition increases it is usually the large trees that die first (Dolph et. al. 1995, In: Fitzgergerald et. al. 2000). It is thought that we may have only a few decades to deal with this situation, or we risk losing the large trees (Fitzgerald, 2002. pers. comm.). Large trees would be lost at a faster rate at higher stand densities than at lower stand densities.

Recent studies have shown the ability of old growth trees to respond to reductions in density from thinning treatments, indicating an improvement in tree vigor and increased resistance to insects and pathogens. Latham and Tappeiner (2002) measured diameter growth increments of old-growth ponderosa pine, Douglas-fir, and sugar pine in the southern Cascades of SW Oregon. Ponderosa pine basal area growth was significantly greater in the treated stands than in the control stands. Fitzgerald and colleagues (2000) are testing the hypothesis that managed old-growth stands, where density and composition are maintained at historic levels, remain viable longer as old-growth habitat (Genesis Research and Demonstration Area). Stands were treated with thinning followed by underburning. Preliminary results, after 3 years of measurement, indicate that vigor of residual old-growth trees is increasing. A similar study has been initiated in the Whitehorse area of the Lolo National Forest (Hillis, et. al. 2001). The authors anticipate increased growth response of the residual old-growth trees, based on nearby research showing response of 800 year old pine to release from competition by fire.

Based on this research, it is assumed that reducing stand densities would help maintain existing large trees, and provide better conditions for the growth of future large trees.

For this project, possible old growth was measured as stands with sufficient number of trees 21" diameter or greater (in ponderosa pine it would be 13 trees or more per acre greater than 21" diameter, and in mixed-conifer it would be 15 trees per acre that size). Alternatives 4 and 5 would remove a small number of trees larger than 21" diameter. Alternatives 1-3 would not remove any trees 21" diameter or greater, so would not have a direct detrimental effect on the number of large trees (see insert on *"what trees would be removed?"*, Chapter 2). However, all action alternatives remove trees where densities or ladder fuels are high and can indirectly benefit remaining large trees by reducing risk and competition for nutrients and water.

There are several other characteristics of old growth stands (snags, down wood, multiple canopy layers, ground vegetation) that were not measured in this analysis. These other characteristics may be affected by actions that remove or potentially consume old growth elements.

Species Composition

An objective of the Metolius Late-Successional Reserve is to "keep species within a healthy range of variability", specifically referring to the amount of white fir (pg. 65). Species composition is a factor influencing the risk and stability of late-successional forests in the approximately 40 percent of the planning area covered by mixed-conifer plant associations. These associations were historically dominated by fire-climax ponderosa pine and western larch, which are more resistant to fire, disease, and insects than either white fir or Douglas-fir (Hessburg et al., 1994). The dramatic change in species composition is shown by the differences between the number of acres dominated by pioneer/early-seral species (ponderosa pine and western larch) and the number of acres dominated by climax/late-seral species (white fir and Douglas-fir) between 1953 and 2001. The acres dominated by pioneer species have decreased approximately 2000 acres and the acres dominated by mixed and climax species has increased by approximately 2000 acres. It is expected these changes would have been greater if approximately 1400 acres of mixed conifer stands had not been harvested and reforested to early seral species, primarily ponderosa pine, over the last 30 years. A reduction of white fir in this type of ecosystem can help move toward species composition more within the natural range of variability (Graham et al, 1999).

The effects of the alternatives on species composition are difficult to quantify, but in general, the greater the diameter of the trees cut, and the more thinning done (as opposed to use of prescribed fire), the greater the shift will be towards ponderosa pine, western larch, and Douglas-fir.

Shrubs. Shrub species are discussed under Wildlife, in relation to big game habitat.

Aspen. Aspen reproduces almost exclusively by vegetative means (suckering), and requires a major disturbance for reproduction to occur (Sheppard and Englby, 1983). A rapid death of the overstory trees creates the hormonal imbalance that triggers sprouting, and aspen seedlings require essentially a full-sunlight environment to grow. Fire exclusion has resulted in loss of young aspen stands, which is a concern because as the aspen clones age they are less able to resprout vigorously after a major disturbance.

Meadows. Without a disturbance that removes or kills trees in the meadows, they tend to get over-grown as surrounding forest vegetation encroaches on the open space. The absence of fire has allowed the few meadows in the project area to grow in. Actions that remove or reduce the number of trees can help maintain this important habitat.

Disturbance Processes

Disturbance size, intensity and patterns can be affected by the previous two factors of forest structure and species composition, and relate to the sustainability of forest stands over the long-term. Disturbances are an important process in forest ecosystems because they may enhance nutrient cycles and promote diversity of habitat and species. However, the severity of disturbances tends to increase with increased stress (e.g. from high stand densities), reduced vigor, and high fuel levels. Severe disturbances can result in the loss, amount, and quality of late-successional characteristics, such as large trees and multi-layer, dense stands.

Factors that affect disturbance size, intensity and patterns include severe drought, stand densities, and species composition. Actions under the Alternatives that influence these factors are tree harvest, mowing, and prescribed burning. These actions are disturbances in themselves, and range in severity with shelterwood being the most intensive, but at a small scale (up to 296 acres) and mowing the least. As with natural disturbances, these actions can both benefit (reduce competition, enhance nutrient cycling, create diversity and mosaics), and impact (compaction, loss of individual habitats, fragmentation) stands affected. However, all are considered less impactive than a severe wildfire or insect and disease epidemic. They also begin to move ecosystem processes back toward the natural range of variability.

The severity of impacts from future disturbances can be reduced, maintaining more resistant species (i.e., ponderosa pine) with prescribed fire, increasing the distribution of single or two storied-stands, maintaining vigor by thinning to lower basal areas, and making treatment units as large as possible (Brookes, etal., 1987; Wickman, 1992).

For instance, thinning can enhance vigor of ponderosa pine trees, which could aid them in resisting severe impacts from armillaria root disease or dwarf mistletoe, which is present in many of the stands within the project area and is expected to become an primary disturbance in these stands. Modeling has indicated that in stands affected with armillaria root disease, tree growth and development would be more extensively retarded if stands remain at high densities. Frequent repeated entries (i.e., light thinning) tend to increase root disease and dwarf mistletoe (Filip, 1980; and 1984).

The primary biotic risk agents identified in the project area were bark beetles, root disease, and dwarf mistletoe. Key measures of the effects of the alternatives on these agents are the following:

- Bark beetle risk reduction is measured in terms of the acres above upper management zone treated with density-reducing treatments (Table 4-1 and 4-2) (USDA 2000).
- Root disease risk reduction is measured in terms of the acres of root disease infected stands treated with thinning and/or regeneration harvest (Table 4-3). Fir engraver beetles are also closely associated with root disease in white fir, so the number of acres treated also reflects risk from this agent. Thinning increases the percentage of immune species (ponderosa pine, western larch, Douglas-fir) in the case of annosus root disease, and increases host vigor in the case of armillaria root disease. Under Alternative 5,

regeneration would be employed where resistant or immune species are basically absent, and infection level is moderate to high.

- Dwarf mistletoe risk reduction is measured in terms of the acres of mistletoe infected stands treated with thinning and/or larch restoration (Table 4-3).

Prescribed underburning is not expected to have an effect on these risk factors because it does not typically have an appreciable effect on stand densities in the types of stands where it can be successfully employed (Covington et. al. 1997). In the case of root diseases, underburning would reduce the amount of white fir and possibly Douglas-fir in the species mix, but would not be selective enough to reduce densities and favor the resistant species in all cases. With dwarf mistletoe, underburning would reduce the amount of mistletoe in the understory, but would not be an effective treatment to reduce infection and spread because the overstory would still be infected.

It is assumed that reduced stand densities increase vigor and reduces stand susceptibility.

Effects of Alternative 1

Stand and Late-Successional/Old Growth Structure. The No Action alternative would not implement any vegetative treatment except for removal of hazard trees and maintenance of plantations that are covered by previous environmental analysis. Without action it is predicted that loss of the large tree structure would continue. An estimated 5300 acres (95%) of possible old-growth, and 8300 acres (86%) of stands with late succession elements would remain at high stand densities (above upper management zone) (Tables 4-1 and 4-2) and remain susceptible to bark beetles and armillaria root disease.

It is also predicted that the development of future late-successional stands and old-growth would be delayed since approximately 6600 acres of stands dominated by trees from 5 to 20.9 inches diameter would remain in a dense condition (above upper management zone). It is estimated, based on the diameter growth, that it would take twice as long, and perhaps longer, depending on initial stand conditions, for untreated stands to become dominated by 21 inch trees with no treatment compared to a thinning treatment. Another less tangible, but very important, effect is the development of crown and limb structure is these dense stands. Lower historic densities allowed the development of long crowns (high crown ratios) and large limbs, which provide the tree with the photosynthetic material for maintenance and growth, and which also provide the habitat structures necessary for many wildlife species (Fitzgerald, 2002. personal communication). Under Alternative 1, this structure is not expected to develop in existing high density stands.

Other predicted effects on late-successional and old-growth structure include:

- Approximately 5500 acres of potential white headed woodpecker habitat would remain in a condition that is not suitable habitat for this species (either too dense or too many canopy layers).

- Risk of stand-replacement crown fire would remain high in late-successional and old-growth stands with two or more canopy layers (51 % of the planning area) – see discussion under Fire and Fuels, next section.

- Root disease centers in mixed conifer stands would continue to expand, leading to loss of canopy cover and risk of losing late-successional strucutre as dead wood accumulates.
- Dwarf mistletoe infection would continue to increase in all affected species.

Tree Size Removed. No trees would be cut in the No Action Alternative, except for trees generally 8" diameter or less in plantations (already covered under a separate analysis).

Insects and Disease Disturbances. Under the No Action alternative the following risk factors would continue:

- Approximately 82 percent of the planning area would remain at high stand densities (above the upper management zone), increasing the likelihood of bark beetle mortality in old-growth pine and in dense second-growth stands (USDA 2000).
- Dwarf mistletoe infection would continue to increase on the approximately 4000 acres where one or more species (ponderosa pine, western larch, Douglas-fir) are moderately to heavily infected.
- Root disease would continue to spread on the approximately 1700 acres of moderate to high root disease infection. Mortality would continue unabated, affecting mainly old-growth ponderosa pine and 9 to 21 in. white fir.

Due to continued high risk, indirect effects could be the occurrence of one or more of these disturbances. Extensive canopy openings could result, leading to extensive areas of brush and other early-successional vegetation in the short-term, and a longer delay of development of sustainable late-successional habitat (Wickman, 1992).

Predicted effects on wildfire disturbances are addressed under the section on Fire and Fuels in this Chapter.

Species Composition. Under the No Action alternative, the shift in species composition towards late seral species (white fir, Douglas-fir, incense cedar) would continue, resulting in less fire resistant species on the landscape, and more ladder fuels from the shade-tolerant trees in the understory; greater amounts of shorter-lived trees (i.e. white fir); more stress on overstory ponderosa pine; and increased risk of future spruce budworm outbreaks, which increases the fire risk over the landscape

Under the No Action Alternative, aspen clones would continue to deteriorate as they age due to cankers, leaf spot, and stem decays. Also, conifers would continue to increase in numbers in aspen stands, further reducing the vigor of the aspen. Delaying the treatment of aspen stands to future planning cycles would increase the risk of not achieving vigorous aspen suckering after future disturbances, either natural or human-caused. Also, there is a risk that genetic diversity could be reduced as individual clones lose their ability to resprout.

Conifers would continue to encroach upon natural meadows under No Action, and this rare habitat may continue to decline in acres.

Late-Successional Reserve Consistency. Alternative 1 is not inconsistent with the recommendations in the Metolius Late-Successional Reserve Assessment (1996), but does nothing to move toward the Late-Successional Reserve objectives of managing for late-successional habitat conditions in fire climax stands that allow for low-intensity/severity fires, and managing stand densities and enhancing large tree character, managing the amount of white fir. See the end of this section for a more detailed discussion on Late-Successional Reserve consistency.

Effects of Alternatives 2, 3, 4 and 5

Stand and Late-Successional/Old Growth Structure. All of the action alternatives treat a similar number of acres; the difference is in how they are treated. Alternative 2 focuses mostly on underburning in pole and small tree stands, whereas alternatives 3, 4, and 5 focus on thinning trees potentially up to 16 - 21 inches diameter. Underburning, as a stand-alone treatment, would not generally reduce densities enough to reduce risks associated with overcrowding, and is not considered a technique which appreciably affects stand structure (in the types of stands where it can be controlled) (Covington et. al. 1997). In fact, under Alternative 2 this action only reduced stand densities on about 75 of the 6,000 acres treated. The actions that are considered to affect stand densities include primarily thinning, shelterwood, larch restoration, and to a lesser extent, small tree thinning.

The objective of underburning stands under Alternative 2 is to reduce the surface fuel loadings on the forest floor, thereby reducing the potential fireline intensity. Reduction of surface fuels deals with only one of the three factors influencing crown fire potential; the other two factors, crown bulk density and crown base height, are not changed.

Proposed actions under Alternative 2 would reduce stand densities the least, followed by Alternatives 3 and 4, while Alternative 5 would reduce stand densities the most. Stand densities, measured by the acres which exceed 100% of the upper management zone, differ between Alternatives 3 and 4 (Table 4-3), so even though the same number of acres are thinned in Alternative 3 and 4, the extent to which stand densities are modified is different, with allowable removal of trees up to 21” diameter under Alternative 4 being more effective at reducing stand densities.

Alternative 2 would accomplish some of the density management objectives and risk reduction by thinning understory trees 12 inches diameter or less on approximately 28% of stands with late-successional elements (an estimated 86% of which are at high densities) and approximately 32% of stands classed as possible old-growth (an estimated 95% are at high densities) (Table 4-1 and 4-2). Therefore, Alternative 2 would accomplish the desired density reduction on only about 1/3 of the acres of high-density late-successional/old-growth stands. The greatest benefits from this treatment would be primarily in two-layered stands of ponderosa pine.

Although Alternative 2 treats a similar number of total acres as the other alternatives, prescribed underburning would be used on 59 percent of the treatment acres. Underburning would be applied mainly in small tree stands (9 to 21 inch diameter) that are prescribed for thinning in the other action alternatives. The use of fire in these stands would not reduce stands densities appreciably, and would not reduce risks from bark beetles, nor increase diameter growth increments. Research has shown that prescribed burning in today's unnatural stand structures may not restore natural conditions in ponderosa pine/bunchgrass ecosystems (Covington et. al. 1997).

Alternative 3 would treat the same number of acres of Possible Old-Growth and pole and small tree stands as alternatives 4 and 5, but the effects in terms of density management would be different. The 16 inch diameter size limit would not reduce stand density to within the upper management zone on about 900 acres of the total acres thinned (Table 4-4).

Alternatives 4 and 5 would reduce stand densities on 79 percent (4200 acres) of the Possible Old-Growth acres, 74 percent (2498 acres) of the pole and small tree acres, and 89 to 92 percent (7400-7650 acres) of the acres with late successional elements. Alternatives 4 and 5 would achieve the density management guidelines on about 64-66 percent of the planning area

Other characteristics typical of dense, moist old growth stands, such as multiple canopy layers, would decline on the acres treated the most under Alternative 5 and least under Alternative 2. However, these characteristics are not desirable in many of the fire climax old-growth stands that historically occupies much of the project area, and it is not the objective of this project to perpetuate dense canopies or midstories in the open pine white-headed woodpecker habitat areas (see Desired Future Condition, Chapter 1). The old-growth characteristics of down wood would decrease the most under Alternative 2 with its reliance on underburning as a primary fuel reduction treatment.

Table 4-1 and 4-2 show the acres of stands either with late-successional elements, or considered possible old-growth, treated to reduce densities, and the acres promoted towards large tree structure.

Table 4-1. Density Reduction Treatments In Late-Successional Stands.

Prescription	2	3	4	5
Shelterwood and Shelterwood/Thinning				269
Thinning trees up to larger diameters[19]		4506	4506	3743
Larch Restoration				664
Thinning trees under 12" diameter.	3064	2907	2907	2979
Total Acres Treated	**3064**	**7413**	**7413**	**7654**
Percent of late-successional stands with Density Reduction Treatments	**32%**	**77%**	**77%**	**79%**

[19] Thin potentially to the diameter limit of 16" under Alternative 3, 21" under Alternative 4, and no specified limit under Alternative 5, though removal of trees larger than 21" diameter would be an exception.

Table 4-2. Density Reduction Treatments in Possible Old-Growth Stands.

Prescription	2	3	4	5
Shelterwood and Shelterwood/Thinning				83
Thinning trees up to larger diameters		2184	2184	1675
Larch Restoration				507
Thinning trees under 12" diameter	2036	2018	2018	2016
Total Acres Treated	**2036**	**4202**	**4202**	**4281**
Percent of Possible Old Growth stands with Density Reduction Treatments	**37%**	**76%**	**76%**	**77%**

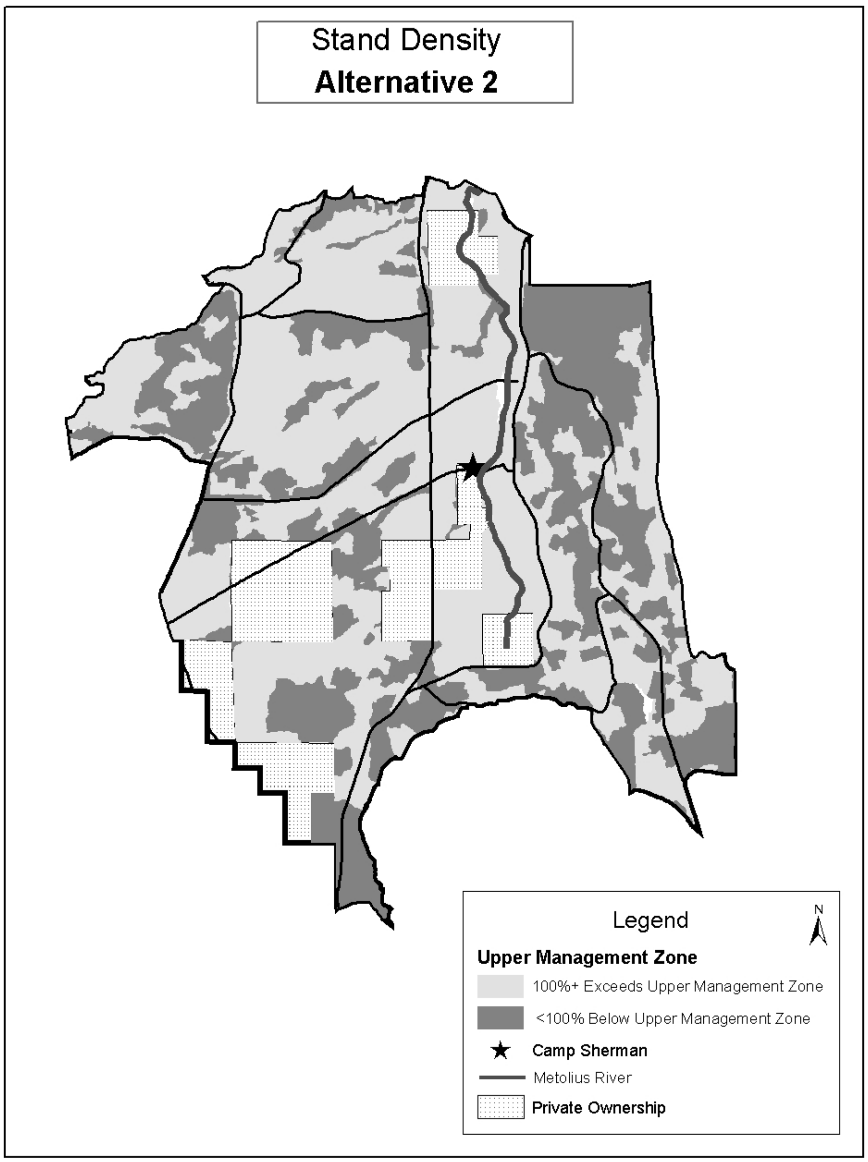


Figure 4-1. Predicted Stand Densities under Alternative 2.

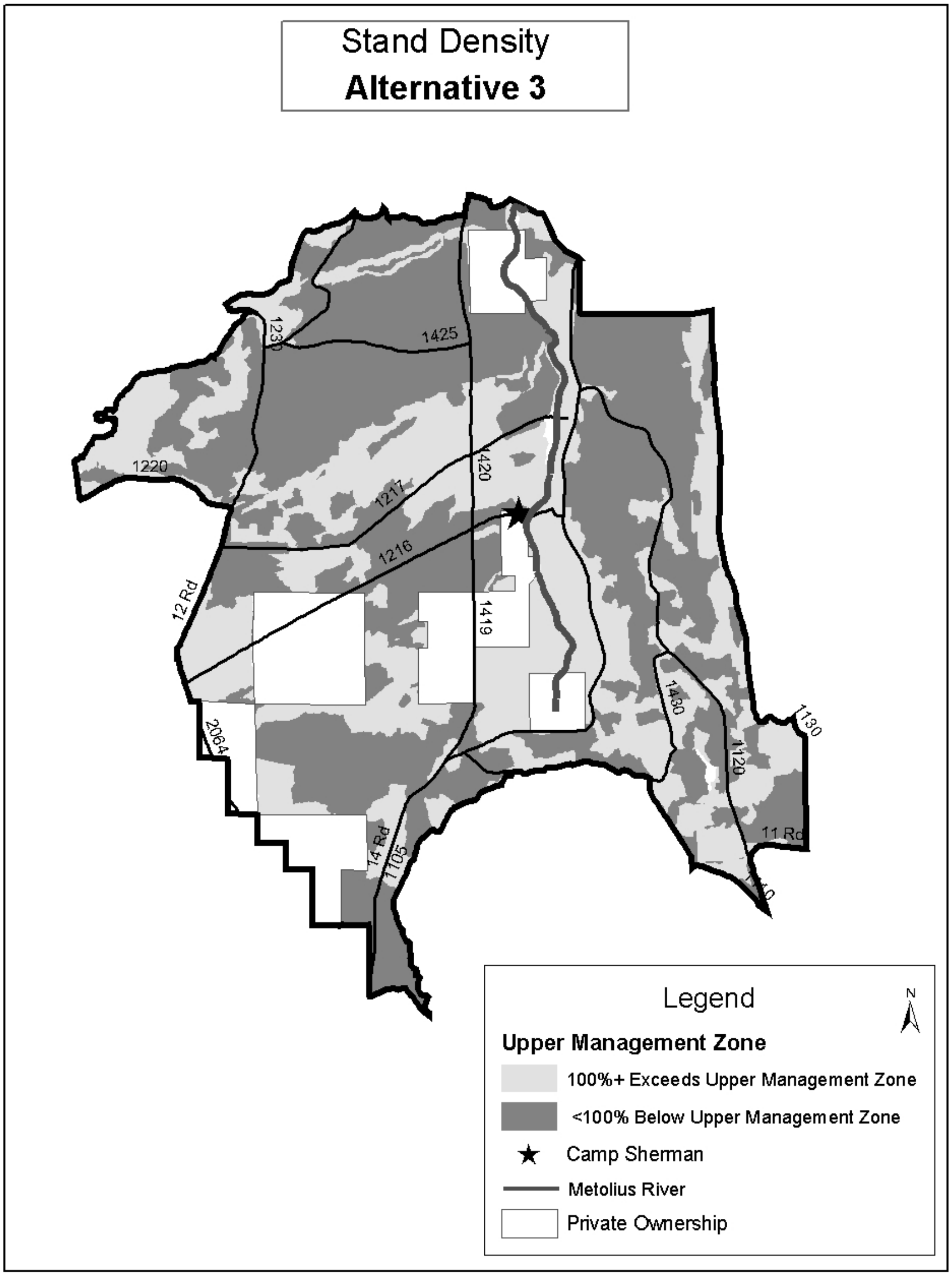


Figure 4-2. Predicted Stand Densities under Alternative 3.

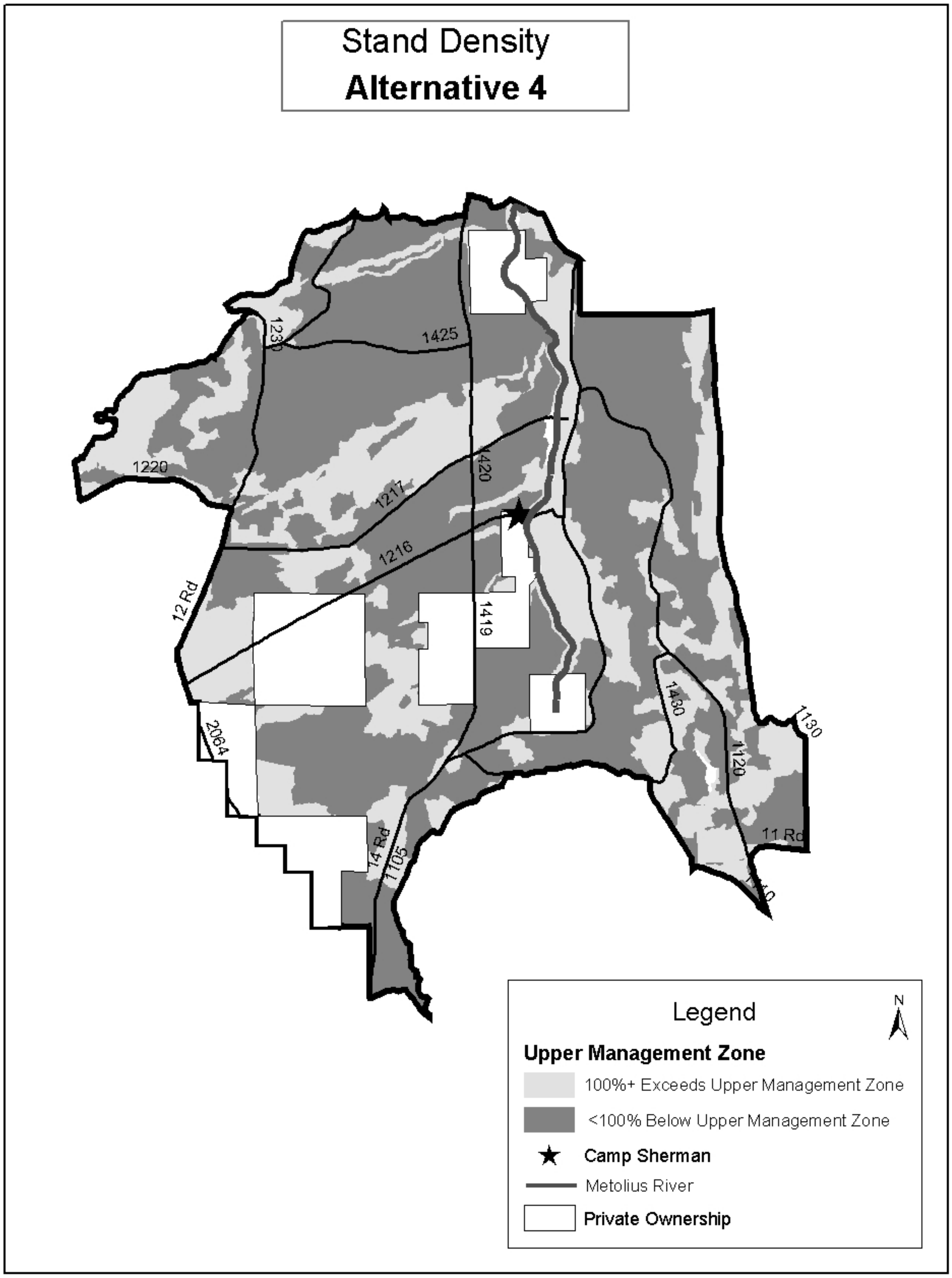


Figure 4-3. Predicted Stand Densities under Alternative 4.

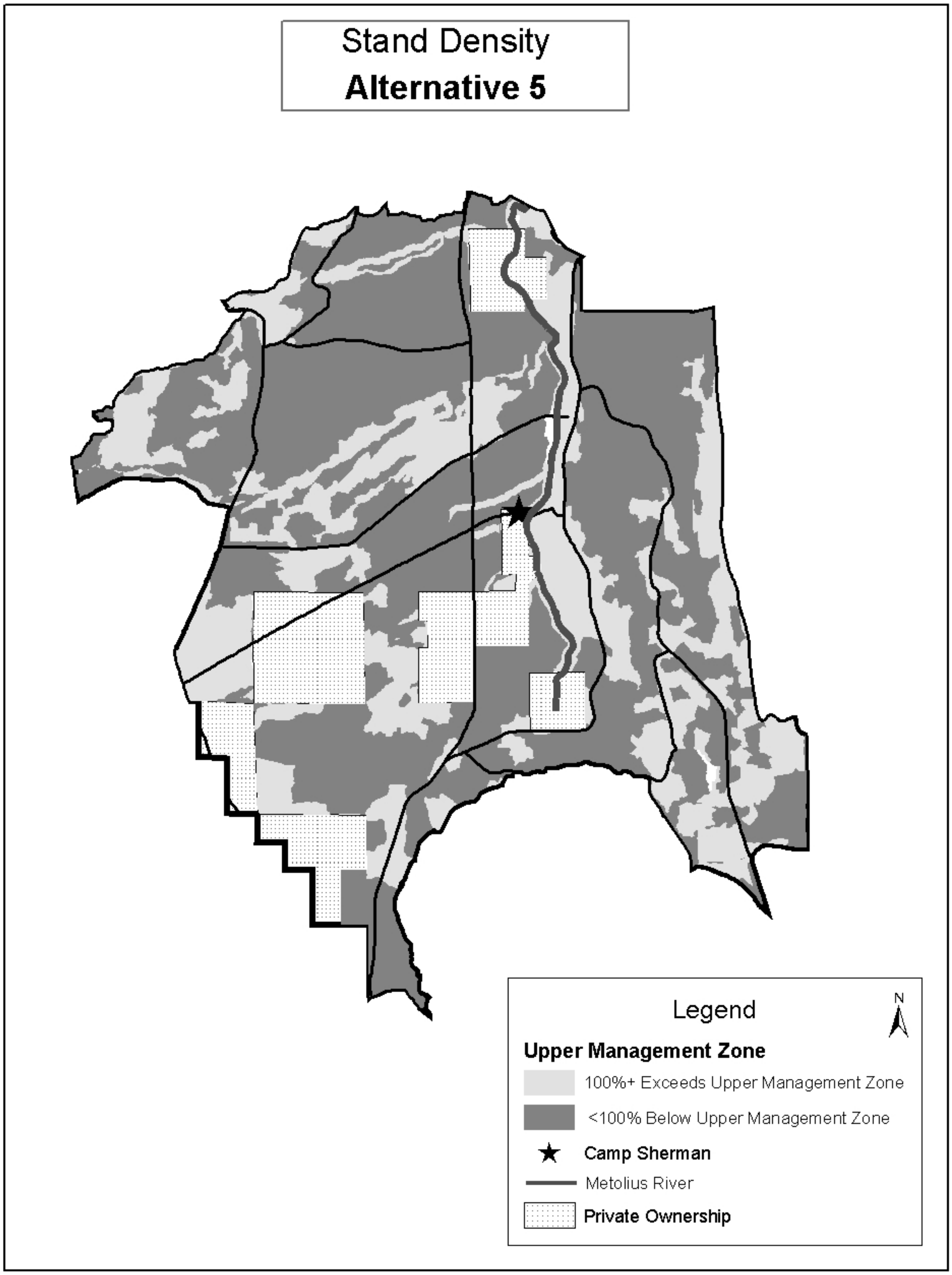


Figure 4-4. Predicted Stand Densities under Alternative 5.

Tree Size Removed. The relevant effect regarding tree size primarily relates to the ability to make logical choices when reduce stand densities to sufficiently reduce severe impacts from insect, disease and wildfire.

Under Alternative 2, trees up to 12 inch diameter would be harvested. This limit would not reduce densities in stands that have dense understories of trees primarily larger than 12 inches diameter. Many stands carry the bulk of their basal area in trees greater than 12" diameter, so thinning smaller trees would not help reduce risks of insects, disease or competition stress. If density management objectives could not be met by cutting trees <12 inches diameter (based on the upper management zone determination) it was proposed to defer treatment rather than doing a partial treatment now and having to re-enter the stand again in the near future to meet forest health objectives. One entry would minimize soil and stand impacts from machinery.

Even though 83% of the National Forest lands in the project area would be treated, approximately 62 percent of the planning area, or about 9000 acres, would remain at high stand densities (based on upper management zone) due to the limitation on size of trees that could be removed. This means 36 to 38 percent more stands would remain at high densities than under Alternatives 3, 4 and 5 (Table 4-4).

Under Alternative 3, trees up to 16 inch diameter could be harvested, with the exception of white fir, which would have a 21 inch diameter limit. This Alternative would be more effective in addressing dwarf mistletoe on western larch and Douglas-fir, and on the ability to meet density management guidelines, than Alternative 2, but less effective than Alternatives 4 and 5 (about 1020 acres fewer would be thinned to upper management zone or below compared to Alternative 4).

Under Alternative 4, trees up to 21 inch diameter could be harvested, with the exception of white fir, which would have a 25 inch limit. This Alternative would be more effective in attaining density management guidelines than under Alternatives 2 and 3, except for about 1600 acres in stands that have the most trees greater than 21 inch. This higher diameter limit would result in more benefits to controlling the extent of dwarf mistletoe on western larch and Douglas-fir.

Under Alternative 5, there would not be any limit on diameter of trees cut, but removal of trees other than white fir greater than 21 in. would be an exception, and would only occur under specific conditions[20]. This limit would generally allow the same attainment of the density management guidelines as Alternative 4, and would allow more effective management of the dwarf mistletoe on western larch, ponderosa pine, and Douglas-fir.

[20] The recommended exceptions, under which 21" or greater diameter trees would be removed include:

- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access roads.

Insects and Disease Disturbances. It is assumed that reduced stand densities increase vigor and reduces stand susceptibility, and, as such, Alternative 5 would have beneficial effects on the most acres, followed by Alternative 4, 3 and lastly Alternative 2.

Alternative 2 would result in the least amount of reduction in dwarf mistletoe, because only infected trees 12 inches diameter and less would be removed. Alternative 5 would result in the greatest reduction in mistletoe, and in the only alternative that specifically addresses larch restoration. Alternatives 3 and 4 would thin and treat the same number of acres, but Alternative 3 would not reduce mistletoe in trees 16 inch diameter and larger due to the size limit (Table 4-3).

Alternative 2 would be less effective in reducing root disease, since thinning trees 12 inch and less, and underburning would not remove or kill larger white fir with root disease. In addition, there would be less reduction in stand density, and therefore less ability of ponderosa pine to withstand armillaria root disease. Alternatives 3 and 4 would result in about the same reduction in root disease, with 3 providing less reduction due to the 16 inch diameter size limit. Alternative 5 provides the most reduction in root disease with regeneration of stands with moderate to high infection levels.

Predicted effects on wildfire disturbances are addressed under the section on Fire and Fuels in this Chapter.

Table 4-3. Acres of Treatment in Stands infected with Disease.

Type of Insect or Disease	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Root Disease	426	2544	2544	2784
Western Larch Mistletoe	98	578	578	578
Ponderosa pine Dwarf Mistletoe	1298	3029	3029	3063
Douglas-fir Dwarf Mistletoe	328	559	559	570
Total Acres of Infected Stands Treated[21]	**2150**	**6710**	**6710**	**6995**

Species Composition. All of the action alternatives would affect species composition to varying degrees (Table 4-4). Alternative 5 would have the greatest effect, followed by Alternatives 4 and 3, and then Alternative 2. In all treatments, late seral species would not be eliminated but rather reduced (the predicted historic amount of white fir in this project area was between 10 to 25 percent of the species composition, (Metolius Late Successional Reserve Assessment, pg. 65)). Alternative 5 would do the most towards promoting early seral species (ponderosa pine and western larch) by removing larger white fir, regeneration of decadent white fir stands (that are not functioning as nesting, roosting, and foraging habitat) to pine and larch, and through the larch restoration treatments. Alternative 2 would only remove white fir trees up to 12 inch diameter, and would have the least effect on changing species composition toward early seral. The extensive use of underburning in Alternative 2 would also help reduce the amount of late seral

[21] The total acres of disease infected stands displayed may include duplicate acres, since some of the acres infected with one type of disease, are also infected with other diseases.

species. Alternatives 3 and 4 would be more effective in reducing the amount of white fir than Alternative 2, and less than Alternative 5.

The proposed treatments are predicted to help rejuvenate species that are currently being displaced by true firs (i.e. quaking aspen, western larch, and large ponderosa pine). In addition, all of the action alternatives would restore 10 acres of aspen and 35 acres of meadows, the amount identified as needing treatment.

Late-Successional Reserve Consistency. Alternatives 2, 3 and 4 are fully consistent with the Metolius Late-Successional Reserve Assessment, though Alternative 2 would not be as effective in meeting the goals of reducing stand densities, and risk of severe disturbances as Alternatives 3 and 4. Shelterwood and shelterwood/thinning treatments on 296 acres under Alternative 5 were not evaluated under the Assessment, and therefore not reviewed or approved by the Regional Ecosystem Office. Activities that were not reviewed initially can be proposed and reviewed on a project-specific basis. See the end of this section for a more detailed discussion on Late-Successional Reserve consistency.

Table 4-4. Comparison of Late-Successional Habitat by Alternatives.

Forest Element	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Stand Density - % of project acres with densities over the upper management zone (UMZ). This relates to the % of project considered to be at **greater risk** of severe insect or disease effects - % of project area[22] Treated	- 82% of stands exceed UMZ - N/A	- 62% of stands exceed UMZ - 83% treated	- 42% of stands exceed UMZ - 86% treated	- 36% of stands exceed UMZ - 86% treated	- 34% of stands exceed UMZ - 88% treated
Species Composition - reduction of white fir in mixed-conifer (closer to historic levels) - acres of aspen restored - acres of meadows restored	No change	- Decrease on 3184 acres - 10 acres of aspen restored - 35 acres of meadow restored	- Decrease on 3481 acres - 10 acres of aspen restored - 35 acres of meadow restored	- Decrease on 3481 acres - 10 acres of aspen restored - 35 acres of meadow restored	- Decrease on 3750 acres - 10 acres of aspen restored - 35 acres of meadow restored
Large Tree/Late-Successional and Old Growth Structure Can trees > 21" diameter be removed?	No	No	No	Yes	Yes
Stands with late-successional elements (9662 acres total) - acres treated - acres (and %) remaining above UMZ	- 0 acres treated - 8300 acres (86%) over UMZ	- 7563 acres treated - 7173 acres (74%) remaining over UMZ	- 8015 acres treated - 5318 acres (55%) remaining over UMZ	- 8015 acres treated - 4369 acres (45%) remaining over UMZ	- 8256 acres treated - 4053 acres (42%) remaining over UMZ
Possible old growth (5599 acres total) - acres treated - acres (and %) remaining above UMZ	- 0 acres treated - 5300 acres (95%) over UMZ	- 4412 acres treated - 4837 acres (86%) remaining over UMZ	- 4456 acres treated - 4202 acres (75%) remaining over UMZ	- 4546 acres treated - 3263 acres (58%) remaining over UMZ	- 4625 acres treated - 3153 acres (56%) remaining over UMZ

[22] Acres referenced to are National Forest lands only – they do not include lands under private ownership

Forest Element	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Stands of smaller trees treated (relates to ability to develop future trees larger than 21" diameter) (8839 acres total) - acres treated - acres (and %) remaining above UMZ	- 0 acres treated - 6600 acres (75%) over UMZ	- 286 acres treated - 6314 acres (71%) remaining over UMZ	- 2498 acres treated - 4102 acres (46%) remaining over UMZ	- 2498 acres treated - 4102 acres (46%) remaining over UMZ	- 2498 acres treated - 4102 acres (46%) remaining over UMZ
Tree Size (Upper diameter of trees that could be removed, with the exception of removing hazard trees to address public safety. Larger trees may be *treated* (but not removed) for dwarf mistletoe by pruning, girdling, or topping)	N/A	12" diameter – All tree species	16" diameter – ponderosa pine, Douglas-fir, larch 21" diameter – white fir	21" diameter – ponderosa pine, Douglas-fir, larch 25" diameter – white fir	Not restricted, however removal of ponderosa pine, Douglas-fir, larch trees larger than 21" diameter would be an exception, and only occur under certain conditions[23]

[23] The recommended exceptions, under which 21" or greater diameter trees would be removed include:
- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access roads.
-

Cumulative Effects

The actions under this project, in conjunction with similar actions on public and private lands in the area may have several cumulative effects. This project is not expected to reduce the amount of late-successional habitat on the Sisters Ranger District, though the quality of the late-successional habitat would be altered, moving from higher density toward lower density fire climax conditions. In combination with other vegetation management projects on the District that have been implemented or are planned in Late Successional Reserves (including Jack Canyon, Santiam Restoration, Santiam Corridor, Highway 20, McCache and South Trout), there is a large-scale trend of reducing stand densities and opening of canopies. However, historic records indicate that the ponderosa pine and mixed conifer dry forests in these areas were more open (Metolius Watershed Assessment, 1996, Metolius Late Successional Reserve Assessment, 1996). The projects listed above focused, in part, on removing dead and dying trees in mixed conifer stands; the mortality resulting from a severe spruce bud worm epidemic. The mortality and removal of dead trees resulted in extensive disturbance patches and fragmentation of what had been dense (though unstable) habitat; some of it late-successional. This project is not expected to contribute to fragmentation, in the short term, except within the 296 acres of shelterwood harvest proposed under Alternative 5, and is expected to decrease risk of future fragmentation from catastrophic disturbances of wildfire, insects or disease. The proposed actions, in combination with these other actions are expected to help protect and improve late-successional forests on the District, and to provide higher quality fire-climax habitat for late-successional species associated with mature, open stands.

Metolius Late-Successional Reserve Consistency

An analysis of the proposed actions under the Alternatives was conducted to determine consistency with management recommendations in the Metolius Late Successional Reserve Assessment (1996).

The Metolius Late Successional Reserve Assessment provides general guidelines for treatment strategies that will develop stand or landscape conditions desired to meet Late Successional Reserve objectives. Proposed treatments are intended to create conditions favorable for the development of late-successional habitat, reduce the risk of severe disturbance that would result in a major loss of late-successional habitat, and to move the condition of existing stands that are unstable toward more resilient conditions. The Late Successional Reserve Assessment has been reviewed and approved by the Regional Ecosystem Office for consistency with the Northwest Forest Plan standards and guidelines.

The conditions which indicate a need for action ("triggers") are primarily stand density (measured as upper management zone in the Metolius Basin project analysis), fuel loads and arrangements, and species composition. In this project, landscape areas and then individual stands were evaluated to determine whether their existing condition exceeded recommended thresholds. Proposed vegetation and fuel treatments generally move stand conditions toward desired range of conditions.

Consistency was assessed in terms of 1) project goals in line with long-term goals listed in the Late-Successional Reserve Assessment, and 2) whether specific actions proposed under this project follow recommendations in the Late-Successional Reserve Assessment.

Long-term Goals

There are three primary long-term goals stated in the Metolius Late Successional Reserve Assessment. Following is a summary of each goal and how the Metolius Basin Vegetation Management proposed actions addresses it.

1. Provide sustainable vegetative conditions within the natural range of variability typical of the Eastern Oregon Cascade Province where succession of vegetation occurred under natural fire regimes.

- Actions proposed in the Metolius Basin project area intend to move stands that are treated toward conditions within the natural range of variability, in terms of density, fuels and species composition.
- Stands that were determined to be functioning well as late-successional habitat for focal species, and were not at as high a risk of impacts from catastrophic fire, insect or disease events, would not be treated under this project.
- If stands were not functioning as late-successional habitat, and/or were at high risk, and:
    - Stand densities exceeded upper management zone (primarily in MCD and PP), densities would be reduced, reducing fuel loads, and modifying tree species composition toward….
    - Fuel loads and arrangements of fuel resulted in high risk, fuel levels would be reduced
    - Species composition of stands demonstrated amounts of true fir (white fir) greater than what would have been found historically, then some (not all) white fir would be removed from the stand (this action was important in reducing stand densities and fuel loads as well).

2 and 3. Maintain vegetation conditions in the mixed conifer plant associations that support at least 9 spotted owl pairs; and Provide 1200 to 1800 acres of suitable spotted owl habitat per pair.

- Within the project area, the majority of the forest is composed of ponderosa pine plant associations which are not considered suitable for supporting spotted owl nesting, roosting, and foraging habitat, and marginally suitable for dispersal habitat. The portions of the project area that are suitable for sustaining spotted owl habitat were identified and mapped (Chapter 1, Figure 1-4) during the planning process. These areas are within the mixed conifer plant associations, along the west, south and east borders. Within these areas, a main objective is to protect and enhance spotted owl habitat.
- Proposed actions in this project are intended to move the landscape conditions toward the ability to maintain the small amount of nesting, roosting, and foraging habitat that exists, and to develop future nesting, roosting and foraging habitat where it can be sustained. The only treatments proposed within nesting, roosting and foraging habitat are thinning trees 8” diameter and less and underburning to reduce surface fuels, most within the

defensible space zones, and treatment of 10 acres of aspen enclosures within nesting, roosting, and foraging habitat stands.

- Each of the 4 home ranges that intersect with the project area have less than the desired amount of nesting, roosting, and foraging habitat. Actions proposed within this project would degrade the quality of foraging within the defensible space zones by about 155 acres, where the priority for the site would be to protect adjacent people and homes. However, the proposed actions would better protect remaining spotted owl nesting, roosting, and foraging habitat over the long-term.

4. Meet the Aquatic Conservation Strategy Objectives and the Metolius Watershed Analysis ACS by restoring and/or maintaining the riparian ecosystem and natural disturbance regimes.

- The proposed actions are consistent with each of the 9 ACS objectives (Environmental Impact Statement, Chapter 4).

Specific Actions Proposed under the Metolius Basin Vegetation Management Project

Specific actions proposed under the project are listed below, followed by the reference in the Metolius Late-Successional Reserve Assessment that addresses that type of action.

Thinning Trees 12 in diameter and larger – Thin trees from below to a density (which would vary by plant association) that would increase diameter growth and delay mortality.

LSRA Reference:

- Treatment Strategies for ponderosa pine mixed conifer wet and dry (Metolius LSRA pgs. 69, 71, 75, 77, 82, and 84) – The above treatment is consistent with recommended treatment strategies for stands in the small to large tree sizes. The proposed action reduces high stand densities to help reduce competition for light water and nutrients; removes ladder fuels and reduces crown bulk densities to decrease the severity of wildfire effects and reduces the risk of crown fires; and promotes development of future large trees.
- LSRA Objectives - Proposed action would meet objectives 1-3, 5 and 7 (pgs. 65-66).

Thinning Trees 12” diameter and less – Cut trees 12” in diameter and less to reduce ladder (vertical) fuels and accelerate stand development.

LSRA References:

- Treatment Strategies for ponderosa pine and mixed conifer plant association groups (Metolius LSRA pgs. 68, 72, & 79) - – The above treatment is consistent with recommended treatment strategies for ponderosa pine and mixed conifer wet and dry stands in the pole to medium tree sizes. The proposed action reduces high stand densities to help reduce competition for light water and nutrients; removes ladder fuels; and accelerates late-successional stand development.
- LSRA Objectives - Proposed action would meet objectives 1-3, 5 and 7 (pg. 65-66).

Larch Restoration – The objective of this treatment would be to restore or re-grow declining larch stands, which provide important habitat and visual diversity in the predominately pine forest. Trees would be thinned in conjunction with group openings (removing the majority of trees except for healthy larch) from ¼ to 3 acres in patches of western larch. This prescription would be applied to larch stands that are moderately to heavily infected with larch dwarf mistletoe. There is widespread decline of larch due to mistletoe and competition from pine, white fir, and Douglas-fir. As many healthy larch as possible would be retained by pruning off the mistletoe infected branches. Removal of the most heavily infected trees would prevent further spread of mistletoe and would open up the stand creating conditions favorable for establishment and growth of natural regeneration and planted larch. The resulting stand would appear much more open than a thinned stand.

LSRA Reference:

- Treatment Strategies for mixed conifer wet and dry stands (Metolius LSRA pgs. 76, 82). The above treatment is consistent with recommended treatment strategies for stands in the small to medium size classes. The proposed action reduces the loss of natural diversity and reestablishes seral species (i.e. restore larch). These stands would also be thinned.
- LSRA Objectives - Proposed action would meet objectives 1, 3, and 5 (pg. 65).

Dwarf Mistletoe Control – Pruning mistletoe-infected branches of lightly to moderately infected trees, to improve the health and longevity of the tree. This treatment would also involve killing (to create snags) moderately to heavily infected overstory trees when these trees are infecting young trees in the understory, preventing stand development. Stands with dwarf mistletoe would also be thinned to reduce competition stress within the stand.

LSRA Reference:

- LSRA Objectives - Proposed action would meet objectives 7, “design treatments to reduce forest fragmentation”, and 8”retain snag habitat” (pg. 66). The specific actions of pruning, creating snags and thinning are not inconsistent with reviewed and approved treatments in the Late-Successional Reserve Assessment.

Hazard Tree Removal – Remove only select hazard trees (as defined by the Region 6 Hazard Tree Rating Guide) to enhance public safety in developed recreation sites and along public roads.

LSRA Reference:

- Highway Safety Act Roads (LSRA pg. 87) – the proposed action is consistent with recommendations and findings in the LSRA.

Prescribed Burn - Burning vegetation that has been scattered from harvest activities, using a “strip head” or “strip backing” fire technique. Underburning can also be used independent of harvest activities to reduce ”natural” fuel levels.

LSRA References:

- Treatment Strategies for ponderosa pine and mixed conifer plant association groups (Metolius LSRA pgs 66-84) - – The above treatment is consistent with recommended treatment strategies for ponderosa pine and mixed conifer wet and dry stands in the pole to medium tree sizes. The proposed action reduces the amount of fuels, either occurring from high mortality, high density under stories, or harvest slash.
- LSRA Objectives - Proposed action would meet objectives 1-5 and 7 (pg. 65-66).

Road Decommissioning and Inactivation

- LSRA Objectives - Proposed action would help meet objective 7 (pg. 65)

Treatments not specifically addressed in the Late-Successional Reserve Assessment, but determined to be consistent with LSRA goals and objectives.

Meadow Enhancement: Restoration and maintenance of natural meadows through removing small (12” diameter or less) conifers. The objective is to reduce the number of trees growing into and closing-up the meadow openings. This action helps promote habitat diversity and is not detrimental to late-successional habitat or species.

Aspen Restoration – the objective would be to remove conifer trees from encroaching into about 10 acres of aspen stands, and reestablish aspen in historic groves. Restoration may be achieved through a combination of thinning conifers (mostly 12” diameter and less) and group selection to remove old, declining aspen so that new trees will be stimulated to grow. These actions are intended to move add diversity and stability to riparian vegetation and adjacent upland vegetation, closer to conditions within the natural range of variability needed to attain Aquatic Conservation Strategy Objectives. This action helps promote habiatat divesity and is not detrimental to late-successional habitat or species.

The following actions are not addressed individually, but “mechanical” treatment of fuel is recommended in the Fire Management Plan of the LSRA. All are felt to be consistent with Late-Successional Reserve Assessment goals and objectives.

Machine Pile - Machinery (usually a tracked bulldozer, or grapple) used to pile and concentrate down and dead vegetation for disposal, either through removing from the site, or burning it on-site.

Hand Pile –Piling dead and down vegetation by hand for future disposal. Though this method is labor intensive and can be more costly, it minimizes impacts to soil and remaining vegetation.

Mowing – This treatment targets shrub fuels that contribute to higher fire intensity and rate of spread. Mowing is done with a high clearance vehicle with rotary mowing heads that cut and mulch shrubs from a vertical to a horizontal fuel. Commonly, this treatment is followed with an underburn to consume concentrations of cut vegetation.

Removal of trees greater than 21" diameter: The Sisters Ranger District proposes to update the Metolius Late-Successional Reserve Assessment to include provisions for when trees larger than 21" diameter could be removed, and is reviewing this proposal with the Regional Ecosystem Office. Recent Late-Successional Reserve Assessments (Cache and Why-chus) completed on the Sisters Ranger District addressed conditions when 21"+ diameter trees could be removed to enhance habitat or reduce risk (see below), and these conditions were reviewed and approved by the Regional Ecosystem Office. The current Metolius Late-Successional Reserve Assessment, which was the first Late-Successional Reserve Assessment completed on the district, does not address removal of trees larger than 21" diameter. The Sisters Ranger District proposes the following conditions under which removal of trees larger than 21" diameter could be removed to be included in the Metolius Late-Successional Reserve Assessment:

- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.

Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access road

Treatments not specifically addressed in the Late-Successional Reserve Assessment, but conflict with some LSRA goals and objectives.

Shelterwood and Shelterwood/Thin – This treatment would occur only under Alternative 5, on approximately 296 acres.

The objective of this treatment would be to regenerate or re-grow healthy late-successional habitat in stands that are declining due to root disease, dwarf mistletoe and spruce budworm activity. These stands are generally mixed-conifer with white fir as the dominant species (approximately less than 25% of the stand would be made up of ponderosa pine, Douglas-fir or larch). The primary species removed would be white fir. All ponderosa pine (free of dwarf mistletoe) 21 inches diameter or greater and additional healthy trees (where present) would be left to achieve a residual spacing of approximately 40 to 75 feet (average of 7-25 trees per acre), with a basal area of approximately 20 to 50 square feet per acre.

LSRA References: While this treatment is consistent with certain recommendations in the Late-Successional Reserve Assessment, it conflicts with others.

- Treatment Strategies for Mixed Conifer wet and dry (Metolius LSRA pgs. 76-77, 82-83) – The above treatment is consistent with recommended treatment strategies for mixed conifer wet and dry stands in the small to large tree sizes for removing excessive mortality/fuels, reducing high amounts of white fir, and protecting existing large trees.

- Management Strategy Area Guidance - recommendations under the specific Management Strategy Areas for areas D, F, and G do not recommend removal of dead trees at this time. The proposed action is inconsistent with this recommendation.
- LSRA Objectives The proposed action would meet objective 3 "Species Composition" (pg 65) – The above treatment would reduce the amount of white fir more towards the natural range of variability within the stands treated. However, the proposed action would be inconsistent with objective 7 "design treatments to reduce forest fragmentation" (pg. 66).

In conclusion, except for the shelterwood treatment, the proposed actions were found to be consistent with recommendations in the Metolius Late-Successional Reserve Assessment. If Alternative 5 is selected as the Alternative to be implemented, the Sisters Ranger District would initiate review of the shelterwood treatment with the Regional Ecosystem Office.

Key Issue #3: Fire and Fuels

Important Interactions

The fuel management actions proposed under the alternatives range from fire exclusion/ suppression only under Alternative 1, to integrated landscape-scale management of fuel under the action Alternatives.

Elements of fuels and fire discussed are wildfire risk, hazard, and severity; safety for the public and firefighters, resource protection, air quality, and reintroduction of fire into the ecosystem.

Direct and Indirect Effects

Wildfire Hazard/Risk

Wildfire susceptibility is defined in terms of risk and hazard. *Risk* is the probability that an ignition will occur from humans or lightning (portions of the project area lie within a common lightning path). Trends based on the last 15 years of data indicate that this project area would receive an average of 3 fire starts per year. For this analysis, risk is affected by the amount of human use in the project area, use of prescribed fire, and change in road status. Proposed actions increase risk of a fire start from machinery and use of fire during restoration activities, but also reduce the risk by closing roads, which in turn reduce human use in certain parts of the project area.

Hazard relates to the availability of fuels to sustain the fire (Maffei et al. 1996) and the amount (loading), arrangement (surface, ladder, crown fuels) and continuity of fuels through the area. The changes that occur in the loading, arrangement or continuity of the fuels will change the predicted fire behavior and associated fire effects. Based on an analysis of stand structure (age, density, and number of canopy layers) and density of shrubs, the acres predicted to burn at different severities were determined.

Timber harvest alone (without cleanup of logging debris) can affect the arrangement and continuity of fuels, increase the proportion of fine fuels on the ground, remove vegetation (both live and dead), create dead, dried material, increases fuel bed depth, change the ground level wind patterns, and change the seasonal and daily drying patterns. Rates of fire spread would likely increase due to the opening of the canopy and exposing ground fuels to greater drying and increased wind. However, resistance to control would be greatly decreased due to lower fuel loading, making fires more easily controlled by ground forces and more receptive to aerial applied fire retardant.

> *We have two choices: the excess trees can either go up in smoke or out on the back of a truck. Where we cannot burn, for whatever reason, the only alternative is to remove the excess trees.*
>
> Dale Bosworth, Chief of the Forest Service (2002).

Disposal of logging debris, and reduction of fuels created by harvest activities can mitigate these effects as proposed under this project (Omi and Martinson, 2002) (see Chapter 2). In addition, prescribed burning and mowing can reduce fuel levels outside of timber harvest areas. Other activities associated with timber harvest, including construction of temporary roads, logging operations, post-harvest treatments (especially prescribed burning), can increase risk of wildfire by increasing the chance for human caused ignitions. Debris burning (including prescribed fire lit by Forest Service, and miscellaneous debris burning by the general public) accounts for less than 1% of the wildfires on the Sisters Ranger District (Rapp, personal communications, 2000).

Timber harvest can also reduce wildfire susceptibility by reducing fuel loads and ladder fuels, and by breaking up the continuity of fuels (Omi 1997, Omi and Martinson 2002). Regeneration harvest, thinning, pruning to remove ladder fuels, and reducing ground fuels can greatly reduce the likelihood of a crown fire. It is recognized that there is disagreement about the effectiveness of harvest in reducing fire hazards. However, experience from recent wildfires during the summer of 1999, 2000 and 2002 on the Deschutes National Forest (Spring Butte Fire and Cache Mtn. Fire) and Ochoco National Forest (Hash Rock Fire) found that fire behavior greatly reduced once the fire entered a recently thinned area, moving out of the crowns and lowering the intensity sufficiently so that firefighters could control the fire. Observations by experienced firefighters (Fitzpatrick and Sandman, personal conversations, 2002) during the Cache Mtn Fire reported that the recent thinning adjacent to Black Butte Ranch resulted in the wildfire dropping down from the tree crowns to the ground. This change in fire behavior on the Cache Mtn. Fire allowed firefighters to control the fire and protect 80 homes in the subdivision which were threatened (2 homes were lost, and these 2 were adjacent to a portion of the forest that had not been thinned).

In a recent study in Idaho, Graham and colleagues (1999) found that harvest activities such as thinning from below and irregular shelterwoods resulted in the greatest reduction of risk of crown

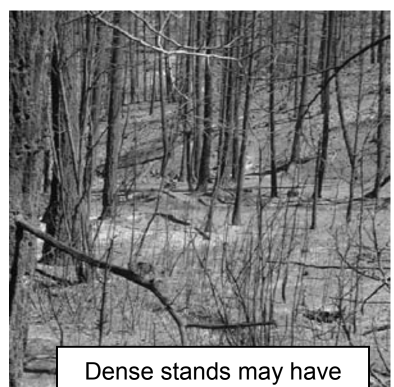
High Severity Wildfire Impacts on Forested Stands versus Soil

Fire severity in this analysis refers to effects on vegetation, not just the soil. Often soil impacts can be somewhat less severe than effects on stands and late-successional habitat. For example, while only 3% of the burned area within the Cache Mtn. fire resulted in high severity soil impacts, almost 33% of the forest stands received high severity impacts (were “stand replacement”). Within the burned area on the Eyerly fire, about 23% of the soils received high severity impacts, while approximately 75% of the forested areas burned at stand replacement intensity.

fires. This study concluded that "the best success in modifying fire behavior through the use of thinnings …is when applied in conjunction with prescribed fire" (Graham et al, 1999). Evidence from recent studies of wildfires point to the importance of treating the entire fuel profile, from surface fuels to crown fuels. Omi and Martinson (2002) found significant correlations between stand conditions and wildfire severity. The most severe wildfire effects occurred in stands where the crowns were lower to the ground (height to live crown) and density and basal area were higher. The authors also concluded that under extremely windy conditions, reduction of surface fuels may be of little importance in reducing high severity crown fires. Studying the 1994 Wenatchee fires, Agee (1996) found that thinned stands were below the critical crown bulk density needed to sustain crown fire, and the fires dropped to the ground in thinned areas; he concludes that forest structure can be manipulated to reduce severity of fire events, and that this is probably most true in lower elevation forests with historic low severity fire regimes, such as the ponderosa pine forests in the Metolius Basin project area.

Open stands can be more resistant to wildfire impacts than dense stands

Forest stands with the greatest resistance to impacts from wildfire are those where canopy closure is less than 40%. A low fire susceptibility stand would have a canopy closure of 20-39%, thus reducing the risk of crown fire, while still providing shade on the ground, cooler temperatures, higher relative humidity, higher fuel moisture, and screening to reduce wind (Beighley and Bishop, 1990). Heat and smoke would be allowed to vent above the canopy and would minimize mortality, especially in ponderosa pine, western larch, and Douglas-fir.



Dense stands may have higher wildfire impacts

As crown closure increases, the risk of crown fire increases, especially in plume-driven crown fires where the power of the fire will overcome the power of the prevailing weather. At 40-70% crown closure active torching would be likely. A large number of trees would be killed due to heat or smoke damage as the canopy traps the heat below. The possibility of a crown fire is high in closed canopy forests, and even ground fire may result in mortality from heat and smoke.

In summary, based on research and observations, this analysis assumes:

- Reduction in the number of canopy layers in the stand reduces fire severity. This parameter relates directly to crown bulk density and crown base height, which are two of the three primary determinants of fire behavior (Omi 1997, Graham et. al. 1999). The acres thinned is a measure of the reduction in canopy layers; the size limit of the trees removed or cut affects the efficacy of the thinning in regards to reduction in crown bulk density and number of layers.

- An increase in average tree diameter of the stand reduces fire severity. Larger trees have thicker bark and are more resistant to flame scorch from surface fuels. The more acres that are thinned, the greater the average diameter of remaining trees.
- Tree harvest, as proposed, will shift stand composition towards fire-resistant species. Thinning, favoring fire-resistant species, is the measure for changing species composition.

> There are two ways of managing crown fire potential: prevention of conditions that initiate crown fire and prevention of conditions that allow spread of crown fire.
>
> Agee (1996)

- Treatment of surface fuels generated from timber harvest will prevent an increase in fire severity. All vegetative treatments would be followed by a fuels treatment, so this element is equal among the alternatives.
- Treatment of natural surface fuels (brush, and trees 3 inch diameter and less) will reduce fire severity. The measures of this element are the number of acres mowed and the number of acres underburned.
- Reduction in road miles can reduce the risk of ignition
- Increase in acres prescribed burn and in mechanical equipment in the forest can increase the risk of ignition, though this risk is low.

Values At Risk, Safety And Protection

As described in Chapter 3, under Fire and Fuels, the values at risk during a large wildfire are public and firefighter safety, property and developments, and important or rare late-successional resources (including both species and habitats). The condition of forest stands has a direct impact to safety and protection. High fuel levels and multiple layers of fuels (e.g. shrubs, dense branches, and tree crowns) increase the probability of an extreme wildfire, increase the risk of a wildfire getting larger, increase the difficulty and danger in controlling a fire, and increase the danger to the public and firefighters.

There are also economic considerations; prescribed fire typically cost less per acre than the suppression of wildfire (Omi 1997). See further discussion of economic effects under the Economic Values in this Chapter.

