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Melvin Butte Vegetation Management Project and Non-Significant Forest Plan Amendments

Sisters Ranger District Deschutes National Forest

Deschutes County, Oregon

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SUMMARY

The Deschutes National Forest proposes to maintain and restore forest resiliency and forest health in conifer stands to provide habitat for interior forest species and reduce the hazard of large scale wildfires. The project area is located about nine air miles south of Sisters, Oregon and is within the Sisters Ranger District, Deschutes National Forest, Oregon. This action is needed to reduce fuel loadings and forest vegetation density to lessen the risk of large wildfires to nearby communities and key ecosystem components, such as large old trees. Recent large wildfires such as the 2012 Pole Creek fire have dramatically changed the landscape leaving the Melvin Butte area isolated and thereby increasing the urgency of protecting the remaining forest.

The action alternatives would move the forests closer to the Historic Range of Variability. The high fire hazard would be lowered from about 45% to around 7% across the project area. There would be no effect to the gray wolf, wolverine, or the Pacific Fisher. The proposed action may effect but is not likely to adversely affect the northern spotted owl.

The proposed action (Alternative 2) and Alternative 3 would decommission about 8 miles of road and close about 6 miles of road. Under Alternative 2 about 0.80 miles of temporary road would be constructed; no temporary roads would be constructed under Alternative 3.

The proposed action (Alternative 2) would produce about 6.6 million board feet (MMBF) of timber as a result of forest restoration activities; Alternative 3 would produce about 6.3 MMBF of timber.

In addition to the proposed action, the Forest Service also evaluated the following alternative:

- Similar to the proposed action, Alternative 3 would address the key issues of temporary road construction; created openings in conifer stands; and large tree removal in areas with dwarf mistletoe.

Based upon the effects of the alternatives, the responsible official will consider the following factors in making a decision:

1. How well the alternatives meet the purpose and need for action
2. How well does the alternative respond to the key issues and have public comments been considered in the analysis
3. What are the likely environmental effects of the action alternatives and in particular, the short-term and long-term effects to federally-listed threatened and endangered species?

CHAPTER 1 INTRODUCTION

DOCUMENT STRUCTURE

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- *Introduction:* The section 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.
- *Comparison of Alternatives, including the Proposed Action:* This section 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 key issues raised by the public and other agencies. This discussion also includes possible mitigation measures and resource protection measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

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

BACKGROUND

In September of 2012 the Pole Creek fire started and eventually grew to 26,584 acres. This is one of many large wildfires that have affected the Sisters Ranger District since 2002. Between 2002 and 2013 approximately 40% of the district has been affected by wildfire, including habitat for the northern spotted owl. For example, prior to the 2003 B&B Fire the district hosted over 24 northern spotted owl nest cores. Multiple fires impacted 18 nest cores. Currently the district has three functioning nest cores. Fires like the 2003 B&B fire and 2012 Pole Creek fire have resulted in dramatic changes in the amount and quality of forested habitat on the district and a heightened awareness in the community to the potential effects of large wildfires. The potential hazard from large wildfires to nearby communities and private property was considered in this project.

When the Pole Creek fire occurred, the Sisters Ranger District was about to release a Draft Environmental Impact Statement for the Popper Vegetation Management Project, which proposed various vegetation treatments across a 17,192 acre planning area. The Pole Creek fire affected 6,545 acres of the Popper Vegetation Management Project Area (38%). Immediately after the Pole Creek fire the district focused on developing a timber salvage sale within the fire boundary and reevaluated the original Popper planning area for a future project. The Melvin Butte Vegetation Management Project is the outcome of the district planning effort.

Dense forest conditions, large scale wildfires, and insects and disease threaten large old trees and the habit of species that depend on them, including fire maintained ponderosa pine forests in the project area. This threat to remaining large trees is important because there has been a loss of 80% of large trees from historic conditions. Large trees are stressed by dense stand conditions which increase competition for site resources and in-growth of tree species such as white-fir have created ladder fuels that can help wildfire reach into the crowns of old trees. Thinning small trees from below and preparing the stands for prescribed fire would help protect and maintain large old trees and contribute to the restoration of fire's natural role in the ecosystem.

The project area has some of the last remaining mixed conifer stands in that portion of the district. Much of the high quality mixed conifer habitat available for wildlife in the area has been lost to wildfire. A major consideration in the Melvin Butte Vegetation Management Project is the retention and restoration of mixed conifer habitat in project area. The project would strive to 1) promote development of mixed conifer stands in areas with potential to become multi-storied complex stands and 2) restore or improve resiliency in stands where soil or water conditions would limit the development of quality mixed conifer habitat.

Another consideration is the high presence and severity of dwarf mistletoe in many of the ponderosa pine stands in the lower elevations of the project area. Dwarf mistletoe can provide wildlife habitat and structural diversity but ponderosa pine dwarf mistletoe in the forest overstory often prevents the development of future large diameter trees (see the silvicultural section of this document for detailed information). Where appropriate, the project would consider modified harvest techniques that retain some large diameter overstory trees but provide for the growth of pines relatively free of dwarf mistletoe in the long run. We feel that treating stands infected with dwarf mistletoe provides for long term forest health and creates more favorable conditions for the development of future old growth trees.

The project area contains a Wildland Urban Interface (WUI) as identified in the *Greater Sisters Country Community Wildfire Protection Plan*. The WUI begins in Sisters and follows Forest Road 16 to the popular and highly used Three Creeks Lake basin. Many stands in the project area adjacent to Forest Road 16 contain varying levels of unburned fuels that could impact ingress of firefighters and egress of the recreational public along Forest Road 16 in the event of a wildfire. About 642 acres of the 2012 Pole Creek fire are located in the project area, west of Forest Road 16.

The economic aspects of forest restoration work were also considered. Wood products such as saw logs and biomass would be a byproduct of conducting forest health and fuel reduction treatments in the project area and help maintain the forest products industry as part of a network of economically diverse local communities. A viable forest products industry is essential to maintain the necessary infrastructure to carry out forest treatments such as thinning and biomass removal and to achieve forest restoration objectives at the landscape level. The proposed action would harvest about 20,371 cubic board feet (CCF) (6.6 million board feet of timber), including biomass, as a byproduct of improving forest health and resiliency in the project area.

Deschutes Collaborative Forest Project

The Melvin Butte project area is located within the *Deschutes Collaborative Forest Project Area, Deschutes Skyline Landscape*, which was selected by the Secretary of Agriculture and an advisory committee in 2010 as a Collaborative Forest Landscape Restoration Project. The Collaborative Forest Landscape Restoration Program (CFLRP) was authorized by Congress in the Omnibus Public Land Management Act of 2009. Selected projects may receive CFLRP funds for implementation and monitoring. The Melvin Butte Vegetation Management Project continues with the collaborative process outlined by the Deschutes Skyline CFLRP proposal that was used for the Popper Vegetation Management

Project. We will continue to work with the collaborative group regarding the Melvin Butte project as we did with the Popper project.

The Melvin Butte Vegetation Management project was initially presented to the Deschutes CFLRA Steering Committee in March of 2014. There was general support for the project but the collaborative did not provide a consolidated response during public scoping.

A field trip to review the project was held on June 3, 2014. There were 24 attendees including 12 members of the collaborative. The discussion focused on dwarf mistletoe treatments, the size of group openings, and mixed conifer treatments. Some members of the collaborative felt that five acre group openings were excessive in size. As a result of the discussion, group openings were reduced from five to three acres in size.

An additional field trip was held on April 24, 2015 to review silvicultural prescriptions for old growth and mistletoe infected pine stands. There were 18 attendees including seven members of the collaborative. Discussions varied about the best approach to treat old growth stands with large diameter trees less than 150 years old and the relationship of stand stocking levels to potential bark beetle infestation. Other discussions focused on the best approach to treating stands infected with dwarf mistletoe. The district continues to work with the collaborative, however, the loss of key collaborative members and changes in their organization resulted in fewer steering committee meetings and some decrease in opportunities for project updates.

Recommendations on possible treatment of ponderosa pine, dwarf mistletoe stands, and dry mixed conifer were developed by the collaborative group and were considered in the development of potential treatment options (see the silviculture section of this document).

LOCATION

The Melvin Butte Vegetation Management Project area includes about 5,375 acres of National Forest System lands approximately nine air miles southwest of Sisters, Oregon in Townships T16S, R09E and T17S, R09E, W. M. and is adjacent to the western boundary of the 33,000 acre Cascade Timberlands property. See Figure 1 for the location of the project area.