The project area encompasses the community of Camp Sherman, which includes over 150 residences, a community center with a store, post office, fire hall, community hall, school, church, and several resorts. In addition, potentially 1,000’s of people visit the project area daily during the summer for recreation. To compound the risk, road access suitable for evacuation is limited into the Basin, and occurs primarily along Forest Roads 14 and 12. Both of these roads provide access to Highway 20 to the south. In the event of a wildfire to the south, these roads may not be safe or effective evacuation routes. During the wildfires of 2002, the community discussed using alternative routes out of the basin, and determined that the other Forest Roads were not optimal for an emergency evacuation since they are narrow, steep and bumpy. Residents of Central Oregon have observed how fast wildfires can advance[24], and firefighters reported observing fire behavior far outside of predicted behaviors. Based on these observations and the high fuel levels in the Basin and surrounding forests, many residents in the Camp Sherman area feel that a wildfire within 5 to 10 miles of the Basin is a perceived threat.

Thinning trees to remove fuels near homes on the Sisters Ranger District

Actions within the defensible space corridors can help reduce the rate of spread within these corridors and help firefighters control the fire, which can help protect community residents and property. Though fuels would be reduced in the defensible space corridor under each of the action Alternatives, the amount of fuel that could be removed would differ, primarily due to the different limits on the size of trees that could be removed.

In the past, there has been some debate about whether reducing fuel levels and arrangements in forests surrounding communities would help protect homes from wildfire impacts. Cohen (2001) found that "a wildland fire does not spread to homes unless the homes meet the fuel and heat requirements for ignition and continued combustion" (pg 2), and that in general, "large wildland flame fronts (e.g. forest crown fires) will not ignite wood surfaces at greater than 40 meters" (Cohen and Butler, in press). Some critics of forest thinning projects implied that Cohen's research demonstrates there is little value in thinning general forest areas because it would not protect homes, and that thinning should only be applied in the wildland urban interface. However, Cohen responded that this takes his research out of context, and that there are many other important values that could be protected by thinning forests outside of the wildland urban interface, including the aesthetic forest setting that many of the residents were attracted to when selecting areas to build or buy homes.

Cohen's research does emphasize the importance of the homeowner's responsibility in creating a fire-safe environment immediately around their homes.

[24] The rate of spread of wildfires can pose a risk to communities and resources a considerable distance from the location of a wildfire ignition. During a wildfire in 2000 on the Bitterroot National Forest in Montana, the fire front traveled up to 30 miles in less than a day. The Biscuit Fire, in 2002, in southern Oregon grew from 800 acres to 40,000 acres in one day.

Road restrictions and obliteration can have a negative effect on fire suppression response due to limiting access for suppression resources. Fires that are able to get established would be larger when initial attack resources arrive and could be costlier and possibly more destructive. However, limiting road access has also been found to help reduce risk of human caused ignitions.

Air Quality

Impacts related to air quality include visibility of smoke and potential health affects of small air bourn particles. In addition, there is a need to meet standards for air quality in adjacent Class I Airsheds (over the wilderness areas to the west). Since the project area is within a basin, and the prevailing winds are out of the west (away from the wilderness), prescribed burning is not expected to result in an incursion into the Class I airshed less than 5% of the prescribed burning time (or less than 20 days (for typically no longer than 6 hours/day) per year, between October and June). Smoke intrusions into Class I airsheds from prescribed fires could be mitigated either by avoidance or through dispersion. However, in the case of wildfire, there would be no control over smoke direction or dispersion and the volume could be much greater than that from prescribed burning. Smoke from prescribed burning would most likely affect forest workers, recreationists, and local residents within the Basin or downwind to the south and east from the planning area.

Since some of the restoration activities (e.g. logging operations and prescribed burning) introduce an additional risk of a wildfire start, these activities may indirectly increase the probability of a wildfire occurring, and thus increase risk of smoke. Drift smoke from a prescribed fire or wildfire would affect recreationists by reducing visibility and views of the surrounding forest and mountains. Visibility could be reduced from the normal 20 miles or more to less than 3 to 5 miles. This impact could last from a few hours to several days for prescribed fire, to weeks or months for wildfires (as experienced by residents in Central Oregon during the 2002 wildfires), depending on the conditions under which the wildfire is burning. Controlling when fuels are burned so that weather conditions help dissipates the smoke would mitigate air quality impacts from prescribed burning.

Analysis of potential air quality impacts in Oregon, Washington and Idaho found that wildfire impacts would be significantly greater in magnitude than prescribed burning impacts over the same area (Hugg et al., 1995; USDA, USDI, Draft EIS Interior Columbia Basin Ecosystem Management Project, 2000). This analysis concluded that wildfires reduced visibility substantially more than prescribed burning (though effects from prescribed burning may be more frequent). This was due to the average s wildfires consuming more fuel per acre burned than prescribed fires. This analysis also concluded that predicted concentrations or particulate matter for prescribed fires would be substantially lower than for wildfires due to: 1) higher fuel moisture levels during management-ignited prescribed fire, 2) better smoke dispersion conditions during prescribed fires in the spring and fall, than typical conditions during summer wildfires, and 3) prescribed fires are dispersed across the landscape spatially and temporally, rather than concentrated in a few locations (pg. 4-34). It is expected that effects would be similar under this analysis.

Ash sediments from fire can also cause short pulses of phosphorous in local streams following slash burning, to long-term elevated nitrogen in streams of 5 years or more following a wildfire (Brown et al. 1973, Brass et al. 1996 as cited by Gresswell 1999).

Reintroduction of Fire into the Ecosystem

Fire is a natural and important process in the Metolius Basin project area, but has been excluded for many years. Reintroduction of fire helps meet the Purpose and Need for the project and objectives for Metolius Late-Successional Reserve (pg. 65). However, a prerequisite for effective reintroduction is reduction of the existing high fuel levels (Omi 1997). Many of the proposed actions, including reducing stand densities, mowing, and prescribed burning, have a direct effect on enhancing sustainable conditions in fire-climax stands, but also have the indirect beneficial effect of preparing the areas treated for effective reintroduction of the fire process over the long-term.

The greater and more contiguous the number of acres on which fuel levels are reduced, the more opportunity and greater effectiveness of reintroducing fire into the system.

Effects Common to All Alternatives

It is expected that a wildfire would occur in the planning area some time in the future under any of the Alternatives. The acres with high fire hazard and the severity of fire will vary by alternative (Table 4-5).

Effects of Alternative 1

> *Over the last century, trees have grown much faster than the amount removed from all of the fires, harvest and mortality combined. In the southwest (Arizona and New Mexico), net annual growth is enough to cover a football field 1 mile high with solid wood. Recent removals have only been about 10 percent of this.*
>
> Dale Bosworth, Forest Service Chief, 2002.

In Alternative 1 the greatest percent of the project area (97%) would remain at risk of a moderate to high severity wildfire, with more than half of the acres at risk of a "stand replacement" fire (table 4-6, and Figure 3-**X**). With continued fire suppression efforts, fuel loads would continue to accumulate and the natural role of fire would continue to be excluded from the project area. This could lead to extensive forest health decline and loss of habitat.

Under this Alternative the greatest amount of area is in an "unsafe" condition for firefighters, and no protection is provided for people, properties or late-successional resources. The residents and visitors to the Metolius Basin would remain at the greatest risk of all the Alternatives. The "defensible space" strategy would not be implemented, so the risk of crown or intense fires adjacent to high use areas, residential areas and along evacuation routes would remain moderate to high. Alternative 1 would have the highest expected cost for suppressing a wildfire, due to the potential for higher intensity and larger fires.

Under this Alternative, fire would *not* be reintroduced back into the ecosystem. The fire regime for the ponderosa pine plant association typically had a fire return interval of 8-12 years. Over the last 80 years, with the advent of fire exclusion, the forests in the project area have missed 10 to 10 fire cycles, and all of the fuel that would have been consumed through these events has instead accumulated.

There is a high probability of a large fire occurring in the project area (Table 4-5). A statistical probability of large fire risk was calculated for the Metolius Basin project area including the Mt. Jefferson Wilderness (the Mt. Jefferson wilderness was included because large fires tend to start in the wilderness and move out to the east because of the predominant wind patterns). This analysis was done using PROBACRE, a computer model for predicting wildfire risk based on past annual fire frequency and associated levels of fire intensities. The following table summarizes the PROBACRE analysis results, which display the probability of wildfires exceeding size thresholds within 20, 50, and 100 year period for the area.

Table 4-5. Probability of a Large Fire in the Metolius Basin.

Fire size (acres)	Probability of Occurrence (%)		
	20 years	50 years	100 years
50 acres	99%	100%	100%
100 acres	98%	99%	100%
1000 acres	24%	83%	99%
5000 acres	<1%	2%	16%

Note: these estimates assume that the expected size to which the fire expands its perimeter at any time of occurrence is independent of both the number of fires and burned acres that have preceded it within the analysis area.

Though the no action alternative would not introduce air quality impacts from prescribed fire, dust, or industrial engines, there is a moderate to high risk of wildfire occurring in the area, and the resultant fire has a greater probability of being larger and more intense than under the action Alternatives, thus increasing the risk of air quality impacts which can not be mitigated. There would be no risk of ignition from forest management activities. Alternative 1 would have the most miles of open road, which can be associated with a slightly higher risk of ignition along roadways.

Effects of Alternatives 2, 3, 4 and 5

Wildfire Hazard and Severity. All of the action Alternatives would lower the fire hazard rating due to removal and modification of fuels through harvest and fuel treatments (Table 4-6). Since all of the action alternatives treat a similar number of acres, they all reduce the percent of acres in the Stand Replacement (high severity) class by a similar amount. The real differences in the alternatives are in the number of acres moved into the “Non-Lethal” class. Alternative 2, with its reliance on underburning, would result in only 6 percent of the acres going to Non-Lethal, while alternatives 3, 4, and 5 would result in 33, 48, and 53 percent of the acres going into Non-Lethal, respectively (Table 4-6). The actions of shelterwood, larch restoration and thinning trees greater than 12” diameter would be the most effective in moving stands at risk of high burn severity to low burn severity.

Risk of fire severity would be reduced from high (stand replacement) to moderate around the Metolius Meadows subdivision, Camp Sherman, and along most of the evacuation routes under Alternative 2. Under Alternative 5 risk of fire severity is further reduced to low, (non-lethal) around the majority of these areas. Fire risk would remain as mixed severity around the forks of Lake Creek west of the Metolius Meadows because of requirements to maintain dense habitat for spotted owl and riparian species. However, the block of private timberland just to the west has been thinned and is likely to result in lower intensities of wildfire that may travel across the property (the trend for the direction of fires to travel is from west to east within the project area). The risk of moderate to some high fire severity would also remain along many of the other riparian areas and spotted owl nesting, roosting, and foraging habitat in the project area. Risk would also remain higher along Green Ridge due to steep slopes.

Alternatives 3, 4, and 5 would reduce ladder fuels and crown density by thinning about 6500 acres more than Alternative 2.

Underburning is not considered a technique that appreciably affects stand structure, and would not have an appreciable effect on stand densities in the types of stands where it can be successfully employed. During analysis, it was assumed that only stands within 10% of upper management zone could be brought within desired densities (at or below upper management zone) by prescribed fire. The objective of underburning stands under Alternative 2 is to reduce the surface fuel loadings on the forest floor, thereby reducing the potential fireline intensity. However, reduction of surface fuels deals with only one of the three factors influencing crown fire potential. The other two factors, crown bulk density and crown base height, are not changed.

Alternatives 3, 4, and 5 would be more effective in treating the entire fuels profile, because they employ thinning on a much larger scale than Alternative 2. Alternatives 4 and 5 would reduce the crown fire potential the most because the 21 inch size limit (versus 16 inch under Alternative 3) would allow for a greater reduction in crown densities and an increase in average tree diameter over the planning area. Alternative 5 would remove the most fire prone white fir, followed by Alternatives 4, 3 and then 2.

<u>Risk of Ignition</u>. Access for fire suppression, and risk of human caused ignitions along roads would be reduced the most under Alternative 5, followed by Alternatives 4 and 3, and then Alternative 2, due to decommissioning and inactivation of roads.

Alternatives 3, 4 and 5 would also result in the greatest risk of human-caused fire starts related to the amount of equipment used in restoration activities, while Alternative 2 would have the greatest risk of ignition from prescribed burning though the risk is considered very low.

Values at Risk/Defensible Space. Each of the action Alternatives would implement a defensible space strategy, and each would improve the ability to protect people and property safely. However, Alternative 5 would be the most effective at reducing the risk of crown fires within and adjacent to the defensible space corridors (Figure 3-X) due to thinning larger tress and, thus, more effectively reducing crown bulk density and canopy layers. Alternative 2 would be the least effective due to the lower limit on the size of trees that could be removed, reducing the ability to remove ladder fuels and not reducing crown densities at all. As such, public and firefighter safety, and protection of property is the greatest under Alternative 5, followed by Alternatives 4 and 3, and the least under Alternative 2.

Within defensible space corridors thinning of trees less than 8 inches diameter would occur to maintain continuity of reduced ground fuels.

Protection of large trees and other forest resources from catastrophic effects of wildfire are also the greatest under Alternative 5 followed by Alternatives 4 and 3, and the least under Alternative 2.

Air Quality. Alternatives 5, 4 and 3 treat the fewest acres by prescribed burning and the number of days required to complete the burning would be considerably less than under Alternative 2. Results from a smoke production model indicate that Alternative 5, followed closely by Alternatives 3 and 4, may produce more smoke from underburning, over the life of project implementation than Alternative 2. Even though Alternative 2 proposes many more acres of underburning as a primary vegetation treatment than the other action Alternatives, Alternatives 3-5 would still apply burning as a follow-up treatment to thinning (either as underburning or burning of piled slash) on the majority of acres treated (Table 4-6).

Reintroduction of Fire into the Ecosystem. It is assumed that, given the historic low severity fire regime of the Metolius Basin planning area, it is possible to move these forests to a more fire-resilient condition by approximating the historic (early 20th century) stand densities and species composition. Though all action Alternatives treat approximately the same number of acres, more fuel would be removed under Alternatives 3, 4 and 5, than under Alternative 2, and successful reintroduction of fire into the project area is expected to be more controllable under Alternatives 3, 4 and 5.

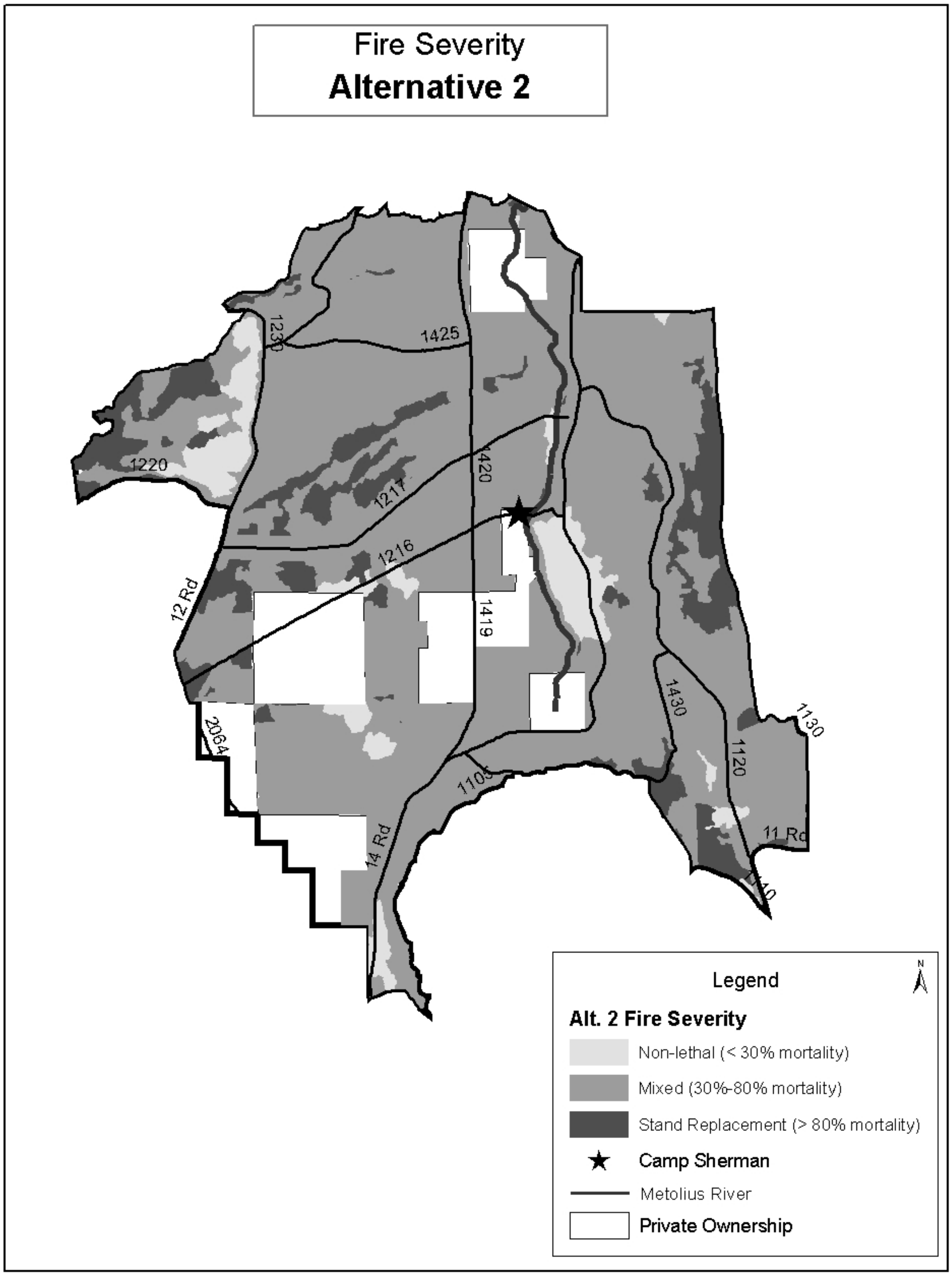


Figure 4-5. Predicted Wildfire Severity Rating under Alternative 2.

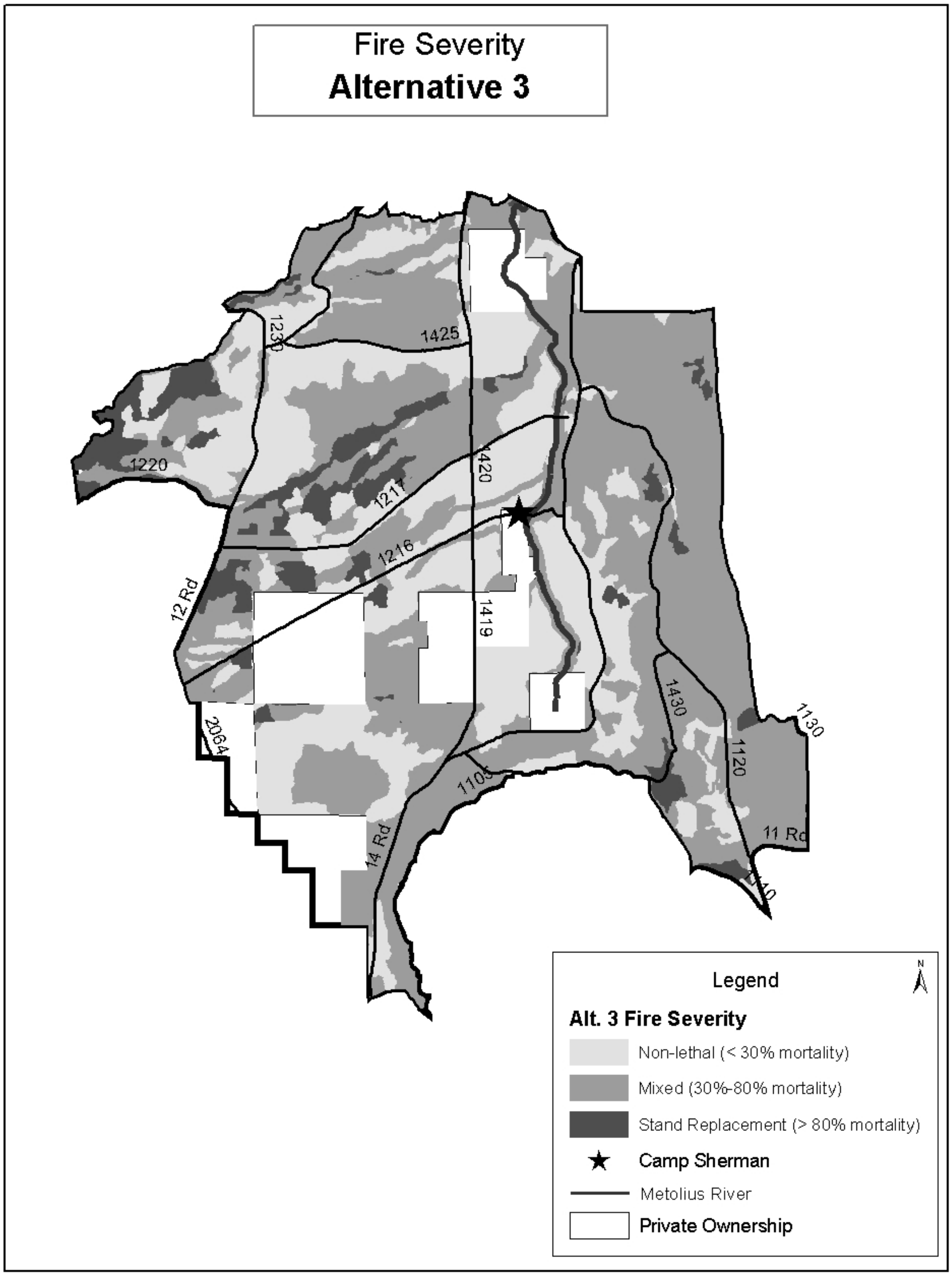


Figure 4-6. Predicted Wildfire Severity Rating under Alternative 3.

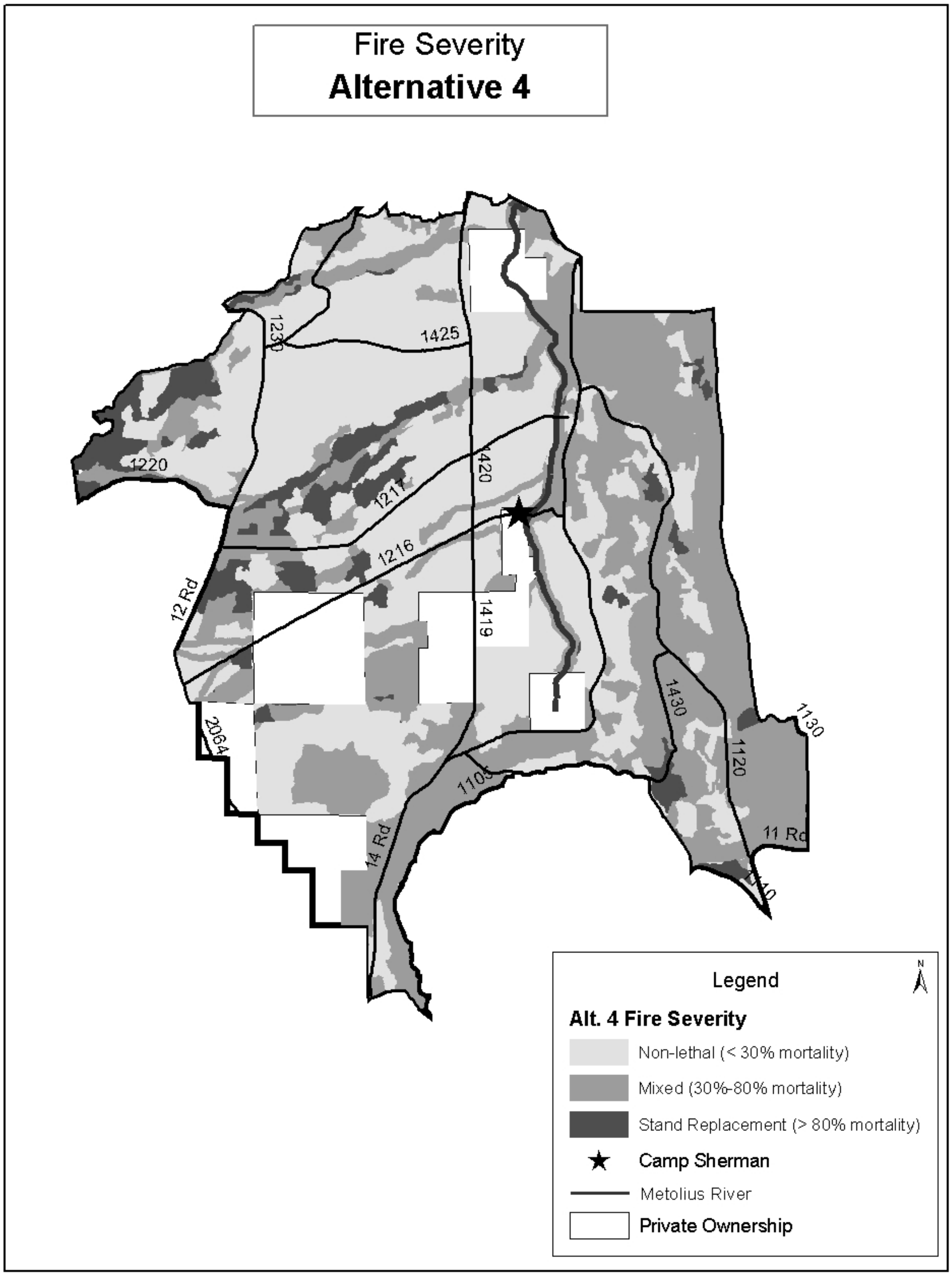


Figure 4-7. Predicted Wildfire Severity Rating under Alternative 4.

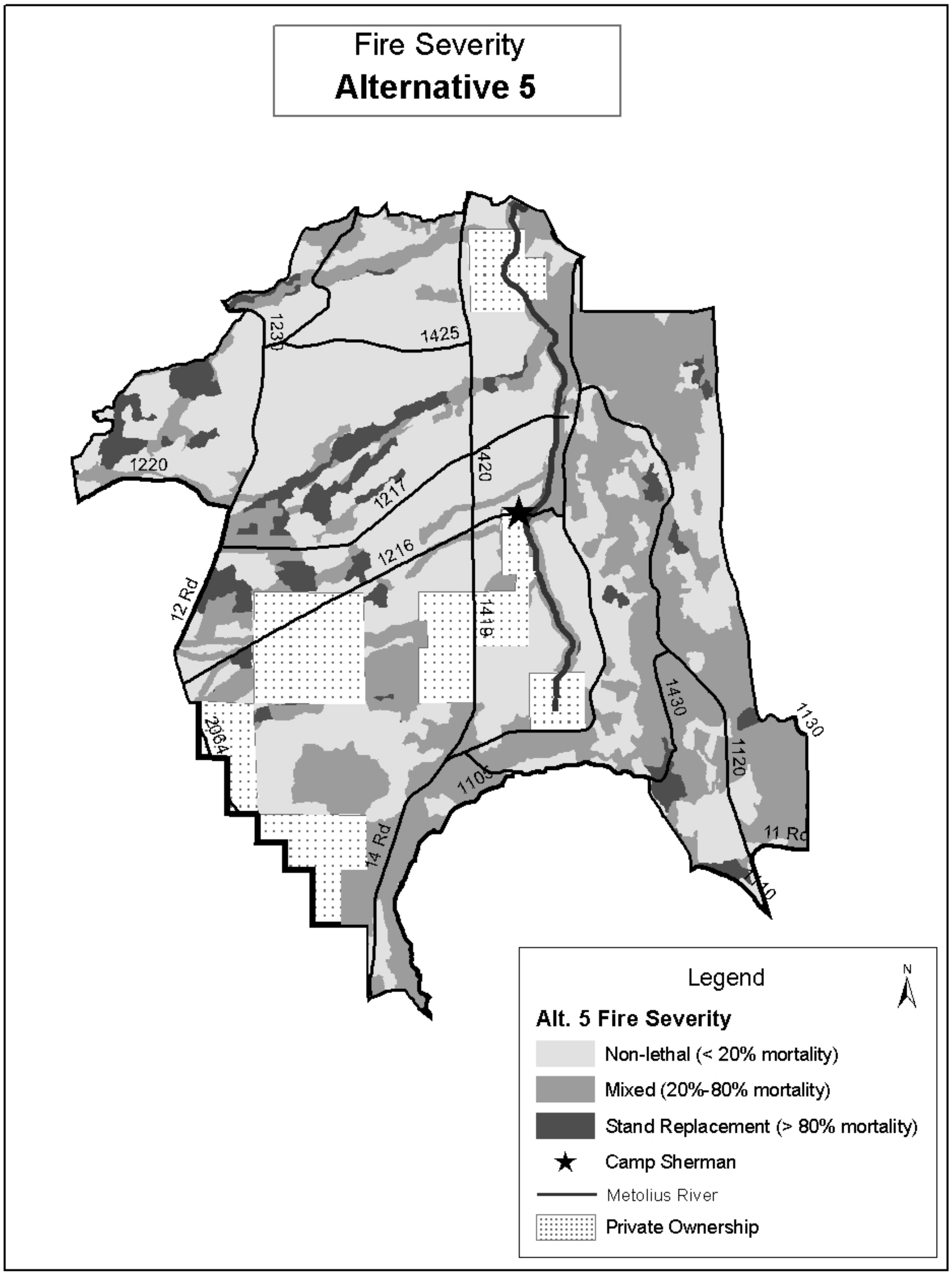


Figure 4-8. Predicted Wildfire Severity under Alternative 5.

Table 4-6. Fire Hazards.

Fire Hazard	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
FIRE SEVERITY - percent of acres that are predicted to burn at low, mixed and high severity[25]					
Low Severity (non-lethal)	3%	6%	33%	48%	53%
Mixed severity (from 30%-80% mortality)	45%	83%	59%	45%	41%
High Severity (stand replacement)	52%	11%	8%	8%	6%
Defensible Space – includes thinning, mowing, burning, and pruning within 1200' of residences and developments, and 600' of evacuation route roads	Not fully implemented. Some small dead and down trees can be removed by homeowners w/in 300' of private lots	Implemented on 4,936 acres. Focus on ground fuels and small ladder fuels. Trees larger than 12" diameter are not removed so no reduction in crown density	Implemented on 4,936 acres. Removes trees up to 16, so ladder fuels treated, but limited effect on crown density	Implemented on 4,936 acres. Removes trees up to 21" diameter. Both ladder fuels and crown density reduced.	
FUELS TREATED					
Acres of ladder fuels and crown densities reduced					
Thinning trees 12" diameter and less	N/A	4913 acres	4716 acres		4799 acres
Thinning trees up to larger diameters		0 acres	6757 acres		5836 acres
Removing dense white fir (shelterwood and shelterwood/thinning)		0 acres	0 acres		270 acres

[25] *Low fire severity* is generally not lethal to the forest stand. These are the most beneficial types of burns because they help clean out fuels on the ground without killing the trees. *Mixed fire severity* means it burns somewhere between low severity and very hot, and can kill from 30%-80% of the forest vegetation, depending on stand structure and conditions. *High fire severity* would generally kill most of the forest vegetation (considered as a "stand replacement" event).

Fire Hazard	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Thinning and opening patches for larch restoration		0 acres larch restoration	0 acres larch restoration	0 acres larch restoration	811 acres larch restoration
Acres of Surface Fuels Reduced					
Mowing	N/A	2452 acres	5666 acres	5666 acres	5666 acres
Underburning (both as a primary and follow-up treatment)	N/A	8557 acres	4229 acres	4229 acres	4235 acres
Hand piling (piles would be burned)	N/A	2212 acres	2474 acres	2474 acres	2472 acres
Machine piling (piles would be burned)	N/A	1259 acres	5855 acres	5855 acres	6118 acres
IMPACTS TO AIR QUALITY - tons of PM10 produced from prescribed burning - relative risk of smoke from wildfires	- N/A - Greatest potential impact of smoke from wildfires	- 35395 tons over 5+ years - Possible smoke from wildfire less than alt 1, but greater than under alts. 3, 4 & 5	- 4563 tons over 5+ years - Possible smoke from wildfire less than alt s1 & 2, but greater than under alts. 4 & 5	- 4563 tons over 5+ years - Possible smoke from wildfire less than alts 1, 2 & 3, but greater than under alt 5	- 4633 tons over 5+ years - Possible smoke from wildfire the least

Cumulative Effects

Wildfire Hazards. One of the objectives of reducing fuels in the project area is to reduce the potential impacts within the area from wildfires that are likely to start outside of the project area. The Mt. Jefferson Wilderness (located 4 miles to the west) is considered at very high risk of an intense fire, due to trends in lightning strikes, the high volumes of fuels and the high mortality of trees. There have been 2 large wildfires in the last 2 years in this area. Due to prevailing winds, wildfires which start in these areas travel east, toward the project area.

The rapid rate of wildfire spread observed in Central Oregon and across the west during the summer of 2002 demonstrated that fuel reduction in one area can protect much more than that area.

Actions under this project, when considered with other similar past and foreseeable future projects that reduce fuel levels on National Forest lands on the Sisters Ranger District (Jack Canyon, Santiam Corridor, Santiam Restoration, Highway 20, Canal, Black Butte Ranch Fuels Reduction, McCache, South Trout, and Big Bear), are expected to greatly reduce the risk of catastrophic wildfire impacts to resources and communities in and adjacent to the National Forest lands.

Wildfire Risk. The risk of ignition is related, in part, to the amount of human use occurring on National Forest lands. Recreation use is increasing in Central Oregon and would likely result in an increase in recreation use in the project area. Increasing recreation may increase the risk of a fire ignition in the project area and would heighten the need for visitor protection. However, the proposed reduction in road miles open to the public under the Alternatives, in combination with reductions in road miles under other projects on the Sisters Ranger District, are expected to help mitigate the risk of ignition associated with an increase in recreation use. A general increase in fire prevention education in Central Oregon is also expected to help mitigate the risk of wildfire ignition.

Air quality. Throughout the year there is considerable competition for pollutant emissions. Local, State, and Federal agencies as well as private entities are all in competition for a limited amount of airshed space. The Oregon State Smoke Management Plan allocates the amount of burning that may be conducted in a given area on a given day. The likelihood of an impact on air quality in and adjacent to the project area is greatest when weather conditions are favorable for prescribed burning, and several agencies/ individuals are all burning at once.

A wildfire in the project area would likely occur during the summer, when there are commonly other wildfires burning in the area, particularly if they are ignited by the same lightning storms. Smoke from a wildfire in the project area could contribute to smoke from other fires in Central Oregon or even the western states (Central Oregon occasionally receive smoke from fires in other parts of the state or adjoining states).

Wildlife

All species on the Forest Service Region 6 Threatened, Endangered, and Sensitive (TES) Species List, and the survey and manage list under the Northwest Forest Plan, that have potential habitat within the project area on the Sisters Ranger District were considered in this analysis. Cumulative effects for wildlife, are discussed at the end of discussions about the individual species.

Threatened, Endangered and Sensitive Species

Three TES species, four sensitive species, and one proposed species and/or their habitats are known or suspected to occur within the project area (Table 3-5, Chapter 3). No suitable habitat or visual sightings for American peregrine falcon, horned grebe, red-necked grebe, western sage grouse, yellow rail, tri-colored blackbird, and pygmy rabbit were identified within the project area, and therefore, not analyzed.

Summary of Conclusions

1. The No Action alternative is not expected to have any effects on Oregon spotted frogs or wolverine or their associated habitats.
2. The Action Alternatives will have No Effect on the Oregon spotted frog and their associated habitats.
3. The No Action alternative "May Effect, but is not likely to Adversely Effect" the bald eagle, northern spotted owl, and Canada lynx and their associated habitats.
4. The No Action alternative "May Impact" buffleheads, harlequin ducks, and Pacific fishers and their associated habitats.
5. The Action Alternatives "May Effect, but are not likely to Adversely Effect" the bald eagle and Canada lynx and their associated habitats. Informal consultation is required for the bald eagle.
6. The Action Alternatives "May effect, are likely to adversely effect" spotted owl, and formal consultation with the US Fish and Wildlife is required.
7. The Action Alternatives "May Impact" buffleheads, harlequin ducks, wolverines, and Pacific fishers and their associated habitats.
8. Alternative 2 is the preferred alternative for the northern spotted owl, bufflehead, harlequin duck, Canada lynx, and Pacific fisher. Alternatives 3 and 4 are the preferred alternatives for the bald eagle and California wolverine. Alternative 5 is the preferred alternative for road closures for the Canada lynx and California wolverine.

A summary of the process used to complete the Biological Evaluation for wildlife, and the results of that process can be found in the Biological Evaluation.

NORTHERN SPOTTED OWL

Important Interactions

Spotted owls require dense, multi-storied forests, with fairly closed canopies that can protect them from predation. Spotted owls probably have not been long-term residents of the east Cascade forests, and moved in within the last 60 years when fire exclusion resulted in the typically open pine forest transitioning to dense forests with a high percent of white fir. Though these conditions are beneficial for the spotted owl, they are not sustainable in most east-side forests (as is evidenced by the increasing mortality of stands along the east slope of the Cascade Mountains) and may result in loss of late-successional habitat. The habitat that is currently occupied by owls in the project area is considered poor and minimally suitable. However, the spotted owl is a species whose viability is threatened, and it is important to maintain and develop suitable habitat, where possible. The existing poor condition of owl habitat occurred over many decades, and will take many decades to improve. There are only limited options for enhancing owl habitat, and the alternatives present the range of these options. Alternatives 1and 2 would preserve short-term habitat at the risk of delaying development and potentially losing future habitat. Alternatives 3, 4 and 5 would result in greater impacts to short-term *dispersal* habitat, but would have a greater possibility of promoting sustainable nesting, roosting and foraging habitat *and* dispersal habitat in the long-term (over 60 years).

The types of conditions that may affect spotted owl are amount and quality of suitable nesting, roosting and foraging habitat, dispersal habitat, risk of habitat loss, miles of open road, and habitat for prey species (Douglas tree squirrel and voles in this project area). Actions that may affect these factors include timber harvest that changes stand density and canopy closure, changes in fuel levels, and decommissioning of roads.

Direct and Indirect Effects

Modification of Habitat

Potential modification to spotted owl habitat would primarily occur in the forested stands outside of the spotted owl focal species area, in areas that owls could use as dispersal habitat. Approximately 17% of the project area would be managed for spotted owl (figure1-4, Chapter 1).

The objectives for thinning within the focal area for spotted owl would be to promote large tree structure, reduce risk of losing habitat, retention of more long-lived, fire tolerant, and disease resistant species, and help develop conditions favorable for future habitat. Treatments in the spotted owl focal area will be concentrated primarily in stands containing higher levels of insect and disease activity and unsuitable habitat. Alternatives that treat more of the focal area can help reach these objectives, but also can reduce denser forest conditions that owls may use, even if poor quality. These dense conditions that owls may be using are not expected to persist because of the instability that high densities bring to a forest stand.

It is recognized that actions to reduce fuel levels and risk of catastrophic loss can be in conflict with maintaining short-term spotted owl habitat. Actions that can modify habitat the most are those that reduce the density and layers of canopy cover. The three silvicultural prescriptions that reduce canopy cover the most are shelterwood, larch restoration, and thinning (USDI Draft Northern Spotted Owl Plan, 1992). However, within nesting, roosting, and foraging habitat, and suitable dispersal habitat in the connectivity corridors, a minimum canopy cover of 30% would be maintained in all areas treated. More open canopies can increase the risk of predation on traveling owls (the primary predators in this project area would be great gray and great horned owls).

Treatments in Nesting, Roosting, and Foraging Habitat. Most of the nesting, roosting, and foraging habitat would not be treated under any of the Alternatives, except for approximately 170 acres within the defensible space corridors, and within aspen stands.

Aspen restoration along the South Fork of Lake Creek is proposed for 10 acres within a hardwood inclusion within the larger conifer stand. Treatment is proposed to promote the health and vigor of the aspen stand. Scattered conifers are present within the inclusion as well as numerous conifer seedlings. It is assumed that this inclusion is not serving as spotted owl nesting, roosting, and foraging habitat. Treatment may impact nesting, roosting, and foraging habitat conditions immediately adjacent to the aspen inclusion from the removal of conifers to promote the expansion of aspen. However, this would be limited in scope.

Thinning trees 12” diameter and less in defensible space would occur in approximately four nesting, roosting, and foraging stands scattered across the project area. These stands occur predominantly within the mixed conifer dry plant association and are characterized as being dominated by ponderosa pine and larch with minor amounts of white fir or Douglas-fir in each stand but one. The quality of habitat in these stands is low due to the lack of fir. Stand conditions tend to be more open than typical nesting, roosting, and foraging stands and large trees tend to rise above the lower canopy isolating them providing little overhead protection from predators. These stands are also isolated patches away from other existing nesting, roosting, and foraging habitat. The probability of use is low due to the lack of connectivity to adjacent suitable habitat. The stand adjacent to Metolius Meadows subdivision is a high priority for treatment to create defensible space and to assure that there is continuity in surface fuel reduction within the corridor. Areas within the defensible space corridors are intended to be managed as reduced fuel zones for the protection of residences, and are not intended to be developed as nesting, roosting, and foraging habitat.

Impacts to existing nesting, roosting, and foraging habitat would be the removal of the lower canopy and structure that currently exists. Stands would be more open and owls may tend to avoid these areas due to the lack of cover and roosting sites. Stands would still maintain the large tree component but would be downgraded due to the loss of canopy layers.

Overall, there will be a loss of structural diversity, snags, and some interior habitat, which may result in a potential increase in predation and increased competition by other owls and raptors. It may also reduce the habitat effectiveness for spotted owl prey base species. Decadent trees and logs already present on site may be removed or degraded by both harvest and fuels activities. Suitable nesting, roosting, and foraging habitat would be reduced by these treatments. Dispersal habitat may be reduced by these harvest methods, especially in the ponderosa pine plant association. Long term effects may be beneficial due to the promotion of more desirable species and an increase in size overall which would result in more late-successional habitat across the project area. However, short term effects would stem from the loss of suitable habitat and dispersal habitat.

Treatments in Dispersal Habitat. There are portions of 4 home ranges for owls in the project area, while only 1 activity area is located within the project area. Minimizing harvest in these home ranges and across the project area could maintain important short-term dispersal habitat for the owls. However, since much of the habitat is at risk of moderate to severe impacts from wildfires, insects and disease, absence of tree harvest would not address this risk.

Thinning trees greater than 12” could result in both negative and beneficial impacts to spotted owls. Negative impacts would result from more open stands by removing dense patches, white fir, and increase sight distance through the stand, which may impact dispersal through the area. Beneficial impacts should result from maintaining large tree structure while minimizing stand densities, reducing risk to existing suitable habitat and facilitating the development of future habitat.

Thinning trees less than 12” diameter and underburning is not expected to have an appreciable direct affect on spotted owl habitat, though, indirectly it would be important for maintaining large tree structure while minimizing stand densities, and can help reduce fuels and thus risk from severe wildfire. These actions would only have a minor effect on reducing stand densities (see discussion under Forest Vegetation and Fire and Fuels, this Chapter). Underburning may consume soft snags and down wood, which provide habitat for prey species. However, the effect is expected to be considerably less than from a wildfire.

Regeneration by irregular shelterwood would occur only under Alternative 5, and would be applied to stands with moderate to high mortality from root diseases and budworm. All ponderosa pine greater than 21” diameter would be retained, and healthy trees would be left to maintain a residual spacing of about 40-75’ (average of 7-25 trees per acre). Beneficial impacts would result in the reduction of risk to existing suitable habitat and facilitating the development of more stable, long term habitat. Negative impacts would result in slightly more open stand conditions that could impact dispersal. However, stands are already open due to the mortality. Another negative impact would result from the removal of some snags and down woody material (though Land and Resource Management Plan standards would be met – see mitigation measures in Chapter 2). This may impact prey densities and dispersal to adjacent suitable habitat.

Larch restoration would also occur only under Alternative 5, and would be applied in stands with a substantial component of western larch that are moderately to heavily infected with larch dwarf mistletoe. The objective is to remove as much mistletoe as possible while creating conditions favorable for establishment and growth of natural regeneration and planted larch. Minor amounts of this treatment would occur within the spotted owl focal area, and would result in more open stands due to the thinning and removal of portions of the crowns. It would reduce the competition between larch and other species and help maintain the live larch, which increases diversity of long-lived species. It would also decrease the fire risk by removing excess dead and downed wood. Beneficial impacts would result in the reduction of risk to existing suitable habitat. Mitigation of retaining live trees would provide for vertical structure throughout the life of the stand. Negative impacts would result in more open stand conditions that could impact dispersal slightly. Though the reduction in competition is good for western larch, this type of habitat doesn't provide much value for spotted owls, especially in the winter months when crowns are bare.

Aspen restoration would occur on about 10 acres, and effects that are predicted to be minor, include the loss of large structure in the form of conifers in these areas over the long term. However, it would increase the limited hardwood diversity within the project area, which may increase the diversity of prey species available. Most of the actions would be concentrated within or adjacent to riparian reserves. This may impact dispersal habitat slightly until stands recover. Activities would more likely mimic natural gaps for the short term (5-10 years).

Fuels treatments associated with harvest treatments may have impacts to spotted owls and their prey species. Handpiling, which retains the most large down woody material, would have the least impact on habitat for prey species. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the mixed-conifer wet plant associations and spotted owl focal area. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing are expected to have little effect on spotted owl habitat.

Overall, vegetation treatments may result in a loss of structural diversity, snags, and some interior habitat, which may result in a potential increase in predation and increased competition by other owls and raptors. It may also reduce the habitat effectiveness for spotted owl prey base species. Decadent trees and logs already present on site may be removed or degraded by both harvest and fuels activities. Dispersal habitat may be reduced by these harvest methods, especially in the ponderosa pine plant association. Long term effects may be beneficial due to the promotion of more desirable species and an increase in size overall which would result in more late-successional habitat across the project area.

Connectivity

Connectivity is addressed in the Programmatic Biological Assessment as an important constituent element of habitat for the spotted owl where habitats are protected from disturbances or are representative of the historical, geographical, and ecological distributions of the species it is designed for. Functional connectivity, according to Noss and Cooperrider (1994) is measured according to the potential for movement and population interchange of the target species. For spotted owls, connectivity is affected more by the suitability of the overall landscape than by the presence or absence of discrete corridors because spotted owls disperse randomly (USDA 1990). However, corridors have become an important tactic for preserving biological diversity. Rosenberg et al. (1997) defined corridors as "a linear landscape element that provides for movement between habitat patches, but not necessarily for reproduction. Thus, not all life history requirements of a species may be met in a corridor."

Connectivity across the Sisters Ranger District is important to the successful dispersal of spotted owls from nest sites in the project area to suitable habitat in adjacent reserves (e.g. wilderness to the west and Late-Successional Reserves to the south), and within the project area. Stand-level connectivity is also important for dispersal within the project area. A connectivity corridor for spotted owl was designated within and adjacent to the project area (Figure 1-4, Chapter 1).

It is assumed that the fewer acres on which canopy cover is reduced, and the greater the amount of late-successional elements that are retained within areas that are treated (as "stepping stones" across openings), the better quality and more contiguous the dispersal habitat in the short-term. However, timber harvest and fuel reduction actions in areas that are not currently suitable and are at risk of loss due to high stand densities and fuel levels, may enhance the quality of future connectivity.

Disturbance

Restoration activities that occur within ¼ mile of a known nest site may disturb nesting or breeding pairs. This effect would be mitigated by limiting management activities during the breeding season (see "Mitigation", Chapter 2).

Road Impacts

Open road densities are relatively high in this project area (3.6 miles/sq mile) and can increase the potential for disturbance, fragment habitat, and increase the potential for snag removal. Reed et al. (1996) found that roads add to habitat fragmentation more than harvest activities. A reduction in road miles and densities can reduce habitat fragmentation and potential for disturbance. Road closures would be most beneficial within nesting, roosting, foraging and dispersal habitat and along riparian areas.

Effects of Alternative 1

There would be no direct effects to suitable spotted owl habitat under this Alternative since there would be no harvest or fuel reduction actions within suitable habitat. In the absence of severe disturbances, canopy layers, canopy cover, structure, down woody material, snags, and connectivity would gradually continue to increase. Mixed conifer stands would continue to lose large ponderosa pine trees, replaced by white fir and other less tolerant species. Suitable habitat would continue to exist with white fir providing the nesting, roosting, and foraging component. This habitat would be short-lived due to short life-span of white fir.

Even though suitable nesting, roosting, and foraging habitat is minor in the project area (only 7% of the area) there would be an increased risk of loss of remaining suitable habitat from stand replacing fire or degradation by insects and disease. 52% of the project area and 75% of nesting, roosting, and foraging habitat would remain at risk of high severity fires under this Alternative (Table 4-7). If such an event were to occur, it would prolong the development of future suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material (though some snags and down woody material would be created). This may lead to reduced numbers of spotted owl pairs occupying the project area due to less available suitable habitat.

Existing habitat is not overly fragmented, and dispersal across the landscape would be provided by about 62% of the project area (has 30% or greater canopy cover). However, some stands show signs of increased occurrence of root disease, decreasing the quality of existing nesting, roosting and foraging habitat and dispersal habitat, and due to openings in high mortality stands, increases the risk of predation (Miller et.al, 1972). However, increased mortality may increase the prey base in the short term due to the additional down material on the forest floor. Some of the best habitat for dispersal would be along the riparian reserves. Stands in the connectivity corridor would continue to become more dense, which could maintain canopy covers beneficial for spotted owl dispersal , but also would leave these stands are high risk of impacts from wildfire, insects and disease.

Other restoration activities would not occur under this alternative, such as road closures, fuel treatments, or aspen restoration. Habitat fragmentation would remain the same without road closures.

The maximum amount of short-term dispersal habitat is associated with Alternative 1, however, the trade off would be an increased risk of impacts to long-term dispersal habitat from fire, insect and disease.

Effects of Alternatives 2, 3, 4 and 5

<u>Modification of Habitat</u>. Under each of the action Alternatives there would be some vegetation treatments within the 4 home ranges (Table 4-7), with the most under Alternative 5 and least under Alternative 2.

Under all action Alternatives only thinning trees 12" diameter and less, underburning and acres of aspen restoration would occur in approximately 170 acres of suitable *nesting, roosting, and* *foraging habitat*. There vegetation treatments are expected to affect habitat by removing portions of lower canopy and structure that currently exists. Stands would be more open and owls may tend to avoid these areas due to the lack of cover and roosting sites. Stands would still maintain the large tree component but would be downgraded due to the loss of canopy layers. No nesting, roosting, and foraging habitat within the home ranges would be treated.

A variety of treatments would occur within forest stands technically suitable for *dispersal* habitat (greater than 30% canopy cover). Under burning is not expected to effect the quality of dispersal habitat. Approximately 2184 (Alternatives 3 and 4) to 2329 (Alternative 2) acres of small tree thinning would occur but the effect on the quality of the habitat is predicted to be minor, since canopy cover would generally not be affected. The most acres of dispersal habitat within home ranges would be treated under Alternative 5 followed by Alternatives 4 and 3, and lastly be Alternative 2 (Table 4-7).

Thinning trees larger than 12" diameter would occur under Alternatives 3, 4 and 5, with Alternative 3 and 4 proposing slightly more acres than Alternative 5. Removal of the larger white-fir trees under Alternatives 4 and 5 may reduce canopy cover and mid layer canopies more than under Alternative 3, where harvest occurs. Within the spotted owl home ranges, there would be from 676 (under Alternatives 3 and 4) to 655 (under Alternative 5) acres of thinning trees up to larger diameters, almost half within Davis Creek home range.

Treatments that could affect spotted owl habitat the greatest would be shelterwood and larch restoration. These actions would only occur under Alternative 5 (Table 4-7). As such, Alternative 5 would have the greatest negative effect on dispersal habitat in the short-term, though these vegetation treatments are intended to restore the long-term health of patches of habitat that are in decline due to insects and disease, and high stand densities. Under Alternative 5 there would be 36 acres in the Davis Creek Home Range and 24 acres in the Canyon Creek home range where treating stands affected with root disease by shelterwood would occur. Also under this Alternative 5 there would be 42 acres of larch restoration in the Davis Creek home range.

<u>Connectivity.</u> Thinning is expected to slightly degrade the suitability of stands that meet the definition of dispersal habitat across the project area within approximately 4,188 acres under Alternative 5 and 4,937 acres under Alternatives 3 and 4. However, the majority of these stands are located in the ponderosa pine plant association which is not able to sustain dense canopy conditions over the long-term, and project goals do not intend maintaining these stands as spotted owl dispersal (many of these stands are within the White-headed Woodpecker habitat area (Chapter 1, figure 1-4).

The action Alternatives would include thinning and underburning in approximately 53% (under Alternative 2) to 77% (under Alternatives 3-5) of the designated connectivity corridor (Figure 1-4). However, the majority of these treatments are not likely to impact the quality of the corridor since treatments would primarily occur outside of stands that currently function as dispersal habitat. Canopy cover in treated stands would be maintained at 30% or denser.

<u>Risk</u>. All of the action Alternatives would reduce the risk of losing spotted owl habitat, both within the habitat and in adjacent forest areas. Alternative 5 would reduce fire severity the most

(Table 4-7) and would reduce the risk of insect and disease the most through a reduction in stand densities and restoration of infected stands (Table 4-3). Alternative 4, followed by Alternative 3 would reduce risk the next greatest amount. Alternative 2 would reduce risk the least. In addition, by reducing stand densities it is predicted that the action Alternatives would enhance development of large tree structure. Again, Alternative 5 would have the greatest beneficial effects followed by Alternatives 4, 3 and then 2.

Disturbances. Decommissioning and inactivation of roads, and reductions in fragmentation would have the greatest benefit to owls under Alternative 5, followed by Alternatives 3 and 4, and then 2. Roads that are near or adjacent to spotted owl activity centers are a priority for closure to reduce the potential for disturbance and to reduce fragmentation. Disturbance activities would be restricted during the reproductive period.

Logging operations that occur within 1/4 mile or close proximity to known spotted owl activity centers under the action Alternatives would mitigate disturbance by not occurring during breeding season (see mitigation, Chapter 2).

Table 4-7. Comparison of Effects on Spotted Owl habitat by Alternative.

Spotted owl Habitat	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Nesting, roosting, and foraging habitat - acres treated (there a total of 1059 acres of nesting, roosting, and foraging habitat in the project area)					
Thinning trees 12" diameter and less (including within defensible space)	N/A	155 acres			
Aspen Restoration		10 acres			
Underburning		5 acres			
Acres at risk of high severity fire.	797 acres at risk of high severity fire	627 acres at risk of high severity fire			
Acres in which proposed treatment may *degrade* habitat quality in the short-term	N/A	Approximately 17% (about 165 acres) of foraging habitat may be degraded by thinning trees 12" diameter or less			
Dispersal habitat - acres treated					
Thinning trees 12" diameter and less	N/A	2,329 acres	2,184 acres		2255 acres
Thinning trees up to larger diameters[26]		0 acres	4937 acres		4188 acres
Aspen Restoration		10 acres	10 acres		10 acres

[26] Thinning under Alternative 3 would remove trees potentially up to 16" diameter (except up to 21" diameter white fir), thinning under Alternative 4 would remove trees potentially up to 21" diameter (except up to 25" diameter white fir), and Alternative 5 would not have set diameter limit, but removal of trees over 21" diameter would be an exception.

Spotted owl Habitat	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4 Proposed Action	Alternative 5
Shelterwood, and shelterwood/thin		0 acres	0 acres		247
Larch Restoration (1/4 to 3 acre openings)		0 acres	0 acres		651
Underburning		4,757 acres	423 acres		423 acres
Acres in which proposed treatment may *degrade* [27] habitat quality in the short-term	N/A	Less than 1% of dispersal habitat may be degraded	Approximately 53% (about 4817acres) of dispersal habitat may be degraded		Approximately 62% (about 5687 acres) of dispersal habitat may be degraded
Home Ranges and the acres treated (no nesting, roosting, and foraging habitat would be treated; dispersal habitat only)					
Canyon Creek	N/A	180 total acres (includes 144 acres dispersal habitat)	201 total acres (including 156 acres dispersal habitat)		223 total acres (including 179 acres dispersal habitat)
Davis Creek		679 total acres (includes 457 dispersal habitat)	753 total acres (including 546 acres dispersal habitat)		770 total acres (including 505 acres dispersal habitat)
Suttle 96		36 total acres (all dispersal habitat)	76 total acres (no dispersal habitat)		76 total acres (all dispersal habitat)
Obsidian		517 total acres (including 319 dispersal habitat)	553 total acres (including 354 acres dispersal habitat)		553 total acres (including 507 acres dispersal habitat)
Total Acres Vegetation treatments in Home Ranges	0 acres	1412 total acres (including 956 acres dispersal habitat)	1583 total acres (including 1056 acres of dispersal habitat)		1622 total acres (including 1267 acres dispersal habitat)
Disturbances Approximate Reduction in road miles	0	20 miles reduced	50 miles reduced		60 miles reduced

[27] The amount of dispersal habitat for northern spotted owl was determined by the acres of forest stands that have an average canopy cover greater than 30%. However, these acres may not all be well connected, and did not consider the quality or functionality of the dispersal acres. Also, many of the acres that qualified as dispersal are across ponderosa pine plant associations, which do not generally provide long-term dispersal habitat.

Cumulative Effects

Cumulatively, Alternative 1 may indirectly lead to reduced survivorship of some or all 4 of the spotted owl pairs with home ranges in the project area involved but not of the population as a whole. This may be due to further loss of habitat from a large fire event or additional loss from insects and disease. The "No Action" alternative "May effect, but is not likely to Adversely effect" spotted owls or their habitat due to further degradation of habitat, risk of loss from a large fire event, and a shift in the species mix from long-lived, fire tolerant species to short-lived, intolerant species.

Cumulatively, all the action Alternatives may indirectly affect survivorship of some the pairs involved, due to reduction in dispersal habitat, but not to the population as a whole. The action Alternatives “May effect, and are likely to adversely effect” spotted owl and their habitat due to removal of habitat constituents within nesting, roosting, and foraging habitat and degradation of loss of dispersal habitat. There Alternatives are not consistent with the Deschutes Joint Programmatic Biological Assessment Design Criteria, and there will be formal consultation with US Fish and Wildlife Service to review these actions.

Past and proposed harvest activities have or will occur south, west and north of this project area in the Santiam Corridor, Santiam Restoration, McCache and Jack Canyon project areas. Approximately 2,200 out of 10,575 total acres of nesting, roosting and foraging habitat would be degraded as these other projects remove dead and dying trees killed by the spruce budworm epidemic. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Future activities may occur within the Why-chus Late-Successional Reserve and South Trout project areas. These areas occur south of the Highway 242. The focus would likely continue to decrease the risk of a catastrophic event and attempt to move stands into more sustainable conditions. Some nesting, roosting, and foraging habitat may be treated to attain these goals. However, the farther south, the less suitable habitat exists for spotted owls. Overall, the quality and quantity of nesting, roosting and foraging habitat would change from existing disturbances and processes. This may be a time when low numbers of spotted owls occupy sites in the east Cascade slopes until stands recover.

Action Alternatives are not consistent with the Deschutes Joint Programmatic Biological Assessment Design (2001-2003) because project activities may remove or degrade the primary constituent elements for critical habitat, and harvest activities are proposed within dispersal habitat (see Table 4-7). Therefore, Alternatives 2, 3 and 4 "May Affect, but are not likely to Adversely Affect" spotted owls and their habitat. Informal consultation with the US Fish and Wildlife has occurred.

In the short-term, Alternative 2 would be the preferred alternative for spotted owls due to fewer direct and short-term impacts from harvest on dispersal habitat. However, it is recognized that this Alternative also carries the most risk, other than the No Action Alternative. Alternative 5 would be the least preferred alternative. Impacts would be reduced with implementation of required mitigation measures (see “Mitigation”, Chapter 2).

NORTHERN BALD EAGLE

Important Interactions

There would be no direct effects to the bald eagle since there are no known nesting areas located within the project area. Vegetation management could affect potential roost sites and long-term sustainability of landscape features, particularly large trees.

Indirect Effects

Removal of potential roosting and perching habitat (large trees and snags) could occur to meet hazard tree safety requirements, especially along roads and recreation sites, and removal of larger white fir trees under shelterwood treatments under Alternatives 4 and 5. However white fir do not typically develop the large limb structure used by bald eagles for nesting.

This area is not a focal area for bald eagle nesting but provides opportunities for foraging and roosting. Maintenance of high stand densities and a high percent of white fir could result in a decline in potential long-term habitat. Actions that reduce the acres at risk to higher severity fire would help maintain higher water quality over the long-term, and thus habitat for fish, the prey base. Long-term benefits to the prey base are considered to outweigh potential short-term impacts to water quality from harvest operations.

Tree harvest that reduces stand densities is predicted to help retain existing large structure and accelerate and promote future large trees.

Proposed fuel treatments would reduce the risk of loss from catastrophic events by reducing down woody material levels and removing small white fir.

No vegetative treatments would occur within a Bald Eagle Management Area.

Effects Common to All Alternatives

Any effects on bald eagles would only be indirect, and would relate to retaining and developing large trees for roosting. Short-term impacts to potential habitat would be the least under Alternative 1 and the greatest under Alternative 5 (due to potential need to remove hazard trees and snags during logging operations on more acres). Sustainability of large tree habitat and retention of existing large trees would be the highest under Alternative 5, followed by Alternatives 4, 3 and then 2, and the least under Alternative 1. Reduction in risk to habitat would be the greatest under Alternative 5 and least under Alternative 1. Long-term benefits of vegetation management under the action Alternatives outweigh short-term effects.

A reduction in road miles and densities would benefit habitat by reducing potential sediment into streams, and by reducing habitat fragmentation. Alternative 5 reduces open road miles the most, followed by Alternatives 4/3, and then 2. Alternative 1 would not reduce open road miles.

This project may effect, but is not likely to adversely effect bald eagles and their habitat. Alternatives 3 and 4 are the preferred Alternatives for bald eagles since they reduce the risk of mixed and high severity fires while maintaining large ponderosa pine trees.

Cumulative Effects

This project, along with vegetation management in the project areas of McCache, Santiam Restoration, Santiam Corridor, Jack Canyon, and Highway 20 may enhance bald eagle habitat in the long term, by promoting healthier ponderosa pine and Douglas-fir stands, reducing competition from white fir, and reducing risks to loss of habitat over the landscape. There is a potential cumulative effect of losing snags across the landscape due to safety concerns during restoration activities, though this is expected to be minor.

CANADA LYNX

Important Interactions

No lynx have been reported in the project area and there would be no known direct effect on lynx from actions proposed under any of the Alternatives. There is no designated lynx habitat within the Metolius Basin project area. This area would be analyzed from a connectivity perspective.

Wildfire, insect or disease, or proposed actions could affect potential habitat by removing or modifying habitat components, and promoting development of future habitat. These actions could also affect habitat for the primary prey species for lynx, snowshoe hare and Douglas squirrel.

Indirect Effects

Fire suppression has altered the vegetative mosaic and species composition and has reduced the quality and quantity of lynx habitat, especially in the mixed conifer plant associations, as well as riparian areas in the project area and range-wide (Morgan et al. 1998). Forest composition and structure has changed with more shade tolerant species, more canopy layers, down woody material, and snags and is more susceptible to severe fires, insects, and disease (Quigley et al. 1996).

Thinning trees 12” diameter and greater would result in a reduction in cover and forage values for lynx and would reduce winter foraging opportunities for snowshoe hares. Depending on remaining densities and the size of the treatment area, lynx movement may be affected (Koehler 1990). Large patches with low stem densities function as openings and disrupt movement. Several authors (Koehler 1990, Koehler and Brittell 1990, and Mowat et al. 2000) suggest that lynx do not hunt in large openings but would utilize stand edges. This may be different for dispersing lynx. Murray et al. (1994) and Poole et al. (1996) found that lynx may move through large areas of non-forest when dispersing from one population to another and may use shrub steppe areas. Cover is still available in these areas however, it's provided by dense shrubs rather than conifers. Thinning results in a reduction of shrubs and understory conifers reducing cover and food for prey. This treatment may result in lynx needing to increase their foraging range.