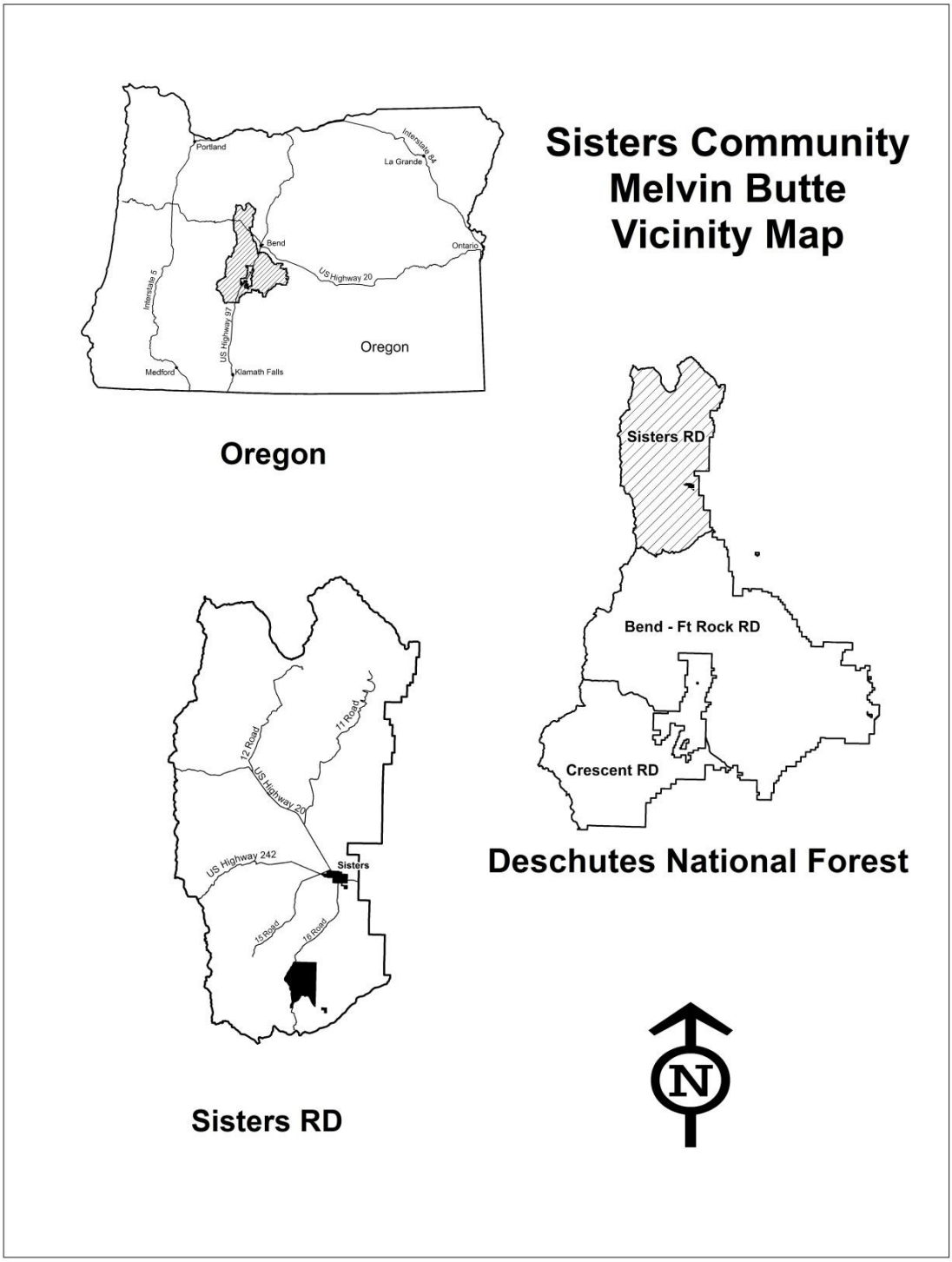


Figure 1 Project vicinity map

PLANNING FRAMEWORK

Development of this environmental assessment follows the implementation regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 219 (36 CFR 219; Title 36 Code of Federal Regulations, Part 200 (36 CFR 220); Council of Environmental Quality, Title 40; CFRs, Part 1500-1508, National Environmental Policy Act (NEPA).

Many federal and state laws, including the Forest and Rangeland Renewable Resources Act (RPA), Endangered Species Act, Clean Air Act, and the Clean Water Act also guide planning and analysis.

Deschutes National Forest Land and Resource Management Plan

This environmental assessment is tiered to the Final Environmental Impact Statement (FEIS) for the Deschutes National Forest Land and Resource Management Plan (LRMP). The Record of Decision (ROD) was signed on August 27, 1990. The LRMP was amended by the Northwest Forest Plan in 1994.

The 1990 Deschutes National Forest Land and Resource Management Plan (LRMP), as amended, guides all natural resource management activities and provides standards and guidelines for the Deschutes National Forest. The goals for each land allocation are given below (see Figure 2).

Scenic Views (MA-9): The goal is to provide Forest visitors with high quality scenery that represents the natural character of Central Oregon.

Old Growth (MA-15): The goal of this land allocation is to provide naturally evolved old growth forest ecosystems for (1) habitat for plant and animal species associated with old growth ecosystems, (2) representations of landscape ecology, (3) public enjoyment of large old-tree environments, and (4) the needs of the public from an aesthetic spiritual sense.

Front Country (MA-18): The goal of this land allocation is to provide and maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim while providing high and sustainable levels of timber production. Portions of the area which cannot be seen from the significant viewer locations will be managed similarly to land in General Forest.

The acres in the project area by the LRMP land allocation are shown in Table 1.

Table 1 LRMP land allocations in the Melvin Butte Vegetation Management Project area

LRMP Management Allocations	Acres
Scenic Views (MA-9)	1,265
Old Growth (MA-15)	167
Front Country (MA-18)	3,943
Total Acres	5,375

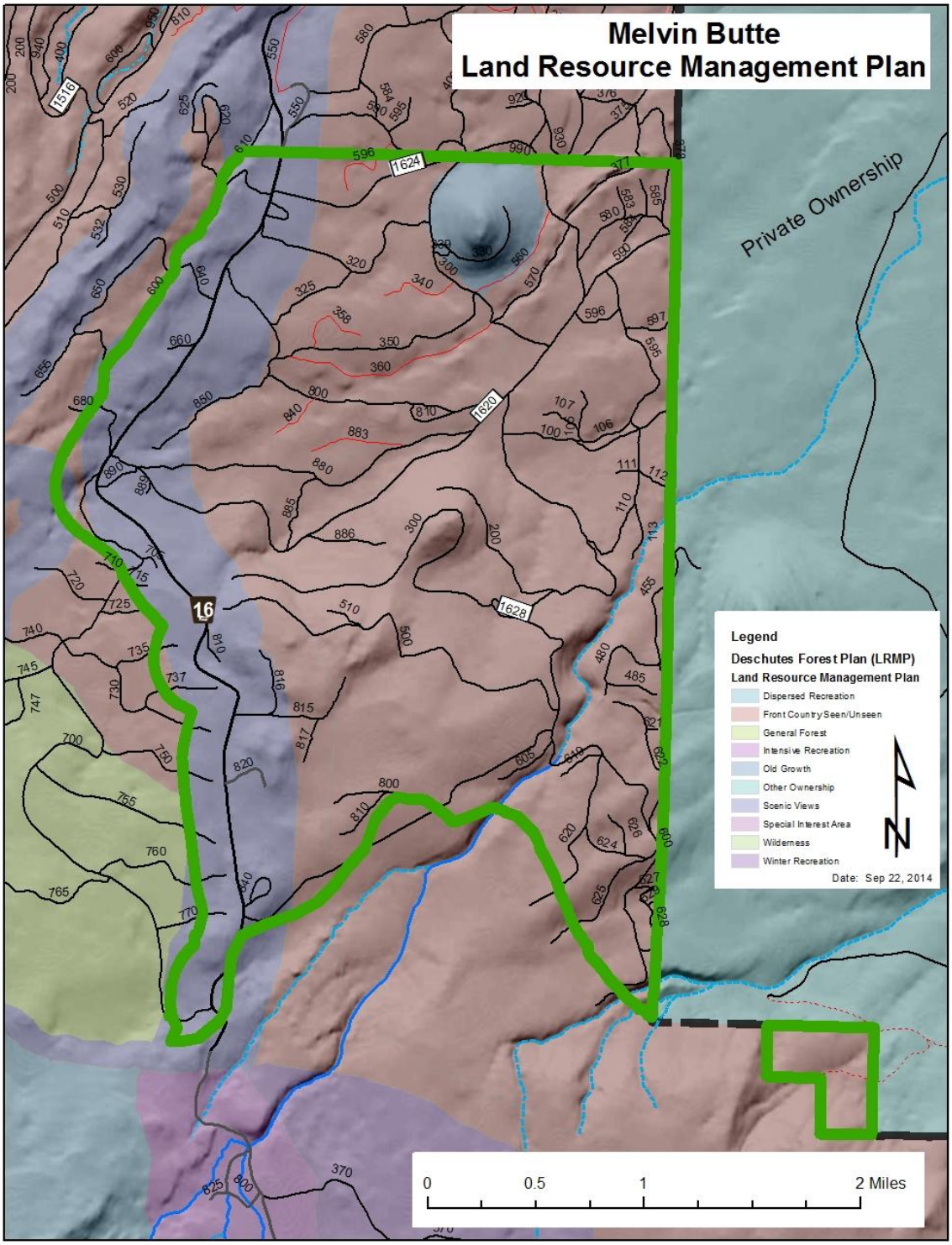


Figure 2 Land and Resource Management Plan land allocation

Northwest Forest Plan

In addition to management direction found in the LRMP, the project area is managed under the Northwest Forest Plan (NWFP). The NWFP amended the LRMP in 1994. The project area contains three NWFP land allocations as described below (see Figure 3).

Administratively Withdrawn: These areas are identified in current Forest Plans where management emphasis precludes scheduled timber harvest and which are not included in calculations of the allowable sale quantity.

Matrix: The Matrix consists of areas where most timber harvest and other silvicultural activities would be conducted, according to standards and guidelines. Most scheduled timber harvest takes place in the matrix.

Riparian Reserves: These areas are a key element of the Aquatic Conservation Strategy. Riparian Reserves provide an area along all streams, wetlands, ponds, and lakes where riparian-dependent resources receive the primary emphasis.

The Melvin Butte Vegetation Management project area is located in a *Tier 2 Key Watershed* as defined in the NWFP. There are two types of Key Watersheds: Tier 1 Key Watersheds were established to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species such as bull trout. Tier 2 Key Watersheds were selected as sources of high quality water and may not contain at-risk fish stocks. A watershed analysis is required prior to vegetation management activities, such as timber harvest, in a Key Watershed (NWFP standard and guideline C-7). The Whychus Watershed Analysis was updated in 2013 and supports the analysis conducted for this project.

The project area does not contain the Late Successional Reserve (LSR) management area.

The acres in the project area by the NWFP land allocation are shown in Table 2.

Table 2 NWFP allocations in the Melvin Butte Vegetation Management Project area

NWFP Management Allocations	Acres
Matrix	5,208
Administratively Withdrawn	167
Riparian Reserves*	102
Total Acres	5,375

Note: Riparian Reserve*acres are included as a subset contained within other NWFP land allocations.

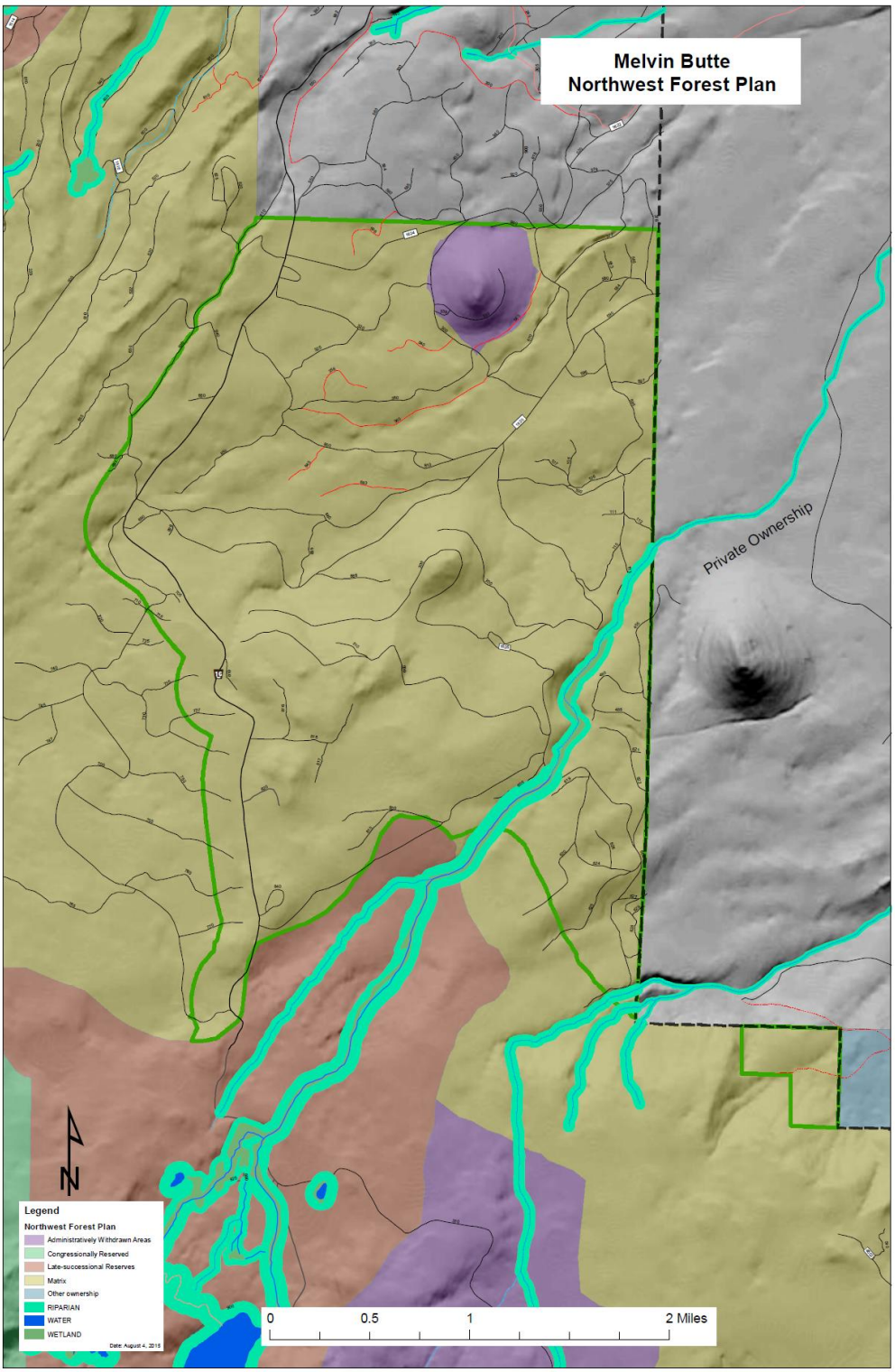


Figure 3 Northwest Forest Plan land allocations

Other Documents Used in Project Planning

The Whychus Watershed Analysis completed in 1998, updated in 2009, and updated again in 2013 to document environmental changes associated with the 2012 Pole Creek fire provides for a general understanding of the ecological conditions and processes within the seven sub-watersheds that comprise the Sisters/Whychus analysis area. The information contained in the watershed analysis serves as a guide for land management planning and makes recommendations for future projects based on the current landscape condition. The watershed analysis provides an opportunity to synthesize and integrate trends and ecosystem risks. The proposed action is located in a Tier 2 Key Watershed.

The project area is located in *Area 1: Cascade Forest* as described in the watershed analysis. The *Cascade Forest* has been identified multiple goals for a variety of forest restoration and forest management projects. Goals include the restoration of forest habitats; reduction of the potential for habitat loss due to stand replacement fires; insects and disease; use of prescribed fire in conjunction with silviculture activities such as thinning; provision of forest commodities; and maintenance and restoration of scenic quality. The updated watershed analysis provides a baseline in order to describe and evaluate the cumulative effects associated with the Melvin Butte Vegetation Management Project.

***Revised Recovery Plan for the Northern Spotted Owl* (*Strix occidentalis caurina*)** was completed in June 2011 by the U.S. Fish and Wildlife Service. The goal of the plan is to improve the status of the species so it can be removed from protection under the Endangered Species Act (ESA). The Melvin Butte Vegetation Management project is located in CHU 7: East Cascade North 8.The critical habitat units became official in January 2013.

The recovery strategy has four basic steps: 1) completion of a rangewide habitat modeling tool; 2) habitat conservation and active forest restoration; 3) barred owl management; and 4) research and monitoring. In addition, there are three recovery objectives: 1) spotted owl populations are sufficiently large and distributed such that the species no longer requires listing under the ESA; 2) adequate habitat is available for spotted owls and will continue to exist to allow the species to persist without the protection and 3) the effects of threats have been reduced or eliminated such that spotted owl populations are stable or increasing and spotted owls are unlikely to become threatened again in the foreseeable future.

The recovery plan of 2011 and the critical habitat final rule of December 2012 and implemented in January 2013 were used to guide project design to eliminate or reduce impacts to the northern spotted owl.

Northern Spotted Owl Consultation

A Level 1 review was initiated on August 18, 2014 to discuss the project's potential impacts to the northern spotted owl Critical Habitat. A Biological Assessment (BA) was prepared and submitted to the U. S. Fish and Wildlife (USFW) on February 215, 2015 and a Letter of Concurrence was issued by the USFW on March 5, 2015.

Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines was completed in January 2001 by the U.S. Forest Service and the Bureau of Land Management. The Record of Decision (ROD) amended a portion of the Northwest Forest Plan by adopting new standards and guidelines for Survey and Manage, Protection Buffers, and other mitigation measures for various plant and animal species.

The action alternatives use the *Pechman Exemptions* in the absence of pre-disturbance surveys to allow for activities in plantations and prescribed fire only treatment units. See the Botany and Fuels section of

this environmental assessment for a discussion of the use of the exemptions in the context of the 2001 ROD.

The 2001 ROD was used to determine potential effects to Survey and Manage species found in the project area. The project is in compliance with the 2001 Survey and Manage Record of Decision.