Small tree thinning reduces the density of sapling-sized trees, reducing snowshoe hare habitat. This reduces foraging opportunities for dispersing lynx. However this treatment does reduce risk and competition to the remaining stand and may accelerate growth. Aspen restoration would result in a short-term loss in habitat for snowshoe hares. However, there would be increases in diversity and summer foraging opportunities for dispersing lynx.

Shelterwood treatments would remove or alter cover values until stands regenerate. Koehler (1990) suggested that shelterwood prescriptions that result in forest openings greater than 100m (325 feet) may restrict movement and use patterns until forest regeneration occurs.

Several fuel treatments are proposed with each alternative. Handpiling would provide some habitat for prey species (primarily cover). This large wood can also provide cover for dispersing lynx. Machine piling may compact soils reducing understory vegetation growth. Machine piling in skid trails concentrates the compaction to a smaller area and is preferred over machine piling. Underburning may reduce the amount of large down wood. It may also stimulate regrowth of herbaceous plants, increasing snowshoe hare habitat. This increases foraging opportunities for dispersing lynx.

Reduction of roads would reduce fragmentation of habitat, reduce potential disturbance and reduce potential winter use by competitive species, which may follow snow-covered roads.

Effects of Alternative 1

Implementation of the No Action alternative would result in an increase in canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands would continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir. Connectivity would continue to exist due to increased stand densities. However, this may be only in the short-term due to the relatively short life span of white fir..

Connectivity would be provided by this alternative due to multi-layered stands, increased stand densities, and high brush levels. However, private land developments may preclude use by lynx and these may interrupt connectivity (Ruediger et al. 2000). Road densities would remain high with this alternative. These have the potential to impact lynx especially during the winter months. Many of the roads are moderately to heavily used by snowmobilers and this may lead to increased compaction levels allowing competing carnivores such as coyotes and mountain lions access to lynx habitat (Buskirk et al. 2000).

Effects of Alternatives 2, 3, 4 and 5

Tree harvest activities under Alternative 5 are expected to have the greatest detrimental effect on connectivity for lynx, due to the greater number of acres that would be opened up. Alternative 5 also would result in the greatest potential of removing larger trees, which could remove habitat for prey. Alternative 4, followed by Alternative 3 would not open the forest stands as much as Alternative 5, but more than Alternative 2.

Fragmentation, and potential for winter travel along roads would be reduced the most under Alternative 5, with the greatest number of road miles reduced. Alternatives 3 and 4 would close the next greatest number of road miles while Alternative 2 would close the fewest roads.

The action Alternatives "May Effect, but are not likely to Adversely Effect" lynx or it's habitat due to the increased risk of loss of connective habitat. Alternative 2 is the preferred alternative due to greater connectivity remaining within the project area. Road closures proposed for Alternative 5 are preferred over the other alternatives due to a greater reduction in road densities over the entire project area.

Cumulative Effects

Cumulatively, these alternatives are not likely to lead to the reduced survivorship of the lynx population or to individuals that may disperse through the project area. Several activities influence lynx dispersal habitat across the district including past timber harvest, small tree thinning, winter and summer recreation use, and road densities.

Past harvest activities have been concentrated along the east slope of the Cascades, primarily in the highest mortality areas with the Jack Canyon, Santiam Restoration, Santiam Corridor and McCache project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. Trade-offs were made to reduce risk of further loss and to create fuel break area where a large fire event may be stopped or contained. A large area running almost the entire length of the district has received harvest and fuels treatments to reduce risk. These activities have reduced overhead cover, down woody material levels, and stand densities potentially impacting use by lynx. However, treatments did not cover entire project areas so complex structure in the form of down woody material and dense stands still exists in many of these areas which may allow for foraging and dispersal by this species.

Small tree thinning has occurred district-wide potentially impacting prey habitat with the removal of small diameter forage. This may limit lynx use by reducing prey densities.

Potential disturbance stem from winter and summer recreation. Use usually occurs along Nordic trails within daylight hours and is most concentrated during weekends and holidays still allowing for lynx to disperse through the area. Use of snowmobile trails also occur throughout the district.

Summer recreation includes, but is not limited to, hiking both inside and out of wilderness, driving forest roads, camping, hunting, fishing, and use of OHV's.

Road densities are high throughout the district.

<u>BUFFLEHEAD and HARLEQUIN DUCK</u>

Important Interactions

There would be no direct effects under any of the Alternatives since there are no known nesting sites within the project area. Treatments that may affect bufflehead are those proposed for riparian areas of permanent streams. For harlequin ducks, the only relevant treatments are those along the Metolius River that affect riparian vegetation large woody debris in the river.

Aspen is the preferred nest habitat for bufflehead, but there are very few acres of this habitat in the project area. Snags and large structure in other tree species is also important habitat for bufflehead. Aspen restoration activities may result in a short-term reduction in mid-sized conifers within the stands, but would increase a minor amount of the preferred aspen habitat. The aspen stand along Lake Creek is the only one that would provide possible habitat so the potential effects on bufflehead are very small.

The majority of thinning in riparian areas would be trees 12” diameter or less, and would occur along intermittent streams, so this treatment is not expected to directly affect either bufflehead or harlequin duck. Thinning outside of riparian areas can help reduce the risk of wildfire impacts in areas adjacent to riparian areas. Harvest near the river corridor may disrupt foraging harlequin’s by altering their behavior or foraging locations.

Small tree thinning would occur throughout the riparian reserves. It would consist of removing trees primarily less than 8”diameter and in some cases up to 12” diameter. This treatment would result in the accelerated growth of remaining trees while reducing the fire hazard. Beneficial effects would result in the reduced risk of loss from fire and insects and disease.

Meadows in the project area are not currently providing habitat for bufflehead and so actions within meadows are not expected to affect this species. Harlequin duck habitat may be beneficially effected as meadows are opened up and riparian vegetation increases.

Underburning may degrade or consume some softer snags, though this is expected to be minimal due to the low intensity of prescribed burns. Underburning may have a short-term negative effect on riparian vegetation in the short-term (1 year), but is expected to stimulate the growth of future riparian vegetation. Handpiling in riparian areas can minimize the loss of snag habitat by piling slash away from snags and only burning the piles.

Effects of Alternative 1

This alternative would result in an increased risk of loss from a wildfire event. This could lead to a reduced number of snags across the project area and would lead to a decrease in potential nesting cavities. A fire event may also create snags, however there would be a decrease in habitat overall. A lag time would exist before additional habitat develops due to the loss of surrounding forested stands. Implementation would also lead to the continued loss of hardwood stands from conifer encroachment. This would lead to a decrease in the preferred nesting structure (aspen).

Increased risk of loss from a wildfire would also result in the loss of shrubby riparian vegetation, down woody material, and snags, which would decrease the potential nesting sites for harlequin ducks. It may also lead to increased sedimentation, which would decrease foraging opportunities by filling interstitial spaces reducing caddisfly levels. Barring a fire event, stand densities would continue to increase which may shade out some riparian vegetation, also decreasing potential nesting sites. However, down woody material and snags would continue to increase over time and caddisfly levels should remain constant.

The No Action alternative “May Impact” buffleheads and their habitat due to the loss of large snag habitat due to competition from white fir and the risk of loss from a wildfire event, but would not likely lead toward a trend for Federal listing. Impacts are minimal due to the small amount of habitat within the project area. The No Action alternative “May Impact” harlequin ducks and their habitat due to the potential loss of habitat due to fire suppression.

Effects of Alternatives 2, 3, 4 and 5

Vegetation treatment within riparian reserves are predicted to be the only ones which would affect habitat for these species (Table 4-8). Diameter limits would be reduced in First, Jack, and Lake Creek riparian reserves for Alternative 5 to provide connectivity across the project area. In other riparian areas, thinning trees greater than 12” diameter would occur, however, many of these are along intermittent streams and do not provide suitable habitat. Alternative 2 would reduce the risk of losing adjacent forest habitat the least, though more snag habitat may be retained with this alternative. Removal of >16” diameter trees may impact future recruitment of snag material by reducing the amount of large structure available.

Table4-8. Proposed Treatments within Riparian Reserves.

Proposed Treatment	Alternative 2	Alternative 3 and 4	Alternative 5
Aspen Restoration	10 acres	10 acres	10 acres
Thinning trees 12” diameter and greater	0 acres	252 acres	176 acres
Larch Restoration	0 acres	0 acres	76 acres
Meadow Enhancement	17 acres	17 acres	17 acres
Small Tree Thinning (up to 12” dbh)	846 acres	857 acres	857 acres
Underburning	315 acres	54 acres	54 acres
Total	**1188 acres**	**1190 acres**	**1190 acres**

The Action Alternatives “May Impact” buffleheads and their habitat due to the loss of large snag habitat but would not likely lead toward a trend toward Federal listing. Impacts will be minor due to the treatments occurring within the riparian reserves. Alternatives 2 or 5 are the preferred alternative for buffleheads and harlequin ducks due to greater retention of snag habitat and the retention of larger material within First, Lake and Jack Creeks.

Action Alternatives “May Impact” harlequin ducks and their habitat due to the potential degradation or loss of habitat adjacent to the Metolius River. However, beneficial impacts should also be realized with some treatments.

Cumulative Effects

Continued loss of large snag habitat around lakes, ponds, and streams continues to decrease available large structure on the landscape. Snag habitat is routinely removed around popular water bodies for safety reasons and for firewood use. Increased recreation pressure around and adjacent to water bodies may further decrease habitat suitability. This, coupled with the widespread mortality caused from the spruce budworm outbreak, has further reduced future snag habitat. A lag time will exist before stands recover and can provide adequate snag habitat around and adjacent to suitable habitat.

Several factors influence harlequin duck habitat within the project area including campgrounds, summer home tracts, and private lands. Hazard trees are routinely removed from recreation facilities. Continued loss of large snag habitat in and adjacent to the six campgrounds and summer home tracts along the Metolius River due to safety reasons limits the available nesting sites along the river. Therefore, large snag habitat outside of designated recreation areas is very important to retain since most, if not all, large snag habitat will be lost in the recreation sites. Approximately 580 acres of private lands occur within ¼ mile of the Metolius River. These sections are not managed for harlequin duck habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

CALIFORNIA WOLVERINE

Important Interactions

There would be no direct effects from any of the Alternatives on wolverine since no wolverine have been detected in or adjacent to the project area. The project area does not contain potential denning habitat but does provide possible foraging and dispersal habitat.

Actions that may affect wolverine include changes in canopy cover, fragmentation of the forest, changes in road status, and risk of habitat loss from fire.

Proposed actions or disturbances (severe fire) that reduce canopy cover sufficiently to increase snow depth could result in big game moving to lower elevation sites, thus drawing wolverines to lower elevations. Similar actions could also result in increased fragmentation of forest stands, and could reduce the ability of wolverine to travel through the area. Both of these conditions may result in greater risk of disturbance from human encounters.

Road closures would result in less disturbance and fragmentation of the landscape in the long-term.

Effects of Alternative 1

Canopy cover, canopy layers, down woody material, snags, and connectivity would continue to increase in the short term, except in those areas that show increased mortality. Those areas would continue to deteriorate and result in more fragmentation. Increased stand densities may increase thermal cover for big game. This may result in a higher survival rate for big game and less carrion for foraging wolverines.

There would be no additional projects completed with the implementation of this alternative such as road closures. The project area receives high recreation use yearlong. This use may displace foraging wolverines from using the project area due to disturbance from motorized vehicles.

The No Action alternative will have "No Impact" on wolverine or their habitat.

Effects of Alternatives 2, 3, 4 and 5

There would be short term effects from vegetation management until stands recover. These treatments would result in more open stands, deeper snow packs, less use by species in fall and winter months, more fragmentation of the landscape, and the potential for more disturbance. Beneficial impacts should result from additional road closures that would result in less disturbance potential and less fragmentation of the landscape in the long term. Alternative 5 would reduce road miles the most, followed by Alternatives 4/3 and then 2. Major travel routes within the project area would not be changed however. During peak use times, these may function as barriers to dispersal, especially the 14 and 1419 roads leading into Camp Sherman and to the Metolius River. Alternative 5 results in the greatest reduction in road density and treats the entire project area.

The action alternatives "may impact" wolverines or their habitat due to more open stand conditions. No direct impacts should occur and impacts should be short term in nature. However, a trend toward Federal listing is not expected with the implementation of any alternative. Alternative 2 is preferred over Alternatives 3, 4 and 5 due to the maintenance of denser canopies. Road closures proposed for Alternative 5 are preferred over the other alternatives due to a greater reduction in road densities over the entire project area. Alternatives 2 through 4 are preferred over Alternative 5 due to less fragmentation proposed.

Cumulative Effects

To better analyze cumulative effects, an area running north and south from the Cascade crest approximately 5-8 miles wide would be analyzed.

Past harvest activities have been concentrated along the east slope of the Cascades, primarily in the highest mortality areas with the Jack Canyon, Santiam Restoration, and Santiam Corridor project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained. Two additional project areas are proposed; McCache and South Trout. These projects would also reduce wildfire risk and remove dead and dying trees affected by insect and disease activity. Therefore, a large area running almost the entire length of the district has received harvest and fuels treatments to reduce risk. These activities have reduced overhead cover potentially impacting dispersal from wilderness areas. However, forage potential for big game may have increased, allowing more foraging opportunities for wolverines.

Along with increased harvest activities adjacent to wilderness areas, both summer and winter recreation use seems to be increasing with more powerful snow machines, more use of wilderness areas and increasing Off Highway Vehicle use.

Several projects have proposed road closures including McCache, South Trout, and Jack Canyon. This, along with Metolius Basin, would aid in reducing overall road densities and lessen fragmentation over time.

PACIFIC FISHER

Important Interactions

An estimated 7% of the project area provides suitable habitat for the pacific fisher, which also serves as spotted owl nesting, roosting, and foraging habitat. In general horizontal and vertical tree structure may not be of preferred quality, because it is not as complex as would typically be found in denser, moister forests. Snow accumulations also tend to be fairly deep, so habitat quality inside the project area may not be ideal.

Aspen restoration, shelterwood harvest, shelterwood harvest with associated thinning, and larch restoration treatments could result in the removal of habitat, structure, and canopy cover. There would also be a decrease in the level of available down woody material, which would decrease foraging, resting, and denning sites in these stands. However, many of these stands are not currently suitable habitat due to open canopies, loss of late-successional habitat due to mortality, and many are dominated by more open ponderosa pine stands. Due to the condition of many of these stands, snow depths are expected to be to high, with little canopy to intercept snowfall. This alone makes these stands unsuitable since fishers have been found to avoid deep snowpacks (Leonard 1980, Raine 1983).

Aspen restoration may only have short-term negative impacts on fisher habitat suitability. Beneficial effects would be an increase in prey diversity over time, especially during the summer months. During the winter, fisher may tend to use the edges more frequently where prey species would be more abundant due to increased cover of adjacent conifers.

The vegetation management actions mentioned above may also increase fragmentation within stands. Large forest openings, open hardwood forests, and recent clearcuts were found to be infrequently used by fishers in the West (Ruggerio et. al 1994). Fishers have shown an aversion to open areas and this has affected local distributions and can limit population expansion and colonization of unoccupied areas (Coulter 1966, Earle 1978).

Thinning trees may result in a slightly reduced canopy closures. Kelly (1977) found that fishers tended to use recently harvested areas when brush and saplings provided some low overhead cover but these areas were avoided during the winter. Thus, treating brush and small diameter material may limit use by fishers in the project area. However, most of these treatments would occur in stands that already do not provide foraging habitat.

Vegetation management may increase habitat quality over the long term by accelerating growth of the remaining stand. Treatment would also reduce the risk of loss by wildfire of currently suitable habitat by reducing stand densities.

Underburning and other fuel treatments could decrease the amount of available down woody material. Underburning, mowing and handpiling would mostly affect smaller material while machine piling would affect larger material. However, some piles could be retained across the landscape to provide prey habitat and potential denning sites.

Approximately 60% of the riparian reserves are proposed for treatment. The majority of proposed treatments within the riparian reserves consist of small tree thinning. These treatments may remove minor amount of canopy and structure. However, many of the reserves currently lack horizontal and vertical structure needed for fisher habitat, except for Lake Creek. Treatment within the reserves may hinder dispersal through the area or use by foraging animals.

Beneficial impacts should result from additional road closures which would result in less disturbance potential and less fragmentation on the landscape in the long term.

Effects of Alternative 1

There would be no direct effects to fisher habitat under this alternative. Indirectly, quality and quantity of habitat may continue to increase for the short term with increased canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands would continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less tolerant species. Suitable habitat would continue to exist in some areas with large wood structure. However, this habitat is primarily composed of white fir and would be short-lived. The lack of ponderosa pine and Douglas-fir in the understory would eventually render these stands unsuitable due to the lack of large structure.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or further degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with these events. This may lead to reduced numbers of fishers occupying the project area due to less available suitable habitat.

Existing suitable habitat is fragmented and some stands show signs of increased mortality, decreasing the quality of habitat currently existing. The highest mortality areas can be found in the mixed conifer plant association in the northern part of the planning area. Complex habitat conditions are not sustainable in the majority of this plant association. Increases in fragmentation due to further degradation of habitat may reduce the habitat quality for this area.

The No Action alternative “May Impact” fishers and their habitat due to loss of structural components over time and the loss of large structure within stands.

Effects of Alternatives 2, 3, 4, and 5

Approximately 220 acres of suitable habitat could be negatively affected by implementation of aspen restoration (10 acres) and thinning trees 12" diameter and less and underburning under each of the action alternatives.

Action alternatives would result in a decrease in small structure and slight decrease in canopy closure within the 10 acres of aspen treated. Removal of trees 12" diameter and less would decrease canopy cover slightly in the overall stand. Several studies have shown that fishers disproportionately use habitat with high canopy cover and avoid areas with low canopy cover (Arthur et al. 1989; Coulter 1966; Jones and Garton 1994; Kelly 1977; Powell 1977; Raphael 1984; Rosenberg and Raphael 1986; and Thomasma et al. 1991, 1994).

All action Alternatives reduce road miles, benefiting fisher by reducing habitat fragmentation. Though Alternative 5 would reduce the greatest number of road miles across the project area, each of the action Alternative would reduce the same road miles within riparian areas, which is important habitat for fisher.

Alternative 2 would be the preferred Alternative for fisher because there would be the least amount of canopy cover removed, while risk of high severity impacts to the stands would be reduced. However, extensive underburning in Alternative 2 may consume more down wood, an important habitat component, than under the other action Alternatives.

Loss of canopy cover would be the greatest under Alternative 5. This may outweigh the long-term reduction in risk to the habitat. Alternative 5 and 2 would maintain more dense habitat along riparian areas than Alternatives 3 and 4.

The Action Alternatives "May Impact" fishers and their habitat due to loss of canopy cover and structure, and due to a slight increase in stand fragmentation under Alternative 5. Alternative 2 would have the least impacts on fisher habitat currently, however it may have less long-term beneficial impacts. Alternative 5 would have the greatest impacts on fisher habitat due to the increase in fragmentation.

Cumulative Effects

Continued loss of large structure across the Sisters Ranger District, due to competition with white fir and increased loss from disturbance events, may lead to reduced survivorship of fishers until conditions are restored. Large tracts of late-successional forests have been impacted by recent insect and disease events reducing habitat quality due to more open stand conditions and increased risk. More open stand conditions also result in greater snow accumulations, which may result in lowered habitat quality over large areas. This project is not expected to contribute to openings in the canopy cover, except for about 296 acres under Alternative 5 where stands are already opening up due to mortality, but the density of the canopy would be reduced.

OREGON SPOTTED FROG

Important Interactions

There is very little habitat for spotted frogs due to very cold water in most of the streams and pools. Actions that open up riparian vegetation (aspen restoration, meadow enhancement, and thinning) could help thermal warming of some pools, however, even slow springs are likely to remain too cold for suitable habitat. Opening up riparian areas could also help stimulate denser riparian vegetation, which could enhance habitat. The majority of vegetation treatments in riparian areas would be implemented by hand, so there is little risk of impacts to riparian vegetation.

Underburning may consume down wood and riparian vegetation in the short-term, but is expected to stimulate growth of riparian vegetation over the long-term (over 2 years).

Effects Of Alternative 1

This Alternative would not have any direct effects on spotted frogs since no activities will occur within riparian reserves and no suitable habitat exists within the project area.

Indirectly, in the absence of a catastrophic event, stand densities would continue to increase, producing more shade along riparian reserves. This would keep water cool rendering the little available habitat unsuitable. Higher stand densities also increases the risk of a wildfire occurring in the project area. Due to increased densities, riparian reserves may burn more intense which could result in little overstory remaining and little down woody material left for microsites. The open environment may warm the waters and lead to increased grasses and other vegetation that could serve as potential breeding sites if other conditions were met for suitable habitat. However, no known populations of spotted frogs occur in the project area or on the District, so establishment of a new population is unlikely.

Effects of Alternatives 2, 3, 4 and 5

There would be no direct effects to spotted frogs since there are no known sites within the project area.

Treatments within riparian reserves are similar under each of the action Alternatives, except Alternative 3 and 4 would have the most thinning of trees up to 16”diameter, and therefore may open up more of the understory to allow thermal heating of waterways. However, the effect is expected to be minimal and only occur in the short-term.

Underburning and mowing would decrease brush density and height and therefore reduce the risk of high severity wildfire. This treatment aids in maintaining the overstory and would occur on the most acres under Alternative 2.

Cumulative Effects

Currently, little suitable habitat for spotted frogs exists on the Sisters Ranger District. Populations that may become established in future years may be isolated due to fragmentation of habitat/connectivity from one area of suitable habitat to another. Road development, off highway vehicle use, increased recreation pressure along riparian reserves, and past harvest practices have all contributed to the loss or degradation of habitat. However, several projects are proposing road closures and riparian restoration work that should aid in providing connectivity.

All of the alternatives would have "No Effect" on spotted frogs or their habitat.

NON-TES WILDLIFE AND SPECIAL HABITATS

Connectivity is addressed under the individual species discussion.

SNAGS/DOWN WOODY MATERIAL/GREEN TREE REPLACEMENTS/ CAVITY EXCAVATORS

Important Interactions

Any action that removes trees would affect the number of possible snags for the future, or replacement snags. This in turn would affect the amount of future down wood. However, the ponderosa pine and mixed conifer dry plant associations in this project area historically did not have high numbers of snags or down wood (Agee 1993) due fewer trees per acre than current conditions. Actions that improve development of large tree structure, particularly of ponderosa pine and Douglas-fir, preferred snag species by many cavity excavators (Bull et al., 1997), may help provide higher quality snag habitat for the future, and consequently, down wood.

Catastrophic wildfire could consume existing and future snags and down wood, while prescribed burning is expected to be of low enough intensity that many of these elements would persist.

An increase in insect and disease events, or less severe wildfire can create many more snags and down wood within the disturbance areas, as has been observed across much of the Sisters Ranger District over the last decade. But dense forest conditions that precipitate the disturbance often leave smaller (and lower quality) structure.

Harvest in higher mortality areas can disturb species currently using the snags, such as Williamson's sapsucker and pileated woodpecker. Retention of live trees in these areas will assure future snags are available in the shelterwood treatments proposed under Alternative 5 (see Mitigation, Chapter 2).

Down wood can be affected by surface fuel reduction. Piling (either by hand or machine) can help control the amount of down wood removed or retained, more than when applying underburning.

Effects Of Alternative 1

In the absence of disturbance events, habitat trends would continue with increased stand densities, and thus snags and down wood. There is the potential for snag/log creation from disturbance events (insects, disease, and wildfire). However, snags and logs created by wildfire may be heavily charred and unusable for a longer period of time leaving less available habitat. It also consumes those components that are more decayed leaving a lag time before there is available habitat for some species.

This alternative would also lead to more smaller, short-lived species and smaller sized snags and logs. In the mixed conifer plant associations, ponderosa pine would continue to be replaced by white fir, resulting in limited nesting and roosting structure in the future and favoring those species that could utilize smaller diameter material (i.e. downy, black-backed and three-toed woodpeckers). Over the long-term, less large structure would be available for both cavity excavators and mammals like marten and bear.

There would be a higher risk of loss from fire. Severe fires may consume more structure than under the Action Alternatives.

The "No Action" alternative may impact snag and down woody material dependent species in the long term by perpetuating the loss of large structure and changing species composition.

Effects of Alternatives 2, 3, 4 and 5

Action alternatives would result in a decrease in some mid-sized and small structure, and a minor amount of large structure (over 21” diameter) under Alternatives 4 and 5. This may impact species that prefer smaller material for nesting and foraging. Species abundance may decrease due to this or species may be displaced into adjacent areas or into areas that may be marginal habitat. However, large structure is limited across the project area so impacts would be felt by all species. Loss of structure would result in less available snag habitat. There could be a minor loss of snags due to safety concerns during harvest operations. However, thinning may reduce the risk of losing this type of habitat from intense wildfires, and may increase stand stability. Tree species composition would also be shifted toward more long-lived and fire resistant species.

Alternative 5 would impact future snags and snag habitat in mixed conifer areas more than the other action Alternatives because of shelterwood activity in higher mortality stands, and larch restoration.

Alternative 2 would maintain more structure over the project area, but of lesser quality (smaller trees and snags). Under Alternatives 3, 4 and 5, the larger the trees that could be removed, the greater the potential impact on the quantity of future snag habitat in the short-term. However, over the long-term, the quality of the snag habitat for those species that prefer larger, longer-standing snags would improve as stand densities are decreased and the risk of fire severity is reduced. Therefore, Alternative 5 would have the greatest negative short-term impact and the greatest beneficial long-term impact on snags. This trend would be followed by Alternative 4, 3 and then lastly Alternative 2. Alternative 3 is the preferred alternative for maintenance of short-term snags and down wood because is reduces the risk of high severity fire commensurate with alternatives 4 and 5 but has less impact to structure.

Actions within the defensible space zones to reduce fuels may reduce the amount of snags and down logs through the incidental loss of smaller material from prescribed burning. More snags and down logs could be protected toward the center of the defensible space zones, but should not be left in clumps.

Fuel treatments would have varying impacts on snags and down woody material. Underburning usually results in smaller material being consumed while retaining larger structure. However, advanced decay class material may be at risk. Handpiling is preferred due to the retention of more material as is machine piling within skid trails.

Under all action Alternatives, 100% of the maximum population potential for snags would be left on site, where they exist (some areas are currently deficient), so all Alternatives would meet the Land and Resource Management Plan standards and guidelines (Table 4-9).

Cumulative Effects

Under Alternatives 1-4, there would be no direct removal snags or down logs, except to address safety hazards along roads and recreation areas, or which may threaten safety of forest workers during thinning or burning operations. Under Alternative 5, there would only be removal of dead trees in 296 acres of stands affected by root rot and spruce budworm, though clumps of untreated areas would remain in these stands. There is expected to be some loss of snags and down wood during prescribed burning, primarily smaller, softer material. Though the project area is deficient in snags and down wood, particularly in the 15-24” diameter size classes, these activities are not expected to have a significant affect on current levels, and action Alternatives are expected to help protect existing and future material from high intensity wildfires.

To understand potential cumulative effects for snags and down wood, levels in the Metolius Basin project area were compared to amounts in different plant associations across the Sisters Ranger District. Data from derived from fixed plot (permanent vegetation plots) information.

The data show (Table 4-9) that, on the average, snags <10” diameter in the project area are below landscape averages in all plant associations. The mixed conifer dry and ponderosa pine wet plant associations are below landscape averages in the small size class (10-14” diameter). Snags 15-24” diameter are the most deficient size class compared to the rest of the district. However, the snags in the 25”+ diameter sizes seem to be meeting averages or are slightly above for all plant associations, with the exception of the mixed conifer wet plant association, which is slightly below the landscape average. It is important to retain snags within the Metolius Basin project area since much of the area is below landscape level averages. This project area may not be able to support the same level of primary cavity excavators as other areas on the Sisters Ranger District due to the lack of available snags.

The Metolius Basin, as well as remainder of the landscape on the Sisters Ranger District, may not be able to meet prescribed levels, as indicated by the variable plot data from across the district (Table 4-9). Harrod et al. (1998) developed a model for estimating historical snag densities in dry forests on the eastside of the Cascades. Their findings support the findings from the variable plot data.

Table 4-9. Existing snag levels for the Metolius Basin project area compared with snag levels across the landscape (from variable plot data averages), and compared to Prescribed levels.

SNAG SIZES	MIXED CONIFER DRY			MIXED CONIFER WET			PONDEROSA PINE DRY			PONDEROSA PINE WET		
	Average Number of Snags Per Acre											
	Metolius Basin	Sisters Ranger District	Prescribed	Metolius Basin	Sisters Ranger District	Prescribed	Metolius Basin	Sisters Ranger District	Prescribed	Metolius Basin	Sisters Ranger District	Prescribed
<10”	3.3	36.2	N/A	3.9	19.7	N/A	1.8	3.5	N/A	2.0	32.3	N/A
10-14”	3.8	8.2	1.4	6.6	6.1	1.9	2.0	0.4	0	1.1	3.5	1.0
15-24”	1.9	4.3	2.1	3.2	4.3	6.0	1.4	0.5	1.5	1.3	2.4	2.1
25”+	1.6	1.3	3.3	1.4	1.6	5.0	0.8	0.2	1.0	1.2	0.8	1.3

MANAGEMENT INDICATOR SPECIES

BIG GAME

Important Interactions

Thickets can provide hiding cover for big game, but also may increase the risk of a higher severity wildfire

Thinning (all size classes) would reduce dense understories and would result in a reduction of hiding cover. It would also decrease the thermal cover properties of these patches by altering the microsite climate (warmer in the summer and colder in the winter). Reduction in overhead canopy may also result in increased snow depths, reducing the effectiveness as suitable winter range. The size of hiding cover patches would decrease and there would be farther distances between these patches. This may result in big game being more visible to predators and hunters and may result in higher mortality rates. However, treatment may result in opening up the stand and allowing more sunlight to reach the forest floor, which may stimulate herbaceous plant growth increasing summer foraging opportunities.

Proposed actions can also affect the shrub communities, particularly bitterbrush, which has the highest browse value for deer. Mowing/underburning of bitterbrush would result in shrub cycling. The project area contains predominantly early and mid seral bitterbrush. Mowing/underburning would set back large areas to early seral shrubs and may increase foraging habitat in the next few years. However, mowing and burning in bitterbrush areas would reduce short-term winter forage opportunities until new forage grew, which could lead to increased competition for food and increased stress levels (Table 4-10). This may lead to increased mortality rates within the area or displacement to other habitats in the short-term. Mowing and burning in areas of heavy snowbrush and manzanita growth could stimulate the growth of herbaceous plant material increasing summer foraging opportunities. This treatment may also reduce Class 4 and 5 logs across the project area. Deer especially seem to use these as bedding sites (personal observation). It also has the potential to reduce down woody material overall decreasing hiding cover for fawns and calves. This could result in increased predation.

The increased light and growing space that would be available to the shrub layer after thinning larger trees would eventually result in an increased growth response to the shrub layer. This could be considered positive in terms of deer browse, and negative in terms of reducing potential fire severity. Research has shown, however, that in terms of reducing wildfire severity, increases in the shrub component of surface fuels have been more than compensated for by reductions in crown bulk density in heavier thinning treatments (Omi and Martinson 2002).

Mowing as a stand-alone treatment would have a different effect on shrubs than mowing followed by underburning, or underburning as a stand-alone treatment. Mowing masticates the shrub, leaving the root collar and some of the above ground growth intact. Underburning may kill the root collar as well as the above ground growth, preventing resprouting, but may also stimulate germination of seed in the soil. Mowing followed by underburning would be expected to have essentially the same result as underburning; the mowing treatment is done to reduce flame lengths from the underburn.

Shelterwood treatments and larch restoration would result in high edge to cover ratios that is favorable to big game. This would result in forage being in close proximity to cover especially if openings are small enough. Forage quality would be increased in the openings that would increase summer foraging opportunities.

Aspen restoration and meadow enhancement are small-scale treatments within the project area but would result in increased diversity of habitat. Aspen restoration would result in small openings in the short term, which will decrease both hiding and thermal cover. However, these openings would stimulate the growth of herbaceous plants and induce suckering of aspen, which would increase forage habitat. Meadow enhancement would result in fewer trees within existing meadows. This may impact hiding cover but his will be very minimal due to the open nature of these areas. Burning in meadows would decrease the forage component of the meadows but this will only last for one season. Reduction of the thatch layer would aid in stimulating new growth which will increase the forage quality overall.

Road closures can reduce fragmentation of big game habitat and reduce disturbances to individual animals.

Effects of Alternative 1

There will be no timber harvest related impacts to big game under this alternative. Cover is likely to decrease in areas of higher mortality, primarily in the northwest section of the project area. This may impact forage potential and access for big game. Jack-strawed logs may impede movement in heavy concentrations and may result in less herbaceous cover due to increased ground cover by logs. However, this is minimal within the project area.

In areas where there is less mortality, increases in canopy cover and canopy layers will continue. Forage potential would decrease due to reduced sunlight reaching the forest floor. The quality of thermal cover may increase in those stands for the short term. Hiding cover would remain constant with late seral shrubs, increased stand densities, and topography providing adequate cover. No cycling of shrubs would occur. Currently, much of the transition range and winter range habitat is dominated by late seral bitterbrush, snowbrush and manzanita. Therefore, forage quality remains low for these areas. Road densities would not be reduced under this alternative.

There is risk to available forage and cover from a landscape level wildfire due to increased stand densities and suppression of fire.

In summary, the No Action Alternative would have no impact on big game or their habitat.

Effects of Alternatives 2, 3, 4 and 5

Implementation of Alternative 2 would result in most of the smaller material (thickets) being removed but the overall canopy and larger trees would be retained. There would be a greater distance between hiding cover patches and less available hiding cover. Burning and mowing would further reduce forage and shrub hiding cover over a large area. However, burning should result in more of a mosaic pattern being left, which may retain some forage and hiding cover across the project area.

Table 4-18. shows the estimated amount of hiding cover that may remain across the project area after treatment, under each Alternative. Without mitigation, most of the remaining hiding cover would be located along riparian areas, in spotted owl nesting, roosting, and foraging habitat, and other areas that would not be treated, and the amount of hiding cover under all action Alternatives would be lower than the 30% standards under the Land and Resource Management Plan. With application of proposed mitigation of leaving thickets of hiding cover in treatment units, the Land and Resource Management Plan standard would be met.

Table 4-10. Hiding cover by Alternative and needed to meet Land and Resource Management Plan Standards and Guidelines.

Hiding Cover	Alternative 2	Alternatives 3 and 4	Alternative 5
Estimated % of hiding cover remaining after treatment	2465 (17% of National Forest Lands in project area)	1954 (13% of National Forest Lands in project area)	1954 (11% of National Forest Lands in project area)
Number of additional acres left in hiding cover to meet the 30% LRMP standard	1937 acres	2448 acres	2716 acres
Amount of hiding cover after mitigation measures (leaving thickets within treatment units)	30%	30%	30%

Implementation of the remaining alternatives would result in most of the smaller material (thickets) being removed along with the larger tree component. There would be a greater distance between non-treatment areas and residual patches. Mowing and burning, which would be done more in conjunction with other harvest treatments, would result in a more complete treatment of each stand. Therefore, less of a mosaic pattern may be left. Alternative 5 would also create more edge with the implementation of shelterwood and larch restoration treatments, which may benefit big game foraging. However, if cover is lost adjacent to these openings, these areas may not be utilized as much.

Road closures are proposed for each alternative. Alternative 2 proposes to close roads within riparian reserves and within the Suttle and First subwatersheds. Alternatives 3 and 4 build upon Alternative 2 by closing additional roads within winter range while Alternative 5 focuses closures throughout the project area. Alternative 5 results in the greatest reduction in road densities with 2.74 miles/square miles being reduced.

Alternative 2 would have the least impacts to winter range, while Alternative 5 would have the greatest impacts to winter range but would benefit summer forage opportunities the most. Under all action alternatives, thermal habitat in the Lake Creek riparian reserve would be thinned in the drier upland patches, but denser patches of vegetation would remain untreated (see Mitigation , Chapter 2). This would help protect thermal and calving habitat by enhancing the health of riparian stands.

Forage from bitterbrush would decrease the most under Alternative 2 due to the greatest number of acres underburned. In combination with mowing, a total of 7696 acres of bitterbrush would be affected under Alternative 2. However, bitterbrush is expected to return to near pre-burn canopy levels after 3 to 5 years (observations in prescribed burn units in the Metolius Research Natural Area). Alternatives 3, 4 and 5 would emphasize mowing over underburning, so there would be less short-term reduction in shrub cover, and quicker recovery of tops than under Alternative 2. The increased light and growing space available to the shrub layer after thinning under Alternatives 3, 4 and 5 would eventually result in an increased growth response to the shrub layer, increasing browse, but also increasing the risk of high fire severity.

Land and Resource Management Plan standards and guidelines for 30% hiding cover across the project area would be met under all action Alternatives. Approximately 17% of National Forest lands would not be treated under the Alternatives and, at a minimum, another 13% area within treated stands would be left in thickets and patches (see Mitigation, Chapter2).

Table 4-11. Acres of Shrubs Underburned or Mowed.

Shrub Type	Treatment	Alternative 2	Alternatives 3, 4 and 5
Bitterbrush	Underburn as a stand-alone treatment	5179	625
	Underburned as a post-thinning treatment	942	2497
	Mowed as a post-thinning treatment	1576	4197
Snowbrush	Underburn as a stand-alone treatment	1781	327
	Underburned as a post-thinning treatment	655	780
	Mowed as a post-thinning treatment	876	1469

Table 4-12. Proposed Treatments In Deer Habitat For The Metolius Basin Project.

Alternative	Type of Treatment	Summer Range	Transition Range	Winter Range
		Acres proposed for treatment		
Alternative 2	Thinning trees 12" diameter and under (reduce hiding covers)	834 acres	838 acres	3292 acres

Alternative	Type of Treatment	Summer Range	Transition Range	Winter Range
		Acres proposed for treatment		
	Aspen Regeneration and Meadow Enhancement (minor reduction of thermal cover)	0	10	40
	Underburning (decrease forage)	492	1777	4788
Alternatives 3 and 4	Thinning trees 12" diameter and greater (reduces thermal cover)	810	1664	4283
	Thinning trees 12" diameter and under (effects hiding cover)	695	806	3265
	Aspen Regeneration and Meadow Enhancement (minor reduction of thermal cover)	0	10	40
	Underburning (decrease forage)	61	233	715
Alternative 5	Thinning trees 12" diameter and greater (reduces thermal cover)	701	1497	3639
	Thinning trees 12" diameter and under	805	783	3211
	Shelterwood and shelterwood/thin (increase edge effect)	157	59	79
	Larch Restoration (increase edge effect)	0	167	644
	Aspen Regeneration and Meadow Enhancement (minor reduction of thermal cover)	0	10	40
	Underburning (decrease forage)	61	233	715

Cumulative Effects

Cumulatively, the action alternatives will not lead to a trend toward Federal listing for big game species. To better analyze cumulative impacts, large projects occurring across the district within the past 5-10 years will be analyzed.

Several large vegetation management projects have occurred in the past several years. These include Big Bear, Broken Rim, Highway 20, Jack Canyon, McCache, Santiam Corridor, and Santiam Restoration. With the exception of Highway 20, all occur within summer range and were developed to address the mass mortality caused by insects in the early 1990's. Within these project areas, there has been an overall decrease in cover. However, stands were declining or dead. A decrease in cover was going to occur whether the area was treated or left alone. Down woody material levels also increased across the landscape. This provides added benefits in the form of hiding cover, especially in fawning and calving areas; but abundant down woody material levels also impede movement and increase the risk of loss of existing cover to a large fire event. An increase in forage also resulted in these project areas. This may have helped to increase the health and vigor of resident herds using the area leading to increased survival rates.

A total of 69,322 acres of biological winter range occurs on the Sisters Ranger District. None of the above-mentioned projects has impacted winter range. The Highway 20 project area was located within transition range. Therefore, the Metolius Basin project area is the first vegetation management project to occur within biological winter range.

Overall, an estimated 12% of the winter range on the Sisters Ranger District is proposed for treatment. This area is not as important as other portions of the winter range in that snow conditions may preclude use for much of the winter.

NORTHERN GOSHAWK

Important Interactions

Northern goshawk is one of the focal species for the project area.

Thinning trees 12” diameter and less would result in the accelerated growth of residual trees while reducing the fire hazard. Long term beneficial impacts of small tree thinning would be the reduction of fragmentation by promoting the development of suitable habitat at an accelerated rate. Short-term beneficial impacts would be seen in the reduction of risk to existing suitable habitat. Stands would also be opened up which would result in greater sight distances enhancing foraging opportunities. Negative impacts may result in the reduction of prey species habitat.

Thinning trees 12” diameter and greater would help maintain large trees by reducing their susceptibility to fire and insects, and results in faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands that may impact prey species habitat. Thinning can enhance foraging habitat if understories are open, yet large trees are remaining with interlocking crowns.

Aspen restoration would result in the loss of large conifers on the 10 acres where prescribed. However, it would increase the limited hardwood diversity within the project area, which may increase the diversity of prey species available. Most of the actions would be concentrated within or adjacent to riparian reserves. This may impact habitat slightly until stands recover.

Beneficial impacts of underburning and mowing would be more stable habitat over the long term. Negative impacts may result in the potential degradation of prey species habitat with the consumption/loss of some softer snags, down woody material, and brush. However, this effect is expected to be minimal due to the lower intensity of prescribed burns.

Minor amounts of larch restoration would occur within the goshawk focal area resulting in more open stands due to the thinning and removal of portions of the crowns. Larch restoration would help maintain live larch trees and would decrease the fire risk by removing excess dead and downed wood. Beneficial impacts would result in the reduction of risk to existing suitable habitat. Maintaining live residual trees would provide for vertical structure throughout the life of the stand. These openings may increase prey densities which would increase foraging within and adjacent to these openings. Negative impacts would result in more open stand conditions that could impact use slightly, especially if there are few large trees left within each opening. Larch habitat doesn't provide much value in the winter months when crowns are bare.

Fuel treatments associated with harvest treatments may have impacts to goshawks and their prey species. According to Reynolds et al. (1991), underburning is the preferred fuel treatment method within nest stands and post-fledgling areas. A minimum amount of handpiling of loosely stacked material can provide some habitat for prey species. Machine piling is not recommended due to compaction issues and the potential for herbaceous plants not to regenerate.

Road closures would decrease the potential for disturbance and reduce fragmentation over time.

Effects of Alternative 1

This alternative does not treat any existing habitat or potential habitat. Nesting and foraging habitat are not static and in the short term (<50 years), may be reduced in quality or lost due to environmental factors such as insects, disease, and wildfires. Much of the existing habitat has a significant white fir component, is overstocked, and in some areas, has a high occurrence of disease. Mixed conifer stands would continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir. Canopy closure may be sufficient for goshawks, however large structure would be sparse over the landscape and may reduce potential nesting habitat. Only an estimated 498 acres (3%) of current goshawk habitat is considered long term due to high site capabilities, have less white fir composition, are not overly stocked, and have less insect and disease occurrence. Stands occurring in the mixed conifer wet and riparian plant associations have a higher potential of becoming goshawk nesting habitat in the long term.

The No Action Alternative may impact goshawks and their habitat due to the perpetuation of loss of large structure and the conversion of stands to non-sustainable species.

Effects Of Alternatives 2, 3, 4 And 5

The project area has been divided into areas that would be managed for specific focal species, including the goshawk (Figure 1-4, Chapter 1). The goshawk focal areas comprise approximately 7% of the project area, occurring in three separate areas. Approximately 86% of the focal areas have been proposed for forest health or fuel reduction treatments, designed to maintain and protect nesting habitat where it currently exists within the focal area. However, stands occurring in the defensible space zone around Metolius Meadows and along major roads would receive small tree thinning to reduce fire risk. Stands identified as foraging habitat currently would be maintained within these focal areas. Thinning trees less than 12" diameter would aid in reducing fire risk while still maintaining foraging habitat. Those stands that are not currently habitat would be managed to promote foraging habitat.

Treatments in goshawk focal areas would be concentrated in stands containing high densities and which are not currently providing habitat (e.g. too dense for goshawk). Treatments would focus on moving stands toward more sustainable habitat conditions, lessen the risk of a large-scale fire event, and the retention of more long-lived, fire tolerant, and disease resistant species. See Table 4-12 for information regarding proposed treatments within each focal area.

The Action Alternatives may impact goshawks and their habitat by impacting nesting and prey species habitat. Alternative 3 or 4 are preferred due to fewer impacts than Alternative 5 and a greater reduction in risk than Alternative 2.

Table 4-13. Treatments and acres proposed within each goshawk focal area.

Type of Treatment	Focal Area 1			Focal Area 2			Focal Area 3		
	Alt 2	**Alts 3-4**	**Alt 5**	**Alt 2**	**Alt 3-4**	**Alt 5**	**Alt 2**	**Alt 3-4**	**Alt 5**
Aspen Restoration	0	0	0	0	0	0	10	10	10
Thinning trees 12" diameter or less in the Defensible Space	17	11	11	14	14	14	13	13	13
Thinning trees up to larger diameters[28]	0	96	96	0	338	328	0	173	112
Larch Restoration	0	0	0	0	0	10	0	0	61
Thinning trees 12" diameter or less (outside of defensible space corridors)	1	1	1	30	30	30	131	130	130
Underburning	78	0	0	353	0	0	209	37	37
Total	**96**	**108**	**108**	**382**	**382**	**382**	**363**	**363**	**363**

Alternative 5 would reduce canopy cover the most within shelterwood, larch restoration and thinning areas , followed by Alternatives 4 and then 3. Alternative 2 is not expected to have a measurable effect on canopy cover. While Alternative 2 would maintain the most mid-story canopy, which is important for prey species, it has the greatest number of acres affected by underburning which could consume down logs and dead wood, also important for prey species. However, Alternative 2 would have the least effect on moving forest stands toward more resilient

[28] Thinning under Alternative 3 would remove trees potentially up to 16" diameter (except up to 21" diameter white fir), thinning under Alternative 4 would remove trees potentially up to 21" diameter (except up to 25" diameter white fir), and Alternative 5 would not have set diameter limit, but removal of trees over 21" diameter would be an exception.

large-tree structure, which is important for goshawk nesting. Alternative 5 would be the most beneficial for development of large tree structure and protection of habitat from loss from insect, disease and wildfire.

Aspen restoration would have a minor positive effect on goshawk habitat under all of the action Alternatives.

Alternative 5 would reduce habitat fragmentation the most, with the greatest number of road closures, followed by Alternatives 4/3, and then 2.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the northern goshawk.

There are 18 known goshawk nest sites across the Sisters Ranger District. Annual monitoring does not occur each year for each site so information regarding nesting success cannot be fully determined. In 2002, 8 of 18 sites were monitored. Only 3 of 8 sites nested successfully while no response was found at the remaining 5 sites monitored.

Table 3-14. Goshawk nest sites by plant association for the Sisters Ranger District.

Plant association	% of Nests	# of Nests
Mixed conifer dry	44%	8
Mixed conifer wet	33%	6
Ponderosa pine dry	17%	3
Riparian	6%	1

The majority of the nest sites are located within the mixed conifer plant associations. These plant associations experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event has probably had the greatest influence on goshawk habitat across the district due to the reduction of canopy. These open stands are considered unsuitable nesting habitat for goshawks.

Overall, implementation of the action alternatives may improve goshawk habitat conditions by promoting the development of large structure and reducing the risk of loss of additional habitat from other large-scale disturbance events.

RED-TAILED, COOPER'S AND SHARP-SHINNED HAWKS

Effects of Alternative 1

Suitable habitat would be maintained for the short-term until past harvest units begin to grow, which would reduce foraging opportunities. However, stand densities would continue to increase with white fir out-competing ponderosa pine and Douglas fir. Over time, large trees may become limited due to white fir encroachment. Increased stand densities also increases the risk of a large scale fire event occurring, which may result in a loss of large snags and structure. This would reduce both existing and future nesting habitat.

The No Action alternative may impact red-tail hawk habitat by perpetuating the loss of large structure. The No Action Alternative would have no impact on Cooper's or sharp-shinned hawks and their habitat.

Effects of Alternatives 2, 3, 4 and 5

Alternatives 2 or 3 would not affect or remove nesting habitat for red-tailed hawks (e.g. trees/snags >21" diameter). Alternative 5 would create openings in the project area with shelterwood and larch restoration, which may increase potential nesting and foraging habitat. However, Alternative 4 and 5 may also remove a small amount potential habitat in trees (>21" diameter snags), which could degrade or decrease suitable habitat for red-tailed hawks. Removal of surface fuels under all the Alternatives may remove some cover for small mammals decreasing foraging opportunities for red-tailed hawks in specified areas. However, increases in higher quality foraging habitat may result in the short-term due to decreased stand densities.

The smaller diameter limit of trees that would be removed under Alternative 2 would not impact Cooper's or sharp-shined hawks habitat greatly though some dense patches may be impacted but this should be minimal across the project area. Thinning under Alternatives 3, 4 and 5 would greatly reduce potential habitat because sharp-shinned's prefer thickets in mixed conifer and deciduous woods, and uses dense cover to escape predators; and Cooper's are associated with densely wooded coniferous woodlands. Harvest would reduce both nesting, foraging, and escape cover, and decrease potential occupancy of the project area. However, canopies would be opened and stand densities reduced to lessen the risk of a large-scale fire event. Reduction of surface fuels under all of the action Alternatives may reduce potential prey habitat, especially mowing treatments, which occur on the most acres under Alternatives 3, 4 and 5 (see Table 4-6).

Alternatives 2-4 would not negatively impact red-tail hawks or their habitat. The Action Alternatives may impact Cooper's and sharp-shined hawks and their habitat due to large-scale reductions of potential nesting and foraging habitat. Alternative 2 is the preferred alternative because it retains denser stand conditions.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for any of these hawk species. To better analyze cumulative effects, large projects occurring across the district within the past 5-10 years were analyzed.

Implementation of the Jack Canyon, Santiam Restoration, Santiam Corridor, Big Bear, and Hazard Tree projects along with the future implementation of the McCache and South Trout project areas may result in a reduction of some large snags across the district primarily due to safety concerns. For red tailed hawks, this would further reduce potential nesting habitat in localized areas. However, in most of these areas, there was heavy mortality and a high risk of losing habitat. Implementation in these projects was designed to reduce the risk of habitat loss on a landscape basis by removing dead material in strategic locations. When all these projects have been implemented, an area running north and south along the Cascade crest would be treated to reduce the affects of a large scale wildfire occurring.

For Cooper's and sharp shinned hawks, habitat has declined in Jack Canyon, Santiam Corridor, Santiam Restoration, Big Bear, Broken Rim, Highway 20, McCache, and South Trout project areas due to the decrease in dense forest conditions. This, along with mortality from the spruce budworm epidemic of the early 1990's and recent fire events, further decreased habitat for these species across the district. However, in remaining areas, habitat would be maintained for at least the short term.

Also occurring within the past 5 years have been the Cache Creek, Cache Mountain, and Eyerly fires on the district. These fire events primarily impacted dense forest habitat not normally occupied by red-tailed hawks. However, high intensity burning resulted in the loss of some snag habitat and future nesting habitat. They also resulted in increased foraging habitat due to the loss of dense forest conditions.

Overall, the implementation of vegetation management projects and the occurrence of large-scale fires may have improved red-tail hawk habitat until stands recover (20-50 years), but may further decrease habitat for Cooper's and sharp-shinned hawks.

GREAT GRAY OWL

Important Interactions

Ponderosa pine plant associations are not considered suitable habitat so actions in these areas would have little or on effect. The primary area of concern would be in and adjacent to meadows, since late-successional stands adjacent to meadows are the preferred habitat for this species. The types of actions that may affect great gray owls include shelterwood harvest, larch restoration and thinning trees over 12" diameter because they can modify canopy cover. These actions would result in more open stands and increase foraging opportunities, but reduce some future snags and down wood habitat for prey species. In addition, improved foraging habitat may increase competition with raptors. However, proposed vegetation management actions can also promote more resilient large-tree structure for future owl habitat and may protect these habitats, and adjacent foraging areas from severe disturbances. This may increase the amount of suitable great gray owl habitat in the long-term.

Effects Of Alternative 1

In the absence of catastrophic occurrences, habitat trends would increase with canopy layers, canopy cover, down woody material, and snags. Meadow encroachment is expected to continue, decreasing foraging habitat. However, in many mixed conifer and ponderosa pine stands, large ponderosa pine and Douglas-fir are being replaced by white fir and other less tolerant or short-lived species. Loss of future large structure may render large areas unsuitable for great grays by decreasing potential nesting structure. Where high stand densities exist, there is an increased risk of fire. Increased fire intensities could destroy critical habitat elements like snags. This would prolong the development of suitable great gray habitat in the Metolius Basin area.

The No Action Alternative may impact great gray owls and their habitat by perpetuating the loss of large structure.

Effects of Alternatives 2, 3, 4 and 5

Approximately 41 acres of the project area, around two meadows would be managed for great gray owls. Proposed actions in these areas include meadow enhancement and thinning of trees 12" diameter and less. Meadow enhancement is designed to enhance great gray owl foraging habitat by removing encroaching conifers and burning to reduce the thatch layer. This may result in short term (1 year) impacts to small mammal populations until the meadow regenerates. Then there should be an increase in foraging opportunities due to the reduced grass layers. Other treatments in the ponderosa pine plant association may have minimal impacts to habitat since ponderosa pine is not considered suitable habitat. Loss of snags and down woody material through underburning is the primary concern, though this impact should be minor in scope across the project area.

The action Alternatives may beneficially impact the owls and their habitat by enhancing foraging habitat.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the great gray owl. To better analyze cumulative effects, large projects occurring across the district within the past 5-10 years were analyzed. Approximately ¼ of the Sisters Ranger District has been analyzed (63,000 acres) in the project areas mentioned below.

Implementation of the Santiam Corridor, Santiam Restoration, Jack Canyon, Big Bear, Broken Rim, Highway 20, and McCache project areas has resulted in the reduction of canopy cover across these project areas. This, coupled with the large scale mortality from the insect epidemic of the early 1990's, resulted in thousands of acres with open stand conditions which is considered unsuitable nesting habitat for great gray owls. However, past harvest activities, particularly shelterwood and clearcut treatments, occurring adjacent to mature stands created suitable habitat for this species outside what is considered typical suitable habitat (meadow habitat adjacent to mature/old growth stands) which may have led to occupation of these areas by great grays. Associated post-harvest activities, primarily gopher baiting, is generally prescribed for these types of treatments. This may lead to increased mortality of birds using these areas as foraging habitat.

Fire suppression has resulted in degradation of some meadows across the district due to conifer encroachment. This further reduces potential suitable habitat for this species. However, meadow enhancement has been implemented in two meadows within the past 5 years (Glaze meadow and Trout Creek Swamp) and is planned for more areas in the future, which may increase habitat.

Also occurring within the past 5 years have been the Cache Creek, Cache Mountain, and Eyerly fires on the district. These fire events primarily impacted dense forest habitat some of which was considered potential habitat for great gray owls. High intensity burning resulted in the loss of some snag and down woody material habitat and future nesting habitat.

Overall, implementation of the action alternatives would further reduce canopy closure across the landscape but would aid in maintaining and increasing large structure (nesting habitat).

GREAT BLUE HERON

Effects of Alternative 1

In the absence of disturbance events, stand densities, canopy cover, down woody debris and snags would continue to increase. Meadow habitat would continue to receive conifer encroachment, which would limit available foraging habitat. Over time, there would be fewer large diameter trees which would limit future nesting structure. Increased stand densities may also lead to smaller limb structure, which would limit nesting habitat.

The No Action alternative may impact great blue herons and their habitat by perpetuating the loss of large tree structure.

Effects of Alternatives 2, 3, 4 and 5

Vegetation management within riparian reserves would include underburning, meadow enhancement, thinning, aspen restoration, and small tree thinning. None of the these actions are predicted to negatively impact large tree structure within riparian reserves. Therefore, existing suitable nesting habitat would remain. Over the long-term thinning would enhance existing and potential habitat by reducing fire risk, accelerating growth of residual stands, increasing diversity, and help maintain open meadow habitat.

The Action Alternatives may beneficially impact great blue herons and their habitat by reducing fire risk, accelerating growth of residual stands, increasing diversity, and help maintain open meadow habitat.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the great blue heron.

Trends are indicating increased recreation levels within National Forests. Much of this use is concentrated around waterbodies/waterways. Increased recreation use along waterways may deter use by herons for nesting. However, locally, road closures proposed within riparian reserves (Jack Canyon, McCache, and Metolius Basin project areas) would aid in reducing disturbance potential for nesting great blue herons.

Fire suppression has resulted in degradation of some meadows across the district due to conifer encroachment and the accumulation of deep thatch layers. This further reduces foraging habitat for this species. However, meadow enhancement has been implemented in two meadows within the past 5 years (Glaze meadow and Trout Creek Swamp) and is planned for more areas in the future, which may enhance foraging habitat.

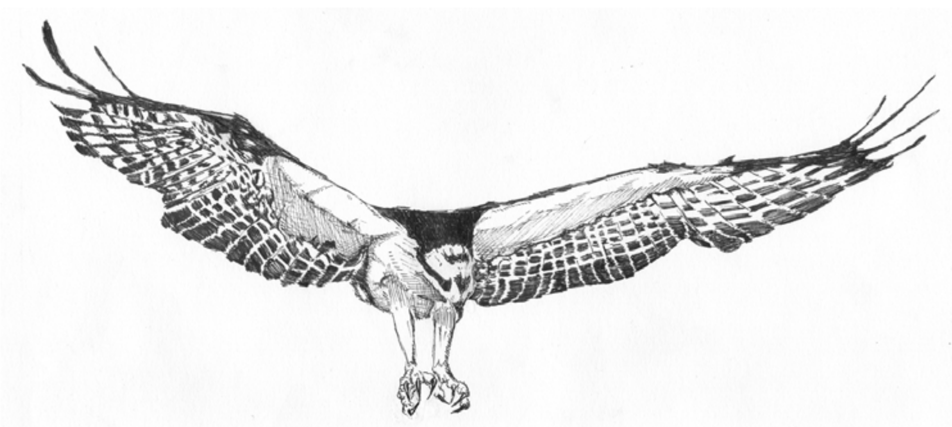
Implementation of fisheries projects (Canyon Creek crossing, adding down woody material to streams, etc.) would aid in promoting healthy riparian reserves, which should increase prey species habitat for foraging great blue herons.

Overall, implementation of the action alternatives would promote the development of large structure, riparian health, hardwood diversity and meadow enhancement, which would increase habitat development for great blue herons.

OSPREY

Important Interactions

The Metolius River provides suitable habitat for ospreys for both nesting and foraging. The most relevant effect from this project is the ability to retain existing and develop future snags and large trees along the river. Thinning and underburning may have a short-term effect on reducing the number of trees that could become future snags, but the beneficial effect of reducing the risk of losing stand structure from insects, disease or wildfire, and in reducing stand densities so that large tree structure could develop outweighs the short-term negative effects.



Effects of Alternative 1

There would be no direct effect on osprey habitat. The risk from wildfire to large tree structure and snags along the Metolius River would not be reduced under this Alternative. The No Action alternative may impact osprey habitat by perpetuating the loss of large structure.

Effects of Alternatives 2, 3, 4 and 5

Proposed treatments occurring within ¼ mile of the Metolius River include thinning, small tree thinning, underburning, and larch restoration.

Alternatives 2 and 3 would not effect or remove any future nesting habitat (e.g. trees >21" diameter). Larch restoration under Alternative 5 and thinning of trees 12" diameter and greater under Alternatives 4 and 5 have the potential to remove trees >21" diameter. Mitigation measures would assure that no large snags are removed (see mitigation, Chapter 2). All treatments reduce the potential fire risk with Alternative 5 showing the greatest reduction.

Alternatives 2 and 3 would not negatively impact osprey or their habitat. Alternatives 4 and 5 may impact osprey and their habitat by the potential removal of >21" diameter trees reducing future nesting habitat.

Cumulative Effects

Removal of large snags to address public safety within campgrounds and summer home tracts is a concern due to the limited amount of snags available, and probably has a greater potential impact on osprey habitat than actions under this project. Competition for nesting structure occurs between osprey and other raptor species so retention of snag habitat is important, especially outside campgrounds and summer home tracts. Increased recreation use along the river is also a concern due to potential disturbance to nesting osprey, and negative affects successful reproduction. However, the effects to maintaining large structure and snags from this project should benefit osprey.

WHITE-HEADED WOODPECKER/FLAMMULATED OWL

Important Interactions

White-headed Woodpecker is a focal species for this project area. The white-headed woodpecker is the largest focal area and comprises approximately 66% (9606 acres) of the project area (Figure 1-4, Chapter 1). Treatments are designed to maintain habitat for a longer period of time by reducing stand densities and fire risk.

These species are associated with mature, open ponderosa pine forests. Actions that help develop large tree structure, reduce brush heights and mid-level canopies, and protect forest stands from catastrophic loss would benefit habitat for these species.

Effects of Alternative 1

Increasing shrub layers and mid-level canopies would limit the available forage base for the owl by decreasing the diversity of forest floor plants, which may discourage some arthropods and other insects from occupying these sites. It would also hinder foraging attempts due to the somewhat limited maneuverability of flammulateds with increased shrub structure (USDA(b) 1994). Increased shrub layers may also lead to an increase in small mammal densities which could lead to increased predation pressures on white-headed woodpeckers (Frenzel 1999).

Increased stand densities perpetuates the problem of losing large structure over time, which both species require for suitable nesting and foraging habitat. It also allows for less available nest sites, which could result in more competition for existing sites between species and may lead to greater predation risks. Increased stand densities may increase the risk of loss from fire. Both species require snags for nesting and both utilize softer snags (moderate decay). These structures would be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

The No Action Alternative may impact flammulated owls and white-headed woodpeckers and their habitat by perpetuating the loss of suitable habitat from increased stand densities and shrub layers.

Effects of Alternatives 2, 3, 4 and 5

Approximately 92-94% of this focal area is proposed for treatment under the action Alternatives (Table 4-13).

Thinning trees 12" diameter and greater under Alternatives 3, 4 and 5 would reduce canopy cover and open up stands which would benefit white-headed woodpecker and flammulated owl. Frenzel (2000) found that adult woodpeckers may be susceptible to avian predators, especially when excavation or feeding young with their heads inside the nest cavity. The visibility at open sites may be attractive to the woodpeckers because of the increased time to react to predation attempts. Negative impacts would result from the potential reduction in thickets that may decrease the potential roosting areas for flammulated owls and foraging areas for white-headed woodpeckers. Dixon (1995) found that white-headed woodpeckers may use relatively high canopy closure (65%) stands for foraging. These areas contained large diameter ponderosa pine surrounded by smaller material. Beneficial impacts would result by reducing risk to existing suitable habitat and facilitating the development of future habitat. These treatments would also reduce the mid level canopy, increasing site distance and potentially reducing the predation potential. Alternative 4 results in the greatest improvement in white-headed woodpecker habitat due to the reduction of risk and the facilitation of habitat while still maintaining larger structure.