OTHER LAWS, REGULATIONS AND POLICY

The following is a brief explanation of other laws, regulations and policy that apply to the Melvin Butte Vegetation Management Project.

The American Antiquities Act of 1906

This Act makes it illegal to appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument or any object of antiquity, situated on lands owned by the Government of the United States, without permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated.

In order to comply with this act cultural resource surveys were accomplished in the Melvin Butte Vegetation Management Project.

The National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects proposed projects may have on the cultural resources of the analysis area.

Following guidelines in the 2003 Regional Programmatic Agreement among USDA-Forest Service, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Office, a finding of "Historic Properties Avoided" was determined for the Melvin Butte Vegetation Management Project. This finding is based on avoidance of all eligible and unevaluated sites.

The Endangered Species Act of 1973, as amended

The purposes of this Act are to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered and threatened species, and to take such steps as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act".

Effects to threatened, sensitive, and endangered species are documented in the biological evaluation prepared for the Melvin Butte Vegetation Management Project.

The Migratory Bird Treaty Act of 1918

The purpose of this Act is to establish an international framework for the protection and conservation of migratory birds. The Act makes it illegal, unless permitted by regulations, to "pursue, hunt, take, capture, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, including in this Convention…for the protection of migratory birds…or any part, nest, or egg of any such bird" (16 USC

703). The original 1918 statute implemented the 1916 Convention between the United States and Great Britain (for Canada). Later amendments implemented treaties between the Unites States and Mexico, Japan, and the Soviet Union (now Russia).

Effects to bird species listed under the Migratory Bird Treaty Act are described in the wildlife report prepared for the Melvin Butte Vegetation Management Project.

The National Environmental Policy Act (NEPA) of 1969, as amended

The purposes of this Act are "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans.

This law essentially pertains to public participation and disclosure, environmental analysis, and documentation.

The Melvin Butte Vegetation Management Project followed the format and content requirements of environmental analysis and documentation. The entire process of preparing this environmental assessment was undertaken to comply with NEPA. Cumulative effects were assessed and displayed where they occur in the manner most informative and logical to display. Also, the depth of analysis was tailored to the degree of effect. In many instances within this analysis, past and present activities, including timber sales, were included in the existing condition. Foreseeable actions were also addressed if there was a proposed action and if it is in the public domain.

The National Forest Management Act (NFMA)

This rule describes the National Forest System land management planning framework; establishes requirements for sustainability of social, economic, and ecological systems and developing, amending, revising, and monitoring land management plans; and clarifies that land management plans under this final rule, absent extraordinary circumstances, are strategic in nature and are one stage in an adaptive cycle of planning for management of National Forest System lands. The intended effects of the final rule are to streamline and improve the planning process by making plans more adaptable to changes in social, economic, and environmental conditions; to strengthen the role of science in planning; to strengthen collaborative relationships with the public and other governmental entities; and to reaffirm the principle of sustainable management consistent with the Multiple-Use Sustained-Yield Act and other authorities.

About 3,660 acres would receive some level of timber harvest under the proposed action. These acres would be reforested, if necessary, as required under the National Forest Management Act.

The Clean Water Act, as amended in 1977 and 1982

The primary objective of this Act is to restore and maintain the integrity of the Nation's waters. This objective translates into two fundamental national goals: 1) Eliminate the discharge of pollutants into the nation's waters; and 2) Achieve water quality levels that are fishable and swimmable. This Act establishes a non-degradation policy for all federally proposed projects. Under Section 303(d) of the Clean Water Act, the State has identified water quality-limited water bodies in Oregon.

Effects to water quality and 303(d) listed stream are described in the hydrology report prepared for the Melvin Butte Vegetation Management Project.

The Clean Air Act, as amended in 1990

The purposes of this Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs." Action alternatives are designed to be consistent with the Clean Air Act. The Oregon Department of Environmental Quality (DEQ) is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with the DEQ, the Oregon Department of Forestry and the Bureau of Land Management, signed a Memorandum of Understanding (MOU) to establish a framework for implementing an air quality program in Northeast Oregon. All prescribed burning is coordinated with the DEQ through the State of Oregon smoke management program.

All fuels reduction activities (burning of logging slash piles) proposed by the Melvin Butte Vegetation Management Project would be conducted in compliance with the State of Oregon Smoke Management System and would meet smoke management objectives for total emissions.

Executive Orders 11988 and 11990

Direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands.

The action alternatives have no specific actions that adversely affect wetlands and floodplains. Proposed activities are compliant with the orders and USDA Departmental Regulation 9500-3 which guide wetlands management on public lands.

Multiple-Use Sustained-Yield Act of 1960

The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be re-established and grown in again if the productivity of the land is not impaired. All lands proposed for active management in the Pole Creek Fire Timber Salvage Project analysis area are classified "suitable." Actions proposed in comply with LRMP standards and guidelines SL-3 and SL-4, and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining soil productivity (Chapter 3, Soil Quality).

The Melvin Butte Vegetation Management Project is in compliance with all federal policies and regulations in regards to land suitability and associated timber harvest.

Migratory Bird Executive Order 13186

On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the *"environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."*

The Melvin Butte Vegetation Management Project is in compliance with Executive Order 131186.

Executive Order 13112 (Invasive Species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species… (iii) monitor invasive species populations… (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;…(vi) promote public education on invasive species… and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species… unless, pursuant to guidelines that it has prescribed, the agency had determined and made public… that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

Invasive Plant Treatments: Deschutes and Ochoco National Forests, Crooked River National Grasslands Final Environmental Impact Statement

The 2012 Final Environmental Impact Statement (FIES) outlines treatment methods for invasive plants found on National Forest Systems lands in the project area. The range of treatments include manual e.g., hand pulling, cutting), mechanical (e.g., weed wacking), cultural (solarization), burning, and herbicide (e.g., ground-based broadcast spraying, spot spraying). New detections of invasive plants that are not identified in the FEIS are approved for treatment under the Early Detection/Rapid Response Strategy. The Record of Decision (ROD) was signed in May 2012.

Effects to invasive plant species and their control are documented in the botany report prepared for the Melvin Butte Vegetation Management Project.

Civil Rights Impact Analysis

Civil Rights Impact Analysis (CRIA) identifies the potential social impacts of a decision on employees and customers, so that these impacts will be considered and appropriately mitigated as part of the decision-making process. CRIA is required for any major decision which has a significant social or civil rights impact (FSM 1730.3). Decisions include natural resource management decisions that potentially impact Forest Service employees or customers. A decision with a significant civil rights impact is one that abolishes positions or reduces services or programs offered to the public.

The current project will not affect employees or customers of the Deschutes National Forest; therefore a CRIA is not required.

PURPOSE AND NEED FOR ACTION

The **purpose** of this project is to maintain and restore forest resiliency and forest health in stands that provide habitat for interior forest wildlife species and pose a potential hazard of large scale wildfires in the Melvin Butte area.

There is a **need** to reduce fuel loadings and forest vegetation density to lessen the hazard of large wildfires to nearby communities and key ecosystem components, such as large old trees. Recent large wildfires have dramatically changed the landscape leaving the project area isolated and thereby increasing the urgency of protecting the remaining forest.

The project area is currently at risk of stand replacement wildfire associated with insects, disease, and overstocking and represents some of the remaining unburned forest in the area. The project area also contains a Wildland Urban Interface (WUI) located along Forest Road 16. This project would also meet a need to provide wood products to the local and regional economy as a byproduct of landscape level treatments.

This action responds to the goals and objectives outlined in the Deschutes National Forest Land and Resource Plan, as amended, and helps move the project area towards desired conditions described in that plan. The Whychus Watershed Analysis provides a framework to conduct vegetation management activities in the project area.

Rationale for the Purpose and Need For Action

Existing Forested Condition

Forested vegetation in the project area varies from southwest to northeast as the elevation changes from 6,200 feet to 4,200 feet respectively. The primary plant association groups include the Ponderosa Pine plant association (21% of the area); the Mixed Conifer plant association (69% of the area); the Lodgepole Pine plant association (10% of the area); and the Mountain Hemlock plant association (<1% of the area).

Broadly, three factors have shaped the existing condition and the purpose and need for action: 1) biotic risk factors such as the presence of western dwarf mistletoe and bark beetles 2) past management actions such as past logging, fire suppression and fire exclusion and 3) and the large-scale 2012 Pole Creek Fire. These factors interact and affect the resistance and resiliency of the project area from future unknown disturbances including wildfire, insects/disease, public safety and ongoing climate warming and drying. Biotic risk factors (primarily western dwarf mistletoe) within the project area are no longer within the historic range of variability and as such threaten ponderosa pine tree longevity and/or development.

Forest tree species composition and sizes have changed over time in the project area. Past management has resulted in more ladder fuels from understory and mid-story trees directly or indirectly impacting the survival of trees within the project area in the event of a wildfire. Under severe conditions, about 40% of the area is predicted to be high severity fire (stand replacement) (this is similar to the result of the adjacent 2012 Pole Creek Fire).

About 88% of the project area contains tree density arrangements (e.g., overstocked stands) that indicate risk to important ecosystem elements by disturbance factors. Dense stands of trees are primarily a result of ingrowth from fire suppression/exclusion or past management actions such as clear-cutting (and subsequent replanting). Seventy-five percent of the project area is now dominated by small trees less than 20 inches diameter at breast height with dense multi-storied canopies, resulting in contiguous ladder fuels or plantations with uniform canopies and a high density shrub layer. About 2/3rd of the project area contains low to high levels of western dwarf mistletoe. These acres are considered at a higher risk for bark beetle (mountain and western pine beetles) mortality, stand replacement fire, further dwarf mistletoe infection, and overall reduction in tree vigor and longevity among all size classes including large old growth ponderosa pine.

In addition, the 2012 Pole Creek Fire created abundant standing and down wood (fuel) along the Forest Road 16 and Wildland Urban Interface (WUI) corridor.

Departure from the Historic Range of Variability

Historically, about 40 to 50 thousand acres of the 1.6 million acre Deschutes National Forest burned annually, primarily in frequent fire adapted ponderosa pine forest but also in mixed conifer forest in the upper elevations of the project area. Fires were a mix of low and mixed severity that maintained the structural and compositional stages within the historic range of variability (HRV). Historic or past forest management practices such as regeneration harvest (clear-cutting and overstory removal) and fire suppression and exclusion have shifted the structural stages outside of the HRV in the Melvin Butte project area. The project uses the HRV as a reference framework for historical estimates of forest size-classes (structure) and seral stages, tree species (or lack of) proportional dominance, that may have been

present at any given point in time in the past 300 years (see the silviculture section of this environmental assessment for more details).

The greatest departure from HRV occurs in the ponderosa pine, where large diameter open ponderosa pine stands were once distributed across a larger portion of the landscape in both the ponderosa pine and mixed conifer plant association groups (Whychus Watershed Analysis). About 90% of the project area was dominated by ponderosa pine across most plant association groups. Currently more than 75% of the project area is dominated by trees less than 20 inches diameter at breast height. Much of this acreage occurs as small blocks of plantations (about 22% of the project area); second growth stands; regenerated stands from wildfire; lodgepole pine stands; or other areas dominated by small trees. The silviculture report contained in this environmental assessment details how the project complies with the NWFP standard and guideline to meet 15% retention of late successional old growth in 5th field watersheds.

Species composition across the project area is outside of HRV. The most dramatic changes have occurred in the mixed conifer (dry and wet) plant association groups because of overstory removal of ponderosa pine and fire suppression and exclusion. There has been an overall increase in advanced grand/white fir persistence and abundance at the expense of ponderosa pine regeneration compared to the reference condition. These conditions can preclude the growth and development of large diameter ponderosa pine over the long term because of competition for site resources such as water, nutrients, and growing space. The densities of grand/white fir regeneration and subsequent development of shade intolerant trees as ladder fuels put the existing overstory old ponderosa pine trees at risk to high intensity wildfires and their potential loss of these cap-stone species reduces the resiliency of the landscape to respond to disturbance over time.

The project proposes to create conditions that move the project area towards the HRV over the long-term. Moving areas towards the HRV would maintain and restore forest resiliency and forest health and help meet the purpose and need for action. This would not occur on every acre; some stands would be retained in their current condition to provide habitat for the northern spotted owl, provide dispersal habitat for other forest wildlife species, or to meet other land management objectives.

Desired Future Condition for Forested Vegetation

The desired future conditions for forested vegetation in the Melvin Butte Environmental Assessment Analysis area include the following goals:

- Maintain and improve long-term[1] habitat for interior forest species
- Reduce fire risk for large[2] stand replacement events[3]
- Improve potential[4] for large ponderosa pine tree development
- Maintain and enhance stand densities[5] that favor resistance and resiliency to future unknown disturbances

The desired future condition would be a forest with medium to large ponderosa pine arranged in a spatially complex arrangement that reflects to the extent possible[6] the historic range of variability; a

[1] Long-term defined: as >30 years.
[2] Large defined as: a total area >537 acres or >10% of Melvin Butte analysis area.
[3] An event defined as: a proportion less than adjacent Pole Creek Fire (2012) which resulted in >40% stand replacement of area burned.
[4] Potential defined as: favorable abiotic and biotic growing environment for large tree development and/ or maintenance.
[5] Density measures provide a framework for understanding inter-tree competition and potential for stands to withstand disturbances

variety of stand conditions distributed among a large tree matrix that as a whole is receptive to fire without likelihood for stand replacement. Stand densities and fuel loadings would be consistent with natural fire frequencies. Snags and down log levels would be consistent with historic levels and the standards and guidelines established in the Northwest Forest Plan. The forest would be near-natural appearing with continuous forest canopy dominated by large trees that would be less susceptible to insects and disease epidemics and large-scale stand replacement fires. This forest would provide habitat for a wide array of forest wildlife species, including providing dispersal habitat for the northern spotted owl.

More specific information about desired future condition for each plant association group in the project area is located in the vegetation specialist's report of this environmental assessment.

CHANGES TO THE PROPOSED ACTION SINCE PUBLIC SCOPING_____

A number of changes to the proposed action have occurred since the March 26, 2014 public scoping. These changes are based on field reconnaissance, use of remote sensing data (i. e., LIDAR), and further review by the project Interdisciplinary Team (IDT). These changes more accurately reflect on-the-ground conditions and would better meet the purpose and need for action. These changes include the following:

- *Scenic Views Enhancement Treatment*: This is a new treatment type comprising about 240 acres. The treatment would help meet the goal for the Scenic Views Management Area (MA-7) as described in the LRMP. The treatment area is located along the west edge of Forest Road 16 in the southwest section of the project area. This portion of the project area experienced stand replacement fire during the 2012 Pole Creek fire.
- *Ponderosa Pine Mistletoe Treatment*: Originally this treatment area contained two treatment types based on the number of trees per acre infected with dwarf mistletoe. Further field reconnaissance indicated that only one treatment type fit conditions found in the forest. About 160 acres would be treated; however, mistletoe treatment stands are not homogeneous and may include small areas within stands where the thinning or mixed conifer treatments could be applied.
- *Prescribed Fire Treatment*: The number of acres of this treatment type has changed from 993 acres to 809 acres. Further field reconnaissance indicated that some acres would better fit the Wildlife Retention Strategy.
- *Lodgepole Pine Improvement Treatment*: The number of acres of this treatment type has changed from 445 acres to 249 acres. Further field reconnaissance indicated that some acres would better fit the Scenic Views Enhancement Treatment.
- *Thinning with Group Openings Treatment*: The number of acres of this treatment type has changed from 1,030 acres to 839 acres. Further field reconnaissance indicated that some acres would better fit the Scenic Views Enhancement Treatment.
- *Thinning Treatment*: The number of acres of this treatment type has changed from 1,367 acres to 998 acres. Further field reconnaissance refined the areas in need of density management.

Plantation Treatments remain the same as described in the original proposed action. About 1,174 acres would be treated.

[6] Adjustment of past management activities is not an overnight process – rather a movement towards HRV amongst social and ecological frameworks.

PROPOSED ACTION

The Sisters Ranger District has identified treatment units on 4,469 acres within the project area to meet the purpose and need for action.

Potential forest restoration treatments were developed by an interdisciplinary team to address hazardous fuels reduction in the wildland-urban interface, tree density reduction for forest health, maintenance of dispersal and foraging habitat for various wildlife species, maintenance and improvement of scenic quality, and protection of special habitats.

Ground-based logging systems would be used. Only areas less than 30% slope would be logged. Secondary treatments could include mowing and/or mastication, prescribed fire, pruning, and road construction and road decommissioning. The proposed action contains about 0.80 miles of temporary road construction.

The proposed action would treat about 642 acres of the 2012 Pole Creek fire. These acres are located in the Wildland Urban Interface (WUI) adjacent to Forest Road 16. Treatment of these acres would facilitate meeting the objectives of the Great Sisters Country Community Wildfire Protection Plan and also assist in meeting the goals and objectives for the Scenic Views (MA-9) land allocation.

Project Design Strategy

Two key project design strategies were used to develop the proposed action: 1) a wildlife habitat retention strategy based on soil productivity and 2) a wildland fire urban interface and fuel reduction strategy based in part the *Greater Sisters Country Community Wildfire Protection Plan*. These strategies are discussed in more detail below.

Wildlife Habitat Retention Strategy

The IDT developed a wildlife habitat retention strategy using a combination of soil type groupings and future habitat needs to identify areas with the greatest potential to develop into mature multi-storied mixed conifer forest structure or areas more likely to become single story mature ponderosa pine. Using the inherent site productivity of different soil types within the planning area, three major soil groupings were identified based on soil textures, depth, rock fragments and the resulting soil water supplying capacity. These three soil types were identified for conifer retention levels of 10%, 15%, and 20%. Areas with higher retention levels had the greatest potential to become mature multi-storied mixed conifer stands. Lower retention levels indicate areas with more potential to become single story mature ponderosa pine stands. See the soils section of this environmental assessment for more detail.