Thinning trees 12” diameter and less would not be as effective as thinning up to larger diameters in opening up canopies and stands, but can be help accelerate growth of remaining trees while reducing the fire hazard. Long term beneficial impacts of small tree thinning would be the reduction of fragmentation by promoting the development of suitable habitat at an accelerated rate. It also may reduce some mid level canopy increasing habitat quality. Another beneficial impact would be seen in the reduction of risk to existing suitable habitat. Negative impacts would result in the potential reduction in thicket habitat, which may decrease the potential roosting areas for flammulated owls and foraging areas for white-headed woodpeckers.

Underburning and mowing may help maintain the overstory by reducing the susceptibility to wildfire, and result in more stable habitat over the long term. Underburning would also reduce brush levels, decreasing habitat for small mammals that prey on nesting birds. Frenzel (2000) noted that adult woodpeckers may be vulnerable to mammalian predators especially when incubating or brooding young. Li and Martin (1991) suggested that cavity nesters preferred relatively open sites that allowed visibility for adults to detect and ward off mammalian predators. This could result in a reduction in the predation potential. Underburning would also result in more herbaceous plant growth in the short term, increasing foraging habitat for the flammulated owl. Negative impacts may result in the potential degradation of habitat with the consumption of some softer snags and down woody material. This would decrease nesting habitat for white-headed woodpeckers. However, this should be minimal due to the lower intensity burn versus that of a wildfire. This would occur primarily with the implementation of Alternative 2.

Shelterwood harvest under Alternative 5 would result in more open stands by removing dead trees and thinning through denser patches. Only 28 acres of these treatment types are proposed within this focal area (Table 4-15). Impacts may result in the reduction of smaller snags, which could reduce the potential nesting habitat.

Larch restoration may have both negative and beneficial impacts. Beneficial impacts should result in the reduction of risk to existing suitable habitat. Maintaining live residual trees would provide for vertical structure throughout the life of the stand. Negative impacts would result in this treatment favoring larch over ponderosa pine, which decreases habitat for both species. This impact would only occur with the implementation of Alternative 5.

Areas proposed for aspen restoration are not considered habitat for white-headed woodpeckers, so there would be no impacts associated with this activity.

Handpiling would result in larger down woody material being retained which maintains potential nesting structure for white-headed woodpeckers. Milne and Hejl (1989) have found that white-headed woodpeckers would use leaning or down logs as nesting substrate where habitat conditions are marginal or snag levels are reduced. Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat. There is also a greater risk of losing existing snags and down woody material, and degrading habitat with underburning.

Seasonal restrictions for harvest activities in white-headed woodpecker habitat are not proposed under this project, unless site-specific reasons dictate. The numerous acres available for White-headed Woodpecker allow individuals to travel to other areas to avoid disturbances and harvest activities would not cover the entire area at any one time. Therefore, some pairs may be displaced by activities but not the population as a whole.

The Action Alternatives may impact flammulated owls and white-headed woodpeckers and their habitat due to the potential removal of snags less than 20” diameter and the reduction of dense thickets. However, action alternatives may beneficially impact habitat by reducing stand densities and brush layers. Alternative 4 is the preferred alternative because it lowers the fire risk commensurate with Alternative 5 and minimizes impacts to large (>21” diameter) structure.

Table 4-15. Treatments proposed within the white-headed woodpecker focal area by alternative.

Treatment	Alternative 2 Acres	Alternatives 3-4 Acres	Alternative 5 Acres
Aspen Restoration	10	10	10
Thinning trees up to larger diameters[29]	0	4659	3990
Thinning trees 12” diameter and less	3600	3536	3557
Larch Restoration	0	0	648
Shelterwood and Shelterwood/Thinning	0	0	28
Underburning	5244	775	775
Total	**8854**	**8980**	**9008**

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the white-headed woodpecker or the flammulated owl.

There are several factors influencing habitat for these species including past timber harvest, post harvest activities, and firewood removal. However, fire suppression is probably the most influential factor.

Open ponderosa pine stands dominated by medium to large structure (>21” dbh) has declined significantly over the past several decades. The Metolius Watershed Analysis (1996) shows that 64% of the Metolius watershed was dominated by medium to large ponderosa pine and 24% dominated by small (9-21” dbh) structure. The medium to large structure occurred throughout the watershed up to approximately the wilderness boundary or high elevation forest where small structured stands dominated. In 1991, only 13% of the watershed was dominated by medium to large structure and 62% dominated by small structure. There was also a shift in species

[29] Thinning under Alternative 3 would remove trees potentially up to 16” diameter (except up to 21” diameter white fir), thinning under Alternative 4 would remove trees potentially up to 21” diameter (except up to 25” diameter white fir), and Alternative 5 would not have set diameter limit, but removal of trees over 21” diameter would be an exception.

composition from ponderosa pine in 1953 to ponderosa pine, white fir mixed, and ponderosa pine mixed stands in 1991.

Table 16. Comparison of Species Composition between 1953 and 1991.

Structure Class	1953	1991
Small (9-21” dbh)	24%	62%
Medium to Large (>21” dbh)	64%	13%

Therefore, large structure ponderosa pine has declined across the watershed which reduces nesting habitat for both species due to a decline in the availability of large snags and also reduces foraging habitat for the white-headed woodpecker who feeds on the seeds of large cone producing ponderosa pine. Another factor stemming form fire suppression is the increase in brush species and abundance. This has led to increased small mammal populations in these stands due to the increased forage base and increased cover from predators. Due to the reduced availability of large ponderosa pine snags and trees, birds are needing to travel farther to forage. This reduces nest attentiveness and increases the vulnerability to predation further decreasing nesting success. Increased brush levels may also limit flammulated owl foraging success across a wide range limiting use to few areas across the district.

Past harvest activities, firewood collection, and burning have also led to reduced levels of large trees and snags. There may be increased competition between other secondary cavity excavators for limited nesting sites, further reducing nesting success.

Overall, implementation of the action alternatives would enhance and improve habitat conditions for these species by promoting the development of large structure, reducing stand densities, and lowering brush levels.

AMERICAN MARTEN

Important Interactions

The project area contains minimal suitable habitat for marten, focused in the mixed conifer wet stands and along the riparian reserves for Jack and Lake Creeks. Marten avoid open forest stands (Ruggerio et al. 1994) so are not likely to use other habitats in the project area. However, they may use the area for dispersal from the slopes of the Cascades to Green Ridge or Black Butte. Actions that affect canopy cover, particularly in riparian areas, would have the greatest ability to affect marten.

Effects Of Alternative 1

Canopy cover and stand densities would increase over time, which would increase the potential for use by marten. It may also result in increased amounts of snags and down woody material. However due to the open nature of the majority of the project area, complex horizontal structure may never be generated. Over time, large structure would be lost due to white fir encroachment leading to degraded habitat quality. With increased stand densities, there is an increased risk of loss from a disturbance event. An insect and disease event would result in increased levels of snags and down woody material. However, canopy cover would be reduced so habitat created may be of a lower quality. A stand replacing fire event would remove most of the structure, which would prolong the development of habitat for several decades. Other projects would not be implemented with the No Action alternative such as road closures that would decrease the potential for disturbance and lessen fragmentation over time.

The No Action alternative “May Impact” marten and their habitat due to further degradation of habitat and loss of structure over time.

Effects Of Alternatives 2, 3, 4 And 5

Effects for marten are similar to those for spotted owl since they would use the same type of habitats. Thinning, shelterwood harvest and larch restoration would decrease stand complexity and may decrease potential prey base habitat. Less available down woody material would be present to aid in both foraging and resting and denning sites.

Thinning trees greater than 12” diameter under Alternatives 3, 4 and 5 would open stands by decreasing canopy cover, which may discourage marten dispersal through the area. However, beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. Alternative 3 results in the least impacts to marten habitat due to the retention of more canopy cover.

Thinning trees 12” diameter and less could benefit marten habitat in the long term by reducing fragmentation and promoting the development of suitable habitat at an accelerated rate. Short-term beneficial impacts would be seen in the reduction of risk to existing suitable habitat. Negative impacts would result in more open stand conditions by reducing canopy cover from existing stands. This may preclude use by marten until stands become dense again. Alternative 3 has the most acres of small tree thinning.

Underburning and mowing may benefit marten habitat by protecting and promoting suitable habitat over the long term. Negative impacts may result in the potential degradation of habitat with the consumption of some softer snags and down woody material. However, this would be minimal due to the lower intensity burn versus that of a wildfire. This would occur primarily with the implementation of Alternative 2.

Shelterwood harvest may have both beneficial and negative impacts. Beneficial impacts should result in the reduction of risk to existing suitable habitat and facilitating the development of more stable, long term habitat. Negative impacts would result in more open stand conditions that could impact dispersal. However, stands are already somewhat open due to the mortality. Another negative impact would result from the removal of horizontal structure (down woody material) and snags degrading habitat. Brainerd (1990) found that *Microtus* populations (a vole species) may be abundant in this type of habitat and if cuts are small enough, martens could forage in them and remain close to cover. Therefore, if down woody material is removed, prey densities could be impacted. This impact would only occur with the implementation of Alternative 5.

Larch does not generally provide habitat, particularly in the winter when it looses its needles. However, larch restoration would help reduce of risk to existing suitable habitat. Maintaining live residual trees would provide for vertical structure throughout the life of the stand. Negative impacts would result in more open stand conditions that could impact dispersal. And though the reduction in competition is good for western larch, this type of habitat doesn't provide much value especially in the winter months when crowns are bare. This impact would only occur with the implementation of Alternative 5.

Aspen restoration is minor and not expected to affect marten habitat.

Handpiling would have the least impact on marten habitat, since it would retain the most large down wood of any of the fuel treatments, thus maintaining habitat for prey species and potential resting and denning sites. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the mixed conifer wet plant association and spotted owl focal area. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry plant associations.

Beneficial impacts should result from additional road closures, which would result in less disturbance potential and less fragmentation on the landscape in the long term. Major travel routes within the project area would not be changed however. During peak use times, these may function as barriers to dispersal, especially the 14 and 1419 roads leading into Camp Sherman and to the Metolius River. Alternative 5 results in the greatest reduction in road density and treats the entire project area.

Action Alternatives "May Impact" marten and their habitat due to degradation of habitat. Alternative 2 is the preferred alternative for marten due to the retention of more habitat components.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the marten.

Past harvest activities have been concentrated along the east slope of the Cascades, primarily in the highest mortality areas with the Jack Canyon, Santiam Restoration, Santiam Corridor and McCache project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. Trade-offs were made to reduce risk of further loss and to create fuel break area where a large fire event may be stopped or contained. A large area running almost the entire length of the district has received harvest and fuels treatments to reduce risk. These activities have reduced overhead cover potentially impacting use by marten. However, complex structure in the form of down woody material still exists in many of these areas that may allow for foraging by this species.

Several projects have proposed road closures including McCache and Jack Canyon. This along with Metolius Basin, would aid in reducing overall road densities and lessen fragmentation over time.

Overall, implementation of the action alternatives should have little impact on marten habitat within the project area since most of the project area is not considered suitable habitat.

BATS

Important Interactions

Only the silver-haired bat, big brown bat, hoary bat, little brown bat, long-legged bat, and western small-footed bat have been documented in the project area. Actions that reduce roost sites (large trees and snags) across the landscape would affect bats.

Effects Of Alternative 1

Primary risks to habitat include fire suppression, which can result in increased stand densities and loss of large tree structure. Increased stand densities may intensify a wildfire event resulting in the loss of large trees, large snags, and important special habitat components like hollow trees.

Effects Of Alternatives 2, 3, 4 And 5

Under all of the action Alternatives tree harvest can remove important roosting and foraging habitat but may reduce risk, accelerating development of large tree structure, and increasing the amount of long-lived ponderosa pine over white fir. Species abundance may decrease or species may be displaced into adjacent areas or into marginal habitat. A minor number of large snags may be lost due to safety concerns during harvest operations. However, reducing stand densities would aid in protecting areas with existing large structure or future large structure. Fire intensities would be reduced and pockets of material could be retained.

The No Action Alternative may impact bats and their habitat by perpetuating the loss of large snag habitat. The Action Alternatives may impact bats and their habitat by the removal or degradation of habitat components. Alternative 3 is the preferred alternative because is reduces risk of high severity fire commensurate with alternatives 4 and 5 but has less impacts to structure.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the any of the bat species analyzed.

Past harvest activities have led to the loss of large tree habitat, which has resulted in a decline in foraging and nesting habitat for several species. However, more recent vegetation management projects are more focused on restoration of large, open ponderosa pine stands by focusing on thinning reducing stand densities and mowing and burning, reducing brush levels. These types of activities would enhance habitat conditions for those species dependent on large tree structure.

Post harvest activities, primarily burning, have led to a reduction in snag habitat, as well as firewood collection. This, in conjunction with safety concerns surrounding recreation facilities and main roads has led to a reduction in snag habitat across the district.

Trends are indicating increased recreation levels within our national forests. Much of this use is concentrated around waterbodies/waterways. Increased human use in the project area can lead to increased disturbance of day and night roosts, maternity sites, and winter hibernaculum.

Overall, implementation of the action alternatives would promote the development of large structure, which would increase habitat development. Some snag habitat would be lost, however, measures are in place to minimize effects.

NEOTROPICAL MIGRATORY BIRDS

Effects of Alternative 1

Risks to suitable habitat include lack of low intensity wildfire to maintain open understories, fragmentation from potential disturbances, loss of large tree habitat to wildfire due to increased stand densities, loss of large snag and down woody material from wildfire, safety concerns, and brush control in specific areas.

Habitat for species that are more dependent on closed canopies and dense understories (i.e. Townsend's warbler, hermit thrush, and red-breasted nuthatch) would continue to increase over time. White fir would continue to out compete ponderosa pine and Douglas fir resulting in increased stand densities and loss of late successional conditions over time. This would eventually result in fewer large snags and down woody material on the landscape and fewer nesting sites. Loss of ponderosa pine and Douglas fir results in fewer foraging opportunities for species like the white-headed woodpecker and brown creeper who need large diameter trees. Increased stand densities and brush densities increases the risk of loss which could further reduce the availability of habitat in the area for most late successional species.

The No Action Alternative may impact Neotropical migratory birds and their habitat due to the continued loss of large trees and open ponderosa pine forests.

Effects of Alternatives 2, 3, 4 and 5

Restoration of aspen stands and meadows under all of the action Alternatives would only occur on a small number of acres, but can benefit birds by adding diverse habitats. Though some potential snag habitat would be lost as conifers are removed, which could decrease nesting habitat, these treatments are expected to enhance habitat for species like the red-naped sapsucker, tree swallow, northern pygmy owl. Burning meadows may enhance foraging opportunities. However, most meadow habitat is adjacent to high human use areas making it unsuitable for species like sandhill cranes who are very prone to disturbance.

Thinning trees 12"diameter and less could provide long term beneficial impacts by reducing fragmentation and promoting the development of suitable habitat at an accelerated rate. Short-term beneficial impacts would be seen in the reduction of risk to existing suitable habitat. This treatment would benefit species like the pygmy nuthatch, red-breasted nuthatch, and hairy woodpecker. However, this treatment may impact species like the chipping sparrow and hermit thrush that require regeneration patches or dense understories. The most small tree thinning would occur under Alternative 2.

Dwarf mistletoe treatments would increase the number of snags but would also decrease the large live tree density. This should not have a considerable affect on birds. By treating these trees, it would allow surrounding stands to benefit by reducing the mistletoe infection and move them toward late-successional conditions. Dwarf mistletoe treatments should benefit species like the pygmy nuthatch, Williamson's sapsucker, and chestnut-backed chickadee.

Thinning trees larger than 12" diameter under Alternatives 3, 4 and 5 may benefit species like the pine siskin, white-headed woodpecker, and Lewis' woodpecker. Impacts may be seen by species like the dark-eyed junco, Townsend's solitaire, and flammulated owl.

Shelterwood harvest and larch restoration may have both negative and beneficial impacts. These treatments increase fragmentation and remove snags and down woody material (though LRMP standards and guidelines would still be met). Fire risk is reduced and these treatments promote more stable long-term habitat. Impacts may be seen from species like the hermit thrush, chestnut-backed chickadee, and Townsend's warbler.

Underburning and mowing would result in the greatest reduction in risk to residual stands however, there is also a greater risk of loss to existing snags, down woody material, and shrub habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry plant associations. Timing of treatments is important to keep in mind. Treating stands in the spring and early summer may have the potential to reduce local populations of ground and shrub nesting species. These treatments could benefit species requiring more open stands and may impact species like the winter wren and many woodpeckers.

Road closures would benefit neotropical migrant bird species by reducing disturbance during the nesting season, reducing fragmentation, and would help retain snag habitat. Alternative 5 results in the greatest reduction of road densities, followed by Alternatives 3, 4 and lastly Alternative 2.

The Action Alternatives may impact NTMBs and their habitat due to the potential loss of snag habitat and increased fragmentation (alternative 5 only). Alternative 3 is preferred because it results in fewer impacts than Alternatives 4 or 5 but shows a commensurate reduction in risk of high severity fire.

Cumulative Effects

Cumulatively, the action alternatives would not lead to a trend toward Federal listing for the any of the neotropical bird species analyzed.

Several factors influence neotropical bird habitat including past harvest activities, post harvest activities, firewood collection, fire suppression, recreation facilities, aspen restoration projects, and roads.

Past harvest activities have led to the loss of large tree habitat, which has resulted in a decline in foraging and nesting habitat for several species. However, more recent vegetation management projects are more focused on restoration of large, open ponderosa pine stands by focusing on thinning reducing stand densities and mowing and burning, reducing brush levels. These types of activities will enhance habitat conditions for those species dependent on open ponderosa pine stands.

Post harvest activities, primarily burning, have led to a reduction in snag habitat, as well as firewood collection. This, in conjunction with safety concerns surrounding recreation facilities and main roads has led to a reduction in snag habitat across the district.

Fire suppression has resulted in an increase in brush layers and stand densities. This created habitat for some species but led to a decrease in habitat for those species more commonly associated with ponderosa pine habitat. Increases in this type of habitat may have increased habitat for predators like accipiters and small mammals. This has not been proven, however research on white-headed woodpeckers is suggesting high nest predation by golden-mantled ground squirrels. These small mammal populations may be increasing due to increased cover from predators and increases in habitat.

Several fires have occurred within the past 5 years including the Cache Creek, Cache Mountain, Eyerly, and Research Natural Area fires. These events have created habitat for species like Lewis' woodpeckers. However, fire intensity and size has been greater than desired.

Overall, implementation of the action alternatives should result in improved habitat conditions for those species dependent on open ponderosa pine habitat. Some snag habitat would be lost, however, measures are in place to minimize effects.

WATERFOWL

Important Interactions

The project area provides potential habitat for the following species: mallard, canvasback, common merganser, Canada goose, wood duck, northern pintail, blue-winged teal, cinnamon teal, northern shoveler, American wigeon, redhead, and hooded merganser. Proposed treatments within riparian reserves include meadow enhancement, underburning, thinning, aspen restoration, and small tree thinning.

Effects of Alternative 1

Riparian areas, aspen stands and meadows would not be thinned to improve habitat conditions. The risk of losing habitat from insects, disease and wildfire is the greatest under this Alternative.

The No Action alternative will have no impact on waterfowl or their habitat.

Effects of Alternatives 2, 3, 4 and 5

Thinning would not directly impact waterfowl habitat for ground nesters. However, it would open up stands, resulting in an increase in riparian vegetation and increasing foraging habitat. Some snag habitat may be lost due to safety concerns during harvest operations adjacent to riparian reserves which would decrease nesting habitat for species like wood ducks and hooded mergansers. However, thinning would primarily occur in habitat unsuitable for waterfowl and impacts would be minor. Aspen restoration would increase diversity. However, the location of known aspen stands occurs within dense areas of the riparian reserves and is probably not used by waterfowl extensively.

Meadow enhancement has the greatest potential to increase waterfowl habitat or increase the quality of existing habitat. Conifers would be removed from meadows and meadows would be burned. This would increase the quality of habitat by promoting new herbaceous growth increasing foraging opportunities.

The acres thinned in riparian areas in the greatest under Alternatives 3 and 4, and the least under Alternative 5. Aspen stands and meadows would be treated the same under all action Alternatives. Risk of losing habitat to insects, disease and wildfire is reduced the most under Alternative 5, followed by Alternative 4, 3 and then 2.

Reduction in road miles adjacent to and within riparian areas would benefit waterfowl by reducing the amount of disturbance by humans. All of the action Alternatives would reduce the same number of road miles in riparian areas.

The Action Alternatives may impact waterfowl and their habitat by removing potential nesting habitat. However, this is a minor impact.

Cumulative Effects

Six campgrounds and several summer home tracts occur along the Metolius River. Loss of snag habitat in and adjacent to these areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat. However, high use recreation areas may not preferred nest sites due to the increased disturbance levels. Snag habitat along the river in between campgrounds and summer home tracts is important to retain due to the loss of this habitat component elsewhere. Much of the suitable meadow habitat associated with riparian areas occurs on private lands.

SURVEY AND MANAGE SPECIES

MOLLUSKS

Effects Of Alternative 1

Increased stand densities have developed in the riparian reserves due to fire suppression. This provides higher canopy closures, higher humidity levels, increased shade and increased soil moistures. It also provides increased levels of down woody material which could benefit the species by providing additional microsites for occupancy. However, fire risk is increased due to high stand densities. Species composition is changing from long-lived, fire tolerant species to more short-lived, fire intolerant species. This, along with increased stand densities, has the potential to increase the risk of fire occurring at higher intensities within the riparian reserves. According to the management recommendations, high intensity fire is very damaging to both the animal and their habitat. Fire can kill mollusks (if not protected) and can destroy logs and other woody debris that hold moisture and create microsites necessary for survival (Applegarth 1995; Burke, personal observation). Sites that appear to be suitable habitat for many gastropods, but which have been burned in the past, support few if any species or individuals even after 50 years or longer (USDA Forest Service. 1999. Management Recommendations, Version 2.0).

The No Action alternative may impact mollusks and their habitat due to the potential loss of habitat from a large-scale fire event.

Effects Of Alternatives 2, 3, 4 And 5

Proposed treatments within riparian reserves include aspen restoration, thinning, small tree thinning, underburning, and handpiling. Treatments proposed would help move stands toward more sustainable conditions, reduce the risk of a large-scale fire event, and retain more long-lived, fire tolerant, and disease resistant species. No treatments would occur within the "riparian vegetation zone" within riparian reserves.

Thinning trees larger than 12" diameter under Alternatives 3-5 would only occur within riparian reserves that are intermittent in nature or are functioning as ditches. These are not considered suitable habitat for mollusks due to lack of riparian vegetation and low moisture levels, and therefore there would be no effects from this activity.

Thinning trees 12" diameter and less is the primary treatment within riparian reserves. Although no treatment activity would occur within the riparian vegetation zone (10-30' in most cases), treatments could still alter riparian microsites by reducing canopy cover. This may reduce soil moisture and increase temperatures within these areas, decreasing the quality of habitat. Heavy equipment use may result in compacted soils that don't hold moisture as long and may be impenetrable by these species. Alternative 2 would have the least amount of thinning in riparian reserves, and therefore would have the least impact on mollusk habitat.

Aspen restoration would result in short term impacts by creating openings within riparian reserves thus altering microsite temperatures and humidities and causing the immediate area to be unsuitable until aspen stands recover. When stands recover, moisture levels should be higher and ground litter will be greater. However, this extent of this effect would be minor since it would only occur on 10 acres under each of the action Alternatives.

High intensity fire is particularly damaging to gastropods and their habitat. Alternatives 3, 4 and 5 all reduce the acres at risk of high severity wildfire adjacent to mollusk habitat more than Alternative 2. Low intensity underburning is not expected to consume all the down wood or mollusk habitat features (Applegarth 1995; Burke, pers obs.), but would have more of a detrimental affect on mollusks than handpiling. Advanced decay class material may be at risk of loss with underburning. Handpiling would result in the least impacts to mollusk habitat and would be used along streams to mitigate potential impacts (see Mitigation, Chapter 2). Alternative 2 would have the most acres underburned within riparian reserves (about 315 acres), while Alternative 3, 4 and 5 would underburn only about 54 acres within riparian reserves.

The Action Alternatives may impact mollusks and their habitat due to habitat loss/degradation, compaction, and prescribed burning.

Cumulative Effects

Several factors influence mollusk habitat within the watershed including past harvest activities within riparian reserves, roads, recreation use along streams and the Metolius River, and implementation of fisheries enhancement projects. Past harvest activities within riparian reserves have led to the loss of substrate like down woody material at times and has resulted in compaction. This has created barriers to dispersal of mollusks and led to unsuitable habitat until soils recover. This project would contribute to this affect slightly.

Roads within riparian reserves limit suitable habitat conditions and dispersal. Proposed reductions in road miles within this project area and in other areas in the watershed (Jack Canyon and Metolius Basin project areas) would help restore riparian reserves over time. However, compacted soils may remain for some time. Effects of subsoiling/ripping to mollusks is unknown.

Increased recreation use along streams and the Metolius River like dispersed camping, user created trails, and ATV use has led to degradation of habitat with the removal of down woody material and riparian vegetation and increased compaction. However, designation of dispersed camping sites has occurred along both Canyon and Jack Creeks. This would aid in enhancing and will improve habitat conditions by moving sites away from the stream and protecting the immediate streambank.

Implementation of fisheries enhancement projects would also enhance and maintain healthy riparian reserves. Addition of down woody material and protection of the streambank and riparian vegetation would be beneficial to mollusks and their habitat.

Overall, implementation of the action alternatives would promote riparian health, which would enhance habitat for mollusks.

Plants

IMPORTANT INTERACTIONS

Effects to rare and sensitive plants, and competing and unwanted vegetation, are addressed in this analysis. Habitat and species can be affected by fire, tree harvest and post-harvest activities, and changes in road status. Impacts include removal of habitat (e.g. host trees), modifications to habitat (e.g. microclimate), disturbance to plants, and changes to stand-level connectivity.

Direct and Indirect Effects

Sensitive and Rare Plants. Actions proposed under this project intend to accelerate the development of late successional conditions and reduce risk. These actions may directly affect known sites and potential habitat of the sensitive plant species Peck's penstemon, Tall Agoseris' and the rare truffle, *Elaphomyces anthracinus*.

Tree harvest or fuel treatments that results in severe ground disturbance can damage Peck's penstemon and other plants (Ingersoll, 1993). Hand thinning would generally have direct and indirect beneficial effects to Peck's penstemon and Tall Agoseris by reducing canopy cover, providing more light, moisture, and bare soil for seedling establishment. Increased open sunny conditions may enhance potential habitat for Peck's penstemon (O'Neil, 1992). However, mechanical harvest could crush, uproot, or bury plants. This could remove parent plants, extripate small populations, and fragment large populations. Soils could be compacted and displaced on up to 20% of a thinning area. This is within guidelines for "managed status" populations of Peck's penstemon. There are no established guidelines for Tall Agoseris, however a 20% loss standard seems reasonable to apply.

A direct effect of tree harvest is removal of green trees and loss of hosts for mycorrhizal plant species, which require live trees. Many fungi are mycorrhizal and require live hosts (FEIS, Appendix J2; Castellano, et. al. 1999; Castellano and O'Dell 1997). In turn, forest trees and other vascular plant species depend on these beneficial relationships for survival and growth (Castellano, et. al. 1999). Removing green trees also removes existing and potential habitat for epiphytic species, such as some bryophytes and lichens, which grow on trees. Effects of thinning and prescribed fire on the rare truffle, *Elaphomyces anthracinus*, are unknown (Castellano and O'Dell 1997), so known truffle sites would be avoided in this project area, and no direct effects are predicted (see Mitigation, Chapter 2).

Mowing has been observed to have little negative effect to Peck's penstemon and other native plants because the mower blades are set high and generally do not cut the plants.

The reintroduction of fire would be beneficial to Peck's penstemon and Tall Agoseris and other fire adapted plant species, causing vegetative spread and enhanced seed production. Low intensity underburns, when used in areas where the overstory (tree hosts) have been retained, should be able to maintain a viable mychorrhizal population (pg IV-47, Ty-chi Fire Recovery EA, 1996). Fuel treatments can reduce fire risk to remaining late -successional habitats and reintroduce the important ecological process of fire. A potential indirect effect of prescribed fire is the potential for an escaped wildfire, with suppression effects that could damage plants. However, the risk of escape is considered low. Indirect and cumulative negative effects may occur if noxious weeds are introduced by management activities and allowed to spread into potential and occupied habitats.


Balsam root, in the Metolius Basin

Fire can alter microclimatic conditions by removing small trees, shrubs and down wood decreasing moisture, and increasing heat and wind. It can change the input of down wood by killing some trees, burning snags which could become future down wood and consuming downed logs. During fire operations it is often difficult to prevent ignition of scattered snags that have been retained for habitat or keep the fire from entering retained clumps of trees where large down logs, snags and other habitats are protected from logging disturbances.

Machine and hand piling creates piles of logging slash for that are later burned, and may have less effect to large coarse woody debris habitats than broad-scale underburning. However, soil and duff habitats under these piles would be heated and consumed. Alternatives which use more underburning are more likely to reduce coarse woody debris and duff habitats on the ground and burn some standing and down log habitats.

Prescribed fire and other fire treatments can create suitable conditions for noxious weed spread by creating bare mineral soil and introducing seeds with off road vehicles which are occasionally used during fire operations. The mitigation measure of requiring clean equipment can be very effective in reducing this risk.

Use of harvest and post-harvest machinery can disrupt fragile mycorrhizal connections and alter the role of decaying wood in the nutrient cycling process. This is especially critical to fungi (FEIS, 1994 3&4, pg 142) and bryophytes which grow on decaying wood, humus, duff and mineral soil (Christy and Wagner, 1996).

Thinning and removing green trees would directly and indirectly degrade habitats for tree epiphytes, decaying wood species, humus, duff, soil and rock species, by removing shade, decreasing moisture, and exposing protected microsites (Christy and Wagner, 1996). This can cause a decline in species that require moister old growth conditions.

Closing roads would be beneficial to plant habitats because it removes a vector of weed introduction; vehicles on roads. However, development of temporary roads for harvest, and creation of landings can add noxious weed vectors to the project area.

Action alternatives should not adversely effect habitats for other Metolius Focal Plant species, because of mitigations in place to protect riparian areas, and because no large hardwoods would be removed.

Connectivity

Action alternatives would retain varying amounts and varying qualities of untreated forest areas on the landscape. This would change landscape level and small-scale connectivity of forest stands and has implication for the reproduction and survival of late-successional plant species with limited dispersal capabilities.

Species such as lichens and fungi, which reproduce mostly by vegetative fragments, have difficulty dispersing across forests, and only can travel short distances (Memo, Linda Geiser 1996; FEMAT IV-91; Christy and Wagner 1994; Castellano, et al. 1999). As old growth fragments become more isolated, sources of innoculum may be too few and far apart to effectively recolonize developing forest stands. Shelterwood harvest areas may not contain suitable habitats receptive to these innoculum for many decades because they lack suitable microclimates and shade and have limited amounts habitat components such as larger green trees, snags, and down logs.

Effects Of Alternative 1

The No Action alternative would maintain short- term habitat conditions if other disturbances such as wildfire do not occur. Forest canopies would continue to close, reducing the amount of light and moisture available to plants and limiting flowering and seed production of Peck's Penstemon and Tall Agoseris. Areas for these species to germinate in bare mineral soil would be limited to road and trail edges, gopher mounds or human caused disturbance, primarily from residential and recreation activities. The rare truffle, *Elaphomyces anthracinus* would not be disturbed or removed by logging or ground disturbance. Noxious weeds would continue to be introduced, mostly along roadways, and treated under existing weed control programs. However, noxious weeds would not be introduced by logging or fuels reduction related actions (see further discussion on noxious weeds at the end of this subsection). Habitats for other Metolius Late-Successional Reserve focal plant species such as riparian areas would be undisturbed by direct management effects. Continued growth of small trees such as white fir and young pine protected by fire exclusion would benefit mycorrhizal species by providing more live tree hosts.

Indirectly, the risk of disturbances such as insects, disease, and fire would increase. The effect of wildfires to plant species of concern depends on fire size and severity as well as the extent of suppression related impacts. If high severity wildfire burns through population areas, plants (Molina et al., 1992) as well as live roots and soil seed banks are likely to be destroyed (Ever, 2000). High severity fire impacts to soils occurred on approximately one third of the 2002 Eyerly Fire, eight miles northeast of the project area. Recovery periods after a high severity fire are long and recovery of rare plant populations requires that some of the meta-population survive and are able to disperse to and recolonize suitable habitats. A hot wildfire could damage or destroy forest remnants which are sustaining late successional plant species, and degrade or remove habitat. Continued monitoring of fire starts and suppression would help mitigate this risk, however increasing fuel loads in some areas will lower the effectiveness of control.

Fire suppression impacts could affect rare plants, including bulldozer firelines, handlines, safety zones, fire camps, retardant plants, and weed introduction. Bulldozer firelines are damaging to vegetation and have a high risk of introducing, spreading, or creating habitat for noxious weeds

(Evers 2000). Sensitive plant population locations can be noted during fire operations and avoided if practical, but if private property or lives are threatened all necessary measures are used regardless of the existence of plant habitats. Wildfire suppression in the Metolius Basin project area would likely have similar suppression related impacts as the Eyerly fire did.

An important indirect and cumulative effect of no action would be the limited ability to reintroduce low intensity fire into rare plant population areas to create habitat and stimulate flowering and germination. Fire is an integral ecosystem process in East Cascade late successional forest systems and some plant species habitat, such as Peck's penstemon and Tall Agoseris would likely benefit from low intensity fire. Few pine stands could be treated with fire without pretreatments, due to high amounts of ground and ladder fuels.

Fire exclusion has also influenced some focal plant species in positive ways and enhanced certain habitats. Shade loving bryophytes and lichen communities (tree epiphytes, decaying wood species, humus, duff, soil and rock species), are likely more abundant in biomass and cover due to the exclusion of periodic fires and have likely expanded their ranges (Christy and Wagner, 1996).

Continuing tree decline and mortality in overstocked areas may slowly result in changes to microclimates as declining trees lose their canopy and dead trees fall. This would allow increased light to the forest floor which would enhance habitat and be beneficial to some species such as Peck's penstemon and noxious weeds, and degrade habitat and be harmful to late successional species which require shaded microsites, such as tree epiphytes, decaying wood species, duff, soil and rock species. Downed trees would create new habitats for some plant species. Direct and indirect effects of past management such as habitat fragmentation, soil compaction would continue. Road systems would continue to be an entry point into the Late Successional Reserve for noxious weed species, however, there would be no development of temporary roads or landings to act as noxious weed vectors.

Effects Of Alternatives 2, 3, 4 And 5

<u>Peck’s Penstemon and Tall Agoseris.</u> Meadow enhancement and underburning are expected to be the most directly beneficial to Peck’s penstemon and tall agoseris and pose the least risk, because they open up understories and canopies so that light can reach the forest floor, and these treatments do not involve heavy equipment driving through the treatment units, which increases the probability of introduction and spread of noxious weeds. These actions and the area affected are addressed in Table 4-14.

There are also actions that, in the short-term, may directly impact individual plants negatively, primarily due to the risk of noxious weed introduction and the potential trampling and crushing from heavy equipment (Table 4-15). A study of logging impacts to Peck’s penstemon determined that the detrimental effects of soil disturbance or altered hydrology in the area studied may outweigh benefits of reduced overstory cover on growth and recruitment of Peck’s penstemon (Ingersoll, 1993). However, if soil disturbance is minimal and noxious weeds are not introduced, the outcome of these actions which open up the canopy and understory, and reduce competing vegetation, may still be beneficial over the long-term by improving habitat conditions. In addition, of the stands treated, it is expected only 20% (or less) of the unit would result in direct negative effects in all but those units which would be machined piled (since the equipment would travel over more of the unit acres).

Alternative 2 treats slightly fewer acres of Peck's penstemon habitat than the other action Alternatives, proposes the most acres of prescribed fire, the least ground based equipment tree removal, and the least amount of machine piling. As such, Alternative 2 would have the least amount of direct negative impacts on individual sensitive plants, and would have the most acres of direct short-term beneficial effects to Peck's penstemon and Tall Agoseris (Table 4-15).

Alternatives 3, 4 and 5 would have similar effects on opening up sensitive plant habitat, but Alternative 5 would have more intensive effects on habitat, due to greater reduction in canopy and stand components within the Shelterwood and larch restoration acres (Table 4-15) than Alternatives 2, 3, or 4. Alternatives 3, 4 and 5 pose more short-term risk to plant habitat by creating conditions favorable to noxious weed invasion through more intensive ground disturbance than under Alternative 2. In addition, the potential for removal of larger trees under Alternative 5 may result in slightly more impacts to soils and plant habitat along skid trails due to heavier trees removed. These Alternatives would beneficially treat the same number of acres as Alternative 2 within meadows and aspen stands, but would treat considerably fewer acres with underburning as a stand-alone treatment.

Table 4-17. Treatments expected to be directly beneficial to Peck's penstemon and tall agoseris, with the least short-term risks.

Treatment	Alternative 2	Alternatives 3 and 4	Alternative 5
Meadow Enhancement – acres treated and percent of the population within the project area treated			
Known Penstemon populations	16 acres (1% of the known populations)	16 acres (1% of the known populations)	16 acres (1% of the known populations)
Protected penstemon populations only	3 acres (<1% of the protected populations)	3 acres (<1% of the protected populations)	16 acres (2% of the protected populations)
Know tall agoseris populations	4 acres (<1% of the known populations)	4 acres (<1% of the known populations)	4 acres (<1% of the known populations)
Underburn only – acres treated and percent of the population within the project area treated			
Known penstemon populations	1071 acres (63% of the known populations)	36 acres (2% of the known populations)	36 acres (2% of the known populations)
Protected penstemon populations only	405 acres (1% of the protected populations)	1 acre (<1% of the protected populations)	1 acre (<1% of the protected populations)
Known tall agoseris populations	237 acres (48% of the known populations)	6 acres (1% of the known populations)	6 acres (1% of the known populations)

Table 4-18. Acres and Percent of Total Peck's Penstemon Treated by harvest activities that may result in direct, short-term impacts.

Treatments	Alternative 2		Alternatives 3 & 4		Alternative 5	
	Protected populations	All populations	Protected populations	All populations	Protected populations	All populations
Small tree thinning	187 acres (28% of population)	419 acres (25% of population)	185 acres (28% of population)	418 acres (25 % of population)	176 acres (26% of population)	405 acres (24% of population)
Thinning	0 acres	0 acres	405 acres (60% of population)	1025 acres (60% of population)	327 acres (48% of population)	881 acres (52% of population)
Larch restoration	0 acres	0 acres	0 acres	0 acres	79 acres (12% of population)	79 acres (5% of population)
Shelterwood	0 acres	0 acres	0 acres	0 acres	9 acres (1% of population)	30 acres (2% of population)
TOTAL ACRES TREATED	**187 acres**	**419 acres**	**590 acres**	**1443 acres**	**591 acres**	**1395 acres**

Rare Truffle. Habitat for the rare truffle, *Elaphomyces anthracinus,* would not be affected by the action Alternatives since known sites would be avoided, and would be protected by required mitigation (see Chapter 2, Mitigation).

Other Metolius Late-Successional Reserve Focal Species. Habitat for nitrogen fixing lichens and bryophytes, and mycorrhizal species would be protected during vegetation and fuel treatments by riparian protection, and would not be affected in areas left untreated. Alternative 2 has the least ground disturbance, and therefore least potential affect on bryophyte or mycorrhizal species.. However, the high number of acres burned under Alternative 2 would result in a loss of coarse wood and duff habitats across more acres than under the other action Alternative.

With the application of mitigation measures (Chapter 2, Mitigation) these alternatives may impact individuals but will not contribute to a trend towards federal listing or cause a loss of viability to the sensitive species.

Connectivity. All action alternatives mitigate loss of habitat connectivity by leaving large trees, untreated areas, riparian corridors, and scattered retention of existing late successional structures and forest areas. Alternative 2 has the least direct effect on habitat connectivity because it removes the least amount of structure, while Alternative 5 has the most. Alternatives 3 and 4 are intermediate in effects. There may be indirect and cumulative beneficial effects to action alternatives if they accelerate the growth of late successional trees and protect forest stands form loss from wildfire.

Cumulative Effects

Positive cumulative effects from no action would include absence of harvest-related disturbance. Habitat elements such as snags and coarse woody debris would be retained at increasingly high levels until wildfire disturbance occurred.

A negative cumulative effect of no action may include decreased longevity of some old trees because of competition with small trees. The perpetuation of overstocked stands delays development of larger trees and places stands at risk to insects, disease and wildfires. The mix of tree species would continue on a trajectory away from historic conditions and become even more dominated by fire sensitive species such as white fir. This would have unknown effects to many late successional plant species, especially mycorrhizal species whose host requirements are not well understood.

Insect, disease and related mortality, harvest, and wildfires have cumulatively affected the connectivity and dense, moist habitats of the Metolius Late-Successional Reserve and adjacent Cache Late-Successional Reserve. Several vegetation management projects have been completed or are proposed on the Sisters Ranger District to reduce fire risk and restore late-successional habitats such as Santiam Corridor and Jack Canyon (which have been harvested) and Santiam Restoration and McCache (pending). In addition, habitat and connectivity in and between the Late-Successional Reserves have been cumulatively affected by the Cache Creek Fire (1999), Eyerly (2002), and Cache Mountain Fire (2002), which burned approximately 6,200 acres of late-successional habitat. However, though stand density reduction is proposed on approximately 12,000 acres with this project within the Metolius Late-Successional Reserve, this action is not expected to have a significant cumulative affect on dense, moist forest habitats since the majority of the action would occur in ponderosa pine plant association, (a plant association that does not typically provided dense or moist forest conditions). In addition, the thinning and underburning activity is not expected to create gaps or fragment the ponderosa pine forest habitat, but result in a homogenous reduction in biomass, thus would have little effect on landscape level connectivity. Over the long-term, this project should help reduce the risk of further fragmentation in the Metolius Late-Successional Reserve due to catastrophic wildfire, insect or disease.

Competing and Unwanted Vegetation, Including Noxious Weeds

The analysis of the project follows the five-step process identified in the Environmental Impact Statement for Managing Competing and Unwanted Vegetation for dealing with noxious weeds and grass and sedges in reforested patches (under Alternative 5 only). This includes:

1. Site specific analysis including existing condition and effects of project implementation. (See Chapter 3, Competing and Unwanted Vegetation, Including Noxious Weeds)
2. Selection of a Strategy (with preference for the prevention strategy per the Mediated Agreement).
3. Project Design incorporating measures applicable to the strategy selected.

4. Implementation.
5. Monitoring to ensure that both, what was planned to be accomplished was done, and that it was effective.

This analysis meets the requirements of the FEIS for Managing Competing and Unwanted Vegetation, the associated Mediated Agreement, the Deschutes National Forest Land and Resource Management Plan, the Deschutes Noxious Weed Control Environmental Assessment (1998), and the USDA Forest Service Guide to Noxious Weed Prevention Practices (2001).

Six known noxious Weed sites have been identified within the project area (see Chapter 3). All of these sites are located along major roads in the area. The populations are scattered, and often small groups or individual plants. Weed control of these populations has been in progress since 1999 under the Deschutes Noxious Weed Control Environmental Assessment (1998) and in general, populations are holding stable or decreasing. Individual noxious weeds plants are occasionally found by field personnel outside these known sites and are hand pulled and removed when encountered.

Noxious Weed Risk Assessment

According to the Noxious Weed Risk Assessment, this project has a high probability of introducing or spreading noxious weeds because known weeds are found in and adjacent to the project and 5 vectors which can introduce weeds are present. All alternatives propose ground disturbance and prescribed burning that create suitable conditions for weed introduction and spread. Alternatives vary in their potential to increase the rate of weed spread directly related to the amount of suitable habitat created (acres treated with ground based logging, machine piling, mowing, or prescribed fire).

Summary of Alternative Effects to Noxious Weeds

Each action alternatives has an assortment of activities that could create favorable habitats for noxious weeds. Aspen restoration and meadow enhancement have the least chance of creating favorable conditions because of the small area affected and because trees are primarily thinned by hand.

Table 4-19. Management activities that may increase the risk of noxious weed spread.

Management Activities (listed in order of highest risk of creating favorable conditions for weed spread)	Alt 1	Alt. 2	Alt. 3/4	Alt.5
Tree removal- mechanical or hand removal (includes 7720 acres of probable ground-based removal)	0	4965	11,526	11,387
Machine piling in units and skid trails	0	1259	5855	6118
Mow and underburn	0	6172	3274	2437
Mow and hand or machine pile	0	2451	5666	5692
Underburn	0	2491	1043	1050

Effects of Alternative 1

This alternative would have the lowest direct effect of creating conditions favorable for competing and unwanted vegetation because ground would not be disturbed and forest canopies would not be opened to create more sunny conditions (both of these actions are favorable for the establishment of weeds). No new vectors for spread would be introduced (i.e. temporary roads or skid trails). The indirect effect would be an increased chance of wildfire and its associated impacts, including fire suppression related dozer and hand lines and fire created habitats, both of which create favorable conditions for introduction and spread. Cumulative effects would be minimized, at least in the short-term because stands would remain closed, soils would remain undisturbed so conditions for weed introduction from other sources such as recreational activities would be less favorable. Though the greatest number of road miles would remain open for public travel, which can act as a vector for the spread of weeds, there would be no ripping of old road beds to decommission roads, which result in potential conditions for growth of weeds.

Since there would be no reforestation proposed under this Alternative, the effects of grass and sedges, and prevention strategies are not a concern.

Common to all Action Alternatives

All action alternatives will create favorable conditions for the establishment and spread of noxious weeds. Dry forest types representative of those in the project area are particularly vulnerable to noxious weed invasion (Interior Columbia Basin Ecosystem Management Project Draft EIS- ICBEMP, 1997). Noxious weed invasion and establishment has the ability to alter ecosystem functions and processes (ICBEMP , 1997).

Project actions are listed in order of risk in table 4-weeds 1, but in general, actions involving large equipment and heavy localized soil disturbance such as mechanical thinning or removal of trees with skidders are likely to create more weed habitat than actions which use smaller equipment such as mowers or equipment that travels on a bed of crushed slash. Hand thinning is a low risk but vehicles and people can transport weed seed into areas. Prescribed fire and fuels treatments are also a lower risk but can create bare soil areas where weeds establish or carry seeds into areas with people or equipment.

Decommission roads by ripping (tilling) portions of the old road bed can create conditions favorable for the growth of new unwanted vegetation. Mitigation measures of washing road equipment can reduce the risk of introducing weeds into these areas. Alternative 2 would decommission the least miles of roads, so would have the lowest risk of this occurrence. Alternative 5 would decommission the most miles of roads, and would have the greatest risk of creating favorable conditions for weed establishment within ripped road beds, followed by Alternatives 3 and 4.

As discussed in the effects to sensitive plant species, road closures would be a beneficial effect in reducing noxious weed spread because of the removal of vehicle vectors carrying weed seed.

Effects of Alternative 2, including Cumulative

This alternative would have the lowest direct effect of any of the action alternatives of creating conditions favorable for noxious weeds because much less ground would be disturbed by thinning and machine piling (see Table 4-weeds1). Because smaller trees are removed there is less opening of the canopy than under the other action Alternatives. This would create less favorable conditions for weeds than Alternatives 3, 4 or 5. The amount of ground mowed is more than in Alternative 5 but less than Alternatives 3 and 4. The indirect effect would be a higher chance of wildfire and its associated impacts, including fire suppression related dozer and hand lines and fire created habitats, both of which create favorable conditions for introduction and spread. There would be fewer cumulative effects with this alternative than Alt 3,4 or 5 because stands retain more closure and shade, and soils would experience less disturbance so conditions for weed introduction from recreational activities would be less favorable.

Because it creates the least ground disturbance, uses the least ground based equipment, would have the least miles of temporary roads (about 0.25 miles), least acres that would be used as landings (about 11 acres) and treats the least acres, Alternative 2 has the least potential to contribute to noxious weed spread.

Mitigation measures which focus on prevention of weed spread are listed below (and in Chapter 2) and will help reduce the risk of weed introduction.

Since there would be no reforestation proposed under this Alternative, the effects of grass and sedges, and prevention strategies are not a concern.

Effects of Alternatives 3, 4, and 5, including Cumulative

These alternatives create very similar risks for noxious weed spread and establishment. Thinning, mowing, machine piling activities are similar in acres treated (see Table 4-weeds1). Alternative 3 has slightly less risk than Alternatives 4 or 5 because it leaves more large trees and more canopy so it provides slightly more shade. Alternative 5 has the highest risk of creating favorable conditions because it opens the canopy the most. An indirect effect of these alternatives would be a lower risk of wildfire and its associated impacts, including fire suppression related dozer and hand lines and fire created habitats, both of which create favorable conditions for weed introduction and spread. Alternative 5 has the lowest fire risk, followed by Alternative 4 and Alternative 3. There would be more cumulative effects with these alternatives, Alt 5 would be greatest followed by Alternative 4 and then Alternative 3 because stands which retain more closure and shade and soils would experience less disturbance so conditions for weed introduction from recreational activities would be less favorable.

Based on more acres of ground disturbance, landings (about 214 acres) and temp roads (about 1.65) under Alternatives 3 and 4 there is a higher risk of introducing noxious weeds into treatment units than Alternative 2 and a slightly lower risk than Alternative 5. Alternative 5 would treat slightly more acres, but would also have more acres used as landings (about 220 acres) and possible miles of temporary roads (1.80 miles). However, Alternative 5 would also close the most miles of roads (approximately 60 miles), more than Alternatives 3 and 4 (approximately 50 miles), which would all close more road miles in the project area than

Alternative 2 (approximately 20 miles), therefore reducing the risk of noxious weed spread and introduction along roadways.

Under Alternative 5, within the 296 acres proposed for shelterwood and shelterwood/thinning treatments to remove dead and declining trees affected by insects and disease, there is a risk of grass and sedges competing with reforestation. Competition from grass and sedges may reduce the growth and survival of planted and seeded seedlings. Post harvest fuel treatments could reduce this competing vegetation. However, further treatment may be necessary to control grass and sedges long enough to establish tree seedlings. Prevention and early treatment may not be effective since the grass and sedge species are already on many of the sites. The most effective treatment for competing and unwanted vegetation (both grass/sedges and noxious weeds) in reforested stands would be immediate re-planting of openings.

Mitigation measures which focus on prevention of weed spread are listed below and will help reduce the risk of weed introduction.

Prevention Strategy

Prevention of noxious weeds is always the preferred strategy because it is most effective and least costly. Prevention and some more aggressive control methods in existing populations are already in place in the project area and will be continued.

Exhibit A to the Mediated Agreement requires that six questions be addressed in the evaluation of the prevention strategy:

1. What is the nature and role of associated vegetation?
2. Do conditions exist that favor the presence of competing and unwanted vegetation?
3. If conditions exists that favor the presence of competing and unwanted vegetation, have past management actions exacerbated the situation?
4. Do natural controls exist on site?
5. Can management actions be taken that either encourage natural controls or help avoid the conditions that favor competing and unwanted vegetation?
6. Is it feasible to undertake the management actions, and if not why? If undertaken are impacts on other Forest Service objectives and goals acceptable?

1. What is the nature and role of associated vegetation?

Fifty nine percent of the project area is in a ponderosa pine plant association group and twenty-seven percent is in a dry mixed conifer group. This totals eighty-six percent of the area in dry forest -ponderosa pine dominated sites with grass and some shrub understory. Historically ponderosa pine dominated dry forests were generally more open with more widely spaced and larger trees than exist today. They had fewer shrubs and more grass. This forest type has changed to more a more dense condition dominated by small trees and brush due to fire exclusion and harvest of large trees.

Twelve percent of the area is a wet mixed conifer, denser forest type with more diversity and cover of understory vegetation. Less than two percent of the area is riparian or meadow vegetation which is moist, diverse and dense.

Relative to noxious weeds the role of all these types of vegetation is to stabilize soil, and utilize nutrients, water, space, and sunlight. This deters the invasion of noxious weeds.

Existing noxious weed populations occur along roadsides where the vegetation is more disturbed and contains more non-native plant species than interior forest areas. Disturbances in roadside areas may include, mowing, road repairs, line installations, parking, and weed control.

Grass and sedges are already present in stands where reforestation would occur under Alternative 5.

2. Do conditions exist that favor the presence of competing and unwanted vegetation?

Within the project area, ground disturbance and shade removal will provide suitable areas for noxious weeds to establish. In the absence of management activities, there is a smaller probability for these favorable conditions to be created. In dry forest areas, weeds like diffuse or spotted knapweed or dalmation toadflax can invade with very little disturbance. Any implementation of the action alternatives will create conditions favorable for noxious weed establishment and spread. As vegetation is reestablished it will act as a barrier against most weeds.

Along roadsides where weed sites currently exist, disturbances continue to create favorable conditions for weeds to spread and establish. Additionally vectors for weed transport and introduction are always present. These include, but are not limited to: passenger vehicles, construction equipment, road maintenance vehicles. All of these factors favor weed invasion.

3. If conditions exists that favor the presence of competing and unwanted vegetation, have past management actions exacerbated the situation?

Past management activities such as road maintenance, road building, timber harvest, grazing, and prescribed and wildfires have contributed to the establishment of noxious weeds in the area.

The presence of grass and sedges has not been exacerbated by past management.

4. Do natural controls exist on site?

Where undisturbed native vegetation exists in the project area there is some limited natural control. Native vegetation occupies space and uses water and nutrients that could support weeds. Duff layers of pine needles and other organic material cover mineral soil and deter weed seed establishment. Denser canopy covers can retard the establishment of grass and sedges that compete with seedlings.

5. Can management actions be taken that either encourage natural controls or help avoid the conditions that favor competing and unwanted vegetation?

Minimizing ground disturbance both in the short term with this project and in the long term with reduced entries will help reduce risk. Road closures to reduce road densities will reduce opportunities for vehicles to carry seed into interior forest areas. Mitigations such as equipment cleaning and pretreatments of existing weed populations will also help reduce risk.

Maintaining a forest condition which is closer to the historic condition of more open stands may help sustain native plant communities which have evolved to live in more open conditions, with occasional bare mineral soil, and low intensity fire. Reducing risk of catastrophic fire through the proposed management actions of thinning and prescribed fire will increase the probability of retaining native vegetation in the project area and may result in more intact soil duff available to deter weed establishment than what could happen in a wildfire which burned at higher intensities than a prescribed fire.

Grass and sedge competition with seedlings in reforested openings is expected to be a short-term problem, until seedlings are able to shade and out-compete them. Rapid reforestation can be the most effective control. If additional measures are needed, vegetation control mats around seedlings could be used. Use of herbicides is **not** proposed as a control.

There are many other possible preventative management actions that could be undertaken (USDA Guide to Noxious Weed Prevention Practices, 2001). They are discussed below.

6. Is it feasible to undertake the management actions, and if not why? If undertaken are impacts on other Forest Service objectives and goals acceptable?

Some management actions that help prevent noxious weeds may not be feasible or they may conflict with the purpose and need of the project (see table 4-weeds2). Those considered unfeasible are discussed. The estimated efficacy (or effectiveness) of each mitigation is listed.

The rating criteria for prevention efficacy is listed below:

- <u>Poor</u>: The action would have benefit, but would have a major conflict with other
- <u>Low</u>: The action would have benefit, but the benefit is difficult or expensive to achieve and of minor value, and may have conflicts with other objectives or goals.
- <u>Medium</u>: The action would have minor or major benefit, and conflicts with other objectives or goals are minor or none.
- <u>High</u>: The action would have major benefit, conflicts with other objectives or goals are minor or none. The action also helps meet other objectives or goals.

Table 4-20. Actions not considered feasible for treating/preventing Competing and Unwanted Vegetation in this project.

Action	Efficacy	Discussion
Begin operations in uninfested areas before operating in infested areas	Poor	Project priority is to work in urban interface to reduce fire risk. Weed infestations are in this area.
Avoid travel through weed infested areas or restrict travel to those periods when spread of seeds is least likely	Poor	Weed sites are major travel routes through the area and cannot be avoided. Project timing is coincident with weed bloom/seed period
Clean all equipment operating in weed sites before leaving the project area	Poor	Weed plants along the sites are scattered and it would be difficult to determine if equipment was in contact with an infested area (especially soil seedback), where plants had been pulled or sprayed. Very costly and difficult to implement.
Workers should inspect clothing and equipment for weed seed ands remove and dispose of properly	Low	Technical challenge of weed seed identification is high and requires expertise and microscopes. Infeasible to train workers to recognize weed seed
Where practical stockpile weed free topsoil and replace it on disturbed areas (landings)	Low	Operators may not have equipment to accomplish this action. Especially those using new low impact thinning machinery. Expensive and complicated to achieve on large scale.
Inspect and document all limited term ground disturbing operations in weed infested areas for at least 3(and up to 5) growing seasons following the project	Poor	Because weed sites are major travel ways numerous small disturbances occur in these areas. Area can be inspected throughout growing season but not after each disturbance
Encourage operators to maintain weed free mill yards, equipment parking, and staging areas.	Poor	Would require contacting numerous people, effectiveness would probably be limited.

Table 4-21. Actions considered feasible for treating/preventing Competing and Unwanted Vegetation in this project- Required Mitigation.

Action	Efficacy	Discussion
Prioritize and pretreat existing weed populations before ground disturbance	High	Action is approved under existing 1998 Deschutes Weed Control EA and is in progress
Survey and monitor areas disturbed by the project, especially landings. Document and handpull any new weeds found.	Medium	Not all areas can be surveyed due to resource constraints (time, funding)
Locate and use weed free project staging areas	Medium	Most staging areas can be located in weed free areas, exception is Rd 1216 St Johns Wort
Require clean equipment	High	This is a Region 6 requirement and part of all

Action	Efficacy	Discussion
		timber contracts. Ensure vehicles used in stewardship contracts, mowing, prescribed fire, and road maintenance/decommissioning are clean.
Evaluate options, including road closure to reduce traffic on sites where desirable vegetation needs to be reestablished (ie. landings, temporary roads)	High	Rehab and close temporary roads and landings as soon as possible
In vegetation types with relatively closed canopy (Spotted owl nesting , roosting and foraging habitat, riparian areas) retain shade to the extent possible	High	This will be possible in these selected areas where retaining closed canopies for cover and shade is a habitat objective
Minimize soil disturbance to the extent practical	High	Forest Plan Guidelines require detrimental soil disturbance is limited to less than 20% of a treatment unit. Prescribed fire objectives to retain some needle duff will also contribute
Where the project creates bare ground, revegetate disturbed soil	Medium	Use native seeds, when available, to revegetate landings in high-risk areas. Only use ephemeral non-natives to temporarily occupy the site (replaced by native plants over time) if natives are not available.
Improve effectiveness of prevention practices through weed awareness and education. Provide information and training and develop incentive programs for locating new invaders	Medium	This can be accomplished through general weed education and awareness, specific training of contract inspectors, and through community partnerships. Partners exist in the Metolius area that are working on this issue.
Minimize soil disturbance by over the snow logging and reuse skid trails	Medium	This is required mitigation for protected sensitive plant population areas.
Minimize soil disturbance in fuels treatments by treating fuels in place instead of piling, minimizing heat transfer to soil in burning, and minimizing fireline construction	Medium	Can be accomplished in many areas.
For long term restoration and weed suppression, and to reduce grass and sedge competition with reforested stands, recognize need for prompt reforestation	High	Most areas would not have created openings, except about 296 acres of shelterwood in declining white fir. These areas would be the first priority for reforestation

Key Issue # 4: Watershed/ Riparian/ Fish and Habitat/ Wild and Scenic River

The other part to Key Issue #4, Soil Health, is addressed in the next section of this Chapter.

Important Interactions

The timber harvest has been shown to have detrimental and beneficial effects on watershed health. Detrimental impacts may range from increased water temperatures and sedimentation, decreased dissolved oxygen levels, decreased riparian function and productivity, and changes to stream pattern, profile, dimension, and flow dynamics. Beneficial effects may include increased riparian function and productivity, increased shading vegetation over the long term, and less probability of water quality degradation due to loss of vegetation from catastrophic wildfire, insect, or disease.

To evaluate the effects by alternative, each subwatershed was analyzed separately. A combination of cumulative watershed effects analysis, field observations, scientific literature review, and consultation with other specialists was done to determine the possible effects.

Proposed vegetative, fuels, and road treatments were analyzed to determine the possible effects. Existing and proposed road densities, by subwatershed and alternative, are located in Table 4 22. Consult the Hydrology specialist report for more details on proposed vegetative treatments by subwatershed and alternative.

Effects to the outstandingly remarkable values (ORVs) of fisheries and water quality in the Metolius Wild and Scenic River are addressed here. A consistency analysis for the Wild and Scenic River Plan is discussed at the end of this section.

This project is consistent with recommendations in the Metolius Watershed Assessment (USDA 1996; pg. 146) to enhance forest health, large tree structure and reduce the risk of loss from catastrophic wildfire, insect or disease event.

Effects to Threatened and Sensitive Fish, and Essential Fish Habitat

<u>Threatened and Sensitive Fish, and Essential Fish Habitat</u>

Bull Trout (Threatened)- May affect, not likely to adversely affect

The bull trout population has been increasing in the last decade, even during the implementation of timber sales in the upper watershed of Jack Creek and Canyon Creek. Mitigation measures and improved road management has been effective in the implementation of the recent management activities. Monitoring of fine sediment has shown an improvement in the quality of spawning habitat since the late 1980's. Reports of new spawning locations (Spring Creek and Metolius upstream of Camp Sherman) in the last two years may indicate an expansion of their range. The Sisters Ranger District will continue monitoring to validate this trend and assess the potential impacts of the landscape scale treatments proposed in this project.

Under the action Alternatives there is a slight risk of increased fine sediment into Jack Creek, Metolius River and Lake Creek. The number of acres of ground based operations and road use may lead to slight increases in fine sediment runoff during storm events. This effect would not rise to the level of significant nor adverse. Shade would be maintained and low impact machinery would be used for removal of small diameter trees. Treatments would protect fish habitat by reducing fire risk while maintaining vegetative cover, shade and reducing road crossings and riparian reserve roads.

Under the no action Alternative there would be no direct impacts form vegetation or fuel treatments on bull trout or their habitat, though there would be a higher risk of indirect impacts from a severe wildfire.

Chinook (Essential Fish Habitat)- No Adverse Effects

Chinook habitat is primarily located in the Metolius River and Lake Creek. Preliminary results of an OSU study of experimental releases of chinook fry in these areas have indicated good growth in the upper reaches of the Metolius River, especially upstream of Camp Sherman. This reach is the primary spawning habitat area because of the springs and is protected from the influences of runoff and fine sediment loading because of the lack of tributary runoff channels. Redband trout successfully spawn in this reach and have been increasing in number in recent years. Reintroduction of chinook salmon to the Metolius River continues to be a goal under the new license for Pelton Round Butte Dams.

Under all Action Alternatives, there would be a slight risk of increased fine sediment into Lower Lake Creek and upper Metolius River. The number of acres of ground based operations and road use may lead to slight increases in fine sediment runoff during storm events. This effect would not rise to the level of significant, nor adverse. Shade would be maintained and low impact machinery would be used for removal of small diameter trees. Treatments would protect fish habitat by reducing fire risk while maintaining vegetative cover, shade and reducing road crossings and riparian reserve roads. Habitat quality for chinook would be protected by mitigation measures such as the limitations to hand cutting/piling along the Metolius River, setbacks to underburning, reducing riparian roads and reducing stream crossings on the tributaries.

Under the no action Alternative there would be no direct impacts form vegetation or fuel treatments on chinook habitat, though there would be a higher risk of indirect impacts from a severe wildfire.