Within these areas, the retention standard would be used to identify no treatment areas that would amount to 10%, 15% or 20% of the area. The eventual size of these areas would vary but would attempt to mimic historic natural variation in the distribution and arrangement of mature stands. The intent of the differing retention strategies is to develop landscape level variation in stand conditions across the planning area.

There are about 745 acres in the project area that would be retained as no-treatment areas to meet this strategy. In addition, there is a 30 acre block that could be underburned using prescribed fire if the conifer overstory can be retained for a total of 775 acres. Riparian Reserves would also not be treated and could provide more acres to supplement the retention strategy. See Table 3 for retention acres by the soil type category.

Table 3 Retention area description for the Melvin Butte Vegetation Management Project

Category	Retention Acres -No Treatment	Retention Acres -Prescribed Fire	Total
10 %	129	30	159
15 %	235		235
20 %	381		381
Total Acres	745	30	775

Wildland Fire Urban Interface and Fuels Reduction Strategy

This strategy would be applied to lands described as Wildland Urban Interface (WUI) in the Greater Sisters Country Community Wildfire Protection Plan, specified Forest Roads, and areas adjacent to private property (the Cascade Timberlands property east of the planning area). After treatment these areas would provide for lower fire intensity and allow for more effective and safe fire suppression. A WUI map is located in the fire and fuels section of this environmental assessment.

Three areas within the project area are the focus of this strategy:

1. Reduce hazardous fuels along the designated Wildland Urban Interface corridor adjacent to Forest Roads 16. Fuel reduction treatments would include thinning from below, retention of residual green trees in areas of high lodgepole pine mortality, mastication and/or mowing of shrubs, and prescribed burning. Wildlife clumps would be limited adjacent to the Forest Road system.
2. Reduce hazardous fuels adjacent to Forest Roads 1620, 1624, and 1628. These are primary travel routes within the project area. Fuel reduction treatments would include thinning from below, mastication and/or mowing of shrubs, and prescribed burning. In these areas wildlife clumps would be limited adjacent to the Forest Road system.
3. Reduce hazardous ladder fuels along the western boundary of the Cascade Timberlands property and along the eastern edge of the project area. This would help prevent fires from moving from National Forest System lands onto private property. Fuel reduction treatments would occur in a 600 foot buffer as measured from the private property boundary and include thinning from below, mastication and/or mowing, and prescribed burning. Wildlife clumps would not be placed in this area.

Treatment Descriptions

Treatments to meet the purpose and need for action are described below:

Lodgepole Pine Improvement Treatment (249 acres): *The goal is to create a mosaic of even aged stands with natural appearing openings within the lodgepole pine, while providing a fuel break adjacent to Forest Road 16.*

Improvement cutting activities (thinning and group openings) are proposed in lodgepole pine stands that were affected by the mountain pine beetle outbreak of the 2000s. Improvement cutting is the removal of less desirable trees of any species in a stand of poles or larger trees, primarily to improve composition and quality. The proportion of their overstory that exhibit poor crowns and/or heavily-infected mistletoe would also be removed. These trees have poor growth rates and potential for infecting the understory with mistletoe is high. These stands would have fewer remaining overstory trees than in those stands that are thinned. The existing understory would contribute considerably to future growth.

A series of patch cuts (up to approximately 3 acres) would also occur across the area, where appropriate, to break up the continuity of the stands, creating a mosaic of even aged stands. No snags would be removed except for OSHA defined danger trees.

This treatment in the lodgepole pine plant association would provide a discontinuous fuel bed east of Forest Road 16 to support of the Wildland Urban Interface strategy. Within the Wildland Urban Interface stands would be continually thinned to maintain a fuel break along the road.

Plantation Treatment (1,174 acres): *The goal is to create more structurally diverse forests*.

Plantations in the Melvin Butte area are a result of clear cutting or group selection harvest practices. Plantation treatments could include small tree thinning, pruning to remove mistletoe, mowing of shrubs, and prescribed burning. The edges of adjacent stands would be treated to remove dwarf mistletoe infestations (e.g. pruning, small tree thinning, and girdling) to avoid infection of smaller trees. Tree planting would occur in areas heavily infected with mistletoe where the majority of trees are removed.

Thinning treatments would be based on variable density thinning sometimes referred to as a "gappy/patchy/clumpy" treatment. About 500 acres of plantations could be thinned within the next five year period.

Ponderosa Pine infected with Dwarf Mistletoe Treatment (160 acres): *The goal is to maintain and restore ponderosa pine stands relatively free of mistletoe while recognizing the role that mistletoe plays in ecosystem function*.

These areas occur primarily in the lower elevations of the project area. All dwarf mistletoe treatments would include removal of the infected pine understory while leaving as many uninfected or lightly infected understory trees as possible. Secondary treatments may include shrub mowing, prescribed burning, pruning, and planting ponderosa pine in understocked areas. In some areas, dwarf mistletoe is not evenly distributed throughout a particular stand; portions of these areas would be thinned as in the thinning treatment described below. Overstory treatment types are based on the number of trees per acre and include:

Treatment Type: Stands with 4-14 trees per acre that are greater than 21 inches dbh (147 acres):

- Girdle the overstory trees to meet wildlife habitat requirements; harvest the remaining overstory trees as wood products

Prescribed Fire Treatment (809 acres): *The goal is to manage in-growth of trees, reduce fuels, and reintroduce fire back into the ecosystem*.

This treatment would be applied to 1) areas that have been previously harvested and that require understory maintenance burning; 2) areas not conducive to mechanical treatment such as mowing and where fire would be used to meet stand objectives; and 3) areas where prescribed fire would be used to maintain fire climax ponderosa pine stands.

The Pechman Exemption (d) was used to treat about 541 acres under the Prescribed Fire Treatment prescription. This is about 67% of the of the total treatment acres. The exemption allows for some small tree thinning (less than 8" dbh) and/or mowing, where appropriate, to reduce ladder fuels that reach into the crowns of old large trees and to meet fire management objectives. Fire effects would range from light to moderate burn intensities. See the Botany section of this environmental assessment for a discussion of the use of the Pechman Exemptions.

Thinning Treatment (998 acres): *The goal is to maintain fire climax ponderosa pine*.

Thinning would occur in the Ponderosa Pine and Mixed Conifer Dry plant association groups. These areas have a predominance of older pine or second growth ponderosa pine in the overstory with some small diameter ponderosa pine and white fir in the understory. Thinning is intended to move multi-story late old structure stands to single story late old structure stands. This change in stand structure is intended to move conditions to where larger trees are more likely to survive stand replacement wildfires, lower susceptibility to bark beetle attack, and extend the lifespan of large trees.

Treatment Type 1: Treatments within the old growth stands would include thinning from below, mowing of shrubs, and prescribed burning. This would move multi-story, late old structure stands toward single-story, late old structure stands.

Treatment Type 2: Thinning treatments in the second growth ponderosa pine would be based on variable density thinning ("gappy/patchy/clumpy"). Thinning in the second growth would include removal of some larger trees, mainly white fir, to change the current spatial arrangement of the trees and prepare the stand for future treatments such as prescribed fire that would move it toward the desired condition for fire climax ponderosa pine.

Thinning with Group Openings Treatment (839 acres): *The goal is to maintain and restore fire climax ponderosa pine stands*.

These treatment areas are predominately located in the mixed conifer wet plant association and are dominated by white fir. The two treatment types proposed are based on the relative presence or absence of ponderosa pine in the overstory.

Treatment Type 1: These areas have a moderate amount of residual ponderosa pine in the overstory with young white-fir/ponderosa pine ladder fuels in the understory. Treatments would include thinning from below, mowing of shrubs, and prescribed burning.

Treatment Type 2: These are areas where currently ponderosa pine is widely scattered, or absent and had been present in the past. Many of these areas had the overstory pine harvested with an objective of managing the white-fir understory or where pine was lost due to insects and disease.

To restore areas where pine is absent, group openings ranging from 1-3 acres in size would be created and planted to ponderosa pine. Created openings could be up to 30% in area of a stand. Where there is some scattered residual ponderosa pine, small diameter trees would be thinned to protect the remaining overstory pine from inter-tree competition and western pine beetle attack. Residual areas between groups and pine overstory treatments would not be thinned and would serve as dispersal and foraging habitat for various wildlife species.

Scenic Views Enhancement Treatment (240 acres): *The goal is meet the direction for the Scenic Views management area.*

Due to the stand replacement fire that occurred during the 2012 Pole Creek Fire along a Scenic Views - Foreground management area adjacent to and west of Forest Road 16, scenic quality standards and guidelines are not being met. The recreating public travels on Forest Road 16 to recreation sites in the area.

In order to meet the long-term goals for the Scenic Views – Foreground management area that is classified as *High Scenic Integrity – SMS* (Retention – VMS), green trees and scattered clusters of fire killed trees would remain in order to slowly transition the area to become scenic once again in the future. Removal of some of the dead trees would create a random cluster grouping and feathered edge instead of a uniformed shape and straight edge of trees when viewed from the road. Newly planted trees in the open areas surrounding the scattered clusters of dead trees would eventually change the appearance of this edge

of the forest over time from burned to green. Logging debris would be lopped and scattered adjacent to Forest Road 16 to meet scenic quality standards and guidelines.

The proposed action also includes two non-significant Forest Plan amendments (see below).

Table 4 provides a summary of the proposed treatments.

Table 4 Summary of proposed treatments

Treatment Type	Acres
Lodgepole Pine Improvement	249
Plantation	1,174
Pondarosa Pine infected with Dwarf Mistletoe	160
Prescribed Fire	809
Thinning	998
Thinning with Group Openings	839
Scenic Views Enhancement	240
Total	4,469

A number of connected actions are associated with the Proposed Action:

- About 8 miles of Forest Roads would be decommissioned
- About 6 miles of Forest Roads would be administratively closed
- About 0.80 miles of temporary roads maybe necessary to access stands for treatment. If these roads are needed they would be closed and restored after use

See the Alternative 2 (Proposed Action) for a discussion of logging systems and post-harvest treatments.

Inventoried Roadless Areas

There are no Inventoried Roadless Areas (IRA) located in the project area. There will be no new or temporary road construction or timber harvest in any Inventoried Roadless Areas. An Inventoried Roadless Area analysis is included in this environmental assessment.

SITE-SPECIFIC FOREST PLAN AMENDMENTS

Affected Environment

The Melvin Vegetation Management Project proposes two non-significant Forest Plan amendments. The amendments are specific to the project area. The use of amendments to existing standards and guidelines follow guidance contained in the 1982 Planning Rule.

The amendments are focused on the Scenic Views (MA-9) land allocation Foreground Retention and Partial Retention Timber/Mixed Conifer standards and guidelines as defined in the Deschutes National Forest Land and Resource Management Plan, as amended. The goal for Scenic Views is "*To provide forest visitors with high quality scenery that represents the natural character of Central Oregon"*. The Scenic Views land allocation on the Ranger District follows major State highways such as Highway 20 and Highway 242, arterial roads such as Forest Roads 15 and 16 (Forest Road 16 is located within the project area); major topographic features such as Back Butte, and areas in the Metolius Basin and Meadow Lakes Basin. About 19,423 acres are allocated to Scenic Views on the Ranger District.

The scenic resources within the planning area have experienced visible changes over time such as the loss of large diameter old trees in foreground areas and large old tree dominated habitats with a 75-80%

departure of late and old forest structure habitats from historic conditions across the planning area. There are higher tree densities, as well as an ongoing species shift to more shade tolerant species, such as white fir in the Scenic Views foreground areas as a result of fire suppression. The combination of these conditions has lead to a degradation of scenic quality in foreground areas adjacent to Forest Road 16.

A Wildland Urban Interface (WUI) as described in the *Greater Sisters Country Community Wildfire Protection Plan* is located as a subset within the Scenic Views Foreground Retention and Partial Retention land allocation (see the Fire and Fuels section of this environmental assessment). The WUI basically encompasses the Forest Road 16 corridor that links the city of Sisters, Oregon with the Three Creeks Lake basin which is a unique recreation asset adjacent to the project area. The Three Creeks Lake Basin is extremely popular and is one of the most heavily used recreation areas on the Sisters Ranger District.

Additionally, areas adjacent to Forest Road 16 were impacted by the 2012 Pole Creek fire. Impacts include areas affected by the fire itself, including some areas of stand replacement fire, and fire suppression activities such as mowing, felling of snags, and back burning operations. Forest Road 16 approximates the eastern edge of the Pole Creek fire. Given the impacts of the Pole Creek fire many foreground areas do not meet scenic quality standards and guidelines.

Standards and Guidelines that would be Amended

The plan amendments would apply to Alternatives 2 and 3. The following Forest Plan standards and guidelines for Timber/Mixed Conifer – Foreground would be amended:

M9-27 *(LRMP 4-125) states: In Retention Foregrounds slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In partial retention foregrounds, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.*

M9-90 *(LRMP page 4-131) states*: *Low intensity prescribed fires will be used to meet and promote the Desired Visual Condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a high intensity fire. In foreground areas, prescribed fire will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered.*

Effects Analysis: General Overview

No Action Alternative

Under the no action alternative no management activities as listed under the proposed action would take place. No treatments would occur in foreground Scenic Views areas or in the Wildland Urban Interface. Fuel conditions along Forest Road 16 could impact the egress of Forest visitors or the ingress of fire suppression resources in the event of a wildfire.

Alternatives 2 and 3: Amendment #1 – Direct and Indirect Effects

<u>Timing of Slash Clean-up (MA9–27)</u>

Although activity fuels would be treated as soon as possible, especially along travel corridors, the use of prescribed fire would create visual impacts (e.g. blackened, scorched vegetation and tree trunks) for about five years, which exceeds the amount of time management actions can be visible within the retention and partial retention allocations addressed by this standard and guideline. In addition, logging residues can

take up to two years to cure (dry out) and subsequent slash pile burning can often be staggered over a period of time contingent on such factors as weather and smoke dispersal requirements. To address these conditions a Forest Plan amendment would be required to increase the time allowed for slash cleanup from a one and two year to five year period to meet the intent of this standard and guideline.

Amendment Change

The project would amend M9-27 to allow the visible effects of slash cleanup and fuels reduction for approximately a five year period for Alternatives 2 and 3 to meet the desired future condition for Timber/Mixed Conifer Foreground areas.

Alternatives 2 and 3: Amendment #2 – Direct and Indirect Effects

Extent of Underburning and Scorch Height (MA9-90)

Limiting the acreage for the use of prescribed fire to five acres in the foreground areas of the Scenic Views management allocation would not meet the stand and fire management objectives for the Melvin Butte project area. Allowing some prescribed burn areas greater than five acres would have the direct beneficial effect of reducing the risk of wildfire, creating a defensible fuel break along Forest Road 16 (a designated Wildland-Urban Interface), and providing for the safe ingress of fire suppression resources and egress of the public in the event of a wildfire event.

Allowing prescribed burn areas greater than five acres in foreground areas would also enhance scenic quality over the long-term. Creating burn blocks greater than five acres would allow the blending of areas affected by the Pole Creek fire and fire suppression activities with other ongoing thinning and fuels reduction activities in foreground areas.

In areas accessible to mechanized equipment the following treatments would be used to limit scorching below 30% of the tree crown (it should be noted that all stands slated for thinning have thinning, mowing, and prescribed burning as linked and associated treatments):

- If stand density is too dense to burn without substantial mortality, thinning with follow-up slash pile and burning would be used.
- If shrubs are present and stand density is low, mowing would be followed with prescribed burning. In some of these areas, tree mortality is expected.
- If stand density is low and no shrubs are present, the areas would be assessed to determine if treatment is needed.
- To achieve stand under-burning objectives, follow-up fuels treatments may be necessary.

In addition, the project would amend M9-90 standard to allow for tree scorching in areas where it is not possible to use mechanized equipment or other methods to limit scorch height for Alternatives 2 and 3.

Amendment Change

The project would amend M9-90 to allow for prescribed burn units to exceed the five acre minimum for fuels treatments and scorch height limitation for Alternatives 2 and 3 to meet the desired future condition for Timber/Mixed Conifer Foreground areas.

Cumulative Effects

Cumulative effects to the Scenic Views and Front country Seen/Unseen management areas would impact scenic quality during the short-term (0 to 5 years). Over the long-term (more than 5 years) overall scenic

quality would be met due to treatments and management of overstocked stands, improved forest health, lower density, and less fuel loading.

Forest Plan amendments to extend cleanup activities from one-year and two-year time frames to five years and to exceed the five acre limitation for fuels treatments would allow scenic quality standards and guidelines to be met in Scenic Views – Foreground management areas classified as High Scenic Integrity – SMS (Retention – VMS) and Moderate Scenic Integrity – SMS (Partial Retention – VMS).

Findings

The proposed revised Scenic Views standards and guidelines would not significantly change Forest-wide impacts disclosed in the Forest Plan Environmental Impact Statement, based on the following factors:

Timing

The effects of the proposed revised Scenic Views standards and guidelines for implementing the Melvin Butte Vegetation Management Project are predicted to occur in the short-term (approximately 5 years after the start of treatment) for prescribed burning and post harvest activities.

Location and Size

The effects of the proposed revised Scenic Views standards and guidelines are site specific and would only affect the area within the Melvin Butte Vegetation Management Project area boundary.

Goals, Objectives, and Outputs

The proposed revised Scenic Views standards and guidelines would not alter the long-term relationship between levels of good and services projected by the Forest Plan. There would not be any change in timber outputs over what might be available if the project was designed without the proposed amendments.

Management Prescriptions

The proposed revised Scenic Views standards and guidelines would not change the desired future condition for land and resources from that outlined by the existing management direction in the Forest Plan in the short-term. It would not affect the whole Forest Plan planning area, but only approximately 5,375 acres of National Forest System lands within the Melvin Butte Vegetation Management Project area. The proposed amendments would not change the Forest Plan allocations or management areas.