Redband Trout (Sensitive Species)- May Impact but will not lead to a trend in federal listing

Under all Action Alternatives, there would be a slight risk of increased fine sediment into spawning habitats for redband trout of Lake Creek, and the Metolius River downstream of Lake Creek The number of acres of ground based operations and road use may lead to slight increases in fine sediment runoff during storm events. This effect may not be measurable and would not rise to the level of significant nor adverse. Shade would be maintained and low impact machinery would be used for removal of small diameter trees. Treatments would protect fish habitat by reducing fire risk while maintaining vegetative cover, shade and reducing road crossings and riparian reserve roads.

Under the no action Alternative there would be no direct impacts form vegetation or fuel treatments on redband trout or their habitat, though there would be a higher risk of indirect impacts from a severe wildfire.

Effects Of Alternative 1

Watershed. The no action alternative would cause no short-term impacts due to project implementation, however problem areas would continue to contribute to long- term degradation. Without active restoration work, including inactivating/decommissioning roads, rehabilitating compacted sites, enhancing meadows and riparian areas, watershed recovery to a more "natural" condition may take many decades.

This alternative would not reduce the risk of catastrophic wildfire in large areas of unthinned stands of timber and dead and dying trees. Intense wildfires could remove all or most riparian and upland vegetation, which could contribute large amounts of sediment to stream systems, increase water yields, remove shading vegetation, and damage riparian function (Campbell and Morris 1988, Helvey 1972 as cited by Gresswell 1999). Furthermore, increased water yields and sediment delivery from wildfire could cause channel and streambank erosion. Increased stream temperature and sediment could adversely affect aquatic species.

Riparian Reserves and Fish Habitat.

No action would maintain the habitat conditions that currently exist with for bull trout, chinook salmon and redband trout. The spring fed habitat of the Metolius River would continue to provide good growing conditions for juvenile chinook and redband. Spring fed habitat for bull trout would continue to develop in complexity from dense stands of ponderosa pine, larch and Douglas fir and white fir. Riparian areas would continue to attract campers and certain riparian zones would continue to be devegetated from the repeated use along Jack Creek and Lake Creek. Certain riparian roads would continue to deliver low levels of fine sediment after heavy rains. This level of runoff is low because of the gentle terrain but the spring-fed streams may be sensitive to it because of their stable flow regime.

The risk to long term shade, instream wood, streambank stability and fine sediment loading increases with the increased risk of intense wildfire. Without fuel treatments, the risk of stand replacement wildfire increases. The lack of upland treatments leave the riparian areas at greater risk. Spring fed stream may be a lower risk to watershed scale wildfires because of their flow regime is more linked and moderated by groundwater. Any increased fine sediment from tributaries within a large intense wildfire may be stored in the bed of spring-fed reaches and may recover more slowly than snowmelt driven watersheds with flashy flow regimes. Spawning habitats in the headwaters of Jack Creek and the Metolius River may serve as refuges from these effects of a large-scale wildfire.

303(d) Listed Streams.

As previously mentioned, the no action Alternative would not reduce the risk of catastrophic wildfire in large areas of unthinned stands of timber and dead and dying trees. Consequently, catastrophic wildfire could reduce and eliminate riparian and upland vegetation, and result in degradation to watershed health (increased turbidity/sedimentation and temperature, and decreased dissolved oxygen levels in Lake Creek, a 303d listed stream). This alternative also poses the greatest risk of ash sediment delivery to streams, which could cause long-term elevated nitrogen levels in Lake Creek, the 303(d) listed stream, and other streams, following a wildfire (Brown et al. 1973, Brass et al. 1996 as cited by Gresswell 1999). Without active restoration of riparian reserves along 303(d) listed streams, risk to disease and wildfire would continue to exist. Restoration of riparian reserves would promote recovery of 303(d) listed streams. However, there would be no direct impacts to Lake Creek water temperature (the limiting factor for which it is listed), under Alternative 1.

There is a greater risk of severe wildfire impacts to riparian areas under Alternative 1

Wild And Scenic River.

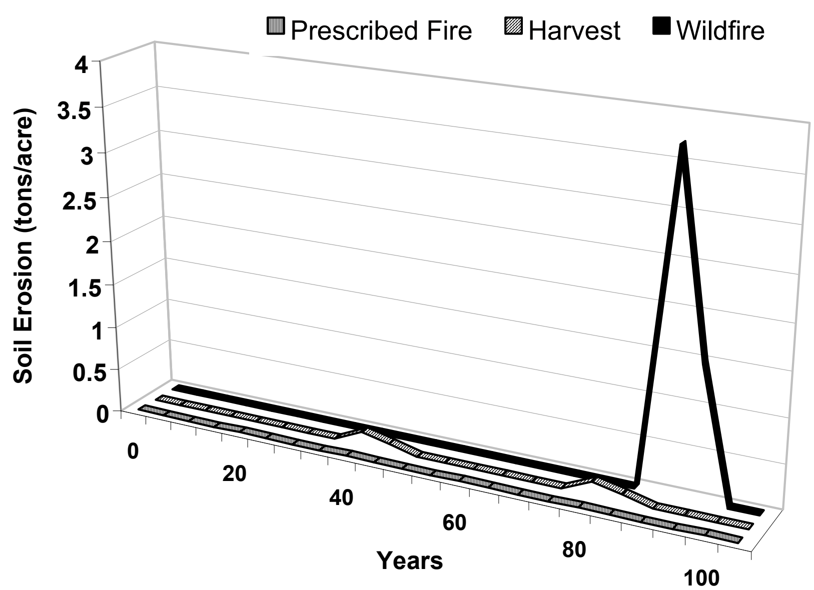
There would be no direct effect on the outstandingly remarkable values (ORVs) of the Metolius Wild and Scenic Corridor under the No Action Alternative. Fisheries and fish habitat would be protected though current management of the corridor that protects large wood and riparian streambank conditions. Water quality would continue to be monitored and protected through permits. However, indirectly, there would be an increased risk of impacts to the ORVs from high severity wildfire adjacent or in the Wild and Scenic River corridor. For further discussion, see the analysis of Wild and Scenic River consistency at the end of this section.

Effects Of Alternatives 2, 3, 4 And 5

Watershed. Fuels and vegetation treatments in all action Alternatives would decrease the potential for large-scale water quality degradation due to catastrophic wildfire, as recommended in the Metolius Watershed Analysis and Metolius Late-Successional Reserve Assessment. Meadow enhancement would promote hydrologic function, riparian habitat, and native vegetation. Controlled burns are not expected to affect more than 75% of ground cover on average, and low intensity prescribed burns are predicted to only have a minor effect on erosion and sediment yield in relevance to wildfire and thinning (figure 4-1). Mitigation measures (Chapter 2) would minimize short and long-term impacts. Inactivating and decommissioning roads would greatly reduce the potential for water quality degradation.

Alternative 2 was designed, in part, to address watershed and water quality concerns, while still reducing the risk of high severity wildfire. Thinning trees less than 12 inches diameter would occur within designated riparian reserves to promote stand health and stream shading over the long-term. This alternative would also maximize inactivating and decommissioning roads within Riparian Reserves, and throughout the First and Suttle subwatersheds (Tables 4-16), which would aid in decreasing the probability for stream degradation, primarily from sediment yield. With the implementation of all standards and guidelines, and recommended mitigation measures, there are no expected measurable adverse effects on watershed health from this alternative.

Figure 4-1. Estimated accelerated erosion from prescribed burning, thinning logging and wildfire. Estimates were generated from the WEPP model for soil erosion. Estimates are given for tons of sediment produced on a 300-acre disturbance area over a 100-year period. Note that prescribed fire is estimated to occur every 20 years, thinning would occur every 40 years and a wildfire would occur once in 100 years.



Overall, alternative 3 may pose more short-term watershed risk (from sediment yield and increased peak flow) than Alternative 2, however with the implementation of all standards and guidelines and recommended mitigation measures, there are no expected measurable adverse effects to watershed health in the long-term. Long-term benefits to stream temperature, dissolved oxygen, and riparian function are expected. From a hydrologic viewpoint, the benefits of this alternative outweigh any short-term consequence(s).

Alternative 4 is similar to Alternative 3, except thinning would be permitted up to 21-inch diameter limit for most tree species, and 25" diameter for white fir. As stated with Alternative 3, there is some risk of short-term impacts from sediment and water yield, however there are no expected measurable adverse effects to long-term watershed health from this alternative.

Alternative 5 would generate the most ground disturbance and the highest potential to cause direct effect to streams and riparian area within the project area. Unlike the previous alternatives, treatment of dead and declining stands would occur in the First and Suttle Subwatersheds. Additional harvest, not included in any other alternative, would include shelterwood regeneration (172 acres) and shelterwood regeneration with thinning from below (124 acres). This alternative would also inactivate/decommission the most miles of road throughout the project area (Table 4 - 22). Group openings (under the larch restoration treatment) in the First and Suttle Lake Subwatersheds may have a slight increase on water and sediment yield. This alternative poses the highest risk for watershed health degradation.

Table 4-22. Open and System Road Densities (mi/mi^2) by Alternative and Subwatershed.

SUBWATERSHED	ALT. 1	ALT. 2	ALT. 3 and 4	ALT. 5
	Open/System	Open/System	Open/System	Open/System
Jack	3.6/4.5	3.63/4.5	3.6/4.3	3.5/4.3
Scarp	3.0/4.3	3.0/4.3	2.8/3.7	2.7/3.6
First	3.4/5.5	2.8/3.6	2.9/3.6	2.9/3.6
Suttle Lake	4.4/5.2	4.2/5.1	4.2/5.1	4.2/5.1
Cache	3.7/4.3	3.7/4.3	3.7/4.3	3.6/4.2
Indian Ford	2.8/4.0	2.8/4.0	2.8/4.0	2.8/4.0

Upon field observations and the establishment of stringent mitigation measures, there would be no expected measurable adverse effects to long-term watershed health from Alternative 2. Alternative 2 would reduce road densities (Table 4-16), but not as much as Alternatives 3, 4, and 5. Alternatives 3 and 4 would reduce the risk of large-scale watershed degradation due to wildfire, yet thinning of trees 16" to 21" would increase canopy openings, which would decrease interception and evapotranspiration, and may indirectly increase water yield. However, the risk of overland flow within the Metolius Basin Area is very rare on undisturbed sites due to overall level topography and highly porous volcanic soils. Alternatives 3 and 4 would reduce open and system road densities as shown in Table 4-16. Overall, Alternatives 3 and 4 would have long-term benefits toward stream shade, suspended sediment, stream temperature, dissolved oxygen, and overall watershed health. Alternative 5 poses more watershed risk than alternatives 1, 2, 3, and 4, yet would improve stand health and decrease the probability of watershed degradation due to catastrophic wildfire and roads that are unstable. From a hydrologic viewpoint, Alternative 5 may have more short-term risks than long-term benefits.

<u>Riparian Reserves and Fish Habitat</u>. Fire severity within riparian reserves would be reduced in all of the action alternatives (Table 4-23). Alternative 2 would reduce the number of riparian reserve acres at risk of stand replacement wildfire, but would not move forest stands toward non-lethal conditions as well as Alternatives 3, 4 and 5.

Table 4-23. Fire severity rating for stands within riparian reserves.

Fire Severity Class	Alternative 1	Alternative 2	Alternatives 3, 4 and 5
Non Lethal	30 (2%)	77 (4%)	329 (17%)
Mixed	937 (48%)	1514 (79%)	1262 (66%)
Stand Replacement	951 (50%)	326 (17%)	326 (17%)

Riparian roads would be reduced the most in the First Creek and Jack Creek subwatersheds (Table 4-24), and stream crossings by roads would be reduced the most in the First subwatershed (Table 4-25). These reductions in roads would contribute greatly in disconnecting the source of the fine sediments and the stream habitat. Spawning habitat for bull trout and redband trout would be protected through these actions. Roads with runoff into streams and stream crossing were identified in the Metolius Watershed Analysis as important restoration protects.

The alternatives 3 through 5 would treat the areas in between the forks of Lake Creek by thinning, burning and small tree thinning. The thinning treatments would be mitigated to reduce the effects of skid trails and rutting from equipment in the low overflow channels between the forks (see Chapter 2, Mitigation for discussion on actions and effectiveness). These areas may have more diverse vegetation and could be excluded from heavy thinning treatments.

Table 4-24. Riparian reserve road densities (all open and closed roads) for subwatersheds in the project area and the changes predicted under the action alternatives.

Subwatershed	Alternative 1 Riparian Road Density - miles/miles^2	Action Alternatives Riparian Road Density Miles/miles^2
Cache	5.0	2.9
First	4.4	2.6
Jack	3.4	2.3
Scarp	6.1	5.8
Suttle Lake	2.0	1.7
Total	**3.9**	**3.1**

Table 4-25. Number of stream crossings of roads in each alternative.

Subwatershed	Alternative 1	Alternatives 2 –5
Cache	4	2
First	31	20
Jack	3	2
Scarp	10	7
Suttle Lake	14	10
Total	62	41

303(d) Listed Streams. With the use of sufficiently stringent mitigation measures outlined in this document, vegetation treatments under the Action Alternatives are not expected to have a measurable effect on water temperature in Lake Creek, the limiting parameter for which the stream was listed. Prescribed fire and vegetation restoration would reduce the risk of catastrophic fire that could result in increases in sediment and stream temperature through the loss of riparian buffers. In addition, proposed reductions in miles of open road would reduce potential sediment delivery to the stream and improve water quality in the long term.

Wild And Scenic River.

The action alternatives would increase the protection of the Outstandingly Remarkable Values by reducing the risk of large-scale stand replacement wildfire that would damage the water quality and fish habitat along the river. Thinning treatments along the river corridor will be low impact by using hand thinning and slash disposal techniques. Fish habitat and recreational fisheries will be protected through setbacks, restrictions on the use of machinery, restrictions on slash disposal and road management directed at reducing runoff impacts to the river. Flows will not measurably change with any of the action alternatives. For further discussion, see the analysis of Wild and Scenic River consistency at the end of this section.

AQUATIC CONSERVATION STRATEGY

The Aquatic Conservation Strategy (ACS) as defined by the Northwest Forest Plan was developed to restore and maintain the ecological health of the watershed and the aquatic ecosystems contained within them. Management activities proposed for watersheds must meet the ACS objectives as specified in the Northwest Forest Plan (pages C31-C38). This section will discuss how each alternative either meets, or does not meet the intent of the Aquatic Conservation Strategy Objectives of the Northwest Forest Plan, and analyzes effects of the Alternatives and their compliance with the Aquatic Conservation Strategy for hydrologic functions and fisheries habitat.

Aquatic Conservation Strategy Objective 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Alternative 1. There would be no direct impact to the distribution, diversity and complexity of the unique habitats throughout the watershed over the short term. However, under no action, riparian forests would grow more dense without fire or thinning and risk of impacts from high intensity wildfire would increase, potentially reducing the diversity of riparian habitats and streambank complexity in the watershed over the long-term. Some riparian areas that are over stocked may selectively thin themselves, absent of a catastrophic event, however this would take many more years than active thinning. Under this Alternative, distribution, diversity and complexity would not be restored through aspen restoration, meadow enhancement, and road inactivation/decommissioning as in Alternatives 2, 3, 4, and 5.

On a watershed scale, stand replacement wildfire can reduce instream large wood, increase sediment and nutrients instream, increase water temperature and alter the timing and magnitude of peak flows (Campbell and Morris 1988, Helvey 1972 as cited by Gresswell 1999). Large scale wildfire can reduce habitat diversity and reduce pool habitat through the loss of large wood (Gresswell 1999, Minshall et al. 1989). In some cases, fish can benefit from a mosaic of postfire conditions within a watershed that can contribute to the recovery of fish populations (Gresswell 1999, Rieman and Clayton 1997). Fish populations of stream reaches completely absent of fish immediately following an intense wildfire recovered to near pre-fire levels within 1 to 3 years (Rieman et al. 1997). Rapid recovery of fish populations may be dependant on the availability of refuges and access for fish to avoid the immediate effects for a large scale wildfire (Rieman and Clayton 1997, Rieman et al. 1997). These refuges would appear to be present in the spring fed streams of the Metolius River and tributaries such as Jack Creek, Spring Creek, and Heising Spring.

Alternatives 2, 3, 4, and 5. The action alternatives would all reduce the risk to landscape scale wildfire through thinning and fuels reduction across the watershed. These treatments would protect the distribution, diversity and complexity of habitats associated within the watershed by focusing treatments in the uplands that would reduce the risk of large wildfires in the riparian reserves. Although treatments proposed may reduce riparian forest complexity in the short-term through thinning and reduction of naturally dense patches of trees, there would be a long term benefit of reducing large scale wildfires, which would benefit the watershed diversity and complexity.

All of these alternatives would meet Aquatic Conservation Strategy Objective 1. However, Alternative 5 has the highest potential for adverse hydrologic effects due to more ground disturbing activities. Aspen restoration and meadow enhancement would help restore distribution, diversity and complexity. These alternatives promote some degree of active treatment (thinning, underburning, inactivating roads, etc) to maintain and restore forest and watershed health, while reducing the possibility of watershed degradation due to catastrophic wildfire.

Aquatic Conservation Strategy Objective 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, upsweep areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Alternative 1. High densities of down wood and instream wood in the tributaries of the Metolius River would remain. As high tree mortality accumulates in the floodplains in the mixed conifer sites, habitat diversity in the floodplain and instream will increase slowly. This alterative allows natural processes to continue in the short term. In the long term, however, increasing densities of trees and brush in riparian reserves may increase the risk of large scale and intense wildfire conditions along streambanks and floodplains, thus putting connectivity at risk.

The no action alternative also would not restore areas that are currently degraded (i.e. along meadows, aspen stands, and other riparian areas). Also, inactivating and decommissioning roads would not occur. Hence, undersized and fish-barrier culverts would not be replaced under this project, and therefore, connectivity would not be restored.

Alternatives 2, 3, 4, and 5. The action alternatives decrease the risk of intense, large-scale wildfires impacting floodplains and fish habitat. A stand replacement fire along streams would interrupt riparian reserve function as connectivity corridors and shade for fish habitat. However, the action alternatives would reduce habitats for species that have requirements for more closed forest conditions in riparian reserves.

These alternatives would provide and promote some degree of connectivity within and between watersheds. This would primarily occur from inactivating/decommissioning roads, eliminating road crossings, and restoring meadows and aspen stands. Alternative 5 has the most harvest acres (which could degrade connectivity), yet also had the highest amount of decommissioned roads (which aids connectivity). The action alternatives also protect floodplain inundation and wetland function through management of roads and protection of riparian reserves.

Aquatic Conservation Strategy Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Alternative 1. This alternative would do little to restore watershed factors that may be degrading the physical integrity of aquatic systems. Roads located in riparian areas would continue to impact the floodplain and may continue or further degrade the physical integrity of the aquatic system. Increases in use of riparian areas and streambanks are expected as recreation use increases and no action would allow devegetated areas and roads to increase along the streams, especially Jack Creek and Lake Creek. Without reducing and/or eliminating road crossings, the physical integrity of the aquatic system would continue to be at risk of degradation.

Alternatives 2, 3, 4, and 5. These alternatives would meet ACS Objective 3. Inactivating and decommissioning roads, reducing road stream crossings and eliminating or replacing culverts would restore the physical integrity of the aquatic systems. Thinning adjacent areas would reduce risk of stand replacement wildfire. Streambank conditions will be protected in thinning operations through mitigations of setbacks for thinning, equipment restrictions and special fuels treatments. Alternative 5 has the highest potential for disturbing the physical integrity of the aquatic system from vegetation management actions resulting in a greater potential influence on the timing and magnitudes or peak flows, yet would also be the most effective in restoring the physical integrity where roads and culverts are influencing channel dynamics.

Aquatic Conservation Strategy Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Alternative 1. Water quality is in relatively good condition at this time, with the exception of Lake Creek, where warm temperatures are highly influenced by the presence of Suttle Lake. This Alternative maintains water quality in the Metolius River and its tributaries through current actions of reducing road impacts through maintenance and restriction of chemical uses permitted on National Forest Lands. No action would allow organic matter to build up in the soil, decompose and beneficial nutrients would leach into the streams. However, this alternative would do nothing to restore water quality (stream temperature) in the North and South Forks of Lake Creek, and would do nothing to prevent possible water quality degradation due to undersized culverts, wildfire and roads throughout the planning area.

Alternatives 2, 3, and 4. These action alternatives would reduce the risk of large-scale wildfire and may help continue the trend of very high water quality in the long term. Increased prescribed fire, especially in Alternative 2, may cause short-term increases in nutrients associated with ash from burned wood and brush. These ash sediments have been linked to very short pulses of phosphorous for a few weeks following slash burning, to long-term elevated nitrogen in streams of 5 years or more following a wildfire (Brown et al. 1973, Brass et al. 1996 as cited by Gresswell 1999). Nitrogen is a nutrient of concern because of the abundant background levels of phosphorous in the Metolius Basin streams (Houslet 2000). Since nitrogen is limiting, increases in nitrogen from prescribed burning may increase aquatic plant and algal growth in streams. This effect may be short term, however. The cold temperature of the Metolius River, Jack Creek and other springs may limit aquatic growth. However, growth of aquatic plants may not be as limited by temperature in Lake Creek, or First Creek.

These alternatives meet Aquatic Conservation Strategy Objective 4 by implementing activities (thinning, meadow enhancement, aspen restoration, riparian treatments, and road/culvert projects) that will aide in maintaining and restoring water quality.

Alternative 5. This alternative would reduce the risk of water quality degradation due to roads, however may also pose a higher risk than the other action Alternatives, with the large amount of ground disturbed. Small group openings and high mortality stand treatments pose a risk for sediment delivery to streams. Highly permeable soils may partially mitigate this concern.

Aquatic Conservation Strategy Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Alternative 1. This alternative does not currently meet Aquatic Conservation Strategy Objective 5, primarily due to sediment inputs from roads located along streams, and from undersized culverts. However, sediment input to streams in the Metolius Basin Project does not seem to be a large problem at this time.

Alternative 1 would not increase fine sediment, though existing streambank roads and camping areas would contribute some background level of erosion and routing of sediments into fish habitats. These may be considered minor under existing recreational traffic. A few roads and stream crossing will continue to add road runoff and fine sediments to spawning habitats primarily in the Lake and First Creek subwatersheds.

Alternatives 2, 3, 4, and 5. The action alternatives would reduce direct inputs of fine sediment through active road decommissioning and reductions of a few stream crossings. A total of 3.2 miles of riparian reserve roads would be decommissioned in all of the action alternatives (Table 4-18). Estimates from a sediment production model found that roads are responsible for most of the sediment production in the basin, even more so than the proposed thinning treatments (Soils specialist report, Craigg). Reduction in roads with active erosion problems would greatly reduce how much of those sediments reach fish habitats. Road reductions are focused on native surface roads that produce the highest level of sediment. Alternative 2 produces the least sediment from thinning but reduced the road network sediments the least. However, much of the connection of road borne sediments into streams would be from riparian reserve roads that would be treated in all alternatives, including alterative 2.

Much of the sediment production from thinning occurs within the first year, and decreases sharply in the next 2 to 3 years (see Soils Effects). This is considered a short term increase in sediment production and would be mitigated through stream set backs to operations in riparian reserves, light treatments using hand work and light machinery in riparian reserves and using existing fuel breaks and set back to prescribed fire.

Alternative 5 may pose the greatest risk of indirect sediment delivery to streams because of the amount of ground disturbing area, especially from small group openings and high mortality stand treatments.

Aquatic Conservation Strategy Objective 6: Maintain and restore in-stream flows sufficient to create and restore riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.

Alternative 1. This alternative would not restore road crossings where flow regimes have been altered.

Alternatives 2, 3, and 4. These Alternatives would meet Aquatic Conservation Strategy Objective 6 by way of inactivating/decommissioning roads and replacing and eliminating stream crossings.

Alternative 5. This alternative would restore locations where roads may be degrading instream flows, however group openings and high mortality treatments in First and Suttle Subwatersheds may lead to alterations in the timing, magnitude and duration of flows.

Aquatic Conservation Strategy Objective 7: Maintain and restore timing, variability, and duration of flood plain inundation and water table elevation in meadows and wetlands.

Alternative 1. This alternative would not meet Aquatic Conservation Strategy Objective 7, as no meadow enhancement activities would occur and no road mitigations would occur within riparian areas.

Alternatives 2, 3, and 4. These alternatives would comply with Aquatic Conservation Strategy Objective 7 by hydrologically improving 35 acres of meadow. These alternatives would also mitigate known adverse road/stream interactions. All other activities are not expected to have measurable adverse effects to the timing, variability, and duration of floodplain inundation.

Alternative 5. This alternative will restore timing, variability, and duration of flood plain inundation and water table elevation through road activities, however may also pose a risk of changing timing, duration and variability of flood events due to canopy opening harvest treatments.

Aquatic Conservation Strategy Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Alternative 1. This Alternative maintains off channel habitats for bull trout and redband trout through no action. Side channels and alcove pools will continue to be formed with no treatments of thinning or road work. Wood will continue to fall into the streams to create such habitats. However, under Alternative 1 the number of large trees in riparian reserves may decrease. Existing stands with moderate to high densities of trees would continue to grow at a slow rate and not move from small to large tree stands very rapidly. This alternative would not have meadow enhancement activities and no road mitigations would occur within riparian areas.

Alternatives 2, 3, 4, and 5. These alternatives would comply with Aquatic Conservation Strategy Objective 8 by implementing 35 acres of meadow enhancement, 10 acres of aspen restoration, and thinning.

The action alternatives would move some stands toward large tree character slightly faster than the no action alternative. The action alternatives would maintain off channel habitat by protecting streamside forests and reducing risk to stand replacement wildfire. Upland treatments would reduce the risk of wildfire spreading into the riparian reserve and may reduce the intensity in drier sites were riparian thinning had been conducted. Roads decommissioning would reduce fine sediment introductions and protect streambanks as crossing. These projects would protect some side channels and alcove pools in the area of the treatments.

Aquatic Conservation Strategy Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Alternative 1. Habitat conditions are fairly stable, and species populations would not be impacted from vegetation management disturbances to riparian reserves and streambank areas. Populations of bull trout and redband trout have increased under the existing condition in recent years and there is reason to expect that these stable levels will be maintained. However, this alternative would not have meadow enhancement, and limited riparian activities would occur to restore habitat. Native plant habitats would remain in the short-term, but may be at risk of severe impacts from wildfire disturbance.

Alternatives 2, 3, 4, and 5. These alternatives would comply with Aquatic Conservation Strategy Objective 9 by implementing 35 acres of meadow enhancement and 10 acres of aspen restoration. All other activities are not expected to have measurable adverse effects on habitat.

The action alternatives would maintain populations of bull trout, redband trout, tail frog and the cascades apatanian caddisfly. Bull trout habitat would be protected through riparian thinning mitigations such as set backs from fish bearing streams, hand thinning and piling along fish bearing streams and use of light equipment along intermittent tributaries. Road reductions would reduce fine sediment runoff into spawning habitat of both bull trout and redband trout. Shade and water quality would be protected for the caddisfly and tail frogs. Tailed frog need cobble substrate as cover for tadpoles. These alternatives would not change the abundance of large gravel or cobble significantly. Habitats for native plants typical in ponderosa pine and mixed conifer dry riparian areas would persist, and risk of loss would be reduced under the action Alternatives. Mitigation would protect sensitive habitats during project implementation.

Discussion: With the compliance to all standards and guidelines listed in the Aquatic Conservation Strategy for Riparian Reserves and proposed mitigation measures (Chapter 2), Alternatives 2, 3, and 4 are not expected to have any measurable adverse effects to water quality and hydrologic function. Alternative 5 would do a lot in an effort to promote high watershed health, yet would also pose a risk for degrading water quality and hydrologic function, due to having the most ground disturbing treatments. Alternative 1 would not restore or promote water quality and hydrologic function.

Even though all standards and guidelines would be complied with, cumulative effects from past activities may have indirect effects to the aquatic environment. Part of the focus of this project is to improve upon watershed health and mitigate any potential adverse hydrologic effects that may exist. The no action alternative would not improve the overall watershed health.

Cumulative Effects

All proposed vegetative, fuels, and road treatments were incorporated into the cumulative watershed effects model to index the possible effects of each alternative (Table 4-20). This model is only an index of watershed health, and does not incorporate specific watershed characteristics such as soil type(s), climate, aspect, elevation, etc. Therefore field observations and consultation with other specialists play an important role in determining the possible effects.

Results show that First and Suttle Lake Subwatersheds have relatively high percent of openings, based on the model. In locations with low soil porosity, one might expect increased overland flow and possibly a change in the timing, duration, and frequency of peak flow. However, soils are generally very porous in the Metolius Basin Planning Area (see soils report), and overland flow is very rare. .

Land-use activities can modify drainage patterns through road construction, soil characteristics from compaction, and water yields from vegetation manipulation. Land use can cause on-site cumulative effects, which result directly from changes in environmental parameters, or off-site effects that are the result of changes in watershed transport processes.

Equivalent Clearcut Area (ECA) methodology, a watershed index of snowmelt and evapotranspiration rates relative to baseline condition where tree stands are considered fully canopied, was used to determine where cumulative watershed effects might occur. Stream channel condition and field observation were also used to verify actual health of the system.

The influential factor in computing ECA is the amount of area altered by human actions or natural fires, defined in terms of the density of remaining vegetation. Each harvest activity is assigned a clearcut equivalent factor, which is multiplied by the area disturbed to arrive at an ECA value for each subwatershed (Bettinger, et al., 1998). For example, clearcuts and roads are generally given a CEF value of 1.0, and partial cuts are given a CEF from 0.0 to 1.0, depending on the density of residual vegetation. The more open the unit is, the more it emulates the snowmelt and evapotranspiration rates of a similar stand that is clearcut. A recovery rate factor derived from local recovery rates (50 years for the Metolius Basin project area) is included to achieve the final ECA determination.

ECAs were calculated, by subwatershed, using past and proposed harvest activities, roads, and urban areas. ECAs on private lands within the watershed where no data was available were assessed using aerial photos and quad maps.

There is debate about the application of ECA model in an area like the Metolius Basin with minimal slope and high porous volcanic soils. However, local and regional specialists agreed using ECA in this context provides a general indicator of watershed health. However, stream channel condition and field observation should be used to verify actual health of the system (Personal Communication with McCammon, 1999).

This cumulative effects analysis included an evaluation of the Cache Mountain Fire that occurred in July and August of 2002. This fire burned through two subwatersheds that pertain to the Metolius Basin Project Area. The Cache and Suttle Lake Subwatersheds had a total of 3,084 and 112 acres burnt, respectively. The level of fire severity on the soil resource was considered to determine the clearcut equivalency (high soil impacts = ECA of 1, moderate = 0.7, and low = 0.1) There was very little high severity burn on the soil, so the effects of the fire on the initial ECA values were minimal. ECA values in the Cache Subwatershed increased by approximately 2 points, while the values in the Suttle Lake Subwatershed increased by approximately 0.2 points.

Table 4-26 displays the results of the cumulative watershed effects analysis, as a function of the existing ECA value, (no action alternative) by subwatershed. Canyon Subwatershed was not analyzed as 45 acres (0.2%) of this subwatershed is in the project area. Measurable adverse effects, due to treatment(s) that take place within this 45-acre area, would not be detectible with current technology.

Table 4-26. Percent Equivalent Clearcut Area by Alternative and Subwatershed.

SUBWATERSHED	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
Jack	33.1	33.2	37.2	37.4	38.7
Scarp	31.0	32.1	38.9	39.2	40.6
First	43.8	44.2	56.3	57.6	58.4
Suttle Lake*	40.5	40.6	42.7	42.8	43.4
Cache*	31.1	31.2	31.5	31.6	31.8
Indian Ford*	33.9	33.9	33.9	33.9	34.0

* These subwatersheds were previously analyzed in the McCache Project.

Research by Troendle and Olson (1993), Troendle and King (1985, 1987), and Troendle (1983) found that there is no one specific threshold as to how much a watershed can be clearcut before a change in peak flow can be documented. ECA thresholds, in relation to changes in peak flow, have been documented as low as 25% and as high as 40%. Proposed actions under the alternatives are expected to increase ECAs from 0.1 in Indian Ford subwatershed to 14.6% in First Creek subwatershed (which already had somewhat high values). However, this threshold is highly dependant upon the physical characteristics of the watershed, and ECA is just one measure of possible watershed effects. Upon field visits and conversation with the district soil scientist and fisheries biologist, First and Suttle Lake subwatersheds are currently showing some sign of stream degradation (downcutting and lateral scour in locations). Other subwatersheds are currently not showing sign of degradation, however may be on the upper limit of the threshold. Inactivating and decommissioning roads would aide in decreasing the probability of watershed degradation. The results from this cumulative effects analysis do **not** indicate a potential significant effect in watershed condition from the proposed actions.

Alternative 5 would have the greatest increase in short-term cumulative watershed effects, followed by Alternative 4, 3 and then Alternative 2, though only a minor amount. *Long-term* (> 60 years) watershed effects are predicted to be reduced.

Reducing net evapotranspiration by harvest of vegetation, in areas with soils that have high infiltrations rates, can also lead to increased water yield through ground water systems (Manga, 1997). The increased yield in groundwater typically takes days to months to “surface” in springs or stream systems, if not stored subsurface. Water yield increase due to groundwater flow, generally is not a concern as some water is stored and/or redistributed subsurface.

Troendle (1999) revealed that the change in duration and timing of peak flows has been shown to create channel erosion and loss of channel stability. However, the physical characteristics of a watershed will determine whether or not increased water yield will increase sediment production. In the case of the Metolius Basin Planning Area, soils are very porous, and overland flow is very rare.

Another potential cumulative effect relates to effects of heavy recreation use on streams, water quality and fish habitat. Some streambank disturbance occurs along the perennial tributary streams where dispersed recreational camping occurs. This is primarily concentrated along Jack Creek and Lake Creek. Developed recreation sites along the Metolius River occupy 84 acres in the project area, or 18% of the riparian reserve. These areas vary in condition, but a few sites are declining in vegetative cover, primarily in sites with dry soils such as Camp Sherman Campground. Riverside Campground is recovering after a change of management to walk-in camping only. Riverside Campground has more riparian floodplain species along the river. Trail use is high in the Camp Sherman area and some trails are receiving heavy trail maintenance to limit the number of redundant trails and to direct traffic off of steep dry slopes.

Metolius Wild and Scenic River Plan Consistency

An analysis of the proposed actions under the Metolius Basin Forest Management Project Alternatives was conducted to determine consistency with management recommendations in the Metolius Wild and Scenic River Plan (1996). The Wild and Scenic River Plan amended the Deschutes National Forest Land and Resource Management Plan. The classification of the river within the project area is “recreational”.

The Outstandingly Remarkable Values (ORVs), identified in the Metolius River Resource Assessment (1992), associated with the Metolius Wild and Scenic River Corridor are ecological (including vegetation), water quality, fisheries, wildlife, scenery, recreation, cultural, and geology. The actions proposed under the Metolius Basin Forest Management Project would directly effect ecological (vegetation) and wildfire (habitat), and may indirectly affect the remainder of the ORVs, except for geology, which will not be addressed in this analysis.

Consistency was assessed in terms of whether proposed actions under the Metolius Basin Forest Management Project are within the standards and guidelines for the ORVs listed in the Wild and Scenic River Plan.

Ecological ORV

The Metolius Wild and Scenic River Plan provides standards and guidelines for vegetation management to meet Wild and Scenic River objectives. Actions proposed under this project are intended to create conditions favorable for the development of large tree structure in the Wild and Scenic River corridor, reduce the risk of severe disturbance that would result in a major loss of late-successional and riparian habitat, and to move the condition of existing stands that are unstable toward more resilient conditions.

The Wild and Scenic River Plan uses the Limits of Acceptable Change as a measure of when conditions are not within those desirable for meeting the goals of the plan, or as a trigger for when action is needed. Actions are proposed under this project within the Wild and Scenic River corridor because vegetation conditions in certain stands are not within the Limits of Acceptable Change (pgs. 20-41), indicated primarily by high stand density, fuel loads and arrangements, and species composition. In this project, landscape areas and then individual stands were evaluated to determine whether their existing condition exceeded recommended thresholds. Proposed vegetation and fuel treatments generally move stand conditions toward desired range of conditions.

Standards and Guidelines for Vegetation Management

Standards and guidelines are provided for upland and riparian vegetation, and then for vegetation in general within the Metolius Wild and Scenic River corridor. Following is a summary of each Standard and Guideline, and how the proposed actions in the Metolius Basin Forest Management project address it.

<u>Upland Vegetation</u>

Restore upland vegetation in areas that are outside the range of desired conditions as defined by the limits of acceptable change (MTEV-1).

Desired forest conditions include:

- Healthy stands as defined by the ability to tolerate stress and recover from disturbances; dominated by open stands of large trees, usually Douglas-fir, ponderosa pine, or western larch; and have understories of appropriate densities necessary to supply future replacement trees as well as structural and habitat diversity
    - *In the Metolius Basin Forest Vegetation Project, thinning high densities stands would improve the ability of the stands to tolerate stress and recover from disturbances, and would create more open conditions where large trees can develop. Thinning would be "from below" which entails removal of trees, beginning with the smallest and moving toward larger trees, until the desired/prescribed basal area (density) is met for the stand, so larger trees would remain in the corridor. However, a range of trees sizes would be left in each stand so that future replacement trees are available.*
- Numbers of snags and large down logs sufficient to provide viability for dependent species

  - *No snags or down logs would be removed to meet forest health and fuel reduction objectives within the Wild and Scenic River corridor. There may be some incidental loss of snags considered hazardous to thinning and burning operations, and there may be some loss of down wood during burning operations, but larger diameter material is expected to be sustained in the low intensity underburns. Mitigation measures (Chapter 2) address protecting existing snags along river corridors, and providing 100% maximum population potential, where it exists.*
- Canopies adjacent to the river of sufficient density to maintain stream temperature requirements of benefiting resources.
  - *Mitigation measures propose (Chapter 2):*
    - *Limiting thinning within the riparian reserve of the Metolius River to 12" diameter (Alternative 2) to 16" diameter (Alternatives 3-5) trees,*
    - *No thinning would occur within 30' of the river bank, and to*
    - *Maintain shade along the river*

<u>Riparian Vegetation</u>

Restore riparian vegetation in areas that are outside the range of desired conditions as defined by the limits of acceptable change (MTEV-2).

Desired forest conditions include:

- Vegetation communities dominated by shrubs and trees that overhang the stream and provide shade sufficient to maintain stream temperatures
  - *Mitigation measures propose (Chapter 2):*
    - *Limiting thinning within the riparian reserve of the Metolius River to 12" diameter (Alternative 2) to 16" diameter (Alternatives 3-5) trees,*
    - *No thinning would occur within 30' of the river bank, and to*
    - *Maintain shade along the river*
- Forbs and grasses are predominately native species
  - *Activities which open up the stands (thinning and underburning) are expected to improve conditions for native forbs and grasses*
- Islands, meadows, and small patches of early seral vegetation are present
  - *Meadow enhancement (removal of encroaching conifers) is proposed in the Allingham meadow (22 acres) along the river under all Action Alternatives*
- Large logs and other woody material are in or directly adjacent to the stream.
  - *No snags or down wood would be removed.*

Vegetation Management

Prescribed Fire is the preferred means of restoring desired vegetative conditions (MTEV-3)

- *Prescribed fire is proposed on about 2,143 acres (about 96% of the Metolius Wild and Scenic River corridor within the project area) under all of the Action Alternatives. Alternative 2 proposes to use prescribed fire as a primary vegetation treatment the most (Table 4-27), while the acres proposed for small tree thinning would be underburned as a follow-up treatment. Under Alternatives 3, 4 and 5, prescribed fire would only be used as a primary treatment of vegetation on approximately 163 acres, though would be used as a follow-up treatment on approximately1981 acres. All of the action Alternatives would help create conditions where fire could be re-introduced into the Wild and Scenic River corridor to maintain desired vegetation conditions in the future.*

Timber harvest, salvage, harvest of commercial forest products, and firewood cutting are only used to restore the desired vegetation conditions, enable the safe and efficient use of prescribed fire, or protect surrounding stands where they are at risk of high intensity disturbance (MTEV-6 and MTEV-9)

- *Proposed vegetation treatments (Table 4-27) are intended to meet these guidelines (see Purpose and Need, Chapter 1).*

Heavy equipment may only be used in riparian areas for restoration of riparian resources provided impacts to soil, water, or vegetation can be mitigated and immediately restored (MTEV-7).

- *Mitigation measures (Chapter 2) states that no ground based mechanized equipment in riparian areas would be allowed, except where specified to promote Aquatic Conservation Strategy Objectives. Small machinery (4x4 All Terrain Vehicles) or light equipment on frozen ground or snow may be used if approved by the hydrologist, soil scientist or fisheries biologist.*

Table 4-27. Acres of Vegetation and Fuel Treatments Proposed within the Metolius Wild and Scenic River Corridor, by Alternative.

Type of Treatment	Alternative 2	Alternatives 3 and 4	Alternative 5
No Treatment	66	66	66
Thinning trees 8" diameter and less in defensible space	167	167	167
Thinning trees 12" diameter and less	506	506	506
Thinning trees up to larger diameters*	0	1307	1030
Larch Restoration (thinning only - no group openings within riparian reserve)	0	0	278
Underburn (as a primary vegetation treatment. The majority of the thinning	1472	163	163

would be followed up with either underburning or burning of piled fuels)			
Meadow Restoration	22	22	22
Total Acres	**2232**	**2232**	**2232**

* Inside Riparian Reserves: Thinning up to 12" diameter in Alternative 5, and up to 16" diameter in Alternatives 3and 4. Outside Riparian Reserves: Thinning up to 16" in Alternative 3, 21" in Alternative 4 and no specified diameter in Alternative 5, though removal of trees larger than 21" would be an exception.

Fisheries and Water Quality ORVs

The Metolius Wild and Scenic River Plan standards and guidelines for fish populations and habitat address the need for direct habitat restoration and control of recreation activities that may affect habitat. The Metolius Basin Forest Management Project does not propose these types of actions. The primary fish habitat standard and guideline affected by this project is presence of large wood, both in the river and as future recruitment of down wood. Standards and guidelines that relate to protection of riparian stands from disturbance (severe wildfire, insect or disease impacts), which would affect fish habitat, are addressed under Riparian Vegetation (see above).

There are no specific standards and guidelines for water quality, though standards and guidelines for other activities are expected to address water quality concerns. For further discussion on fisheries effects, see the analysis on the Aquatic Conservation Strategy objectives, Chapter 4.

Applicable Standards and Guidelines for Fish and Habitat

Restoration of fish habitat is primarily through natural processes of infall and distribution (MTFH-1).

- *Thinning and burning within the corridor is intended to promote the development of large tree structure, which would benefit future down wood. No down wood would be removed from the river corridor. See the discussion under Riparian Vegetation, for proposed mitigation measures that would meet the desired future condition of riparian vegetation.*

Wildlife ORV

The Metolius Wild and Scenic River Plan standards and guidelines for wildlife and habitat primarily address the importance of snags and down wood

Applicable Standards and Guidelines for Wildlife and Habitat

Management of hazard trees within campgrounds (MTWH-1).

- *Hazard trees would be removed following the Region 6 Guidelines.*

Provide snag amounts to meet 100% maximum population potential for dependent species, where they exist (MTWH-2 and MTWH-3)

- *No snags would be removed to meet forest health and fuel reduction objectives within the Wild and Scenic River corridor. There may be some incidental loss of snags considered hazardous to thinning and burning operations. Mitigation measures (Chapter 2) address protecting existing snags along river corridors, and providing 100% maximum population potential, where it exists.*

Retain down logs in developed areas (MTWH-4). Outside of developed areas, maintain a minimum of 120 linear feet/acre, where they exist (MTWH-5). Down logs managed for habitat are a minimum of 15" diameter and 12 ft long (MTWH-6).

- *No down logs would be removed within the Wild and Scenic River corridor. There is expected to be some loss of down wood during burning operations, but larger diameter material is expected to be sustained in the low intensity under burns. Currently, in many stands across the project area, down log levels in the larger size classes are below those recommended (see discussion under Snags and Down Logs, Chapter 3).*

Scenery ORV

Relevant Metolius Wild and Scenic River Plan standards and guidelines for scenery relate to maintaining a natural appearing landscape characterized by the desired vegetative conditions.

Applicable Standards and Guidelines for Scenery

The Scenic Integrity Objective for the Recreational river segment is High (MTSQ-1).

- *The proposed actions are expected to enhance the scenic quality of forested stands and meadows within the Metolius Wild and Scenic River corridor (see analysis under Scenic Resources, Chapter 4). Thinning and underburning would open up forested areas so that the desired park-like stands would be more visible. Large trees would also be more visible, and conditions for retaining large structure would improve as stand densities are reduced..*

Recreation ORV

The Metolius Basin Forest Management Project would not directly affect recreation within the Metolius Wild and Scenic River corridor. However, management of vegetation with and around developed sites as well as throughout the corridor where dispersed recreation occurs, would enhance the scenic quality and reduce the risk of wildfire impacts to recreationists and recreation settings. As such, proposed actions would be consistent with desired conditions for recreation.

Cultural ORV

Relevant Metolius Wild and Scenic River Plan standards and guidelines for heritage values relate to protecting prehistoric and historic sites.

Applicable Standards and Guidelines for Heritage

Significant prehistoric and historic resources are managed to avoid damage or detrimental change. Where damage or change cannot be mitigated, rehabilitated or avoided, data recovery and recording is undertaken (MTCV-1).

- *Mitigation measures discussed in Chapter 2 provide guidance on protecting known prehistoric and historic resources, and propose actions to avoid potential impacts.*

In conclusion, the proposed actions were found to be consistent with standards and guidelines in he Metolius Wild and Scenic River Plan

Key Issue #4: Soil

The other part to Key Issue #4, Water Quality, is addressed in the previous section of this Chapter.

Important Interactions

The potential effects, both physical and biological changes in soil productivity, are primarily a function of the types of disturbance, the timing and location of activities, and the inherent properties of the various soils within affected areas. Direct effects occur at essentially the same time and place as the actions that cause soil disturbance, such as soil displacement and compaction from equipment operations. Indirect effects occur sometime after or some distance away from the initial disturbance, such as increased runoff and downslope erosion from previously compacted areas.

Timber Management

Harvest equipment with low pounds/sq. inch pressure on the soil can mitigate soil impacts

The effects of ground-based logging disturbances on soil productivity vary based on the types of silvicultural treatments used, the duration of activities and the amount of ground disturbance with each entry. Soil productivity monitoring on the forest has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment. The amount of soil impacts is dependent on a number of variables including existing conditions prior to entry, the ability to reuse previously established landings and skid trail systems, types of equipment, amount of material removed from treatment areas, operator experience, and contract administration. In general, silvicultural practices that treat more acres and avoid frequent entries into the same activity areas reduce soil impacts over the rotation of a stand and maintain higher soil quality.

Restoration treatments (e.g. thinning prescriptions) generally have fewer initial impacts because of lighter treatments, but incremental impacts can be expected from future entries. Soil monitoring has shown that thinning treatments generally cause less than 20 percent detrimental soil disturbance from the first entry, due mainly to the low volume harvested from stands (Deschutes Soil Monitoring Reports 1996 to 1998). However, it is the cumulative effect of repeated entries over a long period of time that has the greatest potential of lowering soil productivity on forest sites (Land and Resource Management Plan, Appendix 14). Existing log landings and primary skid trails should be used, wherever possible, to limit the extent of new disturbance in activity areas. Based on soil monitoring data and the fact that not all existing logging facilities can be reutilized due to their orientation within units, each successive entry for thinning treatments would likely cause a 5 to 10 percent increase in detrimental soil conditions (Craigg, 2000). For the estimated percentages of detrimental soil conditions in Table 4-XX, an average increase of 7 percent in additional skid trails and landings was used for mechanical thinning treatments.

Shelterwood harvest prescriptions cause the most immediate soil impacts because equipment use is typically more intensive throughout activity areas. Under Alternative 5, shelterwood regeneration treatments would be implemented on approximately 296 acres of dead and declining stands. Soil monitoring has shown that regeneration treatments often meet or only slightly exceed 20 percent detrimental soil disturbance from the first entry. In comparison to thinning, shelterwood regeneration treatments usually require more skid trails per unit area to access specific trees scattered throughout a stand. Although existing landings and skid trails would be used wherever possible, a 10 percent increase in detrimental soil conditions would likely result from additional landings and skid trails that would be necessary for this type of harvest system. In activity areas treated with regeneration prescriptions, the 10 percent increase was used for estimating percentages of detrimental soil conditions in Table 4-30. Due to the extended amount of time before the next entry, temporary roads, log landings and primary skid trails need to be reclaimed following their use in regeneration harvest units.

The development of temporary roads, log landings, and skid trail networks detrimentally disturb soil properties and remove land from production for as long as these facilities remain in use. Under all action alternatives, there would be no new construction of roads that would remain as classified system roads. The amount of land committed to logging facilities would be limited to the minimum necessary for management needs. Alternative 5 would require the maximum amount of soil disturbance to access harvest units and facilitate ground-based logging activities. Alternatives 3 and 4 would require slightly less commitment of the soil resource, and Alternative 2 emphasizes less intensive management that requires the least amount of soil disturbance associated with new logging facilities. Management requirements, mitigation measures, and Timber BMPs would be applied to limit the extent of soil disturbance and control surface erosion on logging facilities.

The spacing of skid trails determines how much area will be impacted by different logging systems. Tractor logging on random skid trail patterns can cause excessive soil disturbance over more surface area, whereas the use of planned and designated skid trail locations would minimize the area of detrimental soil disturbance. On moderately flat ground in small timber, research found the following skid trail spacings to yield the corresponding areas in skid trails (Froelich, 1981, Garland, 1983). The skid trail pattern is one of generally parallel trails of various spacings.

Table 4-28. Spacing of skid trails and relative impacts.

Spacing	Percent of Area in Skid Trails
Harvester's Choice*	20%
100 feet	11%
150 feet	7%
250 feet	4%

* Harvester's choice = about 50 feet

Based on harvest history, various silvicultural treatments have occurred within the project area prior to Forest Plan direction. Since the majority of these previously managed areas currently have detrimental soil conditions that exceed 20 percent of activity areas, estimates for existing skid trail networks, created prior to 1990, assume spacing distances of 50 feet or approximately 20 percent of the unit area. Matching the most efficient harvest machinery to the type of material being harvested can result in wider skid trail spacings and reduced soil impacts (Craigg, 2000). Based on personal communications with experienced timber sale administrators, management practices have improved since the establishment of Forest Plan standards and guidelines. Therefore, estimates for existing skid trail systems that were created between 1990 and 1993 assume spacing distances of 75 feet (14 % of the unit area). Since 1994, main skid trails have typically been spaced 100 feet apart (11 % of the unit area).

Most of the soil compaction on a skid trail occurs during the first few passes of a machine. At least sixty percent of the increase in bulk density on a well-used skid trail (20 plus passes) occurs after the first 3 to 5 passes (McNabb, Froehlich, 1983). There would be no additional compaction from ground-based skidding when equipment is restricted to designated areas, such as roads, log landings, and main skid trails. Where trees are scattered and logs can be skidded with only 1 or 2 equipment passes, the depth of compaction is shallow (2 to 4 inches) and bulk density increases generally do not qualify as a detrimental condition. The direct effects of shallow compaction between main skid trails and away from landings are expected to return to undisturbed density levels in the short-term (less than 5 years) through natural means (i.e., frost heave, freeze-thaw and wet-dry cycles). Options for preventing or reducing the potential for deep compaction damage are contained in Best Management Practices and mitigation measures (Chapter 2).

Increasing the spacing between skid trails can mitigate soil impacts

The amount of disturbed area associated with log landings would be limited to the minimum necessary for management needs. Existing landings are reutilized whenever possible. On average, one landing (100 feet by 100 feet) is used per 10 acres of harvest (Forest average). This equates to about 2.3 percent of the harvest unit acreage. Disturbed area calculations for log landings was added to acreage estimates for skid trails and roads to determine the overall disturbance in management facilities. Percentages of detrimental soil conditions are displayed in Table 4-28.

All action alternatives propose various silvicultural and fuel reduction treatments on landtypes that contain sensitive soil areas (Figure 4-9). Affected acres are displayed by action alternative and concern category in Table 4-29. The potential for soil puddling and compaction damage is minimized by controlling equipment operations in areas that contain wet soils and/or high water tables. Soil displacement from harvest activities occurs when soil organic layers are scraped away by equipment or gouged by logs during skidding operations. This type of soil disturbance is most likely to occur on the steeper portions of harvest units. Slope limitations for equipment use would be enforced to minimize the effects of soil displacement and reduce the potential for erosion damage. Activity areas proposed for mechanical treatments on sensitive soil areas are identified by unit number in a site-specific mitigation measure (Chapter 2).

Table 4-29. Activity Area (acres) proposed on Sensitive Soil Areas within the Metolius Basin project area (NRCS, Upper Deschutes Soil Survey, 1999).

Management Concern	Alternative 2	Alternative 3/4	Alternative 5
Wet Soil Areas with High Water Tables	2,865	2,889	2,959
Slopes greater than 30 percent	509	774	774

Proper locations and design standards can mitigate potentially adverse effects to soils in sensitive areas. Temporary roads and logging facilities would be located on well-drained sites, upslope from potentially wet areas. Appropriate buffers would be applied to ensure protection of wetlands, seeps, springs and riparian areas. In areas with steeper slopes, surface erosion on cut-and-fill slopes on necessary temporary roads or constructed skid trails can usually be controlled by implementing appropriate Best Management Practices and standard revegetation practices.

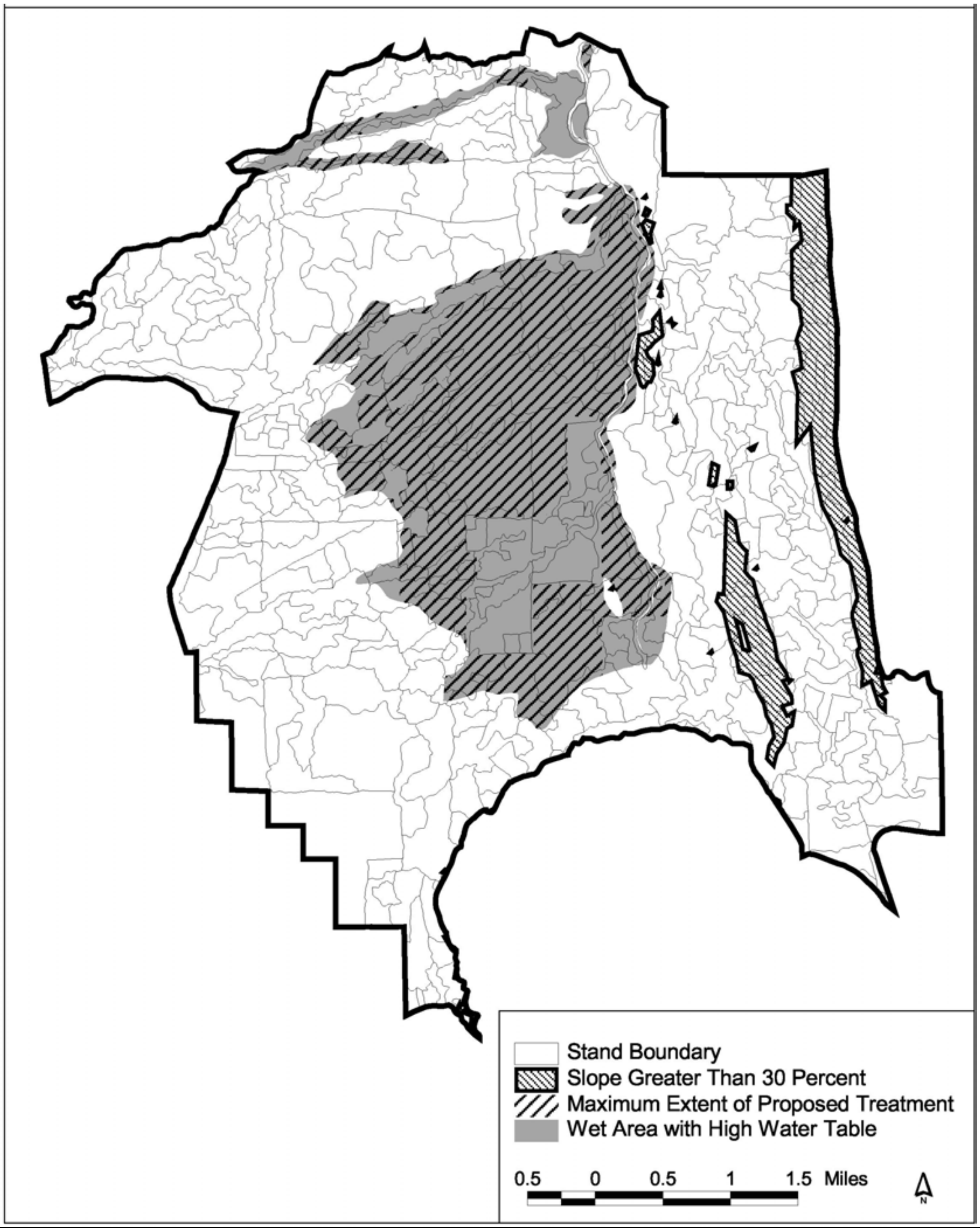


Figure 4-9. Activity Areas that Overlap Sensitive Soil Areas (Maximum Extent of Proposed Treatment within the Metolius Basin Project Area).

Post-Harvest Fuel Treatments

The proposed management activities include various combinations of slash disposal and fuel reduction treatments. As with ground-based logging systems, the use of machinery during post-harvest activities can reduce site productivity through compaction damage and removal of soil organic layers. Impacts from machine piling operations add cumulatively to other soil disturbances caused during logging operations. Therefore, fuel treatments other than machine piling should be used whenever reasonable management options exist. The same mitigation and operational guidelines (Chapter 2) regarding harvest activities can be used to limit the extent of surface disturbance and reduce the potential for soil productivity losses. The same designated skid trail systems used during yarding should be used as primary travel routes. Care must be taken to avoid moving topsoil into piles.

The effects of fuel reduction treatments also depend on the amount of woody material and organic matter retained or removed from affected sites. Care must be taken during post-harvest activities to retain enough, evenly distributed, coarse woody debris (greater than 3 inches in diameter) to ensure long-term nutrient cycling on treated sites. Prescribed burn plans would comply with all applicable Forest Plan standards and guidelines and BMPs prior to initiation of prescribed fire treatments (Chapter 2, Mitigation Measures). Soil moisture guidelines would be included to minimize the risk of intense fire and adverse impacts to soil and water resources.

Ground-level burn severity from slash pile burning and prescribed underburns depend on fuel type, fuel density, and soil moisture. Severely burned soil is a detrimental soil condition that usually results from high-intensity surface fires of long duration. The direct effects of fire on soils can reduce site productivity and interfere with the hydrologic function through nutrient losses, consumption of organic materials, changes in microorganism populations, and reduced infiltration rates due to the creation of water-repellent layers in the soil. The burning of slash piles may cause severe burning of the soil surface under piles because heat is concentrated in a localized area. Soil heating is reduced when the surface layer is moist, so piles would be burned following periods of precipitation. Most logging slash is concentrated into piles on log landings and main skid trails, and these sites already have detrimental soil conditions prior to burning. Prescribed underburns in timber stands would be accomplished under controlled conditions that minimize damage to standing trees and remove only a portion of the protective surface cover. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not cause detrimental changes in soil properties. Under all action alternatives, the extent of severely burned soils would be negligible because burning would occur over moist soils. There is greater potential for beneficial effects that reduce the potential for wild land fires and increase nutrient availability in burned areas.

The hand pile and burn method would not cause cumulative increases in detrimental soil conditions because machinery would not displace or compact the soil. Burning small concentrations of woody material is not expected to result in severely burned soils. This method would be used on sensitive soils, riparian reserves and other upland sites. Increases in available nutrients in localized areas may benefit site productivity and vegetative growth.

Machine piling on main skid trails would have a minimal effect on the overall extent of detrimentally disturbed soil because equipment would operate off the same trails used during yarding operations, and these sites would have already been impacted prior to the fuel treatment entry.

Machine piling off designated skid trails and landings would add cumulatively to other soil disturbances caused during harvest. Post activity review would determine the need for machine piling operations in random locations of activity areas. This method would only be used where machine piling on trails could not be employed and it would not be used on sensitive soils, steep slopes or riparian reserves. The use of low ground-pressure machines would minimize impacts to the soil resource from these operations. It is expected that 1 or 2 equipment passes over accumulated slash would not cause deep detrimental compaction. However, it is estimated that the combination of mechanical harvest and machine piling operations would cause a 15 percent increase in detrimental soil conditions over existing conditions. This amount was used for estimating percentages of detrimental soil conditions in Table 4-30.

Prescribed underburns can be used on steep topography or where the soil is too wet for machine piling. However, burning must be conducted under carefully controlled conditions to minimize the risk of intense burns that remove too much organic matter and cause accelerated erosion. Underburns of light-to-moderate burn intensities would result in nutrient releases and short-term benefits to site productivity over larger areas of ground.

Brush mowing activities would not cause detrimental soil conditions. These activities have been monitored and results show that increases in soil displacement and compaction are minimal (Soil Monitoring Report, 1997).

Decommissioning (Obliteration) Treatments of Roads and Logging Facilities

Restoration treatments of unneeded roads and logging facilities result in beneficial effects by improving the hydrologic function and productivity on detrimentally disturbed soils. Treatments such as subsoiling loosen compacted soil and increase soil porosity to provide improved infiltration rates that reduce surface runoff. In the past decade, subsoiling has been used on the forest to reduce the amount of compacted soil and improve soil conditions in activity areas (Craigg, 2000). These treatment acres were deducted in disturbed area estimates in Table 4-30 because committed soils are reclaimed back to a productive status.

Effects of Alternative 1

Detrimental Soil Disturbance

Under Alternative 1 (No Action), the management activities proposed in this document would not take place. No additional land would be removed from production to build roads or other management facilities. Detrimental soil disturbance would not increase from ground-disturbing project activities. Although disturbed soils would continue to recover naturally from the effects of past management, the current percentages of detrimental soil disturbance (Table 4-30) associated with roads and logging facilities would remain unchanged for an extended period of time.

It is unlikely that decommissioning (obliteration) treatments of unneeded roads and logging facilities would be accomplished to reduce existing amounts of detrimental soil conditions. Surface erosion on existing roads and management facilities will gradually decrease as vegetation becomes established on disturbed sites. Erosion rates within the project area would not change appreciably unless catastrophic wild land fires occur in dense stands of timber that contain dead and dying trees.

Coarse Woody Debris

In the short term, the amount of coarse woody debris and surface organic matter would gradually increase or remain the same. In the long term, fuel accumulations would increase the risk for intense wild land fires (see Fire/Fuels Management section) and potential adverse effects to soil productivity.

Project Design and Mitigation

Under Alternative 1 (No Action), there would be no cumulative increase in detrimental soil conditions from project activities. Therefore, implementation of project design features and mitigation of project-related impacts would not be necessary.

Effects of Alternatives 2, 3, 4, and 5

The types and locations of soil disturbance vary by alternative, but the nature of the effects to the soil resource is similar for project activities that use ground-based equipment to accomplish management objectives. The same types of mechanical treatments would be used on similar landtypes, but the overall extent and locations of new soil disturbance would be somewhat different for each alternative.

The proposed management activities include thinning forest stands, mowing brush, use of prescribed fire and decommissioning (obliteration) treatments on certain roads and logging facilities (i.e., primary skid trails and log landings) which would no longer be needed for future management. Activity areas proposed for ground-based harvest systems and mechanical fuel reduction treatments have the greatest probability of incurring soil displacement and compaction damage that would result in detrimental changes to soil properties. Management practices that disturb more acres with heavy equipment would potentially cause greater amounts of detrimental soil conditions within activity areas.

The best available information about the proposed actions (Chapter 2, Alternative Descriptions and Tables 2-3 to 2-7) was used in conjunction with the location of activities to analyze the potential effects on the soil resource. Past harvest history, research references, Regional and Forest Plan guidance, field observations, and personal communications with experienced timber sale administrators were used to estimate existing and predicted amounts of detrimental soil conditions. Table 4-30 displays percentages of detrimental soil conditions for each of the action alternatives and planned activity areas associated with this project.

Project design and the level of success in implementing the management requirements, mitigation measures and Best Management Practices (Chapter 2) determine the overall magnitude of soil disturbance within individual activity areas. The decommissioning of unneeded roads and logging facilities would result in beneficial effects to the soil resource by improving the hydrologic function and productivity on disturbed soils.

Detrimental Soil Disturbance

Alternative 2 would cause the least amount of new soil disturbance to achieve management objectives. Due to the density of trees that would be left following this type of treatment, frequent entries into the same stands would likely be needed to achieve management objectives and this could result in greater cumulative soil impacts over time. It is anticipated that portions of 1,131 acres would be affected by mechanical thinning, and approximately 514 acres would be affected by machine piling operations (Chapter 2, Alternative Descriptions). Management requirements and mitigation measures would be implemented during and following project activities to avoid or reduce detrimental impacts to the soil resource. This alternative proposes approximately 20 miles (29 acres) of road decommissioning on local classified roads, which would reduce the amount of detrimentally disturbed soil in some activity areas. Of the 50 activity areas proposed for mechanical treatments, it is estimated that 16 activity areas (32 percent) would have percentages of detrimental soil disturbance that maintain existing conditions, 5 activity areas (10 percent) would increase levels above existing conditions but detrimental soil conditions would remain within the Forest Plan standard of 20 percent, and 29 activity areas (58 percent) would result in a net improvement in soil quality following implementation of project and restoration activities (Table 4-1).

Under Alternatives 3 and 4 it is anticipated that portions of 7,332 acres would be affected by ground-based logging systems, and approximately 2,078 acres would be affected by machine piling operations (Chapter 2, Alternative Descriptions). Since these alternatives disturb more acres than Alternative 2, mitigation would be required over more acres to improve detrimentally disturbed soils on temporary roads, log landings and main skid trails. These alternatives propose approximately 38 miles (57 acres) of road decommissioning on local classified roads, which would reduce the amount of detrimentally disturbed soil in some activity areas. Of the 203 activity areas proposed for mechanical treatments, it is estimated that 44 activity areas (22 percent) would have percentages of detrimental soil disturbance that maintain existing conditions, 21 activity areas (10 percent) would increase levels above existing conditions but detrimental soil conditions would remain within the Forest Plan standard of 20 percent, and 138 activity areas (68 percent) would result in a net improvement in soil quality following implementation of project and restoration activities (Table 4-30).

Although alternative 5 would have the greatest effect in reducing the risk of intense heating of the soil surface from intense wild land fires, it would also cause the greatest amount of new soil disturbance to achieve management objectives. It is anticipated that portions of 7,720 acres would be affected by ground-based logging systems, and approximately 2,413 acres would be affected by machine piling operations (Chapter 2, Alternative Descriptions). Alternative 5 would require the most mitigation (restoration) of project impacts to maintain or improve soil productivity. This alternative proposes approximately 45 miles (67 acres) of road decommissioning on local classified roads, which would reduce the amount of detrimentally disturbed soil in some activity areas. Of the 238 activity areas proposed for mechanical treatments, it is estimated that 47 activity areas (20 percent) would have percentages of detrimental soil disturbance that maintain existing conditions, 26 activity areas (11 percent) would increase levels above existing conditions but detrimental soil conditions would remain within the Forest Plan standard of 20 percent, and 165 activity areas (69 percent) would result in a net improvement in soil quality following implementation of project and restoration activities (Table 4-30).

Coarse Woody Debris

The coarse woody debris measure was evaluated qualitatively based on the probable success of implementing the Forest Plan Management Requirement and Mitigation Measure (Chapter 2) that would include soil moisture guidelines in prescribed burn plans. All action alternatives would retain sufficient amounts of coarse woody debris, where is currently exists, to provide ground cover protection and a long-term source of nutrients on treated sites (the Metolius Basin project area is deficient in down logs according to standards for habitat needs).

In addition to existing natural fuels, enough broken branches and unusable stemwood would be generated from harvest activities to provide a sufficient amount of coarse woody debris for maintaining soil productivity. The majority of the project area has a moderate to high fire hazard due to increased fuel loadings over natural levels (see Fire/Fuel Management section). It is expected that previously managed sites have accumulated additional coarse woody debris materials as dead tree boles have fallen to the ground over time. Although site preparation and fuels reduction treatments would potentially reduce coarse woody debris by burning logging slash and natural fuels, burning during moist conditions would help ensure adequate retention of coarse woody debris. Low-intensity fire does not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994).

Project Design and Mitigation

All action alternatives would cause some unavoidable ground disturbances in random locations, but the majority of detrimental soil disturbances would be confined to known locations in heavy use areas (i.e., roads, log landings, and main skid trails) that can be reclaimed when these facilities are no longer needed for future management.

In order to protect or maintain soil conditions at acceptable levels, the projects would include provisions for mitigation of ground disturbances where activities are expected to cause resource damage exceeding Regional and Forest Plan standards and guidelines. For activity areas that have already been impacted by previous management, project plans would include options for avoiding, reducing, and mitigating cumulative levels of existing and predicted amounts of new soil disturbance from project activities. Various references and Forest Service Handbook direction were used as guidance to determine project design and mitigation needs for the Metolius Basin Forest Management project. These information sources are based on the best available technical data, past monitoring of similar activities on representative soils, Forest Plan direction, and nationally and regionally approved soil quality standards and guidelines. The Management Requirements, Mitigation Measures and Best Management Practices (BMPs) contained in Chapter 2 are incorporated into all action alternatives to avoid or reduce adverse impacts from project activities.

All reasonable BMPs for Timber Management, Fuels Management, and Road Systems would be applied to limit the extent of soil disturbance and control erosion on roads and logging facilities. These BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Oregon Department of Forestry evaluated more than 3,000 individual practices and determined a 98 percent compliance rate for BMP implementation, with 5 percent of these practices exceeding forest practice rules (National Council for Air and Stream Improvement, 1999).

Mitigation measures and operational guidelines were developed to address site-specific concerns that were not sufficiently addressed by the more general Management Requirements and BMPs. Impacts in sensitive soil areas (i.e., wet soils with high water tables, slopes greater than 30 percent) would be minimized by implementing highly effective mitigation measures designed to limit equipment operations to locations and ground conditions that are less susceptible to detrimental impacts. Individual activity areas are identified by unit numbers in site-specific mitigation measures (Chapter 2). Operational guidelines are included in a mitigation measure to provide options for limiting the amount of surface area covered by logging facilities and reducing the potential for detrimental impacts. Examples include skid-trail spacing distances, use of planned and designated skid trail systems, limiting the amount of traffic off designated areas, and operating equipment over frozen ground or a sufficient amount of compacted snow. Less surface area committed to logging facilities would result in fewer acres of restoration treatments needed to improve detrimental soil conditions within activity areas. The successful application of these management practices would lower the percentages of detrimental soil disturbance estimated in Table 4-30 and help move conditions toward a net improvement in soil quality.

Options for reclamation treatments are included in a mitigation measure that would reduce the amount of soil committed to temporary roads, landings, and primary skid trails. These practices are designed to restore and stabilize disturbed sites where soil impacts are expected to exceed 20 percent of the unit area. The reclamation of unneeded roads and logging facilities would result in long-term beneficial effects by improving the hydrologic function and productivity on detrimentally disturbed soils.

Prescribed burn plans would comply with all applicable Forest Plan standards and guidelines and BMPs prior to initiation of prescribed fire treatments (Chapter 2, Mitigation Measures). Soil moisture guidelines would be included to minimize the risk of intense fire and adverse impacts to soil and water resources.

Table 4-30. Estimates of Detrimental Soil Disturbance from Mechanical Treatments by Activity Acres (units) and Action Alternatives.

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
1		T/MP	T/MP	4.3	4.3	100%	26%	26%	41%	41%	26%	0.0	20%	0.8	20%	0.8
2		T/MP	T/MP	11.4	11.4	100%	24%	24%	39%	39%	24%	0.0	20%	2.1	20%	2.1
3		T/MP	T/MP	7.6	7.6	100%	23%	23%	38%	38%	23%	0.0	20%	1.4	20%	1.4
4		T/MP	T/MP	14.6	14.6	100%	25%	25%	40%	40%	24%	0.2	20%	3.2	19%	3.2
5		T/MP	T/MP	23.9	23.9	100%	22%	22%	37%	37%	22%	0.0	22%	3.6	22%	3.6
6					9.1	0%	2%	2%	2%	2%	0%	0.2	0%	0.2	0%	0.2
7		T/MP	T/MP	11.7	11.7	100%	25%	25%	40%	40%	23%	0.2	18%	2.6	18%	2.6
8					28.5	0%	13%	13%	13%	13%	11%	0.5	11%	0.5	11%	0.5
9					30.1	0%	2%	2%	2%	2%	1%	0.4	1%	0.4	1%	0.5
16	MP	MP	MP	24.4	27.5	89%	23%	32%	32%	32%	23%	2.6	23%	2.6	23%	2.6
17	T	T	T	25.6	25.6	100.0%	24%	31%	31%	31%	22%	2.4	20%	2.9	20%	2.9
11095		T/MP	T/MP	16.5	16.5	100%	3%	3%	18%	18%	3%	0.0	18%	0.0	16%	0.3
11098	T	T	T	6.7	6.7	100%	28%	35%	35%	35%	20%	1.1	20%	1.1	20%	1.1
11588	MP	MP	MP	3.6	3.6	100%	23%	33%	33%	33%	20%	0.5	20%	0.5	20%	0.5
11590	MP	MP	MP	99.8	105.7	94%	24%	33%	33%	33%	24%	9.6	23%	10.2	23%	10.2
11597		T	T	8.4	8.4	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
11598					22.4	0%	25%	25%	25%	25%	25%	0.0	22%	0.6	24%	0.2
11599		T	T	13.7	13.7	100%	9%	9%	16%	16%	9%	0.0	14%	0.3	14%	0.2
11600		T/MP	T/MP	11.7	11.7	100%	28%	28%	43%	43%	28%	0.0	20%	2.8	20%	2.8
57014		T/MP	T/MP	43.3	47.1	92%	27%	27%	41%	41%	27%	0.0	27%	12.7	27%	12.7
57015			S/MP	12.2	12.2	100%	26%	26%	26%	41%	26%	0.0	26%	0.0	20%	2.5

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated	Unit	Percent	Existing Detrimental Soil	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5	Acres	Acres	Treated	Conditions (%)	Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
57025			S/MP	4.8	6.1	79%	27%	27%	27%	39%	27%	0.0	27%	0.0	20%	1.1
57027		T/MP	T/MP	30.8	30.8	100%	25%	25%	40%	40%	25%	0.0	25%	4.6	25%	4.6
57028			S/MP	24.5	24.5	100%	23%	23%	23%	38%	23%	0.0	23%	0.0	23%	3.7
57031			S/MP	10.8	10.8	100%	30%	30%	30%	45%	30%	0.0	30%	0.0	20%	2.8
57033			S/MP	4.5	4.5	100%	27%	27%	27%	42%	27%	0.0	27%	0.0	20%	1.1
57035		T/MP	T/MP	45.7	45.7	100%	24%	24%	39%	39%	24%	0.0	24%	6.9	24%	6.9
57036			S/MP	14.1	31.1	45%	23%	23%	23%	30%	23%	0.0	23%	0.0	23%	2.2
57040			S/MP	10.3	12.1	85%	24%	24%	24%	36%	24%	0.0	24%	0.0	20%	1.9
57058		T/MP	T/MP	62.6	81.4	77%	26%	26%	37%	37%	25%	0.5	25%	9.4	25%	9.4
57148			S/MP	21.1	21.9	96%	23%	23%	23%	38%	23%	0.0	23%	0.0	20%	4.0
57507		T	T	2.9	10.4	28%	28%	28%	30%	30%	28%	0.0	20%	1.0	19%	1.1
57509	MP	MP	MP	1.4	7.6	18%	23%	25%	25%	25%	20%	0.4	20%	0.4	20%	0.4
57513		T/MP	T/MP	0.7	5.9	12%	25%	25%	27%	27%	25%	0.0	20%	0.4	20%	0.4
57515		T	T	54.7	55.4	99%	23%	23%	30%	30%	23%	0.0	23%	3.8	23%	3.8
57516		T/MP	T/MP	9.7	10.3	94%	28%	28%	42%	42%	28%	0.0	20%	2.2	20%	2.2
57517		T/MP	T/MP	11.1	11.1	100%	23%	23%	38%	38%	22%	0.1	19%	2.1	18%	2.2
57518		T/MP	T/MP	17.6	17.6	100%	25%	25%	40%	40%	25%	0.0	20%	3.6	20%	3.6
57522		T/MP	T/MP	8.7	8.7	100%	23%	23%	38%	38%	23%	0.0	20%	1.6	20%	1.6
57523			S/MP	14.2	14.2	100%	21%	21%	21%	36%	20%	0.1	20%	0.1	19%	2.3
57525		T/MP	T/MP	36.7	36.7	100%	22%	22%	37%	37%	21%	0.3	19%	6.6	19%	6.6
57526		T	T	27.1	27.1	100%	27%	27%	34%	34%	27%	0.1	25%	2.5	25%	2.5
57527		T	T	143.6	143.6	100%	23%	23%	30%	30%	22%	1.2	22%	11.3	22%	11.3
57528		T/MP	T/MP	31.9	31.9	100%	25%	25%	40%	40%	25%	0.0	23%	5.4	23%	5.4

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
57529			S/MP	31.8	31.8	100%	25%	25%	25%	40%	25%	0.0	25%	0.0	23%	5.5
57530		T/MP	T/MP	12.3	12.3	100%	23%	23%	38%	38%	23%	0.0	20%	2.2	19%	2.3
57532		T	T	38.4	38.4	100%	27%	27%	34%	34%	27%	0.0	25%	3.4	25%	3.4
57533		T	T	104.3	104.3	100%	23%	23%	30%	30%	22%	0.8	22%	8.1	22%	8.1
57534		T	T	27.8	40.3	69%	26%	26%	31%	31%	25%	0.4	23%	3.2	23%	3.2
57538			S	8.2	10.1	81%	22%	22%	22%	30%	22%	0.0	22%	0.0	20%	1.0
57539					12.1	0%	23%	23%	23%	23%	21%	0.2	21%	0.2	21%	0.2
57540					9.4	0%	21%	21%	21%	21%	19%	0.1	19%	0.1	19%	0.1
57542					13.5	0%	17%	17%	17%	17%	15%	0.3	15%	0.3	15%	0.3
57549		T	T	23	23.0	100%	23%	23%	30%	30%	23%	0.1	20%	2.2	20%	2.2
57550		T	T	28.2	28.2	100%	24%	24%	31%	31%	23%	0.2	21%	2.7	21%	2.7
57551			S	26.8	26.8	100%	25%	25%	25%	35%	23%	0.5	23%	0.5	21%	3.8
57553					14.2	0%	29%	29%	29%	29%	28%	0.2	28%	0.2	28%	0.2
57554					50.0	0%	24%	24%	24%	24%	23%	0.7	23%	0.7	23%	0.7
57559					15.9	0%	22%	22%	22%	22%	21%	0.2	21%	0.2	21%	0.2
57561					40.9	0%	22%	22%	22%	22%	21%	0.3	21%	0.3	21%	0.3
57562		T/MP	T/MP	1.2	1.7	71%	0%	0%	11%	11%	0%	0.0	11%	0.0	11%	0.0
57565		T/MP	T/MP	67.5	115.2	59%	23%	23%	32%	32%	23%	0.0	23%	10.3	23%	10.3
57568			S/MP	0.6	1.9	32%	3%	3%	3%	8%	3%	0.0	3%	0.0	8%	0.0
57570		T/MP	T/MP	6.5	8.2	79%	18%	18%	30%	30%	16%	0.1	19%	0.9	19%	0.9
57575		T/MP	T/MP	63.1	63.1	100%	24%	24%	39%	39%	24%	0.0	24%	9.5	24%	9.5
57576		T/MP	T/MP	59	59.0	100%	25%	25%	40%	40%	25%	0.0	25%	8.8	25%	8.8
57577		T/MP	T/MP	85.3	85.3	100%	23%	23%	38%	38%	23%	0.0	23%	12.7	23%	12.7

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
57615		T/MP	T/MP	17.9	17.9	100%	24%	24%	39%	39%	23%	0.1	19%	3.5	19%	3.5
57616		T/MP	T/MP	15.7	15.7	100%	2%	2%	17%	17%	2%	0.0	17%	0.0	17%	0.0
57620			S/MP	2	13.3	15%	24%	24%	24%	26%	23%	0.1	19%	0.9	19%	0.9
57621		T/MP	T/MP	3.5	14.5	24%	23%	23%	27%	27%	23%	0.0	20%	1.1	20%	1.1
57955		T	T	21.4	21.4	100%	25%	25%	32%	32%	25%	0.0	20%	2.5	19%	2.8
57956					10.1	0%	30%	30%	30%	30%	30%	0.0	30%	0.0	26%	0.4
57958		T	T	36.5	41.8	87%	23%	23%	29%	29%	23%	0.0	19%	4.1	20%	3.7
57959		T	T	73.8	95.9	77%	24%	24%	29%	29%	24%	0.0	24%	4.8	24%	5.1
57963		T	T	14.6	19.0	77%	21%	21%	27%	27%	21%	0.0	18%	1.7	19%	1.4
57964		T	T	44.8	50.8	88%	25%	25%	31%	31%	25%	0.0	25%	3.0	25%	3.0
57965		T	T	24	24.0	100%	23%	23%	30%	30%	23%	0.0	21%	2.2	20%	2.3
57966		T	T	11.1	11.1	100%	23%	23%	30%	30%	23%	0.0	20%	1.1	19%	1.2
57967		T	T	10.2	10.2	100%	23%	23%	30%	30%	23%	0.0	20%	1.0	20%	1.0
57968		T	T	54.4	58.9	92%	25%	25%	31%	31%	25%	0.1	25%	3.6	25%	3.8
57969		T	T	125	125.0	100%	25%	25%	32%	32%	25%	0.2	25%	9.0	25%	9.1
57970		T	T	106.5	106.5	100%	24%	24%	31%	31%	24%	0.1	24%	7.6	24%	7.7
57971		T	T	72.6	72.6	100%	25%	25%	32%	32%	23%	1.5	23%	6.6	23%	6.6
57972		T	T	69.1	69.1	100%	24%	24%	31%	31%	23%	0.8	21%	7.1	23%	5.6
57973		T	T	87.4	87.4	100%	23%	23%	30%	30%	22%	0.7	22%	6.8	22%	6.8
57974		T	T/MP	61.9	61.9	100%	26%	26%	33%	41%	25%	0.8	25%	5.2	25%	10.1
57975		T	T	191.1	191.1	100%	24%	24%	31%	31%	23%	1.9	23%	15.3	23%	15.3
57976		T/MP	T/MP	28.4	36.7	77%	25%	25%	36%	36%	24%	0.6	18%	6.5	21%	5.4
57977					29.8	0%	23%	23%	23%	23%	23%	0.3	22%	0.3	22%	0.3

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
57979		T/MP	T/MP	8.6	25.6	34%	26%	26%	31%	31%	26%	0.0	24%	1.9	24%	1.9
57981			S/MP	37.5	44.9	84%	25%	25%	25%	38%	25%	0.2	25%	0.2	25%	6.0
57982		T	T/MP	5.2	25.8	20%	23%	23%	24%	26%	22%	0.2	20%	0.9	20%	1.5
57983		T	T/MP	13.9	19.1	73%	24%	24%	29%	35%	24%	0.0	20%	1.7	20%	2.9
57985		T	T/MP	25.1	25.1	100%	24%	24%	31%	39%	24%	0.1	19%	3.1	22%	3.9
57986			S/MP	44.5	62.4	71%	24%	24%	24%	35%	23%	0.9	23%	0.9	23%	7.7
57987		T	T/MP	54.9	54.9	100%	23%	23%	30%	38%	23%	0.0	23%	3.8	23%	6.6
57988		T	T	31.3	31.3	100%	27%	27%	34%	34%	27%	0.0	25%	2.7	25%	2.7
57990		T	T/MP	22.2	22.2	100%	21%	21%	28%	36%	21%	0.0	20%	1.8	20%	3.5
57991		T	T/MP	18.9	18.9	100%	25%	25%	32%	40%	25%	0.0	20%	2.3	20%	3.6
57992		T	T/MP	30.6	30.6	100%	26%	26%	33%	41%	26%	0.0	24%	2.8	24%	5.3
57993		T	T	46.1	46.1	100%	22%	22%	29%	29%	22%	0.0	20%	4.1	20%	4.1
57995		T	T	62.6	62.6	100%	23%	23%	30%	30%	23%	0.0	23%	4.4	23%	4.4
57996		T	T	24.8	24.8	100%	25%	25%	32%	32%	25%	0.1	23%	2.3	23%	2.3
57997		T	T	17.9	23.0	78%	24%	24%	29%	29%	24%	0.0	20%	2.1	20%	2.1
57998	T	T	T	33.1	33.1	100%	26%	33%	33%	33%	24%	3.0	23%	3.4	23%	3.2
58000	T	T	T	37	37.0	100%	25%	32%	32%	32%	22%	3.5	23%	3.3	22%	3.5
58001					28.5	0%	24%	24%	24%	24%	23%	0.0	23%	0.0	23%	0.0
58003		T	T	18	18.5	97%	22%	22%	29%	29%	22%	0.0	20%	1.9	19%	1.9
58004		T	T/MP	60.7	64.5	94%	24%	24%	30%	38%	24%	0.0	24%	3.9	24%	9.3
58005		T	T/MP	6.3	26.4	24%	24%	24%	26%	28%	24%	0.0	22%	1.1	22%	1.6
58006		T	T/MP	7.1	9.0	79%	15%	15%	21%	27%	15%	0.0	20%	0.2	20%	1.1
58007	T	T	T	5.4	18.7	29%	23%	25%	25%	25%	20%	1.0	20%	1.0	20%	1.0

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
58008		T	T/MP	5.9	19.0	31%	23%	23%	25%	28%	23%	0.0	20%	1.0	20%	1.5
58009		T	T/MP	0.9	12.3	7%	22%	22%	23%	24%	20%	0.2	18%	0.7	18%	0.7
58015	T	T	T	40.6	66.0	62%	23%	27%	27%	27%	23%	2.8	23%	2.8	23%	2.8
58016		T	T/MP	1.4	16.7	8%	21%	21%	22%	22%	21%	0.1	18%	0.6	19%	0.4
58017	MP		MP	20.1	43.8	46%	23%	28%	23%	28%	21%	3.1	23%	0.0	21%	3.1
58019			S/MP	0.6	16.1	4%	23%	23%	23%	24%	23%	0.1	23%	0.1	19%	0.7
58020		T	T	111.8	111.8	100%	25%	25%	32%	32%	25%	0.2	25%	8.0	25%	8.0
58021		T	T	36.3	40.1	91%	23%	23%	29%	29%	23%	0.1	21%	3.3	21%	3.3
58022		T	T	8.9	8.9	100%	23%	23%	30%	30%	23%	0.0	20%	0.9	20%	0.9
58023	MP		MP	24.2	34.2	71%	24%	31%	24%	31%	22%	3.0	24%	0.0	21%	3.2
58025		T	T/MP	93.6	93.6	100%	24%	24%	31%	39%	24%	0.0	24%	6.5	24%	11.4
58026					67.2	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	24%	0.4
58027	MP		MP	16.4	107.6	15%	25%	26%	25%	26%	25%	1.1	25%	0.0	25%	1.5
58034	T	T	T	62.4	62.4	100%	27%	34%	34%	34%	27%	4.4	27%	4.4	27%	4.4
58041	MP		MP	13.5	24.9	54%	25%	30%	25%	30%	23%	1.7	25%	0.0	23%	1.7
58042	T	T	T	9.7	9.7	100%	26%	33%	33%	33%	20%	1.3	20%	1.3	20%	1.3
58043	T	T	T	4.2	4.2	100%	16%	23%	23%	23%	20%	0.1	20%	0.1	20%	0.1
58357		T	T	56.3	69.3	81%	25%	25%	30%	30%	25%	0.0	23%	4.8	23%	4.8
58360					22.9	0%	27%	27%	27%	27%	27%	0.0	24%	0.8	24%	0.7
58361		T	T	4.9	4.9	100%	24%	24%	31%	31%	24%	0.0	0%	1.6	18%	0.7
58362		T	T	30.7	49.2	62%	26%	26%	30%	30%	26%	0.0	26%	2.0	25%	2.6
58363		T	T	8.8	14.1	62%	24%	24%	28%	28%	24%	0.0	20%	1.1	20%	1.1
58367		T	T	12.9	13.9	93%	24%	24%	31%	31%	24%	0.0	20%	1.5	20%	1.5

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated	Unit	Percent	Existing Detrimental Soil	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5	Acres	Acres	Treated	Conditions (%)	Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
58368		T	T	3	3.0	100%	26%	26%	33%	33%	26%	0.0	20%	0.4	20%	0.4
58369		T	T	20.5	20.5	100%	29%	29%	36%	36%	29%	0.0	17%	4.1	19%	3.6
58370		T	T	12.1	12.1	100%	25%	25%	32%	32%	25%	0.0	13%	2.2	18%	1.6
58371		T	T	16.1	16.1	100%	26%	26%	33%	33%	26%	0.0	20%	2.1	19%	2.2
58372		T	T	32.8	50.7	65%	25%	25%	30%	30%	25%	0.0	24%	3.3	24%	3.0
58374		T	T	65.5	65.5	100%	25%	25%	32%	32%	25%	0.0	23%	5.7	24%	5.3
58375					27.3	0%	27%	27%	27%	27%	27%	0.0	27%	0.0	26%	0.4
58377		T	T	22.2	22.2	100%	23%	23%	30%	30%	23%	0.0	20%	2.2	20%	2.2
58378		T	T	49.6	49.6	100%	28%	28%	35%	35%	27%	0.5	26%	4.7	27%	4.0
58379		T	T	118.7	118.7	100%	24%	24%	31%	31%	23%	1.0	23%	9.3	23%	9.3
58380		T	T	67.9	67.9	100%	24%	24%	31%	31%	22%	1.2	22%	6.0	22%	6.0
58381		T	T	161.2	181.0	89%	25%	25%	31%	31%	25%	0.7	25%	11.5	25%	11.5
58384		T	T	66.6	66.6	100%	25%	25%	32%	32%	23%	1.3	23%	5.9	23%	5.9
58386		T	T/MP	24.8	24.8	100%	23%	23%	30%	38%	23%	0.1	20%	2.4	21%	2.3
58387		T	T	121.6	121.6	100%	25%	25%	32%	32%	25%	0.2	25%	8.7	25%	8.7
58388		T	T	206	206.0	100%	24%	24%	31%	31%	23%	2.6	24%	16.0	23%	17.1
58389		T	T/MP	69.9	69.9	100%	23%	23%	30%	38%	23%	0.0	23%	4.9	23%	8.4
58390		T	T	24	24.0	100%	24%	24%	31%	31%	24%	0.0	22%	2.1	22%	2.1
58391		T	T/MP	200.6	220.9	91%	25%	25%	31%	38%	25%	0.7	23%	17.7	25%	29.4
58392		T	T/MP	32.4	32.4	100%	24%	24%	31%	39%	24%	0.0	22%	2.9	22%	5.2
58393		T	T/MP	120.1	151.7	79%	22%	22%	27%	33%	22%	0.0	22%	7.6	22%	16.8
58395					21.7	0%	27%	27%	27%	27%	26%	0.2	26%	0.2	26%	0.2
58396		T	T/MP	166.8	199.3	84%	25%	25%	31%	38%	25%	0.2	25%	12.1	25%	26.0

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile Alt 2	Alt 3_4	Alt 5	Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment Alt 2	Alt 3_4	Alt 5	Estimated Detrimental Soil Conditions (%/acres) After Restoration Alt 2		Alt 3_4		Alt 5	
58397	MP		MP	5.3	11.9	45%	0%	4%	0%	4%	4%	0.0	0%	0.0	4%	0.0
58402		T	T	12.4	12.4	100%	23%	23%	30%	30%	23%	0.0	20%	1.2	20%	1.2
58404	MP		MP	1.8	4.4	41%	1%	5%	1%	5%	5%	0.0	1%	0.0	5%	0.0
58409		T	T	21	21.0	100%	26%	26%	33%	33%	26%	0.0	20%	2.7	20%	2.7
58410		T	T	203.4	203.4	100%	23%	23%	30%	30%	23%	0.3	23%	15.0	23%	15.1
58417		T	T	53.7	53.7	100%	25%	25%	32%	32%	25%	0.2	25%	4.2	24%	4.2
58419	T	T	T	98.3	98.3	100%	26%	33%	33%	33%	26%	7.2	25%	7.6	25%	7.7
58420	MP		MP	10.6	53.4	20%	23%	25%	23%	25%	23%	1.4	23%	0.0	23%	1.4
58422	MP		MP	40	40.0	100%	25%	35%	25%	35%	23%	4.8	25%	0.0	23%	4.9
58423	MP		MP	33.8	33.8	100%	29%	39%	29%	39%	27%	4.1	29%	0.0	26%	4.4
58424		T	T	27.2	27.2	100%	26%	26%	33%	33%	26%	0.0	24%	2.4	23%	2.7
58425	MP		MP	70	70.0	100%	26%	36%	26%	36%	26%	7.0	26%	0.0	25%	7.6
58430		T	T/MP	25.8	25.8	100%	27%	27%	34%	42%	27%	0.0	25%	2.3	23%	5.0
58431	MP		MP	43.6	43.6	100%	25%	35%	25%	35%	25%	4.4	25%	0.0	23%	5.1
58432					10.2	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	23%	0.2
58435					16.5	0%	22%	22%	22%	22%	22%	0.0	22%	0.0	21%	0.1
58719		T	T	44.3	53.3	83%	23%	23%	29%	29%	23%	0.0	23%	3.2	23%	3.2
58724		T	T	15.7	15.7	100%	5%	5%	12%	12%	5%	0.0	12%	0.0	12%	0.0
58730		T	T	130.1	145.0	90%	25%	25%	31%	31%	25%	0.4	24%	9.6	25%	9.3
58731	MP		MP	3.1	19.2	16%	23%	25%	23%	25%	20%	1.0	23%	0.0	20%	1.0
58733		T	T	17.8	17.8	100%	25%	25%	32%	32%	25%	0.0	20%	2.2	19%	2.4
58734					31.0	0%	27%	27%	27%	27%	27%	0.0	27%	0.0	26%	0.3
58735		T	T	15	32.0	47%	5%	5%	8%	8%	5%	0.0	8%	0.0	8%	0.0

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
58737		T	T	30.6	30.6	100%	0%	0%	7%	7%	0%	0.0	5%	0.6	6%	0.2
58738	T	T	T	67.7	67.7	100%	24%	31%	31%	31%	24%	4.8	24%	4.8	24%	5.0
58739					20.0	0%	24%	24%	24%	24%	24%	0.0	22%	0.4	23%	0.2
58742		T	T	17.3	18.5	94%	23%	23%	29%	29%	23%	0.0	20%	1.7	20%	1.7
58743		T	T	12.3	12.3	100%	25%	25%	32%	32%	25%	0.0	20%	1.4	20%	1.4
58744		T	T/MP	20.8	35.7	58%	24%	24%	28%	33%	23%	0.2	21%	2.4	21%	3.8
58747		T	T	15.2	15.2	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
58748					41.0	0%	25%	25%	25%	25%	25%	0.0	22%	1.3	23%	0.9
58749					16.4	0%	26%	26%	26%	26%	26%	0.0	26%	0.0	25%	0.2
58750		T	T	36.1	36.1	100%	23%	23%	30%	30%	23%	0.0	21%	3.2	21%	3.2
58753		T	T	19.8	19.8	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
58754		T	T	31.3	31.3	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
58755					61.9	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	24%	0.3
58757		T	T	13.2	13.2	100%	28%	28%	35%	35%	28%	0.0	18%	2.3	19%	2.1
58759					22.2	0%	26%	26%	26%	26%	26%	0.0	26%	0.0	24%	0.3
58760	T	T	T	177.2	180.8	98%	5%	11%	11%	11%	11%	0.0	10%	1.2	11%	0.7
58761	T	T	T	122.2	158.4	77%	2%	7%	7%	7%	7%	0.0	7%	0.0	6%	0.9
58764		T	T	0.1	2.4	4%	0%	0%	0%	0%	0%	0.0	0%	0.0	0%	0.0
58765		T	T	55.3	61.3	90%	22%	22%	29%	29%	22%	0.0	22%	4.3	22%	4.3
58766	MP		MP	2	31.7	6%	21%	22%	21%	22%	20%	0.6	21%	0.0	20%	0.6
58767		T	T	12.9	12.9	100%	25%	25%	32%	32%	25%	0.0	20%	1.6	19%	1.7
58768					17.6	0%	24%	24%	24%	24%	24%	0.0	18%	1.1	23%	0.2
58769		T	T	95.3	95.3	100%	23%	23%	30%	30%	23%	0.0	21%	8.6	21%	8.2

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
58770					8.8	0%	28%	28%	28%	28%	28%	0.0	28%	0.0	26%	0.1
58771		T	T	38.3	38.3	100%	2%	2%	9%	9%	2%	0.0	9%	0.0	9%	0.1
58772		T	T	24.6	29.7	83%	14%	14%	20%	20%	14%	0.0	20%	0.0	20%	0.0
58773		T	T	68.7	69.1	99%	24%	24%	31%	31%	24%	0.0	24%	4.8	24%	4.9
58774		T	T	3.1	3.1	100%	5%	5%	12%	12%	5%	0.0	0%	0.4	10%	0.1
58777		T	T	35.9	35.9	100%	26%	26%	33%	33%	26%	0.0	24%	3.3	23%	3.6
58779		T	T/MP	83.4	83.4	100%	25%	25%	32%	40%	25%	0.0	25%	5.8	25%	12.4
58781	MP		MP	45	45.0	100%	25%	35%	25%	35%	25%	4.5	25%	0.0	25%	4.5
58783		T	T/MP	40.7	40.7	100%	25%	25%	32%	40%	25%	0.0	23%	3.7	23%	7.0
58786		T	T/MP	18.9	18.9	100%	27%	27%	34%	42%	27%	0.0	20%	2.7	20%	4.2
58788		T	T/MP	2.7	2.7	100%	34%	34%	41%	49%	34%	0.0	20%	0.6	20%	0.9
59127	T	T	T/MP	2.9	2.9	100%	30%	37%	37%	45%	20%	0.5	20%	0.5	20%	0.8
59128	T	T	T	2.7	2.7	100%	23%	30%	30%	30%	20%	0.3	20%	0.3	20%	0.3
59129	T	T	T	65.9	65.9	100%	23%	30%	30%	30%	23%	4.6	23%	4.6	23%	4.6
59131		T		72.2	72.2	100%	6%	6%	13%	6%	6%	0.0	13%	0.0	6%	0.0
59133		T		24.1	24.1	100%	0%	0%	7%	0%	0%	0.0	7%	0.0	7%	0.0
59135		T	T	18.6	18.6	100%	19%	19%	26%	26%	19%	0.0	19%	1.3	19%	1.3
59137	T	T	T	158.8	158.8	100%	23%	30%	30%	30%	23%	11.1	23%	11.7	20%	11.9
59139		T		2.4	2.4	100%	23%	23%	30%	23%	23%	0.0	20%	0.2	23%	0.0
59141		T		11	11.0	100%	23%	23%	30%	23%	23%	0.0	20%	1.10	23%	0.0
59142					18.0	0%	24%	24%	24%	24%	24%	0.0	24%	0.0	23%	0.2
59143					22.5	0%	26%	26%	26%	26%	26%	0.0	17%	2.0	25%	0.2
59144		T	T	19.1	19.1	100%	23%	23%	30%	30%	23%	0.0	20%	1.9	20%	1.9

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
59145		T	T	13.9	13.9	100%	25%	25%	32%	32%	25%	0.0	20%	1.7	20%	1.7
59146	T	T	T	98.2	98.2	100%	23%	30%	30%	30%	23%	6.9	23%	6.9	23%	7.0
59148		T	T	17.6	17.7	99%	23%	23%	30%	30%	23%	0.0	20%	1.8	20%	1.8
59149		T	T	24.3	24.3	100%	23%	23%	30%	30%	23%	0.0	21%	2.2	21%	2.2
59150		T	T	37.3	37.3	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
59154		T	T	30.8	30.8	100%	23%	23%	30%	30%	23%	0.0	21%	2.8	21%	2.8
59155		T	T	22.2	22.2	100%	23%	23%	30%	30%	23%	0.0	21%	2.0	21%	2.0
59156		T	T/MP	30	30.0	100%	25%	25%	32%	40%	25%	0.0	23%	2.7	22%	5.4
59157					34.3	0%	26%	26%	26%	26%	26%	0.0	26%	0.0	25%	0.2
59158		T	T	25.1	25.1	100%	23%	23%	30%	30%	23%	0.0	21%	2.2	20%	2.4
59159					26.2	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	23%	0.5
59160					11.9	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	23%	0.2
59161					22.7	0%	24%	24%	24%	24%	24%	0.0	24%	0.0	23%	0.3
59162		T	T/MP	11.3	11.3	100%	20%	20%	27%	35%	20%	0.0	20%	0.8	20%	1.7
59163					46.9	0%	24%	24%	24%	24%	24%	0.0	24%	0.0	23%	0.3
59164		T	T/MP	9.4	10.2	92%	28%	28%	34%	42%	28%	0.0	20%	1.4	19%	2.3
59165		T	T/MP	34.3	34.3	100%	23%	23%	30%	38%	23%	0.0	21%	3.1	21%	5.8
59167		T	T	29.2	29.2	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
59170		T	T/MP	9.8	9.8	100%	23%	23%	30%	38%	23%	0.0	20%	1.0	20%	1.8
59172					29.1	0%	28%	28%	28%	28%	28%	0.0	28%	0.0	26%	0.6
59173		T	T	22.5	22.5	100%	23%	23%	30%	30%	23%	0.0	21%	2.1	21%	2.1
59174		T	T	29	29.0	100%	0%	0%	7%	7%	0%	0.0	7%	0.0	7%	0.0
59177	MP		MP	2.5	20.5	12%	25%	26%	25%	26%	20%	1.3	25%	0.0	20%	1.3

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
59178			S/MP	27.5	27.5	100%	25%	25%	25%	40%	25%	0.0	25%	0.0	23%	4.8
59179		T	T/MP	27.5	27.5	100%	23%	23%	30%	38%	23%	0.0	21%	2.5	21%	4.7
59181	MP		MP	48	48.0	100%	24%	34%	24%	34%	24%	4.8	24%	0.0	24%	4.9
59182					25.3	0%	25%	25%	25%	25%	25%	0.0	25%	0.0	24%	0.3
59183		T	T	11.2	11.2	100%	25%	25%	32%	32%	25%	0.0	20%	1.3	20%	1.3
59184					23.7	0%	26%	26%	26%	26%	26%	0.0	26%	0.0	24%	0.4
59186		T	T/MP	41.6	41.6	100%	25%	25%	32%	40%	25%	0.0	25%	2.9	25%	6.3
59187		T	T	18.6	18.6	100%	23%	23%	30%	30%	23%	0.0	20%	1.9	20%	1.9
59188		T	T	19.9	19.9	100%	25%	25%	32%	32%	25%	0.0	20%	2.4	18%	2.8
59189			T	14.9	19.3	77%	23%	23%	23%	28%	23%	0.0	23%	0.0	20%	1.5
59190					30.3	0%	23%	23%	23%	23%	23%	0.0	23%	0.0	22%	0.2
59191	MP		MP	23.6	23.6	100%	24%	34%	24%	34%	22%	2.9	24%	0.0	21%	3.4
59192					15.7	0%	18%	18%	18%	18%	18%	0.0	18%	0.0	16%	0.3
59193					79.1	0%	24%	24%	24%	24%	24%	0.0	24%	0.0	23%	0.5
59195	T	T	T	15.1	15.1	100%	23%	30%	30%	30%	20%	1.5	20%	1.5	20%	1.5
59198		T		14.9	14.9	100%	23%	23%	30%	23%	23%	0.0	20%	1.5	23%	0.0
59200	MP		MP	2.1	33.2	6%	26%	27%	26%	27%	24%	1.0	26%	0.0	24%	1.0
59201					10.8	0%	18%	18%	18%	18%	18%	0.0	18%	0.0	15%	0.3
59202	MP		MP	57.8	57.8	100%	25%	35%	25%	35%	25%	5.8	25%	0.0	23%	7.1
59203	MP		MP	21.7	21.7	100%	27%	37%	27%	37%	20%	3.7	27%	0.0	20%	3.7
59204	MP		MP	30.5	30.5	100%	25%	35%	25%	35%	23%	3.8	25%	0.0	23%	3.9
59205	MP		MP	0.3	9.7	3%	25%	26%	25%	26%	20%	0.6	20%	0.0	17%	0.9
59209	T	T	T	10.2	10.2	100%	22%	29%	29%	29%	20%	0.9	20%	0.9	19%	1.0

Unit/Stand Number	Proposed Activity S=shltrwd; T=thinning; MP=machine pile			Treated Acres	Unit Acres	Percent Treated	Existing Detrimental Soil Conditions (%)	Estimated Detrimental Soil Conditions (%) After Treatment			Estimated Detrimental Soil Conditions (%/acres) After Restoration					
	Alt 2	Alt 3_4	Alt 5					Alt 2	Alt 3_4	Alt 5	Alt 2		Alt 3_4		Alt 5	
59210					24.1	0%	17%	17%	17%	17%	17%	0.0	14%	0.6	15%	0.3
59213					48.2	0%	25%	25%	25%	25%	25%	0.0	24%	0.3	25%	0.0
59214		T	T	44.1	45.9	96%	23%	23%	30%	30%	23%	0.0	23%	3.2	22%	3.6
59216					25.6	0%	15%	15%	15%	15%	15%	0.0	14%	0.2	15%	0.0
59217	T	T	T	16	16.0	100%	23%	30%	30%	30%	20%	1.6	20%	1.6	20%	1.6
59219	T	T	T	29.7	29.7	100%	23%	30%	30%	30%	21%	2.7	21%	2.7	21%	2.7
59220		T	T	14.5	14.5	100%	25%	25%	32%	32%	25%	0.0	20%	1.8	19%	2.0
59221		T	T	34.7	34.7	100%	24%	24%	31%	31%	24%	0.0	22%	3.2	21%	3.5
59222	MP		MP	9.7	9.8	99%	25%	34%	25%	34%	20%	1.4	25%	0.0	19%	1.5
59224					13.2	0%	22%	22%	22%	22%	22%	0.0	22%	0.0	21%	0.1
59225					43.5	0%	24%	24%	24%	24%	24%	0.0	24%	0.0	23%	0.1
59228					29.8	0%	18%	18%	18%	18%	18%	0.0	18%	0.0	17%	0.3
59229		T	T/MP	17.7	22.9	77%	23%	23%	28%	34%	23%	0.0	21%	1.6	21%	3.0
59230	T	T	T	31.2	31.2	100%	3%	10%	10%	10%	10%	0.0	10%	0.0	9%	0.5
59231		T	T/MP	89	89.0	100%	0%	0%	7%	15%	0%	0.0	7%	0.0	15%	0.4
59232		T	T/MP	33.2	33.2	100%	26%	26%	33%	41%	26%	0.0	24%	3.0	22%	3.6
59234		T	T/MP	2.6	2.6	100%	34%	34%	41%	49%	34%	0.0	20%	0.6	20%	0.9
59238					16.2	0%	29%	29%	29%	29%	29%	0.0	29%	0.0	28%	0.2

Cumulative Effects

Cumulative effects on the soil resource include all past, present, and reasonably forseeable actions that cause soil disturbance within the same activity areas on National Forest System lands. Forest Plan standards and guidelines for soil productivity are not intended for private lands.

Alternative 1

Past soil disturbances from natural events and management activities were described in the Chapter 3.

Detrimental Soil Disturbance

The majority of past soil disturbances are associated with existing roads and ground-based logging facilities which were used for timber management activities between 1968 and 1996. There is little evidence of severely burned from past wildfire events, and the extent of localized disturbances from recreation use is relatively minor in comparison to those created by timber management activities. Detrimental soil conditions exist on and adjacent to heavy-use areas such as primary skid trails and log landing, where topsoil layers were displaced and/or several equipment passes caused deep compaction. It is estimated that over 80 percent of the activity areas proposed with this project have detrimental soil conditions that exceed allowable limits for maintaining soil productivity. All of these past disturbances occurred prior to the establishment of the Forest Plan in 1990. Where logs were skidded with only 1 or 2 equipment passes between main skid trails or away from landings, soil compaction was shallow and changes in bulk density levels have likely recovered to near natural levels in the short-term (less than 5 years). Under Alternative 1, there would be no increase in detrimental soil disturbance from ground-based logging activities.

Coarse Woody Debris

Adequate amounts of coarse woody debris currently exist within the majority of activity areas to protect the soil surface and provide a long-term source of nutrients. Marginal sites have been improving towards recommended conditions as dead tree boles have fallen to the ground over time. Under Alternative 1 (No Action), the amount of coarse woody debris would gradually increase or remain the same.

Project Design and Mitigation

Under Alternative 1 (No Action), there would be no cumulative increase in detrimental soil conditions from project activities. Therefore, implementation of project design features and mitigation of project-related impacts would not be necessary.

Alternatives 2, 3, 4, and 5

The combined effects of current disturbances and the proposed actions are addressed in the previously in this section. Estimates for both existing and predicted amounts of detrimental soil conditions for each of the proposed activity areas are displayed in Table 4-30.

Detrimental Soil Disturbance

Under all action alternatives, equipment operations would cause some new soil disturbances in portions of previously managed areas where ground-based logging and mechanical slash piling are proposed for this entry. Estimates of existing and predicted amounts of detrimental soil conditions (Table 4-30) indicate that Alternative 5 would cause the greatest overall extent of cumulative soil impacts, Alternatives 3 and 4 would cause slightly less disturbance, and Alternative 2 would cause the least amount of cumulative impacts due to less intensive management. The successful application of Best Management Practices and effective mitigation measures would limit the extent of new soil disturbance from equipment operations and lower the percentages in Table 4-30. Decommissioning treatments would be applied to restore and stabilize detrimentally disturbed soils committed to temporary roads and logging facilities. These conservation practices would reduce the amount of cumulative soil impacts within activity areas and help move conditions toward a net improvement in soil quality.

Soil moisture guidelines would be included in prescribed burn plans to minimize the risk of intense fire and adverse impacts to soil properties. It is not anticipated that prescribed burning would cause any long-term increases in surface erosion because burning would occur over moist soils, and ground cover vegetation is expected to recover rapidly. Broadcast burns of low-to-moderate intensity may result in beneficial effects to soil productivity through increased nutrient availability in burned areas. The proposed actions would further reduce fuel densities and the risk for intense wild land fires that could cause adverse effects to soil and water resources.

Coarse Woody Debris

Although fuel reduction treatments would potentially reduce coarse woody debris by burning logging slash and natural fuels, burning during moist conditions (Chapter 2, Mitigation Measure) would help ensure adequate retention of coarse woody debris on treated sites. Low-intensity fire does not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). Under all action alternatives, the probable amount of coarse woody debris is expected to meet recommended guidelines for maintaining soil productivity within activity areas.

Project Design and Mitigation

All action alternatives include provisions for mitigation of ground disturbances where activities are expected to cause cumulative increases in detrimental soil conditions that exceed Regional and Forest Plan standards and guidelines. Chapter 2 contains management requirements, mitigation measures, BMPs, and operational guidelines for avoiding, reducing, and mitigating detrimental soil disturbances from project activities. BMPs are commonly used to minimize the effects of road systems, fuels and timber management activities on soil and water resources. Each BMP or mitigation measure includes a description, the objective and an effectiveness rating.

The BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Oregon Department of Forestry evaluated more than 3,000 individual practices and determined a 98 percent compliance rate for BMP implementation, with 5 percent of these practices exceeding forest practice rules (National Council for Air and Stream Improvement, 1999).

Forseeable Actions

Future management activities are assumed to occur as planned in the schedule of projects over an approximate 3 year period. No outyear timber sales or other ground-disturbing management activities are currently scheduled within the Metolius Basin project area boundaries. The only foreseeable future activities include continued recreation use, standard road maintenance, and prescribed maintenance burning to further reduce fuel densities and the risk for intense wild land fires.

The effects of recreation use would be similar to those described in Chapter 3. The Forest Service conducts annual maintenance of developed recreation sites to prevent serious erosion problems. There are no major soil-related concerns associated with the combined effects of these future activities.

Road maintenance activities would reduce accelerated erosion rates where improvements are necessary to correct road drainage problems. There are no major soil-related concerns associated with the combined effects of these future activities. A variety of BMP practices are available to control erosion and limit sediment delivery to streams. Although surface erosion rates on roads would still continue to exceed the natural rates of undisturbed soils, proper road maintenance can mitigate potentially adverse effects to soil and water resources.

The effects of prescribed maintenance burning would be similar to those described in the Environmental Consequences section. Prescribed burn plans would comply with all applicable Forest Plan standards and guidelines and BMPs prior to initiation of prescribed fire treatments (Chapter 2, Mitigation Measures). Soil moisture guidelines would be included in plans to minimize the risk of intense heating of the soil surface. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not cause detrimental changes in soil properties. Under all action alternatives, the extent of severely burned soils would be negligible because burning would occur over moist soils that would help ensure adequate retention of CWD on treated sites. There are no major soil-related concerns associated with the combined effects of these future activities.

The overall effects of the action alternatives combined with all past, present, and reasonably foreseeable management would be within allowable limits set by Forest Plan standards and guidelines for maintaining soil productivity.

Key Issue #5: Road Access

Important Interactions

Road access is a key issue in this project because access to National Forest lands is important to the public. However, reducing road miles in the Metolius Watershed, a Key Watershed under the Northwest Forest Plan, can help reduce resource impacts and mitigate projected impacts from proposed vegetation treatments, particularly sedimentation in the river system, and can help move toward guideline road densities from the Land and Resource Management Plan and Metolius Watershed Assessment.

Road densities in the project area are higher than Land and Resource Management Plan guidelines (see Table 3-20, Chapter 3). It is typically assumed that high road densities in watersheds can be a major source of sediment into streams, decreasing water quality, and subsequently, fish habitat. However, road density is only a measure relating to miles of roads in an area. Densities may not indicate much more about potential resource impacts. Better indicators of potential impacts may be road type, surface, condition, and location.

Roads and road use can also contribute to fragmentation of wildlife habitat and facilitate vehicle access to some potentially sensitive resource areas, such as along rivers. Vehicle use can result in soil compaction and displacement. Vehicles on roads not regularly maintained can result in surface erosion and sedimentation. A reduction of road miles can mitigate these impacts.

Public roads also strongly influence the type, amount and location of recreation use. A reduction in road miles would reduce the acres of the project area that are accessible to the public by vehicles. Some visitors to National Forest lands prefer to have the maximum amount of roaded access maintained for public use. This is particularly relevant to visitors who may not be able to access these areas by non-motorized means due to mobility impairments. Other residents and visitors would like the road density reduced so that the sights and sounds of vehicle use are reduced, and the opportunities for unroaded recreation experiences are increased.

A project objective is to analyze roads in the project areas and propose changes as needed to mitigate potential watershed and habitat effects from proposed vegetation and fuel treatments. A secondary benefit is to create more economical and environmentally sensitive road network, and move closer to recommended Land and Resource Management Plan guidelines.

Effects of all Alternatives

To mitigate actions proposed under the action Alternatives, reductions in road miles are proposed. Alternative 2 proposes reducing about 20 miles of roads in First and Suttle subwatershed. This meets the objectives of this Alternative to minimized watershed effects in these 2 watershed that have been showing signs cumulative impacts. Alternatives 3 and 4 propose reducing about 50 miles of roads in First and Suttle subwatershed, and in deer winter range. Alternative 5 proposes to reduce about 60 miles of roads in First and Suttle subwatershed, deer winter range, and other sensitive resource sites in the project area. These actions are expected to have high effectiveness on reducing a major source of sediment

The effects displayed here only refer to the measures in the changes of road miles by Alternative (including all roads, and just open roads), in both the entire Project Area and within the Metolius Heritage Area. The guideline road densities in the Land and Resource Management Plan are 1.5 miles per square mile in the Metolius Heritage area and 2.5 miles per square mile elsewhere on the Deschutes National Forest. Alternative 5 would reduce road miles the most, followed by Alternatives 3 and 4, the lastly Alternative 2. As such Alternative 5 moves toward the Land and Resource Management Plan guidelines the most (Table 4-31). Temporary roads are also displayed in Table 4-31, but these would not result in a net increase in area road miles because they will be closed after project implementation is complete.

Table 4-31. Changes in Road Miles and Density[30]

Road Characteristic	Alternative 2	Alternatives 3 and 4	Alternative 5
Entire Project Area			
Reduction in all (open and closed) Road Miles in Project Area	20 miles reduced	50 miles reduced	60 miles reduced
Reduction in open Road Miles in Project Area	6 miles reduced	13 miles reduced	18 miles reduced
Road Density of all roads in Project Area	4.9 miles/sq mile	3.8 miles/ sq. mile	3.4 miles/ sq. mile
Road Density of open roads in Project Area	3.4miles/sq mile	3.1 miles/sq mile	2.9 miles/sq mile
Metolius Heritage Area			
Reduction in all (open and closed) Road Miles in the Metolius Heritage Area	17 miles reduced	40 miles reduced	42 miles reduced
Reduction in open Road Miles in the Metolius Heritage Area	4.4 miles reduced	10 miles reduced	10.7 miles reduced
Road Density of all roads in the Metolius Heritage Area	4.6 miles/sq. mile	3.1 miles/ sq. mile	3.0 miles/sq mile

[30] All road mile and density numbers are approximate

Road Density of open roads in the Metolius Heritage Area	2.9 miles/sq. mile	2.5 miles/sq. mile	2.4 miles/sq. mile
Temporary Roads Developed (maximum that may be needed. Will be decommissioned after project implementation complete)	0.25	1.65	1.8

151.3 miles of all (open and closed) roads, and 96.1 miles of open roads in the Project Area. Total Project area = 26.6 sq. miles
87.1 miles of all (open and closed) roads, and 47.8 miles of open roads in the Metolius Heritage area. Total area in Metolius Heritage = 15.2 sq miles

Preliminary road maps were reviewed by local residents, and several errors and omissions were identified concerning road status, use or location. The Friends of Metolius organization collected additional data and used GPS to update the road information. This information was added to the analysis, including approximately 2.25 additional miles of open roads, 1.3 additional miles of closed roads that had been breached.

The effects of changes in the road access and densities (including the change in type and surface of road miles in locations of road miles) relating to effects on resources are discussed under the other resources in this Chapter. Proposed changes in road status, and proposed road improvements can be found in Chapter 2, under the description of Alternatives, and in Table 2-5 at the end of Chapter 2. Proposed road decommissioning and inactivation was evaluated using the guidelines in the Road Analysis (USDA, 1999) handbook and meet the requirements of the National Forest Transportation Policy (USDA 2002).

A comparison of the estimated costs of road inactivation and decommissioning by Alternative is provided under the Economic analysis, this Chapter.

Appendix E is a summary of the road analysis process.

Economics

Important Interactions

Activities associated with the Proposed Action or its alternatives may generate various economic benefits and costs, depending on design. The economic values provided under these alternatives may be less than associated costs. Agency costs associated with planning and administration are not included, but are expected to be similar under the action Alternatives.

Management activities, which incur costs and generate impacts, can also change the risk and intensity of wildfires and their associated costs and impacts. Cost and benefits associated with reducing the risk of moderate to high severity wildfire were not assigned a dollar value though there would likely be changes in resource values such as increases or decreases in wildlife habitat, recreation use and other ecosystem services, and costs associated with wildfire suppression. Non-market values are also briefly discussed.

Estimated costs for road inactivation and decommissioning by Alternative are also displayed.

<u>Market Values.</u> Factors that can affect economic value are the amount of saw timber versus pulpwood, the volume available for sale, and the costs of required brush disposal and road reconstruction. The market value for pulp and chip is considerably lower than for saw logs, and could deter potential purchasers. It is estimated, depending on the Alternative, that approximately 25% to 50% of the material proposed for removal from the project area would not be considered suitable for milling into saw logs, but only suitable for pulp and chips.

This project does not have the same objectives as a traditional timber sale, which primarily would be to offer wood products in the most cost efficient manner. The objectives are forest health restoration, or "forest stewardship." Cost efficiency is desirable, but should not drive the project. Much of the work done on National Forests, other than traditional timber sales, are funded through a variety of means, including appropriated funds, partnerships with other agencies or private entities, and service or stewardship contracts. Those options would be considered as ways to fund the restoration work under this project, as well as through viable timber sales

There are opportunities to use timber sales to remove material when receipts from sale of the material cover the costs for conducting the entire planning and operation. However, since up to half of the wood material proposed for removal to meet restoration objectives has very low market value (pulp), a timber sale may not be the most cost efficient way for removing that material. Alternative funding methods are recommended (see Appendix B for a discussion on optional methods that may be available to do vegetation management and restoration work under stewardship authorities).

Values of possible wood products, assumptions were based on estimated market value in June 2002 for various sizes and various species of trees. At that time, the market for ponderosa pine, the primary species that would be removed from the project area, was depressed. If the market improves the values would increase, and conversely, if the markets go down, the values would be less. Another assumption was that the wood products would be hauled to Springfield, OR.

Given the depressed market conditions for small ponderosa pine sawlogs, even thinning higher volumes per acre is predicted to be essentially a breakeven operation (net costs equal net return) or slightly deficit, depending on the amount of white fir and Douglas-fir harvested. An increase in market values of only $20 per thousand board feet (<10 percent) would make these treatments more economically viable.

The majority of acres of proposed for thinning (about 3590 acres) that would have lower volumes (due to lower diameter limit on the trees that could be removed) were evaluated to be deficit at the time of the analysis. A substantial market improvement would be necessary to make these treatments economically viable. However, per acre costs of thinning these stands appeared to be comparable or even less than the cost of treating them with prescribed underburning in Alternative 2.

The following assumptions were used in appraising the value of products under the different alternatives:

- The average selling value for logs ≤16” diameter delivered to the mill for Alternative 3 would be $275/mbf. This reflects a 10 percent decrease in value due to the 16 in. diameter limit on harvested trees. Ponderosa pine would be the primary species harvested.
- The average selling value for logs ≤21”diameter delivered to the sawmill for Alternative 4 would be $300/mbf. Ponderosa pine would be the primary species harvested.
- The average selling value for logs delivered for Alternative 5, shelterwoods and shelterwood/thinning, would be $315/mbf. Ponderosa pine would still be the primary species harvested, but there would be more white fir, Douglas-fir, and larch, which have higher selling values than pine.
- Harvest volumes for Alternative 3 were reduced by 25 % to reflect the 16 in. diameter limit. This reduction was based on simulated thinning from the FVS model using 21 in. and 16 in. diameter limits.
- Total logging costs were based on a similar recent offering (Springtail Timber Sale).
- Total logging costs under Alternative 3 would be $15/mbf higher due to the 16 in. dbh limit.
- Hauling costs were based on a haul to Springfield, Oregon.
- Chip prices were assumed to be $25/ton in Thin to 12 in. treatments
- Chip values were not calculated for thinning to 16/21 in. diameter. Inclusion of the chip values in these treatments would improve the bottom line by $25/ton.

<u>Non-Market Values</u>. The preceding economic analysis was presented from the view of resource utilization, where wood-fiber is a market commodity. The economic principles are fairly well understood and are an important consideration in overall project design and resulting consequences.

Another economic aspect of resource management consideration is the values of “ecosystem services”. Direct relationships and clear principles for accounting for such things are only beginning to be developed, including how to quantify the value of the forest in its current condition, or the value of standing timber as a form of "natural capital", the biophysical structure that provides ecosystem services (Hawken et al. 1999). Ecosystem services can include purification of air and water, generation and preservation of soils and renewal of their fertility, protection of stream channels and banks from erosion during high water, and provision of aesthetic beauty and intellectual stimulation that lift the human spirit.

While some ecosystem services may be on a much larger scale than would be measurably affected by this project (e.g. partial stabilization of climate) some of the proposed actions, on a local-scale, can affect certain ecosystem services, and are discussed under the other resources in this Chapter.

Wildfire Costs. The purpose of the action alternatives is to reduce risks from wildfire. It is important to understand there would be costs associated with impacts from a potential wildfire (to people, property and resources) and related wildfire suppression expenditures. Costs to ecosystem services are described qualitatively under the other sections on effects to resources in this Chapter. The average costs of wildfire suppression were estimated by reviewing the average per acre costs of suppression activities in Central Oregon over the last few years. There is a considerable range to suppression costs, and expenditures are dependent on a variety of factors. Assumptions were made that the more fuel that is removed from the landscape, particularly relating to crown bulk densities, the less severe a wildfire would be and the lower the suppression costs. However, there are many factors that affect suppression costs that cannot be determined at this time, including conditions under which a wildfire may burn (wind speed and direction, fuel moistures, terrain, immediate risks to people, etc…). The average suppression cost should only be used for comparison purposes, and may not reflect actual costs of suppressing a future wildfire in the project area.

As can be seen in Table 4-32, the costs for suppressing small wildfires can be significantly greater than the costs for suppressing large wildfires, but clearly the total costs would be less for smaller fires than for large ones. It is assumed that firefighters would be better able to control wildfires under the Alternatives that reduce surface and ladder fuels and crown bulk densities the most, thus keeping the overall size of wildfires smaller and resulting in a lower total costs for wildfire suppression.

Table 4-32. Average Costs per Acre for Wildfire Suppression from 1987-1997.

Size of Wildfire	Deschutes National Forest Average costs	Sisters Ranger District Average Costs
0.0-0.25 acres	$6,575/acre	$3,290/acre
0.26-9.9 acres	$4,101/acre	$3,305/acre
10 – 99 acres	$3,065/acre	$2,808/acre

Size of Wildfire	Deschutes National Forest Average costs	Sisters Ranger District Average Costs
100-299 acres	$1,954/acre	$1,886/acre
300-999 acres	$2,133/acre	$2,133/acre
1,000-4,999 acres	$825/acre	$825/acre
5,000 + acres	$286/acre	$286/acre

The estimated costs per acre for the suppression of the 2 most recent (2002) wildfires on the Sisters Ranger District were about double the average cost over the last decade for their size class. Suppression of the Eyerly Fire (23,573 acres) was estimated at about $454/acres, and suppression of the Cache Mtn. Fire (4,200 acres) was estimated at about $1,667/acre. This may indicate a trend of rising costs for local wildfires.

Road Costs. The costs of inactivating or decommissioning a road could vary, depending on the condition of the road and the terrain. However, average costs were estimated based on costs for similar work on the Deschutes National Forest over the last 5 years.

Table 4-33. Predicted cost of road decommissioning and inactivation.

Type and average Cost of Road Work	Alternative 2	Alternatives 3 and 4	Alternative 5
Decommissioning ($2,760/mile)	$44, 160 (16 miles)	$102,120 (37 miles)	$113,160 (41 miles)
Inactivation ($1,110/mile)	$5,550 (5 miles)	$12,210 (11 miles)	$18,870 (17 miles)
Total Cost of Road Work	**$49,710**	**$114,330**	**$132,030**

Employment. The primary effect on local communities would be in terms of employment provided by preparation, implementation and administration of forest health and fuel reduction activities by alternative. The alternatives provide a variety of activities that would require widely varying equipment and skills. The level of benefit to local communities would depend on the capacity of existing contractors residing in the area in terms of skills and equipment, the labor force available to these contractors, the amount of existing work they have under contract, their desire to acquire larger contracts, new contractors seeking opportunities, and other contracting requirements such as programs for small businesses. The level would also depend on the amount of funding received for activities over the next 5+ years.

It is unknown how many and what type of jobs could be created by stewardship contracting opportunities in Central Oregon, or the extent to which they could support or enhance the social well-being and economies of rural communities. However, forest health and fuel reduction employment could help diversify the local economy some, and help increase the community capacity or resiliency (Committee of Scientists 1999).

Another economic benefit from forest health and fuel reduction activities in the Metolius Basin Forest Management Project area is a supply of wood products to mills in Eastern and Central Oregon and the Willamette Valley. Secondary benefits to employment in the wood products industry could result over the 5+ years during which the project is implemented.

Effects of Alternative 1

The main economic ramification of the No Action alternative is that, in the long run, funds that would be spent in the Metolius Basin Planning Area would be for emergency fire suppression, and not for treatments that would reduce the potential for large-scale fires. Non-market values, or ecosystem services, would not be directly affected under this Alternative, however, there would be an increased risk of impacts to many of the local services due to the current extensive areas at risk of high severity wildfire, insects and disease. There would be no potential net savings in wildfire-related costs and benefits. See descriptions under Alternative 1 (No Action) under the other resources addressed in this Chapter for an understanding of non-market values as they currently exist.

Effects Common To The Action Alternatives

Cost of Vegetation and Fuel Management. Non-market values of ecosystem services would be enhanced under the action Alternatives, through short-term impacts would be expected on many of the services (e.g. visual impacts during the project implementation, and potential short-term increases in sedimentation). See discussions under the other resources in this Chapter for an understanding of effects on relevant local ecosystem services.

The action alternatives are compared in terms of total costs and total product values. Costs of the vegetation and fuel treatments were estimated based on recent treatments in projects on the Sisters Ranger District, including the Highway 20 and Black Butte Ranch projects.

All of the action alternatives have net values that are “in the red” (costs exceed the value of products), due to the large number of acres with small tree thinning (<12 inch diameter), prescribed burning, mowing, defensible space, plantation thinning, and other treatments with little or no product value. Table 4-22 summarizes the volume and value of products produced, and the net values of each alternative (total costs minus total product values). Alternative 3 would have the highest costs and lowest net value (highest deficit), followed by Alternatives 2, 4, and then 5.

Given the current market conditions for small ponderosa pine sawlogs, thinning with higher volumes per acre over 2619 acres will break even or be slightly deficit depending on the amount of white fir and Douglas-fir harvested (Thinning 1; Table 4-34). An increase in market values of only $20/mbf (<10 percent) would make these treatments economically viable.

Thinning 2, 3, and 4 (Table 4-34) represent 3590 acres where a substantial market improvement would be necessary to make these treatments economically viable. However, per-acre costs of thinning these areas appear to be comparable or even less than treating them with prescribed underburning as discussed under Alternative 2.

Table 4-34. Product Volumes and Values by Alternative.

Treatments that produce Sawlogs	Alt. 3 ac	Alt. 3 total vol.(mbf)	Alt. 4 ac	Alt. 4 total vol.(mbf)	Alt. 5 ac	Alt. 5 total vol.(mbf)
Thinning 1 (≥4.0mbf/ac)	2619	16107	2619	21476	2619	21476
Thinning 2 (2.5-3.9 mbf/ac)	1412	3495	1412	4660	1412	4660
Thinning 3 (1.0-2.4 mbf/ac)	1151	1295	1151	1727	1151	1727
Thinning 4 (<1.0 mbf/ac)	1027	385	1027	514	1027	514
Larch restoration	0	0.0	0	0	811	6488
Shelterwood	0	0.0	0	0	172	3440
Shelterwood/Thinning	0	0.0	0	0	124	1860
Small sawlogs ≤12”	1121	420	1137	569	1137	569
Total Volume (mbf)		**21,702**		**28,946**		**40,734**
Total Log Selling Value		**$5,968,029.38**		**$8,683,170.00**		**$12,830,548.50**
Treatments that produce chip/pulp	**Alt. 3 ac**	**Alt. 3 total tons**	**Alt. 4 ac**	**Alt. 4 total tons**	**Alt. 5 ac**	**Alt. 5 total tons**
Thin ≤12” - Chip material	1121	11,210	1137	11,370	1137	11,370
Total Tons		**11,210**		**11,370**		**11,370**
Total Chip Selling Value		**$280,250.00**		**$284,250.00**		**$284,250.00**
TOTAL PRODUCT VALUE		**$6,248,279.38**		**$8,967,420.00**		**$13,114,798.50**

EFFECTS OF ALTERNATIVE 2

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 2 would be considerably less than under the No Action Alternative, but more than under Alternatives 3-5, because it would not reduce crown bulk densities much (an important factor in crown fires).

In terms of costs for management, Alternative 2 would harvest trees only up to the 12 “ diameter limit, so under current markets and demand for wood products, there would be limited product value. However, the total cost of vegetation treatment is less than Alternatives 3, 4 or 5 because underburning, a lower cost treatment, would be used on many of the acres which are proposed for thinning under the other Alternatives. Still, this alternative has the second highest net cost or highest deficit of $4,242,705.

It is assumed that the risk of moderate to high severity wildfire is greater under Alternative 2 than the other action Alternatives, and there would be a greater cost associated with wildfire suppression.

The fewest miles of road would be decommissioned and inactivated under Alternative 2, so would have the lowest cost this work (Table 4-33).

EFFECTS OF ALTERNATIVE 3

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 3 would be less than under the No Action Alternative and Alternative 2, but more than under Alternatives 4 and 5, because it would not reduce crown bulk densities as effectively.

The main economic consideration in Alternative 3 is the 16 " diameter limit on trees that could be removed. It is predicted that this limit would in turn reduce thinning volumes by 25 percent from Alternative 4 and 5, increase the number of deficit treatment acres (costs exceed product values) by 20 percent, and would result in logging costs that would exceed the value of the wood products by approximately $410,000.

Alternative 3 would have the highest net cost (or highest deficit) at $5,098,425, due to the increases in logging costs and reductions in product volume.

It is assumed that the risk of moderate severity wildfire under Alternative 3 is greater than under Alternatives 4 and 5, but that Alternative 3 would reduce the risk of both moderate and high severity wildfire more than under Alternative 2. Therefore, wildfire suppression costs may be higher under Alternative 3 than under Alternatives 4 and 5, but lower than under Alternative 2.

Alternative 3 and 4 would reduce more road miles and cost more for road work than more than Alternative 2 but less than Alternative 5 (Table 4-33).

EFFECTS OF ALTERNATIVE 4

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 4 would be less than under the Alternatives 1, 2 and 3 but slightly more than under Alternatives 5, because it would not reduce crown bulk densities as effectively.

Alternative 4 has the second lowest net costs (or is the 2nd least deficit) of $4,173,014.57. Product values exceed logging costs by approximately $516,000. If the Forest Service is able to retain these receipts, this $516,000 could be used to fund vegetation treatments that have little or no market value such as thinning trees under 12 " diameter, underburning, or mowing.

It is assumed that the risk of moderate severity wildfire under Alternative 4 is greater than under Alternative 5, but less than under Alternatives 3 and 2. Therefore, wildfire suppression costs may be higher under Alternative 4 than under Alternative 5, but lower than under Alternatives 2 and 3.

Alternative 3 and 4 would reduce more road miles and cost more for road work than more than Alternative 2 but less than Alternative 5 (Table 4-33).

EFFECTS OF ALTERNATIVE 5

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 5 would be least of all the Alternatives because it would be the most effective in reducing crown bulk densities, the risk of moderate and high severity wildfire, and because the greatest number of acres would treated under Alternative 5..

Alternative 5 has the lowest net costs, estimated at $3,451,129. Product values exceed logging costs by approximately $1,294,000. If the Forest Service is able to retain these receipts, this $516,000 could be used to fund vegetation treatments that have little or no market value such as thinning trees under 12 " diameter, underburning, or mowing.

It is assumed that the risk of moderate and high severity wildfire under Alternative 5 is least of all the Alternatives, and therefore, wildfire suppression costs may be the least.

The most miles of road would be decommissioned and inactivated under Alternative 5, so would have the highest cost this work (Table 4-35).

Table 4-35. Summary of Costs and Values (as of June 2002).

Activity	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Estimated Volume - saw logs - pulp/chip		21,702 mbf 11,210 tons	28,944 mbf 11,370 tons	40,732 mbf 11,370 tons
Cost of harvesting trees greater than 12" diameter, including transportation to the mill	$0	$6,658,000	$8,452,000	$11,821,000
Cost of thinning small trees, prescribed burning and mowing	$2,901,000	$1,697,000	$1,696,500	$1,711,000
Cost of cleaning up fuels from harvest and other vegetation treatments	$1,721,000	$2,992,000	$2,992,000	$3,034,000
Total Costs	**$4,622,000**	**$11,347,000**	**$13,140,500**	**$16,566,000**
Total Product Values	**$395,800**	**$6,248,300**	**$8,967,400**	**$13,114,800**
Net Value	**- ($4,224,2000)**	**- ($5,098700)**	**- ($4,173,100)**	**- ($3,451,200)**

Details on some of the costs for vegetation and fuel treatments are displayed in Tables 4-36, and 4-37.

Table 4-36. Details: Costs of Vegetation Treatments by Alternative.

Alternative Rx	cost/ac	Alt. 2-ac	Alt. 2-total cost	Alt. 3-ac	Alt. 3-total cost	Alt. 4-ac	Alt. 4-total cost	Alt. 5-ac	Alt. 5-total cost
Aspen Rest.	500	78	$38,990	78	$38,990	78	$38,990	78	$38,990
Thin in Def. Space (outside of landscape treatments)	175	629	$110,0282	534	$93,363	534	$93,363	506	$88,634
Dwarf Mistletoe Control	350	51	$17,729	51	$17,729	51	$17,729	51	$17,729

Alternative Rx	cost/ac	Alt. 2-ac	Alt. 2-total cost	Alt. 3-ac	Alt. 3-total cost	Alt. 4-ac	Alt. 4-total cost	Alt. 5-ac	Alt. 5-total cost
Meadow Enhancement	100	35	$3,531	35	$3,531	35	$3,531	35	$3,5315
Thin Plantations	50	1276	$63,782	1276	$63,782	1276	$63,782	1276	$63,782
Thin under 12" outside plantations	175	1809	$316,580	1691	$295,862	1691	$295,862	1800	$315,078
Thin under 12" outside plantations – some marketable product	835	1121	$936,022	1137	$949,203	1137	$949,203	1137	$949,203
Thin in Dwarf Mistletoe Stands	400	79	$31,597	79	$31,597	79	$31,597	79	$31,597
Underburn	180	1858	$334,440	175	$31,500	175	$31,500	175	$31,500
Mow/Underburn	205	5199	$1,065,795	834	$170,970	834	$170,970	834	$170,970
Total		**12134**	**$2,918,493**	**5888**	**$1,696,527**	**5888**	**$1,696,527**	**5971**	**$1,711,014**

Table 4-37. Details: Costs of Fuels Treatments by Alternative.

Post Treat Fuels Activity	cost/ac	Alt. 2 ac	Alt. 2 total cost	Alt. 3 ac	Alt. 3 total cost	Alt. 4 ac	Alt. 4 total cost	Alt. 5 ac	Alt. 5 total cost
Hand Pile	520	2212	$1,150,240	2474	$1,286,480	2474	$1,286,480	2474	1,286,480
Machine Pile	155	655	$101,525	2266	$351,230	2266	$351,230	2973	460,815
Machine Pile on Skid Trails	155	604	$93,620	3589	$556,295	3589	$556,295	3145	487,475
Underburn	180	633	$113,940	868	$156,240	868	$156,240	875	157,500
Mow/Underburn	205	973	$199,465	2440	$500,200	2440	$500,200	2437	499,585
Mow	25	2451	$61,275	5666	$141,650	5666	$141,650	5692	142,300
Total		**7528**	**$1,720,065**	**17303**	**$2,992,095**	**17303**	**$2,992,095**	**17596**	**3,034,155**

Social Resources

Important Interactions

The relevant social issues are how people feel about the proposed management actions and about the area if it were to be left alone. Interpretations are based on public input into this analysis process, and perceptions reported in similar analyses. Responses from scoping indicate that the most disagreement among the public was on the size of trees that *should* be removed to meet project objectives. This issue is addressed under the first section of this Chapter, Vegetation Management in Late-Successional Reserves, under the subsection on "Tree Size". Other relevant social issues are addressed under Fire/Fuels/Air Quality (in regards to risk of impacts from wildfire and smoke), Road Access and Recreation (regarding public access to the National Forest and possible effects on recreation activities), Economics (regarding market and non-market values), and Scenic Resources (regarding possible effects on scenery).

Passive Use Values

The Project Area is in a Late Successional Reserve and provides a myriad of ecosystem values include passive use. All of the alternatives can affect the values associated with the Project Area and the surrounding landscapes. These values differ among individuals, groups, and landscape conditions, and they can be associated with threatened species, unique ecosystems, biological diversity, and the ability of nature to function independent of human influence. Individuals who prefer maintaining current ecosystem values such as clean water, beautiful scenery, and recreation opportunities may prefer any of the action alternatives that reduce the potential affects of high intensity wildfire. Those individuals who reject timber harvesting as a fuels management activity would exclude Alternatives 3, 4 and 5 as feasible options. Other individuals may prefer the No-Action alternative in order to have the ecosystem operated unfettered by human influences, accepting the potential impacts from a high severity wildfire.

In general, people who value more passive approaches to forest management would likely prefer No Action, or the least intensive and extensive acres of thinning and burning (Alternatives 2) compared to people who prefer active management to achieve restoration objectives (Alternatives 3-5).

Scenic Resources

IMPORTANT INTERACTIONS

Scenic effects are analyzed based on how each of the alternatives changes the existing scenic character and integrity. Scenic character refers to the naturally established landscape patterns that make each landscape identifiable or unique. Scenic integrity is the state of naturalness, or conversely, the state of disturbance created by human activities or alteration. Activities analyzed that can affect scenic resources include timber harvest and associated activities (temporary roads, landings, post-harvest cleanup), larch and aspen restoration and meadow enhancement (visual diversity), burning (both prescribed and wildfire), insect and disease epidemics, mowing brush, and road closures.

Both short-term (0-5 years) and long-term effects (5 years and beyond) were analyzed on scenic resources from the proposed alternatives, specifically on landscape character, scenic quality, and scenic integrity level. It is predicted that some impacts from proposed activities would be visible for more than one year, and would therefore exceed Land and Resource Management Plan standards under the visual quality objective of retention. Under the action alternatives, a site specific, short-term Land and Resource Management Plan amendment would permit these activities. See the end of this Chapter for a description and analysis of the proposed amendment to visual quality standards and guidelines. See the end of this Chapter for a discussion of the proposed Forest Plan Amendment.

Scenic effects would be the most visible within the immediate foreground (0-300 feet), and the distant foreground (300 feet to 1/2 mile), particularly along roadways, and trails.

Scenic quality is an Outstandingly Remarkable Value under the Metolius Wild and Scenic River plan (1996). The actions proposed under this project within the river corridor (primarily thinning trees 12” diameter or less and underburning) are expected to have a beneficial affect on the scenic quality. See further discussion on the Wild and Scenic River effects at the end of the Watershed analysis in this Chapter.

DIRECT AND INDIRECT EFFECTS

Vegetation Management

Timber harvest and associated activities can affect the scenic resource by altering the naturally established form, line, color and texture in a given area. Scenic impacts are affected by the acres treated, and the number of temporary roads and landings, silvicultural prescriptions, and post-harvest fuel treatments.

Removal of trees opens up views, both as seen from the foreground and from a distance. The degree of impact depends on the degree of change from surrounding forest stands. In otherwords, if surrounding stands are very dense, then extensive tree removal will be more noticeable. However, if harvest removes smaller trees from high density stands, or removes dead trees from stands with high mortality, the visual impact may be perceived as positive, particularly after slash is cleaned up and the remnant stand visually improves in health and vigor (beyond about two years). There would be short-term impacts during and immediately following harvest activities, such as exposed soils and disturbed ground vegetation from skid trails and heavy equipment, and visibility of down or decked logs and piled branches.

Tree removal that opens stands may be visible from distant view points, usually as a lighter green color and finer texture than surrounding stands, and as more visible white patches during the winter when snow is on the ground. Shelterwood harvest and larch restoration treatments may also have a visible line between the harvest area and surrounding stands, visible from viewpoints.

More intensive silvicultural prescriptions (those that remove the most trees per acre), would have different scenic impacts. Shelterwood, which would remove the most trees per acre of all the prescriptions, would likely be the most visible. Thinning trees greater than 12” diameter would be less visible than shelterwood, but more than thinning smaller trees.

Aspen and larch can add seasonal diversity and value to forest scenery. Currently, the aspen and larch stands in the project area are declining. Restoration of aspen and larch stands can enhance scenic quality of the vistas in which they occur.

Though mowing opens up the understory of stands, it is not usually noticeable from distant views, and would not be very visible in foreground views (personal observation).

Roads can change the lines and color within view sheds. Road decommissioning can reduce the visible impacts and fragmentation of the view of forest stands after vegetation begins to grow into the old roadbed (5 to 10 years). Development of temporary roads and landings for timber harvest activities can increase the scenic impact during the period that the roads are open and used, and for the short-term after decommissioning. It is assumed that the more miles of temporary roads and acres of landings built the greater the negative impact, and, conversely, the more miles decommissioned, the greater the positive impact on scenic quality.

Information on public preferences collected during this project indicate that people prefer to see open stands with large trees, rather than dense stands with smaller trees, particularly since the old growth ponderosa pine stands are a signature quality of the Metolius Basin. Restoration activities that reduce stand densities can both help retain existing large trees and promote future large trees more quickly than no action.

Disturbances

Disturbances such as wildfire, insect and disease can alter landscape character through modification of vegetation patterns, colors and textures. The immediate scenic effect of wildfires is a reduction in vegetation, replacement of green with black and gray (fire-blackened trees) and a change from diverse textures to a more homogeneous landscape. The extent of impact depends on the size and intensity of the fire. In general, people perceive views of an area affected by an intense wildfire as having low scenic value.

However, scenic impacts from wildfires gradually diminish as the landscape recovers and vegetation is reestablished. As soon as one to three years after a fire, scenic quality may return, with the flush of grasses and wildflowers, which can provide a unique scene when contrasted to standing black trees. Intensively burned areas often take longer to recover and are subject to soil erosion, which can also negatively affect scenic quality. When wildfire is within the naturally occurring fire regime (often less intense), the resulting patterns can enhance scenic quality by providing diversity to the landscape.

Prescribed burning tends to have similar types of impacts to those from wildfires; blackened trees and removal of understory vegetation, but the extent of impacts is considerable less severe and would cover generally smaller areas. These impacts are usually short-term (2 to 5 years) and black would be replaced with green within the growing season following the burn. Low intensity fires also are not predicted to result in impacts to soils, and thus there would be little visible impacts from erosion.

Prescribed burning can leave tree trunks blackened for several years

The result from extensive insect and disease attacks (e.g. dead trees) would be similar to impacts from wildfire (personal observations from areas on the Sisters Ranger District with extensive mortality from insects or disease). The area affected would range from individual trees to large patches. Large patches of dead trees change the color and texture of forest stands, from diverse and green to more homogenous stands of red (from dead needles) and then gray (from standing dead trees). Eventually the standing dead trees fall and the landscape appears even more open and homogenous. Removing dying and dead trees can enhance the re-growth of a forest, and return the area to one with higher scenic integrity more rapidly than if no action were taken.

Effects Of Alternative 1

Under this Alternative there would be no vegetation management activities and thus none of the visual impacts associated with the activities (landings, logging debris). Scenic integrity and landscape character would not change in the short-term, but would have a greater risk of impact from severe disturbances (insects, disease or wildfire) over the long-term. It is expected that increasing amounts of dead and dying trees would be visible, as stands become denser. The dense stands that create the current "tunnel effect" along the main access roads (Forest Roads 12 and 14) would remain dense, and opportunities for views into the forest would continue to be screened by thick understories. Views of the signature open park-like stands would continue to degrade as understories grown in.


High stand densities can reduce scenic quality

There would be no restoration of aspen or larch stands or meadows, and visual diversity from these forest elements may continue to decline.

There would be no reduction in scenic impacts associated with miles of open roads under this Alternative.

Under this Alternative, the direction in the Deschutes National Forest Land and Resource Management Plan for scenic resources in the Metolius Conservation area would **not** be met. However, there would also be no short-term impacts that require an amendment of the LRMP.

Effects Of Alternatives 2, 3, 4 And 5

Proposed vegetation activities under each of the action Alternatives would result in short-term visual impacts associated with the activities (e.g. change in line and color from temporary roads and landings, slight change in textures and color from removing trees). Each of the action Alternatives would move the current scenic resource more toward that desired under the Deschutes National Forest Land and Resource Management Plan direction (MA-9, chpt 4, pgs. 121-131), the least under Alternative 2 and the most under Alternative 5.

Vegetation management activities would mostly be visible in the foreground from roads, trails and along the Metolius River. Some of the activities, primarily shelterwood harvest, would be visible from distant vistas, such as Black Butte or Green Ridge, but are not expected to stand out in the landscape (it is expected that shelterwood harvests would only be partial openings, and would mimic natural openings). Larch restoration would create small canopy gaps (1/4 to 3 acres) which are within the size that would naturally occur in ponderosa pine, and would be designed to mimic natural openings.

These actions are expected to enhance long-term scenic quality, such as reducing stand densities, promoting large trees, restoring aspen and larch stands, and meadows, and reducing road miles. The majority of actions proposed under all of the action Alternative are thinning and underburning. Thinning is expected to enhance the long-term scenic quality, with the more intensive thinning under Alternatives 5 and 4 having the greatest benefit. However, short-term alterations would be more visible under Alternatives 5 and 4, since large trees could be removed and thinning is expected to more intensive (remaining stands would be more open). Alternative 2, with the limited tree size removed (12" diameter and less) would have the least visible short-term effects, but would also be the least effect on enhancing long-term scenic quality.

The tunnel-effect of views along the scenic corridors of Forest Roads 12 and 14 would be altered and diversified, and more filtered views into forest stands and of distant peaks would be offered. The densely stocked stands would be opened up and the desired quality of open park-like stands would be met on many acres. This scenic enhancement would be the best under Alternative 5, followed by 4, 3 and then lastly, Alternative 2.

Effects from prescribed underburning would be visible on the most acres under Alternative 2, with over 7,000 acres proposed for burning. Alternatives 3, 4 and 5 would have fewer acres underburned (about 4,500 acres, including both primary and follow-up treatments) so would have less of a visual impact than under Alternative 2. However, the effects of underburning (blackened trees and reduction of shrubs) would be short-term (in some cases, as short as one growing season), and can be mitigated (see Chapter 2, Mitigation, and Appendix C for additional project design enhancements).

There would be more visible short-term alteration in line and form within treated areas from temporary roads and landings under Alternative 5 and the least effect under Alternative 2 (see Table 4-23).

Under each of the action Alternatives, approximately 10 acres of aspen would be restored, and 35 acres of meadows would be maintained (removal of smaller encroaching conifers), and under Alternative 5, approximately 811 acres of larch stands would be restored. These actions would enhance scenic diversity, the most under Alternative 5 with the addition of opening larch stands.

A short-term, site specific amendment to the Land and Resource Management Plan would be required under each of the action Alternatives. See the end of this Chapter for further discussion of the proposed Forest plan amendment.

CUMULATIVE EFFECTS

Type and level of various treatments, equipment being used, residual vegetation, and post treatment activities all are expected to cumulatively effect scenic resources in the project area. The cumulative effect of proposed treatment is much more apparent in Alternative 5, followed by Alternative 4, Alternative 3, and the least in Alternative 2, respectively (Table 4-38).

Table 4-38. Cumulative Effects on Scenic Resources.

Management Areas (Forest Plan)	Alternative 1 No Treatment	Alternative 2	Alternative 3 and 4	Alternative 5
Metolius Heritage Area Total 9,734 Acres (Or 66.2% Of Total 14,694 Acres) Retention Foreground And Middleground Scenic View Allocation	No Change To Short-Term Landscape Character. Long-term scenic quality is expected to be altered by social and ecological processes.	Approximately 7,958 acres (or 82.0% of 9,734 acres) to be treated for fuel reduction and forest restoration resulting in a slightly altered landscape character during short-term. Slightly improved long-term scenic quality.	Approximately 8,572 acres (or 88.0% of 9,734 acres) to be treated for fuel reduction and forest restoration resulting in a moderately altered landscape character during short-term. Moderately improved long-term scenic quality.	Approximately 8,311 acres (or 85.4% of 9,734 acres) to be treated for fuel reduction and forest restoration resulting in a severely altered landscape character during short-term. Greatly improved long-term scenic quality.
Metolius Black Butte Area Total 2,170 Acres (Or 14.8% Of Total 14,694 Acres) Retention Foreground And Middleground Scenic View Allocation	No Change To Short-Term Landscape Character. Long-term scenic quality is expected to be altered by social and ecological processes.	Approximately 1,935 acres (or 89.2% of 2,170 acres) to be treated for fuel reduction and forest restoration resulting in a slightly altered landscape character during short-term. Slightly improved long-term scenic quality.	Approximately 1,841 acres (or 84.8% of 2,170 acres) to be treated for fuel reduction and forest restoration resulting in a moderately altered landscape character during short-term. Moderately improved long-term scenic quality.	Approximately 1,966 acres (or 90.6% of 2,170 acres) to be treated for fuel reduction and forest restoration resulting in a severely altered landscape character during short-term. Greatly improved long-term scenic quality.

Management Areas (Forest Plan)	Alternative 1 No Treatment	Alternative 2	Alternative 3 and 4	Alternative 5
Metolius Wild And Scenic River Area Total 1,317 Acres (Or 9.0% Of Total 14,694 Acres) Retention Foreground And Middleground Scenic View Allocation	No Change To Short-Term Landscape Character. Long-term scenic quality is expected to be altered by social and ecological processes.	Approximately 1,268 acres (or 96.3% of 1,317 acres) to be treated for fuel reduction and forest restoration resulting in a slightly altered landscape character during short-term. Slightly improved long-term scenic quality.	Approximately 1263 acres (or 95.9% of 1,317 acres) to be treated for fuel reduction and forest restoration resulting in a moderately altered landscape character during short-term. Moderately improved long-term scenic quality.	Approximately 1,317 acres (or 100% of 1,317 acres) to be treated for fuel reduction and forest restoration resulting in a severely altered landscape character during short-term. Greatly improved long-term scenic quality.
Metolius Special Forest Area Total 478 Acres (Or 3.3% Of Total 14,694 Acres) Retention Middleground Scenic View Allocation	No Change To Short-Term Landscape Character. Long-term scenic quality is expected to be altered by social and ecological processes.	Approximately 255 acres (or 53.3% of 478 acres) to be treated for fuel reduction and forest restoration resulting in a slightly altered landscape character during short-term. Slightly improved long-term scenic quality.	Approximately 412 acres (or 86.2% of 478 acres) to be treated for fuel reduction and forest restoration resulting in a moderately altered landscape character during short-term. Moderately improved long-term scenic quality.	Approximately 466 acres (or 97.5% of 478 acres) to be treated for fuel reduction and forest restoration resulting in a severely altered landscape character during short-term. Greatly improved long-term scenic quality.

Recreation

IMPORTANT INTERACTIONS

The project area is very popular for developed and dispersed recreation. The types of proposed activities that may effect recreation are restoration activities (harvest, prescribed burning, mowing) that may occur in or near developed recreation facilities or traditional dispersed use areas for individuals or groups, change in road status, and large-scale disturbances (wildfire, insect or disease).

Recreation is an Outstandingly Remarkable Value under the Metolius Wild and Scenic River plan (1996). The actions proposed under this project within the river corridor are expected to have a beneficial affect on the recreation by reducing the risk of high intensity wildfire in and adjacent to the river corridor, and by improving the health of forest stands in the river corridor. See further discussion on the Wild and Scenic River effects at the end of the Watershed analysis in this Chapter.

DIRECT AND INDIRECT EFFECTS

Tree harvest and fuel reduction activities may displace recreationists in the short-term, particularly those who cannot tolerate changes to their traditional recreation setting. Displacement may be due to physically closing access to areas during vegetation management activities and, indirectly by altering the setting. Harvest and post-harvest activities would have the longest duration effect on use by recreationists (several months to 1 year), while prescribed burning and mowing would only physically prevent recreationists from visiting areas during implementation of the activity (one day to several weeks). In addition, hauling timber along forest roads may also affect visitors by increasing the perceived hazard of traveling along narrow forest roads with log trucks. Tree harvest and fuel reduction activities that occur during seasons other than summer would impact fewer recreationists.

Removal of hazard trees along haul routes and recreation sites would have a positive effect on both the actual and perceived safety of recreation sites and travel routes.

Changes in road status can change the ability of visitors to access recreation sites. Temporary roads built to harvest units open up new areas to vehicle traffic and can establish areas of new recreation use. Closing roads (either temporary or long-term) to vehicle use restricts vehicle access, but can result in additional non-motorized trail opportunities (walking, biking and horseback riding). Public input during this project indicated there was very strong support for closing roads that resulted in resource impacts. However, there were a few people who expressed concern that not too many roads should not be closed because too much access was being restricted to forest areas. Road closures may be the biggest concern for recreationists who want to drive to a river for camping or fishing, very popular pursuits.

An indirect effect from opening dense stands in this project area is the increased ability for people to drive vehicles through the open forest (the project area is relatively flat). Off road travel is prohibited within the Metolius Heritage Area (see figure 1-2 In Chapter 1), however, there may be an increased risk of off road vehicle use if the forest is easier to drive through.

Noise and visibility of timber harvest and post-sale activities adjacent to popular recreation areas could impact opportunities for solitude and isolation from sights and sounds of humans close to recreation sites.

Large-scale disturbances from wildfire, insect or disease, can result in broad changes in recreation settings, particularly by altering the aesthetic quality of settings, the quality of riparian habitat that supports fishing, and by reducing the thermal cover from high summer temperatures and exposure (Evers 2000, Omi 1997). Recreationists would also not be able to visit forest areas during wildfire suppression activities.

Effects Of Alternative 1

Under the no action Alternative there would be no impacts on recreationists and forest recreation settings from restoration activities, and there would be no timber hauling from National Forest lands to conflict with recreational traffic. There would be no net reduction in road miles available for public travel.

Impacts associated with no action are a continued high number of acres at risk from severe disturbances from fire, insect or disease, which may reduce the amount of area suitable for recreation activities, and recreation facilities could be negatively impacted. Hazard trees would still be removed on an annual basis along public Highway Safety Act roads. No road segments would be closed and there would be no additional non-motorized trail opportunities. However, there would be no impacts to these areas from timber harvest and post-harvest activities. Scenic quality would continue to decline due to the high stand densities (see Scenic Resources effects in this Chapter).

Effects Of Alternatives 2, 3, 4 And 5

Tree harvest and fuel reduction activities would occur under each of the action alternatives, the therefore would result in some level of changes to the recreation setting. Short-term impacts, such as displacement from forest settings during restoration activities, and conflicts with timber hauling along forest roads would be on the fewest acres under Alternative 2 because fewer acres would have trees mechanically removed than under the other action Alternatives (see Table 2-4). Alternatives 3, 4 and 5 would all have similar number of acres with tree harvest (with Alternative 5 having slightly more), and thus would have similar amounts of log haul traffic. Since the impacts on scenic quality are expected to be short-term (see the Scenic Resources discussion in this Chapter) and are expected to enhance the scenic quality over the long term (longer than 5 years), it is not expected that recreationists would be displaced due to a change in the forest setting. In fact, since driving for pleasure and sightseeing is an important activity in the project area, it is expected that the proposed actions would improve the quality of this activity (Scenic Resources effects, this Chapter), though Alternative 5 would have the most intensive short-term scenic effects and may result in a short-term displacement of people who prefer recreating in dense forest settings.

All of the action alternatives would reduce road miles; the least under Alternative 2 (20 miles), the next most under Alternatives 3 and 4 (50 miles) and the most under Alternative 5 (60 miles). Conversely, the fewest temporary road miles would be developed under Alternative 2 (about 0.25 miles), more under Alternatives 3 and 4 (about 1.65 miles) and the most under Alternative 5 (about 1.8 miles). Overall, Alternative 5 would reduce the opportunity for the public to drive on forest roads within the project area more than the other Alternatives. However, Alternative 5 is expected to open up the understory of the forest the most through thinning than under the other action Alternatives, so may increase the risk of people driving vehicles *off* roads the most. Mitigation measures (Chapter 2, Mitigation) would help reduce the risk of this occurring in riparian areas. All of the action Alternatives would result in the same amount of road closures in riparian areas (about 2.75 miles) so would have equal effects on recreationists who want to drive to rivers.

Proposed activities may affect the quality of hunting and fishing in the project area. Changes to the riparian areas are not expected to be very noticeable to recreationists, so setting for fishing may not change in the short-term. However, the riparian areas may be more resilient to disturbances (e.g. from insects, disease or wildfire) after fuels and stand densities are reduced, so may be more sustainable. Big game hunting is another popular recreation activity in the area, and Alternative 2 is expected to have the most positive effect on big game habitat in the short-term, because it retains the most midstory, but all action Alternatives would retain small trees used as hiding cover by deer and elk.

All of the action alternatives would remove hazard trees along haul routes and in recreation sites, so would increase safety of recreationists.

Proposed activities are predicted to reduce the risk of severe disturbances on the acres they occur, and thus would reduce the potential impacts to forest settings for recreation by maintaining more sustainable thermal cover and aesthetic background for recreation activities.

Cumulative Effects

A reduction in the miles of forest roads open to motorized travel in the action Alternatives, in combination with the recent enforcement of a long standing Off Highway Vehicle restriction in the Metolius Heritage Area is likely to cumulatively effect recreationists who are looking for areas to drive vehicles in the forest. There is a trend across public lands in the west to control and restrict where vehicles can travel, and these actions would add to that effect. Also, closing roads in the riparian areas within the project area may have a cumulative effect on recreationists who are looking for opportunities to camp and fish in undeveloped forest settings where they can drive a vehicle. An indirect cumulative effect from these restrictions in access is continued displacement of recreationists who can not tolerate this type of management control. These people may end up substituting other forest settings where restrictions have not yet been enforced, and thus, may end up simply moving the resource impacts from concentrated recreation or vehicle use to other areas.

Actions under this project are expected to contribute to the increased perceived and actual safety of recreationists from wildfire on the Deschutes National Forest.

Heritage Resources

Important Interactions

The primary resource associated with tribal or treaty rights that may be affected by this project is the Metolius River and water quality (personal conversation with The Confederated Tribes of Warm Springs). See Watershed Effects in this Chapter for how proposed actions can affect water quality.

Timber harvest, heavy equipment, skidding of logs, intense activity at landings, and possible pile burning can all effect an historic property by breaking artifacts, changing their association and locations, and breakage or loss of hydration rinds from intense heat from pile burning. Thinning small trees by hand (chainsaws) with no pile burning would have no effect on lithic scatter sites. Machine piling and pile burning can effect sites by dozer activity breaking and redistributing artifacts and pile burning shattering lithic artifacts and removing hydration rinds with the intense heat. Mowing or mechanical shrub treatment has similar light impacts that does not have an effect on lithic scatter sites but can affect some historic sites by damaging glass and tin artifacts in historic debris dumps or scatters, and potential for damaging any remains of historic structures, corrals, and fence lines. Underburning can have similar impacts to historic sites that contain perishable materials. Burning can also impact prehistoric sites by breakage or redistribution of artifacts by line construction by hand tools and dozers or mopping up.

Associated actions in the project can also have an effect on historic properties. Road obliteration by subsoiling or ripping up the road bed can destroy features and break or redistribute artifacts from the surface to a depth of one meter. Road closures that involve the emplacement of boulders, bollards, or other installed barriers to road use can do similar damage to a site where these barriers are placed. Both of these road actions also have the beneficial effect of stopping ongoing damage from road use and maintenance that can break and redistribute artifacts.

All of the above effects can be avoided through proposed mitigation (see Chapter 2).

Indirect effects on heritage resources can be increased erosional movement of artifacts after treatment, increased visibility of historic and prehistoric artifacts that puts the sites at higher risk for looting, and potential collection of artifacts by the people working on the activities in this project.

Most effects to heritage resources can be mitigated by avoiding project activities in locations where the resource is present. Some sites that are in (or consist of) roads would be difficult to avoid entirely. However, restricting activity to already impacted parts of the sites would result in no additional impact to these locations.

Additional impacts to heritage resources could happen if additional sites were discovered during implementation of this project. Several of the heritage resources in this area are not where predictive models suggested they should be. The potential of additional resources being located where not recorded or previously predicted is considered moderate.

Dispersed recreation and vehicle use may affect heritage resources through breaking artifacts, removal of trees with cultural features for firewood, and vandalism and looting. Restricting vehicle access through road closures could reduce these impacts.

Cultural values are an Outstandingly Remarkable Value under the Metolius Wild and Scenic River plan (1996). The actions proposed under this project within the river corridor (primarily thinning trees 12" diameter or less and underburning) are note expected to have a negative affect on the cultural values. See further discussion on the Wild and Scenic River effects at the end of the Watershed analysis in this Chapter.

Effects Of Alternative 1

There would be no direct impacts to heritage resources from restoration activities under Alternative 1. However, there would be more acres at risk from wildfire related impacts (expose sites to additional erosion and collection, and impacts from fireline construction and other suppression activities) than under the action Alternatives. There would also be no reduction in impacts to heritage resources from dispersed recreation use through road closures.

Effects Of Alternatives 2, 3, 4 And 5

Each of the action alternatives have 34 historic properties (either prehistoric or historic) within the proposed treatment units that have the potential to be effected by the project. The effects of the treatments are described in the section above (Important Interactions). The most severe impacts would be from using heavy equipment to skid logs through a heritage site or the intense heat of pile burning on a site. Both of these impacts could be avoided by designating any heritage site in a unit that needs protection as part of a "no-treat patch" or changing unit boundaries to exclude the heritage site. Road decommissioning (removing the road completely) and road inactivation (closing off access to the road) can have severe effects to heritage resources also. If soil compaction is treated through sub soiling or scarification it can mix up all artifact associations in a site and destroy features such as fire pits or house floors. These effects can be avoided by not subsoiling or scarifying within the site area and by not using excavation to close a road entrance or to "install" boulders or bollards for a road closure (inactivation). Treatments with little or no effects include hand thinning using chain saws with no fuels treatment (no impacts), mechanical shrub treatment (mowing) that avoids some historic features that could be affected, and underburning that avoids sites with fire line construction and historic sites with wooden components are avoided. Table 4-24 Displays the type of treatments that will affect each of the sites under each of the Alternatives.

Alternative 2 has 24 sites in areas proposed for underburning that may also include mowing. Twelve sites are in units that are proposed for small tree thinning that may include underburning and/or mowing after the thinning. Three sites are whole or part in areas proposed for aspen restoration and one site is in an area proposed for meadow enhancement. A total of 34 sites have potential effects, some of the sites are partially in more than one treatment type.

Alternatives 3 and 4 have the same 34 sites in treatment areas but the types of treatments are different. Only four sites in areas with only underburning and potential mowing proposed. Twenty one sites are in units with thinning through a commercial harvest sale that may include small tree thinning, pile burning, underburning, and/or mowing after the commercial harvest. Twelve sites are within areas proposed for small tree thinning that may include burning or mowing also. Three sites are in aspen restoration areas and one is in a meadow enhancement area.

Alternative 5 also has the same 34 sites with potential effects. Four sites in areas with only underburning and potential mowing proposed. Seventeen sites are in units with thinning through a commercial harvest sale that may include small tree thinning, pile burning, underburning, and/or mowing after the commercial harvest. Fifteen sites are within areas proposed for small tree thinning that may include burning or mowing also. Two sites are in areas identified for larch restoration. One is in a unit proposed for a shelterwood cut (commercial) and the associated other post sale treatments. Three sites are in aspen restoration areas and one is in a meadow enhancement area.

All of the action alternatives would reduce potential impacts to heritage resources from wildfire and suppression activities, the most under Alternative 5 and least under Alternative 2. Seven historic properties are located in road locations proposed for decommissioning and three sites on roads proposed for inactivation. In alternative 2 there are five sites located in roads proposed for decommissioning and two where road inactivations are proposed. In alternatives 3 and 4 there are seven sites located in roads proposed for decommissioning and two where road inactivations are proposed. In alternative 5 there are seven sites located in roads proposed for decommsioning and two where road inactivations are proposed. Decommissioning and inactivation of roads could prevent future impacts to heritage resources from collection.

Under all three of the action alternatives appropriate mitigation and monitoring measures would result in no effect on significant heritage resources (see Mitigation and Monitoring, Chapter 2).

Table 4-39. Type of Vegetation and Fuel Treatment Proposed near Heritage Resources.

Site #	Type of Site	Alternative Teatment and Unit Number		
		Alternative 2	Alternatives 3 & 4	Alternative 5
016	prehistoric	Underburn	Underburn	Underburn
035	prehistoric	Underburn	Thin trees up to larger diameters	Larch Restore
036	prehistoric	burn/thin/meadow	Thin trees up to larger diameters/ small tree thin/ meadow	Comercial/pre/meadow
037	prehistoric	Underburn	Thin trees up to larger diameters	Small tree Thin
042	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
065	prehistoric	Underburn	Thin trees up to larger diameters/underburn	Thin trees up to larger diameters/underburn
067	Prehistoric and Historic	underburn/small tree thin	Thin trees up to larger diameters/small tree thin	Comercial/small tree thin
081	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
082	prehistoric	Underburn/aspen restore	Thin trees up to larger diameters/aspen restore	Thin trees up to larger diameters/aspen restore
088	Prehistoric and Historic	Small tree thin	Small tree thin	Small tree Thin
097	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
125	historic	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
173	prehistoric	Small tree thin	Small tree thin	Small tree Thin
174	prehistoric	Small tree thin	Small tree thin	Small tree Thin
175	prehistoric	Small tree thin	Small tree thin	Small tree Thin
219	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters/shelterwood
220	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
239	prehistoric	Underburn	Thin trees up to larger diameters	Small tree Thin
257	historic	Underburn	Underburn	Underburn

Site #	Type of Site	Alternative Teatment and Unit Number		
		Alternative 2	Alternatives 3 & 4	Alternative 5
304	historic	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
383	historic	Small tree thin	Small tree thin	Small tree Thin
385	historic	Small tree thin	Small tree thin	Small tree Thin
465	prehistoric	Underburn/aspen restore	Thin trees up to larger diameters/aspen restore	Comercian thin/aspen restore
469	historic	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
470	historic	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters
538	prehistoric	Underburn/aspen restore	Thin trees up to larger diameters/aspen restore	Thin trees up to larger diameters/aspen restore
545	prehistoric	Small tree thin	Small tree thin	Small tree Thin
590	prehistoric	Underburn	Underburn	Underburn
592	Prehistoric and Historic	Small tree thin	Small tree thin	Small tree Thin
596	prehistoric	Underburn	Thin trees up to larger diameters	Small tree Thin
602	prehistoric	Small tree thin	Small tree thin	Small tree Thin
603	Prehistoric and Historic	Small tree thin	Small tree thin	Small tree Thin
623	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters/larch restore
627	prehistoric	Underburn	Thin trees up to larger diameters	Thin trees up to larger diameters

Cumulative Effects

Under the all action Alternatives all potential effects are expected to be avoided or mitigated (see Mitigation under Chapter 2), resulting in no net negative cumulative affects to the heritage resources within the project area. Beneficial cumulative effects include road closures that would reduce ongoing impacts from road use and maintenance, and a reduction in the risk of high severity wildfire, which reduces both the risk of impacts from fire and from fire suppression activities.

Past effects to heritage resources in the project area include the rural and residential developments of Camp Sherman, and recreation developments and use, particularly along the Metolius River and its tributaries. Road development and use (historic and recent), wildfires and fire suppression activities, past vegetation management activities, natural disturbances (rodent burrows) and development of utilities have also affected heritage resources. Future potential impacts include continued recreation use in certain sensitive areas, and continued road use and maintenance.

Forest Plan Amendments

Visual Quality

A short-term, non-significant, site specific amendment of several visual quality standards and guidelines in the Deschutes National Forest Land and Resource Management Plan, is proposed to allow impacts from tree removal and prescribed burning to be visible to the "casual observer" for slightly longer periods, and openings (due to the removal of dead and declining trees under Alternative 5) to occur on slightly more acres than under the existing Standards and Guidelines. Though the current Visual Quality Standards and Guidelines would not be met in the short-term, the proposed actions are expected to better meet visual quality objectives for the long-term (over five to ten years). Following is a description of proposed changes to the existing standards and guidelines for Scenic Views (MA9), Metolius Heritage (M19), Metolius Black Butte (M21), and Metolius Special Forest (M22).

A goal for scenic views in the project area is to provide forest visitors with high quality scenery that represents the natural character of Central Oregon. The objectives call for enhancing landscapes by opening views to distant peaks, and highlighting large ponderosa pine. The scenic views allocation of "retention-foreground" is located ¼ mile either side of Forest Roads 14, 1419, 1420, 12, 1217 and 1120, and along the Metolius Wild and Scenic River, and 1/8 mile either side of the Metolius-Windigo Trail. The remainder of the project area is considered "retention-middleground", except for the area west of Forest Road 12 in the Metolius Special Forest. Although proposed activities are intended to meet this goal and the Standards and Guidelines over the long-term (longer than 5 years), short-term visual impacts are expected from removing vegetation (slash, stumps, stacked logs, skid roads), reducing fuels (blackened, scorched vegetation and tree trunks), and creating openings (under Alternative 5 only). As such, it is recommended that the following Standards and Guidelines be amended:

<u>M9-4, M19-26 and M21-9: Ponderosa Pine Foreground, Metolius Heritage and Metolius Black Butte – Desired Visual Condition</u>

The proposed actions of thinning and underburning are expected to result in visible changes noticeable by the casual observer in these management areas. It is proposed that these Standards and Guidelines be amended to accept that the casual forest visitor may notice short-term changes in these allocations. These objectives would be met over the long term through re-establishment of open, park-like stands of ponderosa pine and enhancement of existing large pine trees.

<u>M9-8, M9-27, M9-44, M21-20, and M22-13: Timing of Cleanup Activities in Ponderosa Pine Foregrounds, Mixed Conifer Foregrounds, Middlegrounds and Backgrounds, and forested areas in the Metolius Black Butte and Metolius Special Forest areas.</u>

These Standards and Guidelines establish that slash, logging residue, or other results of management activities will not be obvious to the casual forest visitor one year following the activity in Retention areas, and two years following the activities in Partial Retention areas. Although the Sisters Ranger District intends to clean up the slash as soon as possible, especially along travel corridors, this project would employ prescribed burning to reduce natural fuels, and fuels created by timber harvest activities. Prescribed burning is considered an important management tool in this fire-adapted ecosystem, but effects from burning (blackened, scorched vegetation and tree trunks) may be visible for approximately 5 years. This exceeds the standard for the amount of time management actions can be visible within both retention and partial retention allocations. It is recommended that these Standards and Guidelines be amended to allow visible effects of harvest cleanup and fuels reduction for approximately 5 years.

<u>M-29, M9-34 and M22-8: Openings in Mixed-Conifer Foreground, and in Metolius Special Forest.</u>

Under Alternative 5, proposed actions would remove dead and declining white fir from about 296 acres of stands that have been moderately affected by spruce budworm, root disease and dwarf mistletoe. The intent of management actions in these areas is to reduce fuels, restore large ponderosa pine to the landscape, and, where possible, to mimic the shape of natural-occurring openings on the landscape. The stands where this activity would occur would not be completely open, since the healthiest and largest ponderosa pine, Douglas-fir, and larch (with minor amounts of large white fir) would remain. However, these partial openings are expected to exceed 5-10 acres (the maximum standard for this Mixed Conifer Foreground is 5 acres, and the maximum for Metolius Special Forest is 10 acres). It is recommended that, under Alternative 5, this Standard and Guideline be amended to allow openings, less than 40 acres, to remove dead and declining trees. Openings would be reforested, as needed, if insufficient natural reproduction exists. It is recommended that this Standard and Guideline be amended to allow openings to be visible for approximately 7 to 10 years, the estimated time it would take for seedlings in these openings would reach 4 ½ feet[31], depending on the site conditions.

<u>M9-90 and M21-43: Fire Management in Scenic View Areas and Metolius Black Butte.</u>

This Standard and Guideline restricts the size of prescribed fire to 5-acre patches in foreground areas. Prescribed burning is considered an important management tool in this fire-adapted ecosystem, and it is proposed that burning occur at a landscape-scale to most effectively reduce surface fuels and promote fire-climax conditions. However, effects from burning (blackened, scorched vegetation and tree trunks) may be visible in the short-term. It is recommended that this Standard and Guideline be amended to allow prescribed burning on larger than 5-acre patches.

Fuelwood Collection

A site-specific, non-significant amendment of fuelwood standard and guideline in the Deschutes National Forest Land and Resource Management Plan is proposed to allow the Forest Service to permit commercial and personal use fuelwood collection in the Metolius Heritage area.

<u>M19-27: Fuelwood, Metolius Heritage Area.</u>

[31] 4 ½ feet is the tree height at which "openings" are considered returned to a forested condition, Regional Guide, Pacific Northwest Region, 1984

It is assumed that this standard and guideline was initially developed to prevent impacts that could be associated with collection of fuelwood, such as user-created roads, piles of limbs and slash from wood cutting, and visible cut stumps. However, fuelwood may be a product that could be utilized as an outcome of implementing forest health and fuel reduction objectives under this project. Both commercial and personal fuelwood collectors could help accomplish these objectives by removing excess vegetation. The activity would only be permitted in specified areas and under specified terms and conditions that would mitigate potential impacts.

Effects of Proposed Forest Plan Amendments

The proposed revised Visual Quality and Fuelwood standards and guidelines would not significantly change the forest-wide impacts disclosed in the Deschutes National Forest Land and Resource Management Plan Environmental Impact Statement, based on the following factors:

Timing: The effects of the proposed revised Visual Quality standards and guidelines for implementing the Metolius Basin Forest Vegetation Management project are predicted to occur in the short-term (approximately 5 years) for prescribed burning and post harvest activities. Created openings from removing dead and dying trees would be visible for longer periods (7 to 10 years) but are expected to appear forested more quickly than if they were not treated (where needed, openings would be reforested).

The effects of the proposed revised Fuelwood Collection standard and guideline for implementing the Metolius Basin Forest Vegetation Management project are predicted to occur in the short-term (approximately 5 years) during implementation of the project.

Location and Size: The proposed revised Visual Quality standards and guidelines are site specific and would only affect the area within the Metolius Basin Forest Management project area boundary. The proposed revision of the Fuelwood Collection standard and guideline would only affect the Metolius Heritage area.

Goals, Objectives and Outputs: The proposed revised Visual Quality and Fuelwood Collection standards and guidelines would not alter the long-term relationship between levels of goods and services projected by the Land and Resource Management Plan. There would not be any significant change in timber outputs over what might be available if the project was designed without the proposed amendment. Wood material that could not be removed through the use of fuelwood permits, would be removed by other means.

Management Prescriptions: The proposed revised Visual Quality and Fuelwood Collection standards and guidelines would not change the desired future condition for land and resources from that contemplated by the existing management direction in the Land and Resource Management Plan in the short-term. It would not affect the whole Land and Resource Management Plan planning area, but only approximately 14,700 acres of National Forest System lands within the Metolius Basin project area. The proposed amendments would not change the Land and Resource Management Plan allocations or management areas.

Other Effects

Short-term Uses and Long-term Productivity

Analysis by the IDT indicates that long-term production and quality of water, maintenance and development of late-successional habitat, and protection of Late-Successional Reserve values would be enhanced by the implementation of fire hazard reduction activities. All action alternatives would help to protect long-term productivity by reducing the risk of large-scale high severity wildfire, to some extent (see Soils and Watershed Effects). With full implementation of the mitigation measures and management requirements and constraints developed for the action alternatives, soil productivity would be maintained over the long-term. The action alternatives would improve soil productivity in specific areas where reclamation (obliteration) treatments are implemented on soils committed to roads and logging facilities. Under the No-Action Alternative fire hazard would continue to increase. The risk of large-scale stand replacing fire would be higher than with implementation of any of the action alternatives.

Unavoidable Adverse Effects

The implementation of any of the action Alternatives would result in some adverse impacts. Many of these impacts can be mitigated to acceptable levels using the Mitigation Measures specified in Chapter 2, in addition to project design enhancements discussed under Appendix C. The unavoidable adverse impacts summarized below are those that are expected to occur after the application of mitigation measures, or that cannot be mitigated to a level approaching existing conditions.

<u>Increased short-term sediment delivery:</u> Although mitigation measures and Best Management Practices are expected to reduce the potential for accelerating sediment production to near base line levels, there would be some minor risk for short-term indirect impacts to water quality as a result of implementing the action alternatives. See a discussion under Watershed effects, this Chapter.

<u>Compaction/Site Productivity:</u> Under the action Alternatives, additional detrimental soil compaction would occur as a result of the use of ground-based equipment to remove trees. Mitigation measures would limit the area compacted to comply with Forest Standards and Guidelines for soil protection (no more than 20 % cumulative detrimental impacts). Areas currently in excess of 20% detrimental impacts would not increase from current activity and are expected to show an improving trend, due to rehabilitation. See a discussion under Soil effects, this Chapter.

<u>Air Quality:</u> Project design and mitigation measures are expected to reduce the potential for air quality degradation. The potential exists for changes in atmospheric conditions that could result in smoke and particulate matter to drift, causing minor short-term impacts on air quality, primarily within the Metolius Basin. All prescribed burning operations would be conducted in compliance with the Oregon Smoke Management Guidelines administered by the Oregon Department of Environmental Quality. See a discussion under Fire and Fuels effects: Air Quality, this Chapter.

Noxious Weeds. Under all action alternatives, conditions would be created that increase the risk of introduction and spread of noxious weeds. Mitigation measures would be used to reduce this risk, however, the desired open stand conditions in the ponderosa pine plant associations would remain vulnerable to weed introduction.

Disturbance to Residents and Visitors: Implementation of activities under any of the action Alternatives will cause noise, and may result in localized dust that could affect visitors and residents in or adjacent to the activity area. In addition, transportation of equipment and materials along Forest Roads may be a concern for visitors and residents. Visitors and residents would be notified of activities that may affect them prior to implementation.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Under Alternative 1 there would be no irreversible or irretrievable commitments of resources. The Action Alternatives would have temporary roads and landings that would remove these specific sites from development of late-successional habitat or from timber production. Vegetation removed would be an irretrievable (but not irreversible) impact. The construction and use of new roads and logging facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity. The action alternatives include decommissioning activities that would improve the hydrologic function on disturbed sites. There would be no irretrievable losses of soil productivity associated with watershed improvement activities that obliterate unneeded roads and management facilities.

Forest conditions could return, but the objective of the project is to maintain the forest in a more open condition. All action Alternatives would maintain or mitigate impacts at levels that would be in compliance with Land and Resource Management Plan standards and guidelines, other than site-specific short-term impacts to visual quality.

Effects on Wetlands and Floodplains

Effects on and protection of wetlands and floodplains are described under Watershed effects, this Chapter. In summary, riparian reserves, including wetlands, are intact and impacts are expected to be primarily beneficial over the long-term.

Effects on Prime Farmland, Rangeland and Forest Land

All Alternatives are in keeping with the intent of Secretary of Agriculture memorandum 1827 for prime farmland. The Metolius Basin project area does not contain any prime farm lands or rangelands. Prime forest land is not applicable to lands within the National Forest System. In all

Alternatives, Forest System Lands would be managed with sensitivity to the effects on adjacent lands.

Energy Requirements of Alternatives

Under the action Alternatives, additional consumption of fossil fuels and human labor would be expended for the use of vehicles transporting forest workers, chainsaws, heavy equipment and trucks. Fossil fuel energy would not be retrievable. However, there are no unusual energy requirements for implementing any of the action Alternatives.

Effects on Minorities and Women, and Environmental Justice

There would be no discernable impacts among Alternatives in effects on Native Americans, women, other minorities, or the Civil Rights of any American Citizen.

Environmental justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share 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.

The Proposed Action has been conducted under Departmental regulation 5600-2, December 15, 1997. The Proposed Action, Purpose and Need and area of potential effect have been clearly defined. Scoping under the National Environmental Policy Act has utilized extensive and creative ways to communicate.

The Proposed Action does not appear to have a disproportionately high or adverse effect on minority or low-income populations. Extensive scoping did not reveal any issues or concerns associated with the principles of Environmental Justice. No mitigation measures to offset or ameliorate adverse affects to these populations have been identified. All interested and affected parties will continue to be involved with the public involvement and decision process.

Public and Worker Safety

Signing activity areas and notifying the public of additional project-related traffic would mitigate safety to the public during implementation of the project. Other mitigation measures would include restricted operations during specific harvest actions and partial or complete of some areas during implementation.

All project activities (Forest Service actions and actions under Forest Service contracts) would comply with State and Federal Occupational Safety and Health (OSHA) codes. All Forest Service project operations would be guided by Forest Service Handbook 6709.11 (Health and Safety Code).

Inventoried Roadless and Wilderness

There are no Inventoried Roadless or Wilderness area in or adjacent to the project area. There are also no contiguous unroaded areas entirely or partially within the project area 5,000 acres or greater.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

The Forest Service has consulted with the agencies listed below as required under the following Acts and laws:

The Oregon State Preservation Office has been consulted with on compliance with the National Historic Preservation Act regarding ground disturbing actions in historical places. The review is in progress at the time of the Draft Environmental Impact Statement.

U.S. Fish and Wildlife Service and the National Marine Fisheries Service were consulted, in accordance with the ESA implementing regulations for projects with threatened or endangered species. The result was a recommendation to continue formal consultation on potential affects to spotted owl (in process at the time of the Draft Environmental Impact Statement). No further review was recommended regarding other fish or wildlife species.

The Oregon Department of Fish and Wildlife has reviewed the alternatives in regards to potential effects to wildlife (in process at the time of the Draft Environmental Impact Statement).

There was no action under this project that required consultation with US Fish and Wildlife Service under the Fish and Wildlife Coordination Act for causing water to be impounded or diverted.

CHAPTER 5. CONSULTATION AND COORDINATION

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, state and local agencies, tribes and non-Forest Service persons during the development of this environmental impact statement:

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Washington Natural Heritage Program Website.

APPENDIX A

Silvicultural and Fuel Treatments

Table 1 displays a detailed list of the silvicultural and fuel treatments that are proposed for each stand, or portion of a stand in the project area, by the Alternative. Many stands would have more than one type of treatment, so are broken out in the more than one unit. A map that coincides with this table can be viewed on the project website at http://www.fs.fed.us/r6/centraloregon/index-metolius, or can be requested from the Sisters Ranger District.

hp = handpile, m=mow, mp = machine pile, ub= underburn

Table 1. Detailed list of silvicultural and fuel treatment by stand by Alternative

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
1	4.26	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
2	11.38	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
3	7.59	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
4	13.62	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
4	1.02	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
5	23.92	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
6	1.74	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
6	7.37	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
7	11.72	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
8	22.69	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
8	5.84	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
9	8.32	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
9	21.82	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
10	4.82	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
11	13.18	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
11	0.73	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
12	6.52	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
12	5.67	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
13	3.78	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
14	9.97	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
15	7.17	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
16	2.77	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
16	0.29	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
16	24.41	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
17	8.86	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
17	15.31	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
17	1.46	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
18	2.33	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
19	1.45	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
11095	9.87	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
11095	6.68	no treatment	no treatment	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
11096	0.17	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
11096	0.98	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
11096	4.85	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
11096	29.07	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
11098	6.65	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
11588	3.63	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
11590	5.92	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
11590	99.82	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
11591	11.47	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
11591	45.35	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11596	14.45	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11596	79.98	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11596	2.06	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11597	3.29	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
11597	5.10	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
11598	22.18	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11598	0.20	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
11599	5.94	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
11599	6.99	no treatment	no treatment	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
11599	0.80	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
11599	0.01	no treatment	no treatment	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
11600	1.63	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
11600	10.05	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57014	0.04	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57014	3.76	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57014	43.30	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57015	12.16	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57025	0.91	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57025	0.38	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57025	0.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57025	4.77	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57025	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57026	0.13	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57026	52.80	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57027	30.84	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57028	24.49	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57029	56.23	underburn		underburn		underburn		underburn	
57030	0.07	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57030	38.57	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57031	10.81	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57033	4.53	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57034	16.78	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57034	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57034	11.92	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57035	45.72	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57036	9.66	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57036	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57036	7.32	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57036	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57036	14.11	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood/thin > 12" dbh	machine pile
57040	1.77	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57040	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57040	10.29	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57058	0.00	no treatment	no treatment	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57058	0.00	no treatment	no treatment	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57058	0.90	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	3.97	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	3.59	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	9.96	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57058	0.36	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57058	20.77	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57058	41.82	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57058	0.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57148	0.35	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57148	0.28	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57148	0.03	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57148	19.34	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57148	1.90	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57507	1.10	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57507	6.42	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57507	0.29	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57507	0.37	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57507	2.22	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57508	3.37	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57508	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57508	0.01	no treatment	no treatment	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57509	6.20	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57509	1.36	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
57513	5.23	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57513	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57513	0.69	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57514	1.39	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57514	29.71	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57514	1.26	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57515	0.65	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57515	25.49	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57515	29.22	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57516	0.06	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57516	0.26	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57516	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57516	0.31	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57516	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57516	9.69	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57517	11.08	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57518	17.58	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57522	0.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57522	8.65	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57523	0.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	shelterwood	machine pile
57523	14.21	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57524	5.53	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57524	60.65	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57525	0.32	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57525	36.36	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57526	27.05	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57527	30.34	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57527	113.28	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57528	31.89	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57529	31.81	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57530	12.35	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57531	18.29	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57532	38.35	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57533	1.27	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57533	1.47	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57533	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57533	11.06	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57533	90.45	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57534	8.33	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57534	4.21	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57534	18.46	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
57534	9.31	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp
57535	1.36	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57535	6.10	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57535	0.02	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57535	0.46	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57535	6.33	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57535	50.82	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57537	2.29	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57537	11.89	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57537	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57537	0.92	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57537	4.35	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57538	0.11	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57538	0.55	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57538	2.25	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57538	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57538	5.99	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	shelterwood	ub/hp
57538	1.22	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57539	5.34	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57539	0.74	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57539	6.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57540	4.21	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57540	0.83	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57540	0.85	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57540	3.47	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57541	6.41	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57541	0.13	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
57541	5.18	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57542	1.88	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57542	8.74	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57542	0.02	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57542	1.23	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57542	0.01	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
57542	1.61	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57543	3.62	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57543	8.19	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57543	6.61	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57543	22.14	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57543	12.30	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57546	3.06	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57546	4.14	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57546	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57546	25.81	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
57547	5.75	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57547	4.24	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57547	0.16	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57547	8.63	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57547	22.32	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57548	0.22	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57548	2.67	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57548	2.30	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57548	1.88	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57549	0.02	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57549	4.89	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57549	2.37	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
57549	15.73	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
57550	8.69	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57550	3.07	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
57550	16.43	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
57551	17.14	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	shelterwood	ub/hp
57551	9.64	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	ub/hp
57553	2.19	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57553	3.06	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57553	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57553	8.94	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57554	3.64	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57554	8.45	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57554	10.62	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57554	27.25	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57555	1.42	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57555	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57555	10.81	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57556	8.51	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57556	0.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57556	16.66	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57558	6.81	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57558	8.36	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57559	0.64	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57559	3.60	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57559	1.32	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57559	10.38	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57560	0.42	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57560	5.80	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57560	0.52	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57560	8.75	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57561	0.12	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57561	2.09	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57561	1.49	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57561	37.24	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57562	0.11	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57562	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57562	0.42	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57562	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57562	1.20	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57565	0.55	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.25	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.82	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	19.12	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.09	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.02	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57565	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.60	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	26.06	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57565	0.15	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57565	0.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57565	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57565	0.77	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57565	66.72	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57566	36.18	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57566	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57566	0.30	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57566	5.41	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57568	1.33	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57568	0.56	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57569	14.85	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57569	3.62	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57570	1.07	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57570	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57570	0.55	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57570	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57570	2.39	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57570	4.14	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57575	1.92	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57575	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57575	16.35	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
57575	44.86	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57576	22.85	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
57576	36.11	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57577	82.22	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
57577	3.07	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57615	6.55	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57615	11.39	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
57616	0.56	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57616	15.13	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57617	0.27	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57617	23.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57617	2.92	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57617	0.14	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57617	5.99	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57618	16.42	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
57619	6.83	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57619	1.17	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57619	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57619	11.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57620	11.23	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57620	2.03	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
57621	11.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57621	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57621	3.53	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57628	2.51	underburn		underburn		underburn		underburn	
57628	63.81	underburn		no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57953	20.66	underburn	M	underburn	M	underburn	M	underburn	M
57953	19.03	underburn	M	underburn	M	underburn	M	underburn	M
57954	40.69	underburn	M	underburn	M	underburn	M	underburn	M
57954	5.30	underburn	M	underburn	M	underburn	M	underburn	M
57955	2.85	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57955	18.40	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57955	0.17	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
57956	10.09	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57958	5.33	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57958	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57958	12.19	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57958	24.32	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57959	1.51	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57959	20.62	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57959	11.28	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57959	62.50	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57960	13.36	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57961	2.31	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57961	5.86	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57962	8.40	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57962	10.56	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57962	0.00	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57962	0.53	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57963	0.45	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57963	4.02	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57963	0.87	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57963	13.70	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57964	5.35	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57964	0.15	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57964	0.09	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57964	0.03	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57964	0.40	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57964	0.07	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57964	6.95	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57964	37.80	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57965	23.95	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57966	2.08	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57966	9.04	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57967	2.42	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57967	7.83	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57968	2.60	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57968	1.91	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57968	53.68	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57968	0.76	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57969	24.43	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57969	100.55	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57970	106.51	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57971	72.65	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57972	69.06	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57973	13.83	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57973	73.60	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57974	61.93	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	larch restoration	machine pile/underburn/mow
57975	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57975	1.34	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57975	189.77	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
57976	0.37	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57976	8.35	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57976	27.99	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57977	0.34	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57977	8.55	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57977	20.90	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
57978	39.92	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57978	15.93	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57979	16.93	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57979	8.63	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57980	16.03	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57980	17.43	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57981	2.82	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57981	3.33	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57981	1.28	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57981	37.51	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood/thin > 12" dbh	machine pile
57982	20.05	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57982	5.79	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57983	0.89	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57983	5.23	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57983	12.97	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	larch restoration	machine pile/underburn
57984	18.19	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57984	40.08	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57985	1.26	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57985	8.45	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57985	15.41	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	larch restoration	machine pile/underburn
57986	17.93	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57986	3.89	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	shelterwood/thin > 12" dbh	machine pile
57986	40.60	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood/thin > 12" dbh	machine pile
57987	3.70	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57987	29.04	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	larch restoration	ub/hp/mow
57987	22.17	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	larch restoration	machine pile/underburn/mow
57988	31.34	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57989	0.13	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57989	2.73	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
57989	10.71	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57989	1.70	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
57989	15.52	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57990	0.02	no treatment	no treatment	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57990	0.00	no treatment	no treatment	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57990	0.73	no treatment	no treatment	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57990	1.65	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57990	19.76	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57991	3.98	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57991	14.92	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
57992	2.98	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57992	0.13	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57992	4.42	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57992	23.00	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	larch restoration	ub/hp/mow
57992	0.06	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	larch restoration	machine pile/underburn/mow
57993	3.82	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57993	0.97	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57993	0.14	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
57993	24.83	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57993	16.39	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57994	6.34	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57994	5.70	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
57994	20.84	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57995	8.37	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57995	25.45	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
57995	28.73	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
57996	9.28	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
57996	15.48	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
57997	0.33	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57997	4.87	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57997	17.85	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
57998	5.43	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57998	2.35	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
57998	12.54	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
57998	12.82	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
57999	4.01	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57999	0.49	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57999	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
57999	14.90	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58000	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58000	5.38	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58000	31.64	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58001	13.49	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58001	0.22	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58001	14.82	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58003	0.04	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58003	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58003	0.43	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58003	18.01	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58004	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	0.28	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	0.07	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	0.33	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	0.29	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	2.84	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58004	34.31	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	larch restoration	machine pile/underburn
58004	26.36	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	larch restoration	machine pile/underburn
58005	15.69	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58005	4.42	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58005	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58005	6.31	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58005	0.01	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58006	0.87	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58006	0.29	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58006	0.28	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58006	0.37	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58006	5.99	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58006	1.16	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58007	12.03	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58007	1.26	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58007	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58007	5.30	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
58007	0.08	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
58008	5.28	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58008	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58008	7.86	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58008	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58008	5.88	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58009	11.42	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58009	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58009	0.86	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58014	4.28	thin 12" dbh or less	hand pile	underburn		underburn		underburn	
58014	0.00	thin 12" dbh or less	hand pile	underburn		underburn		underburn	
58014	0.88	underburn		underburn		underburn		underburn	
58014	0.00	underburn		underburn		underburn		underburn	
58014	0.07	underburn		underburn		underburn		underburn	
58014	31.92	underburn		underburn		underburn		underburn	
58015	6.78	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58015	9.90	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58015	5.08	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58015	3.67	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58015	26.54	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
58015	14.06	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
58016	2.44	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58016	12.93	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58016	1.37	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58017	23.71	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile
58017	0.00	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile
58017	20.07	aspen restoration	machine pile	aspen restoration	machine pile	aspen restoration	machine pile	aspen restoration	machine pile
58019	15.43	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58019	0.63	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood	machine pile
58020	3.54	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58020	108.26	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58021	0.78	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58021	2.95	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58021	0.21	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58021	0.66	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58021	0.57	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58021	1.26	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58021	33.64	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58022	6.22	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58022	2.66	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58023	9.98	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile	aspen restoration	hand pile
58023	24.23	aspen restoration	machine pile	aspen restoration	machine pile	aspen restoration	machine pile	aspen restoration	machine pile
58024	3.96	underburn		underburn		underburn		underburn	
58024	136.13	underburn	M	underburn	M	underburn	M	underburn	M
58024	92.51	underburn	M	underburn	M	underburn	M	underburn	M
58025	0.17	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58025	1.65	underburn		thin > 12" dbh in connectivity corridor	hand pile	thin > 12" dbh in connectivity corridor	hand pile	thin > 12" dbh	hand pile
58025	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58025	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58025	16.38	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
58025	30.94	underburn	M	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58025	0.23	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
58025	44.18	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58026	12.21	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58026	3.75	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58026	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58026	0.19	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58026	10.83	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58026	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58026	14.98	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58026	8.95	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58026	0.71	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58026	3.91	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58026	11.64	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58027	4.36	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58027	5.46	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58027	16.01	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58027	0.36	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58027	62.37	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58027	19.02	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58029	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58029	0.84	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58029	15.47	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58030	0.31	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58030	2.64	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58030	0.28	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58030	11.67	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58031	2.10	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58031	4.70	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58031	3.80	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58031	2.80	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58031	32.88	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58031	1.95	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58031	0.11	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58032	2.69	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58033	11.10	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58033	20.99	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58034	55.40	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58034	6.96	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58035	0.65	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58035	0.12	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58035	24.50	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58039	19.04	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58040	25.12	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58041	11.40	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58041	0.00	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58041	13.50	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58042	9.70	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58043	2.89	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58043	1.32	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58046	10.00	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58357	6.32	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58357	2.41	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58357	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58357	4.29	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58357	0.04	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58357	55.40	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58357	0.86	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58360	0.95	underburn		underburn		underburn		underburn	
58360	0.79	underburn		underburn		underburn		underburn	

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58360	6.00	underburn	M	underburn	M	underburn	M	underburn	M
58360	15.12	underburn	M	underburn	M	underburn	M	underburn	M
58361	0.77	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58361	4.09	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58362	0.58	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58362	17.91	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58362	30.74	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58363	5.24	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58363	8.83	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58364	6.63	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58364	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58364	0.00	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
58367	1.00	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58367	12.91	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58368	3.02	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58369	20.52	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58370	8.99	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58370	3.07	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58371	6.61	underburn		thin > 12" dbh	underburn	thin > 12" dbh	underburn	thin > 12" dbh	underburn
58371	9.46	underburn		thin > 12" dbh	underburn	thin > 12" dbh	underburn	thin > 12" dbh	underburn
58372	4.53	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58372	13.36	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58372	10.12	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58372	22.64	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58373	8.96	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58374	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58374	6.61	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58374	58.87	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58375	8.73	underburn	M	underburn	M	underburn	M	underburn	M
58375	18.53	underburn	M	underburn	M	underburn	M	underburn	M
58377	22.21	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58378	2.68	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58378	46.91	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58379	24.74	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58379	93.97	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58380	1.90	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58380	4.12	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58380	6.47	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58380	55.38	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58381	2.31	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58381	6.56	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58381	9.10	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58381	1.90	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58381	78.70	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58381	82.47	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58382	13.15	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58382	7.35	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58382	0.81	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp	thin 8" dbh or less in defensible space	ub/hp
58382	2.59	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58383	1.87	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58383	5.27	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58383	2.23	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58383	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58383	2.21	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58383	3.54	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58384	8.13	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58384	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58384	58.50	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58385	35.39	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58385	4.59	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58386	10.68	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58386	2.49	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58386	1.61	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58386	0.83	underburn		thin > 12" dbh	underburn	thin > 12" dbh	underburn	larch restoration	machine pile/underburn
58386	9.24	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58387	19.74	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58387	25.40	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58387	2.15	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58387	4.17	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58387	50.34	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58387	19.83	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58388	1.15	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	15.15	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	0.03	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	13.86	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	11.71	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	9.36	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	0.87	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58388	29.01	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58388	124.88	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58389	2.42	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58389	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58389	11.19	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58389	0.07	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58389	29.11	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	larch restoration	ub/hp/mow
58389	27.09	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	larch restoration	machine pile/underburn/mow
58390	24.04	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp
58391	12.13	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58391	12.48	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58391	0.90	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58391	4.93	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58391	1.78	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58391	0.03	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58391	0.14	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58391	118.46	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58391	70.02	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58392	0.04	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58392	5.64	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58392	0.05	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	larch restoration	hand pile
58392	26.70	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	larch restoration	machine pile/underburn
58393	11.94	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	3.75	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	1.83	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	9.89	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	2.83	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	1.39	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58393	112.81	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58393	7.24	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58394	1.50	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58394	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58394	0.72	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58394	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58394	4.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58394	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58394	1.51	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58394	0.01	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58394	2.96	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58395	9.54	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58395	12.19	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58396	3.09	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58396	12.65	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58396	8.43	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58396	8.33	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58396	88.76	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58396	78.01	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58397	1.46	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58397	5.14	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58397	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58397	5.32	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58402	12.42	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58404	1.08	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58404	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58404	1.52	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58404	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58404	1.82	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58404	0.00	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58405	3.68	thin 12" dbh or less	hand pile	underburn		underburn		underburn	

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58405	6.43	underburn	M	underburn	M	underburn	M	underburn	M
58409	0.12	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58409	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58409	20.86	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58410	18.06	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58410	162.94	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58410	22.39	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58412	2.19	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58412	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58412	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58412	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58412	0.00	underburn		thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58413	0.62	thin 12" dbh or less	hand pile	underburn		underburn		underburn	
58413	20.48	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58413	0.18	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58413	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58413	0.92	underburn		underburn		underburn		underburn	
58413	0.00	underburn		underburn		underburn		underburn	
58413	0.92	underburn		underburn		underburn		underburn	
58413	2.77	underburn		underburn		underburn		underburn	
58416	5.87	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58417	0.39	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58417	0.32	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58417	1.77	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58417	0.00	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58417	0.01	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58417	41.90	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58417	9.30	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58418	5.31	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58418	23.34	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58419	82.36	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58419	15.96	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58420	2.78	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58420	2.37	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58420	40.02	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58420	8.24	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58421	3.07	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58421	32.56	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58422	5.72	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58422	34.31	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58423	33.66	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58423	0.15	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58424	4.48	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58424	22.75	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58425	14.77	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58425	2.86	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58425	31.17	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58425	21.18	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58426	0.80	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58426	1.09	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58426	24.45	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58427	0.11	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58427	4.72	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58430	0.53	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
58430	25.22	underburn	M	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
58430	0.00	underburn	M	thin > 12" dbh	machine	thin > 12" dbh	machine	thin > 12" dbh	machine pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
					pile/mow		pile/mow		
58431	18.68	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58431	24.83	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58431	0.01	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58431	0.04	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58431	0.01	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58432	10.20	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58435	0.17	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58435	1.25	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58435	0.62	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58435	14.45	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58669	6.28	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.09	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	20.79	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	3.35	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.23	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.19	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.02	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	2.97	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.00	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	5.78	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.06	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58669	15.42	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	3.16	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.62	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58669	0.03	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58669	0.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58669	0.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58669	0.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58714	5.20	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58719	0.73	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58719	8.26	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58719	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58719	44.35	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58720	0.00	underburn		underburn		underburn		underburn	
58720	0.15	underburn		underburn		underburn		underburn	
58720	10.80	underburn	M	underburn	M	underburn	M	underburn	M
58722	3.76	underburn		underburn		underburn		underburn	
58722	0.00	underburn		underburn		underburn		underburn	
58722	1.27	underburn	M	underburn	M	underburn	M	underburn	M
58723	28.88	underburn		underburn		underburn		underburn	
58723	4.05	underburn		underburn		underburn		underburn	
58723	108.44	underburn	M	underburn	M	underburn	M	underburn	M
58723	3.03	underburn	M	underburn	M	underburn	M	underburn	M
58724	15.66	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58726	38.15	underburn	M	underburn	M	underburn	M	underburn	M

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58726	123.15	underburn	M	underburn	M	underburn	M	underburn	M
58727	5.27	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58727	0.16	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58727	0.17	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
58728	0.20	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58728	12.21	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58729	2.69	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58729	21.72	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58729	0.00	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
58730	10.33	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58730	3.54	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58730	0.02	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	0.08	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58730	0.03	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58730	0.05	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58730	0.85	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58730	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58730	0.03	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	0.12	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	0.42	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	0.12	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	0.96	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58730	100.82	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58730	27.63	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58731	1.43	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58731	0.33	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58731	7.65	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58731	6.74	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58731	3.08	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58731	0.01	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58732	12.92	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58732	29.28	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58733	17.21	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58733	0.57	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58734	27.18	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58734	3.81	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58735	15.72	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58735	1.29	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58735	14.99	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58736	1.30	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58736	15.75	underburn	M	underburn	M	underburn	M	underburn	M
58737	22.85	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58737	7.71	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58738	12.15	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58738	55.57	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
58739	4.86	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58739	15.10	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58740	21.24	underburn	M	underburn	M	underburn	M	underburn	M

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58740	1.67	underburn	M	underburn	M	underburn	M	underburn	M
58741	15.81	ME	hand pile	ME	hand pile	ME	hand pile	ME	hand pile
58741	0.21	ME	hand pile	ME	hand pile	ME	hand pile	ME	hand pile
58741	0.62	ME	hand pile	ME	hand pile	ME	hand pile	ME	hand pile
58741	5.43	ME	ub/hp	ME	ub/hp	ME	ub/hp	ME	ub/hp
58742	2.49	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58742	0.01	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58742	0.13	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58742	0.99	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58742	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58742	10.95	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
58742	3.90	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
58743	12.34	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
58744	14.88	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58744	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58744	0.03	underburn		thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58744	15.01	underburn		thin > 12" dbh	machine pile on trails/ub/hp	thin > 12" dbh	machine pile on trails/ub/hp	larch restoration	machine pile/underburn
58744	5.80	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	larch restoration	ub/hp
58745	28.17	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58745	1.33	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58745	0.31	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58745	0.10	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58745	35.92	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58746	21.95	underburn	M	underburn	M	underburn	M	underburn	M
58746	1.75	underburn	M	underburn	M	underburn	M	underburn	M
58747	4.32	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58747	10.84	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58748	6.11	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58748	34.94	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58749	16.36	underburn	M	underburn	M	underburn	M	underburn	M
58750	36.07	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58751	13.51	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
58752	2.81	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58752	7.17	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58753	19.78	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58754	31.31	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58755	61.87	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58756	24.46	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow
58757	13.16	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58758	4.87	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58758	9.29	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58759	0.15	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow
58759	22.05	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow
58760	3.11	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58760	0.46	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58760	156.60	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58760	20.63	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58761	34.96	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58761	1.25	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58761	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58761	109.39	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58761	12.82	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58762	1.13	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58762	3.13	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58762	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58762	0.00	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58762	0.00	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58764	0.45	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.07	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	1.55	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.27	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58764	0.00	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58764	0.09	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58765	4.79	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	0.37	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	0.03	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	0.89	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58765	54.46	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
58765	0.01	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58765	0.74	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58766	0.10	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	1.20	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	1.82	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	5.80	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	20.79	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58766	0.00	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58766	1.07	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58766	0.89	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58767	12.91	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58768	17.61	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58769	15.09	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58769	80.18	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58770	8.85	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58770	0.00	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58771	37.57	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58771	0.73	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58772	3.12	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
58772	1.49	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
58772	0.45	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58772	11.99	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58772	12.63	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58773	0.08	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58773	0.24	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58773	0.01	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58773	0.03	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58773	67.71	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58773	0.98	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58774	1.60	underburn		thin > 12" dbh	hand pile	thin > 12" dbh	hand pile	thin > 12" dbh	hand pile
58774	0.17	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58774	0.36	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58774	0.71	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58774	0.26	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58776	4.69	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
58776	10.96	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58776	0.24	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
58776	0.59	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
58777	27.69	underburn	M	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
58777	8.17	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
58778	3.87	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58778	34.69	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58779	15.29	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
58779	68.11	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
58780	13.73	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58780	8.48	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58781	44.87	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58781	0.17	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
58782	25.10	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58782	0.79	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58783	4.45	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
58783	36.26	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
58784	19.70	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58784	2.37	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58784	0.11	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58784	0.03	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58784	0.02	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
58785	0.81	underburn		underburn		underburn		underburn	
58785	26.28	underburn		underburn		underburn		underburn	
58786	0.36	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58786	12.07	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58786	6.46	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
58788	2.66	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59127	2.90	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59128	2.67	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59129	65.93	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59130	7.73	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59130	18.12	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59131	55.00	thin 12" dbh or less	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin 12" dbh or less	ub/hp
59131	17.24	thin 12" dbh or less	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin 12" dbh or less	ub/hp
59133	24.13	thin 12" dbh or less	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin 12" dbh or less	ub/hp
59134	12.29	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59134	1.97	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59135	3.36	underburn		thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh	ub/hp
59135	15.20	underburn		thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp
59136	24.81	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59137	34.82	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow	thin 12" dbh or less	ub/hp/mow
59137	123.99	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59138	8.40	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59139	2.43	thin 12" dbh or less	ub/hp	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin 12" dbh or less	ub/hp
59141	7.13	thin 12" dbh or less	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin 12" dbh or less	ub/hp
59141	3.87	thin 12" dbh or less	ub/hp	thin > 12" dbh	ub/hp	thin > 12" dbh	ub/hp	thin 12" dbh or less	ub/hp
59142	18.00	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59143	9.47	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow
59143	13.00	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59144	18.34	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59144	0.81	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59145	13.93	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59146	2.14	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59146	8.28	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59146	87.81	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59147	12.71	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59147	2.21	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59148	17.54	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59148	0.13	no treatment	no treatment	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59149	24.32	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh	ub/hp
59150	37.33	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59154	30.81	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59155	17.66	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59155	4.57	no treatment	no treatment	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59156	16.60	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59156	13.42	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59157	18.45	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow
59157	15.87	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow	thin 12" dbh or less-dwarf mistletoe Control	hand pile/mow
59158	9.32	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59158	15.78	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59159	6.95	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow
59159	19.24	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow	dwarf mistletoe Control	hand pile/mow
59160	11.93	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59161	3.26	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59161	19.48	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59162	1.73	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59162	9.54	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59163	29.81	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59163	17.05	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59164	9.25	thin 8" dbh or less in defensible space	ub/hp/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59164	0.99	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59165	1.55	no treatment	no treatment	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59165	7.74	thin 8" dbh or less in defensible space	ub/hp	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59165	24.97	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59166	10.04	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59166	0.59	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59167	29.18	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59169	21.94	underburn	M	underburn	M	underburn	M	underburn	M
59169	0.53	underburn	M	underburn	M	underburn	M	underburn	M
59170	5.57	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59170	4.19	underburn	M	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59171	21.52	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59171	10.82	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59172	2.59	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59172	26.55	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59173	22.34	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59173	0.15	no treatment	no treatment	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59174	28.98	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh in connectivity corridor	ub/hp/mow	thin > 12" dbh	ub/hp/mow
59176	1.43	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59176	0.62	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59176	0.04	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59177	18.00	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59177	2.49	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59178	2.62	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood/thin > 12" dbh	machine pile/mow
59178	24.84	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	shelterwood/thin > 12" dbh	machine pile/mow
59179	27.46	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59180	15.94	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59181	37.57	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59181	10.43	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59182	8.68	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59182	16.62	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59183	0.64	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59183	10.56	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59184	15.42	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59184	8.32	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59185	20.40	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59185	15.06	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59186	11.36	no treatment	no treatment	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
59186	30.20	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59187	18.64	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh	ub/hp
59188	19.91	no treatment	no treatment	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh in connectivity corridor	ub/hp	thin > 12" dbh	ub/hp
59189	19.28	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59190	30.32	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59191	22.38	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59191	1.24	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59192	0.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59192	15.69	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59193	1.35	underburn	M	underburn	M	underburn	M	underburn	M
59193	36.01	underburn	M	underburn	M	underburn	M	underburn	M
59193	41.78	underburn	M	underburn	M	underburn	M	underburn	M
59194	5.83	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59194	28.94	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59195	4.81	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
59195	10.25	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp	thin 12" dbh or less	machine pile on trails/ub/hp
59196	15.41	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59197	9.57	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59197	29.27	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59197	23.00	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59198	9.27	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59198	5.64	underburn	M	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow	thin > 12" dbh	underburn/mow
59199	15.62	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59200	2.15	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59200	31.05	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59201	10.82	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59202	20.53	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59202	37.22	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59203	21.38	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59203	0.32	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59204	2.75	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59204	2.99	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59204	20.22	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59204	4.55	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59205	9.44	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59205	0.27	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59206	0.28	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59206	13.26	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59206	0.21	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59207	5.97	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59208	0.35	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59208	17.81	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59209	3.35	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59209	6.01	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59209	0.86	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59210	0.43	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59210	12.00	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59210	11.71	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59211	19.28	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59212	17.31	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59213	48.17	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59214	1.80	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59214	0.04	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
59214	14.76	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
59214	29.32	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
59215	2.33	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59215	12.43	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59216	0.99	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
59216	0.86	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59216	3.30	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59216	0.84	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59216	18.93	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59216	0.67	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59217	16.03	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59218	17.78	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59218	0.84	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59219	29.35	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59219	0.37	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59220	0.28	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
59220	14.18	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow
59221	21.16	underburn	M	thin > 12" dbh in connectivity corridor	machine pile on trails/ub/hp/mow	thin > 12" dbh in connectivity corridor	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
59221	13.30	underburn	M	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh in connectivity corridor	underburn/mow	thin > 12" dbh	underburn/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59221	0.26	underburn	M	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow	thin > 12" dbh	machine pile on trails/ub/hp/mow
59222	0.17	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59222	9.66	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow	thin 12" dbh or less	mp/ub/hp/mow
59223	0.13	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile	thin 8" dbh or less in defensible space	hand pile
59223	5.37	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59223	2.44	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59223	12.73	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow	thin 8" dbh or less in defensible space	ub/hp/mow
59224	1.16	ME	ub/hp	ME	ub/hp	ME	ub/hp	ME	ub/hp
59224	12.08	ME	ub/hp	ME	ub/hp	ME	ub/hp	ME	ub/hp
59225	5.14	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59225	38.36	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp	thin 12" dbh or less	ub/hp
59226	48.59	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59227	68.53	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59228	3.63	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59228	0.15	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59228	25.99	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59229	2.80	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59229	2.42	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile	thin 12" dbh or less	hand pile
59229	4.63	underburn		thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59229	1.33	underburn		thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59229	2.96	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59229	8.73	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59230	20.16	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow
59230	11.03	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow	thin 12" dbh or less	machine pile on trails/ub/hp/mow

STAND	ACRES	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Veg. Action	Fuel Action	Veg Action	Fuel Action	Veg Action	Fuel Actoin	Veg Action	Fuel Action
59231	11.76	thin 8" dbh or less in defensible space	ub/hp	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59231	75.07	no treatment	no treatment	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59231	0.32	thin 8" dbh or less in defensible space	ub/hp	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59231	1.83	no treatment	no treatment	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59232	30.56	underburn		thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh in connectivity corridor	machine pile	thin > 12" dbh	machine pile
59232	2.66	underburn		thin > 12" dbh	machine pile	thin > 12" dbh	machine pile	thin > 12" dbh	machine pile
59233	4.59	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59233	6.22	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
59234	0.03	no treatment	no treatment	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh in connectivity corridor	machine pile/mow	thin > 12" dbh	machine pile/mow
59234	2.60	no treatment	no treatment	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow	thin > 12" dbh	machine pile/mow
59237	1.75	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment	no treatment
59238	16.19	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow	thin 12" dbh or less	hand pile/mow
	14672.91								

APPENDIX B

Stewardship Contracting and Multi-Party Monitoring

Background

Section 347 of the 1999 Omnibus Appropriations Act (Public Law 105-277; H.R. 4328) authorized the USDA Forest Service to implement up to 28 stewardship contracting pilot projects to test new contracting authorities. The legislative language indicated the agency had been granted these authorities for three reasons: 1) to test the potential advantages of greater collaboration within the agency and with outside partners; 2) to test the potential for effective and more efficient land management; and 3) to help meet the needs of local and rural communities. in 2000 and 2002 an additional 56 pilot projects were authorized. The Sisters Ranger District applied for Stewardship Pilot Authority for the Metolius Basin Forest Management Project in 2002.

Land management goals for projects under Section 347 of P.L. 105-277 include,

- Use of prescribed fires to improve the composition, structure, condition, and health of stands or improve wildlife habitat;
- Noncommercial cutting or removing of trees or other activities to promote healthy forest stands, reduce fire hazards, or achieve other non-commercial objectives;
- Road and trail maintenance to restore or maintain water quality, soil productivity, habitat for wildlife and fisheries, or other resource values;
- Watershed restoration and maintenance;
- Restoration and maintenance of wildlife and fish habitat; and
- Control of noxious and exotic weeds and reestablishing native plant species.

What Is Stewardship Contracting?

Due to a number of factors (including declining Agency budgets), employment opportunities and project implementation within the National Forest system have been steadily declining. Despite these reductions, the need for restorative or maintenance work in ecosystems remains paramount. Such work includes watershed restoration and maintenance, road obliteration for sediment control, wildlife habitat improvements, fuel load reductions, timber stand improvements, and insect/disease protection. In the past, these stewardship projects were completed largely within the confines of timber sale contracts and performed by an independent contractor or smaller sub-contracting firms. Revenues generated within these sales provided the funds necessary for stewardship work. However, with a decline in the federal timber sale program, available funds for such work have declined as well. Limited appropriations from Congress and restricted money within existing trust funds further exacerbate the situation.

Given this inadequacy of appropriations and the continued likely trend of lower timber sales on federal lands, creative approaches must be utilized to complete the necessary work and simultaneously contribute to the economic growth of local rural communities. Stewardship contracting may provide some solution to this growing dilemma.

Land stewardship contracting can best be explained as a set of natural resource management practices that seeks to promote a closer working relationship with local communities in a broad range of activities that improve land conditions, consistent with a community's ecological, social, and economic objectives. Such projects are seen as a means of shifting the focus of federal forest and rangeland management towards a desired future resource condition, rather than meeting on-the-ground targets or a predetermined schedule of resource outputs. They are also considered a means by which federal agencies can contribute to the development of sustainable rural communities through restoring and maintaining healthy forest ecosystems and providing a continuing source of local income and employment.

The concept of stewardship contracts began in the 1980s, when service management contracts were first introduced as a response to shrinking federal budgets, reduced personnel, and demands from the public for a broader range of outputs from federal forests and rangeland. These early contracts were designed to create significant savings of public funds through improved contract administration, specification of desired end-results, and the consolidation of multiple stand improvement contracts into one mechanism. Although these contracts were initially developed to facilitate traditional timber management objectives, they soon evolved into a more comprehensive approach, supporting the many tenets and practices defined within ecosystem management. In the 1990s, these early stewardship contracts broadened to include local small business participation, alternative land management strategies, and locally based planning efforts.

Today, some or all of the following key points can be used to characterize stewardship contracting:

<u>Broad-based public (community) collaboration:</u> The intent of stewardship contracts is to develop a process of broad-based community participation that is open, transparent, and inclusive. This collaboration can be used to bolster public and agency learning, to encourage interaction among a broad array of stakeholders, and to utilize the existing knowledge base. As such, collaboration often facilitates the production of a unified vision (desired future conditions) that can then be applied during implementation and monitoring phases of a given project.

<u>Provisions for multi-year, multi-task, end-results oriented activities:</u> Within stewardship contracts, bidders are typically given a description of the desired future condition from the agency and asked to describe how they would use their skills and experience to achieve the defined vision. This format provides an opportunity for contractors to be flexible and innovative in their approaches and practices. These contracts can incorporate numerous tasks, over a course of years to reach the desired goal and objectives.

<u>Comprehensive approach to ecosystem management:</u> Within stewardship contracts, techniques and practices are designed under the umbrella of holistic, ecosystem approaches. Often these management activities are coordinated within a diverse set of objectives, including vegetation

management, wildlife habitat enhancement, recreational development, and stream or riparian restoration. They also refocus the scope of projects from stand-level (as used in the past) to new ecological scales.

Improved administrative efficiency and cost to the agency: It should be noted that stewardship contracts are designed to complement and expand, not replace existing procurement or timber sale instruments. They are an alternative means of implementing ecosystem management policies, relying on the shift of forest management towards achieving a desired future resource condition rather than meeting an assigned target or predetermined schedule of output. Unlike timber sale contracts or service contracts, stewardship contracts are designed to combine a set of activities into a single contract, thereby improving contract efficiency and possibly reducing cost to the Agency.

Creation of a new workforce focused on maintenance and restoration activities: Because stewardship contracts often contain a wide array of services (including those that involve the collection of multiple forest products), such contracts have the ability to contribute to the development of sustainable rural communities. Through improved and increased restoration/maintenance of the natural environment, stewardship contracts help provide living wages, new employment opportunities, and overall diversification of rural economies.

To this end, land stewardship contracts benefit the agency and the public in different ways. For the Forest Service, land stewardship contracts provide a means to improve contracting flexibility and efficiency; to address forest health concerns in areas of low-value material; and to increase collaboration among federal agencies and outside partners. Within the surrounding local communities, stewardship contracts are capable of promoting local involvement in National Forest management, while also strengthening local economies through the diversification of available jobs and the development of new and expanded markets. From a biological perspective, stewardship contracts provide a means of improving the health of forest systems, such as reducing the threat of wildfire, improving forest composition and structure, improving wildlife habitat and forage, and improving water quality.

Types of Contracts

There is a variety of authorities that are being tested under the Stewardship Contracting pilots. Following is a brief description on the different types.

Exchange of Goods for Services

The exchange of goods for services provides a means of extending the value of appropriated funds available to help carry out needed ecosystem restoration, maintenance, and improvement activities. This extension occurs by virtue of the fact that some or all of the value of commercial timber products being sold is retained and reinvested on-site as opposed to being returned to the Treasury or deposited in one of the Agency's special trust funds. The existing financial structure within the Forest Service accounts for the disposal of goods based upon receipts, and the purchase of services based upon expenditures from appropriated and other special funds.

Receipt Retention

Through receipt retention, portions of proceeds from the sale of commercial products can be retained at the local level to fund other non-revenue producing activities. However, they must be reinvested in the specific pilot project that generated them or by another approved pilot project. Historically, the Agency has had limited authority ot retain receipts through the various Forest Service trust funds (e.g., Knutson-Vandenberg Act, the Brush Disposal Act, and the Salvage Sale Fund provisions within the National Forest Management Act). In nearly all of the instances, funds from these accounts must be re-applied to those project areas in which commercial material has been extracted and any remaining funds must be returned to the National Forest Fund in the federal Treasury for future Congressional appropriation.

Designation by Description or Prescription

Designation by description or prescription offers a potential way to reduce sale preparation costs and to more fully apply the concept of end-results contracting. Traditionally, the designation, marking, and supervision of timber harvesting activities are conducted by federal employees or service contractors who have no prospective tie to the timber sale, thereby ensuring the accountability for products sold by the government. Under the expanded authority, land managers can provide prescriptions or area designations that clearly describe the silvicultural objective or desired “end results” in replace of federal designation and marking. It should be noted that designation by description has been used in the past under very strict silvicultural prescriptions (e.g., in areas designated for clearcuts, by specific species, by live versus dead material, or by basal area).

Best-Value Contracting

Best-value purchasing allows the Forest Service to use factors besides price when awarding contracts. These other factors include: past performance, work quality, delivery, and experience. In making award decisions, the Forest Service may, among other techniques, compare offers and hold discussions and negotiations with offerors, and may make awards to a more qualified firm at a higher price. As a result, those vendors who have performed well in the past, provided quality work, complied with wage requirements, and have high standards of workmanship will have a competitive advantage.

Multi-year Contracting

Among the desired goals of stewardship projects is the ability to engage contractors in long-term management services. It ahs been theorized that operators who provide services within a given management area over a long period are likely to develop a stronger sense of stewardship for that area. Additionally, the use of multi-year contracts may help to provide more stability for the contractor, as well as administrative continuity for the Forest Service contract supervisor.[1] Historically, both timber sales and service contracts operated under specific time limitation.

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[1] Ringgold, 1999. Land Stewardship Contracting in the National Forests: A Community Guide to Existing Authorities.

Whereas both can extend beyond the appropriations period during which they were initiated, the National Forest Management Act limits the length of timber sale contracts to 10 years (and restocking efforts in five years) and annual Congressional appropriations limit the length of service contracts. Unlike multiple year contracts, which require the Forest Service to exercise an option for each designated project year, multi-year contracts allow the purchase of more than one year's requirement of product or service only at the onset of the project.

What is Multiparty Monitoring/Evaluation?

Multi-party monitoring is a process which seeks to engage community based groups, local/regional/national interest groups, and public agencies to ensure that natural resource management is responsive to diverse interests and objectives. It validates and reduces the amount of bias in project evaluation. In a sense, the multi-party process not only legitimizes monitoring and evaluation, it helps build bridges between a variety of parties and interests through effective and meaningful public involvement (from criteria development through the implementation phase of a project). A multi-party approach can improve the process through increased collaboration, improved public education, and an increase in the overall understanding of pilot efforts and impact.

The multi-party monitoring team for the Metolius Basin Forest Management Project is currently getting established. Participants from the local community, environmental groups, wood products industry, Confederated Tribes of Warm Springs, representatives from Senator Wydens' office, and state and federal resource agencies are expected. Goals and objectives for the monitoring group are also being established. Contact Bob Flores, and the Sisters Ranger District for further information.

APPENDIX C

Recommended Project Enhancements

There are many actions that the Forest Service may apply to enhance project design, but may not be required to avoid or mitigate potentially significant impacts from implementing the selected Alternative. Optional project enhancements, listed in this Appendix, would be considered during project implementation. There may be other enhancements that may be identified during project implementation. These recommendations are similar to a menu of tools the Forest Service could use depending on site-specific conditions, funding, and availability of resources.

Fuels

- Maintenance of Treated Areas - Maintain low fuel levels over time in areas treated. Monitor fuel levels and arrangements approximately every 5 years to determine whether actions are needed to reduce fuels. Consider a variety of methods to maintain low fuel levels, including natural or prescribed fire, pruning and mowing.
- Protect improvements during prescribed burn operations.

Snags and down wood

Protect existing snags and down wood, particularly along riparian areas. Consider topping snags that must be treated to reduce hazards to people. If snags need to be removed along the Metolius River, consider dropping them into the river to increase harlequin duck loafing habitat.

Protect all snags >21” diameter outside recreation facilities during harvest activities.

Leave more than minimum levels (125%) of snags and down woody material to accommodate losses from post harvest activities in shelterwood cuts.

Guidelines for Locating Untreated Forest Patches during Treatment

Within Shelterwood and Larch Restoration Units (Alternative 5 only)

- Leave green tree replacements in groups, where possible. This helps reduce blowdown and protect fragments of late-successional habitat. These should be composed of the largest, oldest live trees, decadent or leaning trees, and hard snags occurring in the area.
- Identify and record locations of untreated patches in the GIS corporate database, harvest layers and associated data dictionary. Untreated patches should be protected until adjacent areas are again providing the missing components and processes.

Wildlife

Goshawk

- Underburning is the preferred fuels treatment within goshawk focal areas.
- Machine piling is not recommended.

Flammulated Owl And White-headed Woodpecker

- Maintain dense thicket habitat, especially surrounding or adjacent to large ponderosa pine, for roosting areas for flammulated owls and foraging habitat for white-headed woodpeckers at a rate of one patch every 5-10 acres.
- Strive to maintain 20-40% canopy closure.

Big Game

Close roads to show a trend toward meeting the 2.5 miles/square mile open road density standard (WL-53).

Leave patches of bitterbrush within winter range to provide winter forage.

Red-tailed Hawks

- Where large (>21" dbh) snags exist adjacent to openings, protect from harvest and post-harvest activities.

Neo tropical Birds

- To avoid potential nest destruction and loss of broods for neotropical migrant birds, schedule harvest and post harvest activities after the nesting season (after June 15th).
- Leave thickets of ponderosa pine to accommodate the foraging needs of species like the flammulated owl and western tanager.

Waterfowl

Burn meadows during the fall if possible to minimize disturbance to nesting waterfowl.

Plants

Peck's Penstemon and Tall Agoseris

Within "Managed" populations

- Use prescribed fire as fuel treatment of choice- it is beneficial to the plant
- Burning piles is less beneficial because it sterilizes areas of soil and plants

- Chipping, leaving lots of logging slash on ground is not beneficial- plant needs bare soil to seed

Watershed and Soils

Required mitigation are listed in the body of the Environmental Impact Statement, Chapter 2. Following are a range of BMPs to consider, where applicable. Some of these are also listed in Chapter 2.

Best Management Practice's (BMPs) for Soil and Water Mitigation:

The following BMPs can be used to reduce potential impacts to water quality. BMPs should be selected and tailored for site-specific conditions to arrive at the project level BMPs for the protection of water quality. A complete explanation of the BMPs is found in General Water Quality Best Management Practices (USDA, 1988) and is available at the District Office or Supervisors Office.

<u>Roads</u>

R1- General Guidelines for the Location and Design of Roads

R2- Erosion Control Plan

R3- Timing of Construction Activities

R4- Road Slope Stabilization

R6- Dispersion of Subsurface Drainage Associated with Roads

R7- Control of surface Road Drainage Associated with Roads

R8- Constraints Related to Pioneer Road Construction

R9- Timely Erosion Control Measures on Incomplete Roads and Stream Crossing

R11- Control of Sidecast Material

R12- Control of Construction in Streamside Management Units

R14- Bridge and Culvert Installation and Protection of Fisheries

R15- Disposal of Right-of-Way and Roadside Debris

R17- Water source Development Consistent with Water Quality Protection

R18- Maintenance of Roads

R19- Road Surface Treatment to Prevent Loss of Materials

R20- Traffic Control During Wet Periods

R21- Snow Removal controls to Avoid Resource Damage

R23- Obliteration of Temporary Roads and Landings

<u>Timber</u>

T1- Timber Sale Planning

T2- Timber Harvest Unit Design

T3- Use of Erosion Potential Assessment for Timber Harvest Unit Design

T4- Use of Sale Area Maps for Designating Water Quality Protection Needs
T5- Limiting the Operating Period of Timber Sale Activities
T6- Protection of Unstable Lands
T7- Streamside Management Unit Designation
T8- Streamcourse Protection
T9- Determining Tractor Loggable Ground
T10- Log Landing Location
T11- Tractor Skid Trail Location and Design
T13- Erosion Prevention and Control Measures During Timber Sale Operations
T14- Revegetation of Areas Disturbed by Harvest Activities
T15- Log Landing Erosion Prevention and Control
T16- Erosion Control on Skid Trails
T17- Meadow Protection During Timber Harvesting
T18- Erosion Control Structure Maintenance
T19- Acceptance of Timber Sale Erosion Control Measures Before Sale Closure
T21- Servicing and Refueling of Equipment
T22- Modification of the Timber Sale Contract

<u>Fire and Fuel Management Units</u>
F1- Fire and Fuel Management Activities
F2- Consideration of Water Quality in Formulating Prescribed Fire Prescriptions
F3- Protection of Water Quality During Prescribed Fire Operations
F4- Minimizing Watershed Damage from Fire Suppression Efforts
F5- Repair or Stabilization of Fire Suppression Related Watershed Damage

<u>Watershed Management</u>
W1- Watershed Restoration
W2- Conduct Floodplain Hazard Analysis and Evaluation
W3- Protection of Wetlands
W5- Cumulative Watershed Effects
W7- Water Quality Monitoring

Vegetative Manipulations
VM1- Slope Limitations for Tractor Operation
VM2- Tractor Operation Excluded from Wetlands and Meadows
VM4- Soil Moisture Limitations for Tractor Operation

Recreation / Social Concerns

- Keep interested public informed of the ongoing activities, their potential short-term impacts and their scheduled timing. Use Multi-party Monitoring to help evaluate implementation (see Appendix B on Stewardship Authorities and Multi-party Monitoring).
- Metolius Heritage Demonstration Project – encourage visitors and residents to visit the interpretive displays in the demonstration units to learn about the objectives of different vegetation management methods and to view the results of these methods.
- Provide information for public about proposed changes in road status (consider posting information at road entrances several months or more prior to implementation)
- It is recommended that vegetation treatment (hazard tree removal, thinning, burning and hauling) adjacent to high use areas, occur during periods when recreation and summer home use is low (before Memorial Day and after Labor Day, and weekends during deer hunting season). To minimize conflict between recreational traffic and timber haul, post haul routes with caution signs.
- Mowing would be allowed during most of the year unless it is adjacent to private lands, developed recreation sites and the summer homes. In these adjacent areas, mowing would occur in the lowest season of use to minimize the effects of noise and dust.
- Minimize the effects of smoke on the residential areas and high-use recreation areas (along the Metolius River).
- Tract Objectives will be used when treating summer home lots. Owners should be consulted and involved in the treatment decisions. Provide screening between lots when feasible.
- Complete vegetation management plans for developed recreation sites to help guide vegetation treatments. Environmental surveys and inventories would be completed by specialists as a result of this project.
- Maintain screening (i.e. do not remove all thickets or shrubs) near camp sites.

Scenic Quality

- Slash treatment shall be completed within the period as required by Deschutes National Forest Land and Resource Management Plan Standards and Guidelines (within one year for the Metolius Basin). Small hand pile and then burn is desirable within the immediate Foreground landscape (0-300 feet) in proximity of residential area, recreation site, and road and trail corridor that falls within the Foreground Scenic View landscape areas.
- Paint on backsides of all leave trees, as necessary, to help mitigate the effects of residual paint on scenic resource following treatments. When possible, use cut tree marking to minimize painted trees left behind.
- Removal of ribbons and other timber harvest markers following post treatment and completion of the project.

- Where possible, design and locate skid trail and landing area at least 300 feet away from primary travel corridor, such as Forest Road 14, Road 12 and Nordic, hiking, and horse trails, so that it will not be highly visible from the scenic and travel corridor.
- Minimized ground disturbance within the Foreground sensitive viewing areas to reduce soil contrast that may adversely affect scenic quality. Acceptable and recommended measures including, but not limit to, logging on pack snow and/or frozen ground, utilize cable and/or helicopter logging system.
- When and if possible, avoid scorching above 2/3 of dominant and co-dominant tree crown during a prescribe burn within a proposed treatment areas in the Foreground landscape. Utilize appropriate measure(s); such as thinning and/or pruning, to guard against high crown fire that may adversely affected scenic quality. Severely damaged and/or burned trees (2/3 burnt crown or more) shall be treated and/or removed with a year following the completion of treatment.

APPENDIX D

Ecological Types and Site Potentials

This analysis was completed to determine where and how much big game forage could be supported within the project area. For additional information, see Chapter 3; Wildlife, & Soils.

Ecological Unit Inventories (EUI) and maps display soil types and potential natural vegetation of a site. Existing maps reflect what is currently in an area, but potential natural vegetation may differ from the current vegetation. At any time, the potential natural vegetation described in an EUI may or may not exist on the site, but the site still has the potential to produce that vegetative type. This concept is the foundation of an ecotype.

Within the Metolius Basin Forest Management project area, EUI map units were grouped to develop five ecological types, four major and one of limited extent (Upper Deschutes Soil Survey 2000). Factors used to group EUI mapping units into ecotypes include climate, topography, vegetation, soil parent material, and age of the surface. The existence of seasonally high water tables was one of the main factors used to group Ecotypes in this project area. Areas with seasonally high water tables collect runoff from higher elevations and tend to favor mixed conifer vegetation, while dryer sites adjacent to these areas favor ponderosa pine communities.

Table 1 lists the five ecotypes identified in the project area, the EUI mapping units used to identify the ecotypes, and the acres of each.

Table 1. Upper Deschutes Soil Survey (EUI) map unit groupings by Ecotype

Ecotype	Ecotype Name	EUI Soil Mapping Units*	Acres
1	Ponderosa pine high site	4C, 4D, 15C, 122C, 123D, 124C, 125D, 146C	8382
2	Ponderosa pine high site steep slopes	161E, 163E	1890
3	Mixed conifer	13C, 16E	593
4	Mixed conifer moist	29A , 48C, 143B, 145C, 164A	5567
5	Types of limited extent		106
Total			**16538**[2]

* See Table 4 for a description of mapping units
From: Natural Resources Conservation Service (NRCS)

[2] Includes all ownerships (not just National Forest lands)

Uses Of Ecotypes During Planning

Understanding different ecotypes within a planning area can help identify areas that have different:

- Site productivity (including tree canopy cover, shrub and grass species, and shrub and grass productivity)
- Treatment options for brush (burn and mow, burn or mow, mow only)
- Fire risks (fire regimes)
- Expected seral stages following disturbance
- Expected shrub recovery times (ecotype one, longer recovery than ecotype two)
- Potential for conversion to less desirable species (increase in rabbitbrush)

Table 2 lists the major vegetation types as described in Volland, 1985 for each of the four major ecotypes. Table 3 lists additional information about type of vegetation and potential canopy cover by eco-type.

Table 2: Major plant associations by Ecotype (Volland, 1985).

Ecotype	Major Volland Vegetation Type	Potential Natural Vegetation
1	CP-S2-17 (p 58)	Ponderosa pine/bitterbrush-manzanita/fescue
2	CP-S2-13 (p 61)	Ponderosa pine/bitterbrush-manzanita/needlegrass
3	CW-C2-12 (p 74)	Mixed conifer/snowbrush-chinkapin/pinegrass
4	CD-S6-12 (p 78)	Mixed conifer/snowberry/twinflower flatlands

Table 3: Potential vegetation types and percent canopy cover by Eco-Type.

Eco-Type	Potential Natural Vegetation	% Canopy Cover
1	Ponderosa pine	7-40
	Bitterbrush	3-43
	Manzanita	2-25
	Fescue	3-23
2	Ponderosa pine	5-40
	Bitterbrush	5-30
	Manzanita	1-40
	Needlegrass	T-5

Eco-Type	Potential Natural Vegetation	% Canopy Cover
3	Ponderosa pine	7-52
	Douglas fir	0-40
	White fir	0-40
	Snowbrush	0-20
	Chinkapin	0-20
	Pinegrass	5-60
4	Ponderosa pine	2-20
	Douglas fir	T-30
	White fir	1-50
	Snowberry	2-30
	Twinflower	T-40

Table 4: Additional site productivity data from site index

Map Unit Symbol	Map Unit Name (soil series names and soil phases)	Site Index	Acres
4C	Allingham-Circle Complex, 0-15 % slope	77, 77*	2018
4D	Allingham-Circle Complex, 15-30 % slope	77, 77	287
13C	Belrick fine sandy loam, 0-15 % slope	91	196
15C	Belrick fine sandy loam, Dry 0-15 % slope	87	483
16E	Belrick-Douthit Complex, 30-50 % slope	91, 94	396
29A	Cryaquolls, 0-3 % slope		399
48C	Flarm-smiling Complex, 0 to 15% slopes		82
122C	Sisters Loamy Sand, 0-15 % slope	79	1627
123D	Sisters- Yapoah Complex, 15-30 % slope	79, 76	209
124C	Smiling Sandy Loam, 0-15 % slope	79	2171
125D	Smiling-Windego Complex, 15-30 % slope	79, 66	618
143B	Suiloten-Circle Complex, 0-8 % slope	120	3645
145C	Suttle Very Gravelly Loamy Sand, 0-15 % slope	110	1199
146C	Suttle Very Gravelly Loamy Sand, Dry, 0-15 % slope	90	968
161E	Windego-Smiling Complex, 30-50 % slope	66, 79	1061
163E	Windego-Smiling-Rock Outcrop Complex, 30-70 % slope	66, 79	829
164A	Wizard Sandy Loam, 0-3 % slope	85	245

From: Natural Resources Conservation Service (NRCS), Upper Deschutes Soil Survey.

*Site Index

Ecotype and Big Game Habitat

Ecological types were mapped for the project area using information on soil types and the potential natural vegetation. The potential natural vegetation may differ from the existing vegetation, however the ecotype has the potential to produce the climax vegetation if disturbance events were to occur naturally.

Four ecotypes were developed for the Metolius Basin project area. They are as follows: ponderosa pine high site, ponderosa pine high site – steep slopes, mixed conifer, and mixed conifer moist. Each area shows differences in site productivity, fire risks, expected shrub recovery times and seral stages, and conversion potential to less desirable species. Only ponderosa pine sites show the potential to produce bitterbrush in the amounts needed for winter range requirements. The mixed conifer sites do not contain the potential to produce bitterbrush under natural conditions. It is present on site currently, however, with more frequent fire regimes it probably would not persist.

Approximately ½ (40%) the winter range consists of the mixed conifer moist ecotype (Types 3 and 4). Bitterbrush is not considered to occur as the potential natural vegetation for this ecotype. However, snowberry is identified to be present in minor amounts, which may offer similar palatability for deer. This area also contains the majority of the urban interface potential for the project area and exhibits high human use. The area receives low to moderate use by deer and elk. Most deer occurring in the area are yearlong residents probably due in some part to supplemental feeding by area residents. Bitterbrush is present in this ecotype currently. However, it is patchy in nature. Snow depths in the Basin may preclude use in some areas, which may account for the low to moderate use. Much of the use seems to be concentrated near the Metolius River and the urban interface.

The remainder of the project area consists of the ponderosa pine ecotypes (Types 1 and 2). Bitterbrush is a major component of the potential natural vegetation that is an important food source for big game during the winter months. See Table 11 for information on big game habitat within the ponderosa pine ecotype. In years of light snowfall, many deer and elk will stay in the lower elevations. In heavy snow years, most deer and elk move out of the Metolius Basin to the Crooked River National Grasslands and private lands and north to the Warm Springs Reservation.

Table 5. Big game habitat within the ponderosa pine ecotype.

Big Game Habitat	Ponderosa Pine – High Site	Ponderosa Pine – Steep Slopes
Summer Range	640 acres	683 acres
Transition Range	2956 acres	0 acres
Winter Range	4785 acres	1207 acres
Total	**8381 acres**	**1890 acres**

APPENDIX E

Road Analysis Summary

This Appendix is a summary of the Road Analysis process that the Sisters Ranger District interdisciplinary team used to assess resource and road conditions, and to develop a set of recommendations to inform the decision-making process for the Metolius Basin Forest Management Project environmental analysis. The Road Analysis itself **is not** a process that follows the National Environmental Policy Act (NEPA).

Background and Introduction

On January 12, 2001, the Forest Service adopted the final National Forest System Road Management Policy. The final rule removes the emphasis on transportation development and adds a requirement for science-based transportation analysis, consistent with changes in public demands and use of National Forest resources. The final rule is intended to help ensure that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; that unneeded roads are decommissioned and restoration of ecological processes are initiated; and that additions to the National Forest System road network are only those deemed essential for forest resource management and use.

Roads analysis is a six-step process that provides a set of possible issues and analysis questions for which the answers can inform choices about road system management. The six steps in the roads analysis process are:

1. Setting up the analysis
2. Describing the situation
3. Identifying the issues
4. Assessing the benefits, problems, and risks
5. Describing opportunities and setting priorities
6. Reporting

The full Road Analysis Report is available from the Sisters Ranger District, and is a part of the Project Record for this analysis. Results are summarized in this appendix.

STEP 1: SETTING UP THE ANALYSIS

This roads analysis was completed on the project scale, instead of at the watershed scale, because of the immediate need to address roads within the project area in conjunction with the current environmental analysis, and the limited resources (personnel, time, funding and information) available to address roads at the broader scale. The Metolius Basin Forest Management project area covers approximately 17,000 acres. The road analysis area extends beyond the project boundary area as needed to address level 1 and 2 roads that occur both within and outside the project area.

The main objectives of this road analysis are:

- Identify the need for changes by comparing the current road system to the desired condition
- Balance the need for access with the need to minimize risks by examining important ecological, social and economic issues related to roads
- Address future access needs, budgets, and environmental concerns
- Address mitigation for vegetation and fuel treatments proposed under the Metolius Basin Forest Management Project

STEP 2. DESCRIBING THE SITUATION

See the Metolius Basin Forest Management Environmental Impact Statement, Chapter 3, under "Roads" for a description of the existing conditions.

The district road manager drove most of the open road miles in the project area to verify conditions and identify maintenance and construction needs. However, when local residents reviewed the preliminary road maps, several errors and omissions were identified concerning road status, use or location. The Friends of Metolius organization collected additional data and used GPS to update some road information. This information was added to the analysis, including approximately 2.25 additional miles of open roads, 1.3 additional miles of closed roads that had been breached.

STEP 3: IDENTIFYING ISSUES

Using information on watershed and resource trends, and management goals and direction from the Deschutes National Forest LRMP, the Northwest Forest Plan, Metolius Late Successional Reserve Assessment, and Metolius Watershed Assessment, and input from the public and agency resource specialists, several issues were identified that related to managing the transportation system in the Metolius Basin project area. The primary issues identified are:

- Resource Protection and mitigation of proposed vegetation and fuel management actions
- Public Access to National Forest lands
- Administrative Access to National Forest lands

STEP 4: ASSESSING BENEFITS, PROBLEMS AND RISKS

The purpose of this step is to assess the various benefits, problems, and risks of the current road system and whether the objectives of the Deschutes National Forest LRMP, the Northwest Forest Plan, Metolius Late Successional Reserve Assessment, and Metolius Watershed Assessment are being met.

The agency guidelines (USDA Forest Service, 1999) for completing the Road Analysis Process included a series of questions for planning teams to consider when identifying benefits, problems and risks of the current road system. Response to all of the questions can be found in the full Road Analysis Report. A summary of the findings follows.

Ecosystem Functions & Processes

Questions about ecosystem functions and processes addressed potential effects of introducing non-native species and disease, noise, and disturbance patterns.

Forest habitats in the Metolius project area were identified as regionally significant for late-successional species and managed as a Late-Successional Reserve under the Northwest Forest Plan. The primary concern about the effect of roads on the ecosystem processes and function is their role as vectors along which non-native plant species are spread. Weeds are increasing along both the Metolius River and roads. Once established, seeds are spread along roadways by tires, animals, wind, and overland flow of water. Roads are not expected to facilitate the introduction exotic animal species in the project area.

A road system that meets the needs for managing timber would adequately contribute to the control of insects and diseases. However, roads can affect the rates of flow of disturbances such as floods. Most roads in the project area are low speed, so noise levels are relatively low.

Aquatic, Riparian Zone, and Water Quality

Questions in this section addressed a variety of potential watershed and wetland effects such as erosion and sedimentation, pollutants, and stream crossings.

In general, roads can alter the surface and subsurface hydrology of an area by altering natural channels and runoff patterns. Fortunately, much of the project area is relatively level, and this shallow slope helps minimize impacts from erosion and overland flow. There is some localized evidence of roads/water interactions in the project area. Road-stream crossings with culverts can increase sediment levels and result in erosion and waterflow on road surfaces. Roads can also facilitate stream contamination from pollutants such as de-icing salts, fertilizers, oils, and hydraulic fluids from vehicles.

Terrestrial Wildlife

Forest roads originally constructed to facilitate logging now facilitate numerous types of recreation. An increase in roaded recreation has resulted in an increase in wildlife disturbances, increased stress, and resulted in loss from legal and illegal hunting. Roads can result in the direct loss of available habitat and reduce habitat effectiveness for many wildlife species. Habitat can also be lost as a result of activities such as firewood collection.

Many roads within the project area are concentrated in special or unique areas. Some have resulted in the separation of streams from their floodplains and created barriers to dispersal. Road inactivation and closures, especially in sensitive habitat areas, can help the district meet Land and Resource Management Plan restoration goals.

Economics

Road costs and revenues are affected by the size of the road system. Revenues associated with roads include timber sales, recreation fees and special-use permits. Costs include resource restoration and road maintenance; at present costs exceed revenues. Long-term maintenance costs can be reduced with a reduction in the miles of open roads.

Commodity Production/Timber Management, Minerals and Range Management

The current road system was developed to provide access for resource management, including timber production. A reduction in roaded access to stands which require mechanical maintenance would increase the cost of future silvicultural treatments.

Currently there are no mineral developments or active range allotments in the planning area; there is one special use permit for grazing for horses.

Water Production

There are numerous irrigation ditches in the project area; many of these are not under special permit because they pre-date the special use permit authorization of the Deschutes National Forest. Roaded access to the ditches can help facilitate maintenance; the ditches are mostly in upland areas where the rate of vegetation growth is relatively slow. Road changes would not expected to affect municipal watersheds or hydroelectric power generation.

Special Forest Products and Special Use Permits

The existing transportation system meets the need for current special forest product collection activities. These products include mushrooms, dry decorative cones, cedar boughs, and Christmas trees. Most of these products are not easily transported by hand for any distance, so it would be important to maintain adequate access to collection areas.

Firewood collection is not presently permitted except for collection of dead and damaged trees under 8” diameter on National Forest lands adjacent to private property. However, there is high potential for firewood in areas with small trees damaged by ice storms. Allowing firewood collection could help meet project objectives by reducing concentrations and densities of small trees.

Special use permits have been issued for summer homes, access to subdivisions and other private lands, utilities, ditches, and other facilities associated with the Camp Sherman area. Most of these permitted uses require roaded access, and current roads are adequate.

General Public Transportation and Administrative Use

Access in and out of the project area is primarily provided by arterial roads 11, 12, and 14 and collector road 1216. Other collector roads in the Camp Sherman area also provide access to private land and recreation. All these roads are maintained in accordance with their prescribed Road Management Objectives.

The existing road system is adequate to provide access to research projects, forest inventory, and monitoring activities. However, it also allows for present and future illegal activities such as trash disposal and poaching. Closure would decrease opportunities for these activities.

Protection

The current road system in the project area provides adequate access for fire suppression and forest management activities. System roads can act as fuel breaks for prescribed fires and low-moderate intensity wildfires.

Current conditions in the project area (fuel types, dense stands, heavy surface fuels) indicate the potential for high intensity, rapidly spreading wildfire. Fuel reduction along roads is critical to meet firefighting and public safety objectives.

Unroaded Recreation

The demand for unroaded recreation is expected to increase as the population of Central Oregon grows. However, within the project area there are no large blocks of unroaded areas or Inventoried Roadless Areas.

Road-related Recreation

The existing road system provides adequate access to developed and dispersed recreation, trails, and the Metolius River. There is not expected to be an increase in demand for new roads. However, current dispersed recreation use in riparian zones has resulted in impacts to natural resources. Proposed changes would reduce vehicle travel within riparian areas and would help these areas recover.

STEP 5: OPPORTUNITIES AND PRIORITIES

Problems and Risks Posed by the Current Road System

Resource specialists on the Sisters Ranger District reviewed each of the mapped and recorded roads in the project area, incorporated information from the Friends of Metolius, and evaluated the potential risks to resources and public access needs. The team worked in an interdisciplinary fashion to discuss each of the road segments, and then, based on risk and need assessments, recommend a course of action to meet area objectives.

Table 2-6 in Chapter 2 of the Environmental Impact Statement displays the road segments in the project area, and risk assessment by resource, public needs assessment for each road, and then a recommended changes to road status, if any.

Recommended Priorities for Action

The highest priorities for closure (either decommissioning or inactivation) are listed below.

Table E-1. Road Management Priorities for Addressing Resource Impacts

Forest Road Number	Rationale	Recommendation
Water Quality/ Soil, and Fish Habitat Risk		
1120800	Moderate to heavy surface erosion	Maintain (install waterbars and drain dips)
1200360	Breached road (previously closed). Receiving off-road vehicle use. Rutting and erosion evident	Decommission or inactivate
1200350	Receiving off-road vehicle use. Rutting and erosion evident. Peck's penstemon and tall agoseris are present. Also, deer winter range	Decommission
1200359	Breached road (previously closed) crosses Jack Creek. Receiving off-road vehicle use. Rutting and erosion evident	Decommission
1216100	Road in poor condition, resulting in minor erosion. Used as dispersed camp site	Maintain (install 5 drain dips), or inactivate
1420160	Road runs along the bottom of a draw, acts as a channel during overland flow. Recommend	Decommission
1420240	Breached road (previously closed) causing erosion adjacent to Jack Creek (Bull Trout habitat)	Decommission
Wildlife Habitat		
1200130	Spotted owl core and nesting, roosting, and foraging habitat	Decommission
1200140	Spotted owl core and nesting, roosting, and foraging habitat	Inactivate
1120150	Sensitive Meadow Habitat	Decommission
1200120	Spotted owl core and nesting, roosting, and foraging habitat (also crosses the riparian reserve)	Decommission
Social Impacts		
1400049	Currently access for unauthorized motorized access to Black Butte trail system	Inactivate