Given these findings, the proposed Forest Plan amendments are not significant under the National Forest Management Act (NFMA).

Conclusion

The proposed amendments would allow for more effective and efficient fuels treatments in the Timber/Mixed Conifer foreground areas, help meet the desired future condition for lands located in a designated WUI, in addition to providing safe egress of the public and ingress of fire suppression resources in the event of a wildfire, as well as meeting long-term management goals for the Scenic Views land allocation.

Extent of Plan Amendments

The proposed plan amendments would apply to the following units in the project area: Units 2, 4, 5, 6, 18, 19, 29, 31, 38, 39, 40, 41, 42, 44, 48, 49, 52, 56, 63, 64, 66, 67, 68, 69, 70, 75, 82, 84, 85, 88, 91, 92, 94, 97, 108, 109, 110, 117, 118, 119, 120, and 121.

About 1,217 acres would fall under the plan amendments.

Conclusions by Resource Area

The following provides the effects analysis by resource area for the proposed site-specific Forest Plan amendments.

Soils: In areas of Retention Foregrounds (M9-27), visible slash or other visible results of management activities for up to a five years, rather than one year, is expected to have no direct or indirect effects to the soil resource. In areas of Foreground (M9-90), allowing burned areas to be greater than five acres may result in less ground disturbance due less of a need to construct fire line and more opportunities to use existing features such as roads for containment of prescribed fire. Thus, the direct effect of less ground disturbance reduces the risk of the cumulative effect of increased detrimental soil disturbances due to fire line construction in excess of that allowed by FS Region 6 Soil Quality Standards. Scorch height of the forest canopy in these areas is expected to have no direct or indirect effects on key soil functions.

Hydrology: Increasing the time visual effects from management activities could occur would not affect the hydrology resource because visual effects in general do not affect it. Increasing the extent of burn in the foreground area and the allowable scorch height also would not affect the hydrology resource based on analysis in the streamflow and sedimentation sections of this report. Although underburning may occur across a small portion of an ephemeral channel, burn severity would not be at a level to alter soil infiltration rates and associated overland flow rates. Also, killing more trees by allowing higher scorch heights would not increase overland flow because overland flow in the project area does not generally occur from a reduction in evapotranspiration when trees are killed because infiltration and permeability rates often exceed precipitation rates and stands are already over stocked. Therefore, soil within 30 ft of potentially hydrologically connected areas (ephemeral draws) would not be detrimentally impacted by activities associated with revised M9-27 and M9-90.

The effects of revising Forest Plan Standard and Guideline M9-27 and M9-90 on the hydrology resource are insignificant and would not affect the hydrology resource nor add to cumulative effects.

Fisheries: Since there are no direct or indirect effects to fisheries or aquatic resources from the action alternatives, there would be no effects from the proposed plan amendments. The proposed amendments changes are located outside of Riparian Reserves and would not significantly increase ground disturbance as outlined in the action alternatives.

Wildlife: Upon review of the proposed Forest Plan amendments for the Scenic Views land allocations (M9-27 and M9-9), both of the proposed amendments are associated with the Scenic/Aesthetic quality of Forest Road 16. These standards and guidelines do not pertain to the biological attributes of the wildlife habitat associated with these stands.

Therefore, the Forest Plan amendments associated Alternative 2 and 3 will have *No Effect* to the following Threatened, Endangered, and Proposed species; gray wolf, northern spotted, Oregon spotted frog or pacific fisher. Alternative 2 and 3 will have *No Effect* to designated northern spotted owl Critical Habitat, or proposed Critical Habitat for the Oregon Spotted Frog. Alternative 2 and 3 will have *No Impact* to the following Region 6 Sensitive species; Townsend's big-eared bat, fringed myotis, pallid bat, North American wolverine, Lewis' woodpecker, or white-headed woodpecker. The following list of MIS

are associated with the project area: Cooper's hawk, sharp-shinned hawk, northern goshawk, red-tailed hawk, black-backed woodpecker, hairy woodpecker, northern flicker, pileated woodpecker , red-breasted nuthatch, three-toed woodpecker, white-breasted nuthatch, elk, mule deer, snags and down wood. Implementation of Alternatives 2 and 3 will not contribute to a change in viability for these species. The following landbirds are associated with the project area: chipping sparrow, pygmy nuthatch, brown creeper, Williamson's sapsucker, flammulated owl, hermit thrush, and olive-sided flycatcher. Implementation of Alternative 2 and 3 are consistent with the Biological Objectives in the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington.

Silviculture: The amendments address issues surrounding visuals along the forest Road 16 corridor. The amendments would result in beneficial direct and indirect effects in regards to implementation (efficiency and efficacy implied) from within the Scenic Views Management Area. The amendments ensure the implementation of these thinning acres including fuels reduction and visual treatments including prescribed fire and hazardous fuel removal along the Wildland Urban Interface located along Forest Road 16. As such these amendments help meet the desired future condition and purpose and need of the project.

Fuels and Fire: The proposed forest plan amendments are needed to meet desired conditions along Forest Road 16, which is designated as Wildland Urban Interface. Without amending these standards implementation of prescribed burns would be extremely difficult and likely result in fewer acres treated within the WUI. Road to road burning also creates less ground disturbance as the need to construct new containment line is reduced. The effects of the Pole Creek fire are visible on the west side of Forest Road 16 and some areas already show tree scorch up to 100%. Limiting tree scorch to less than 30% is not always possible, especially in stands that already experience high intensity fire. Without these forest plan amendments it would unlikely that management activities would move the area toward a desirable condition for fuels within the WUI.

Botany: Implementing the two amendments which address the visual effects of fire would have no direct or indirect effects on botanical resources or invasive plants. Intervals of fire are a natural part of this forest ecosystem and beneficial to growth and reproduction of the native plants that occur. No Sensitive or Survey and Manage Plant species would be affected. There are no known invasive plant populations in the area which could be stimulated by fire, and most of this area has already burned in 2013 and is being monitored for invasive plant introduction. None have been detected.

Visuals: Forest Plan Amendment #1 to extend cleanup activities from one-year and two-year time frames to five years and Amendment #2 to exceed the five acre limitation for fuels treatments would allow scenic quality standards and guidelines to be met in Scenic Views – Foreground management areas classified as High Scenic Integrity – SMS (Retention – VMS) and Moderate Scenic Integrity – SMS (Partial Retention – VMS).

In Scenic Views – Foreground management areas along Road 16, prescribed fire is proposed to reduce the risk of wildfire, create a defensible fuel break, and provide for safe ingress of fire suppression resources and egress of the public in the event of a wildfire event. Prescribed burn units that are greater than the five acre limitation would be necessary to accomplish those described safety needs and to enhance future scenic quality. Melding vegetation restoration activities would allow enhancement of scenic quality especially in areas damaged by the Pole Creek Fire along Road 16.

Heritage: The proposed forest plan amendment, M9-27: Activities would be visible up to a five year period would have no direct or indirect effects to cultural resources as there are no resources in the affected units that have landscape visual considerations such as a historic property, historic landscape or traditional cultural property.

The proposed forest plan amendment, M9-90: Foreground areas greater than 5 acres can be burned; scorch height greater than 1/3 of the forest canopy can occur in some areas, would have a positive indirect effect. The increased burn area would reduce fuels over a broader area helping to reduce fire intensity around cultural resources sensitive to high intensity fires. Because all cultural resources identified within treatment units will have ground disturbance avoidance and only receive low intensity prescribe fire treatments and there are no resources in the affected units that have landscape visual considerations, there are no direct effects or negative indirect effects from the change to the plan amendment.

Because there are no negative direct or indirect effects and one positive indirect effect to cultural resources there is a positive accumulative effect on cultural resources from the proposed forest plan amendments.

Transportation: The effects to the transportation system are very similar with or without these site specific plan amendments. The amendments focus on duration of activities and the scenic values along Forest Road 16 and neither of these activities would result in increased damage to the transportation system. The potential impact to the transportation system associated with these site specific plan amendments would be an increased duration for traffic control along Forest Road 16, which gets substantial traffic associated with recreation sites at Three Creek Lake. Mitigations for cautionary signing that are included in Alternatives 2 and 3 would remain in place longer. There would not be increased physical damage to the transportation system, just longer implementation.

Climate Change: The proposed forest plan amendments would not contribute to impacts to climate change that differ from analysis completed for the three alternatives. The time period of activities being visible does not change the amount of work originally proposed. Allowing for increased scorch height may not result in increased tree mortality and larger prescribed burn areas could increase short carbon outputs but is expected to improve the resiliency of the stands and therefore reduce potential for increased fire intensity should a wildfire occur.

DECISION FRAMEWORK

The Forest Supervisor, Deschutes National Forest, is the responsible official for deciding the type and extent of management activities in the Melvin Butte Vegetation Management area. The responsible official can decide on several courses of action ranging from no action, to one of the action alternatives or a combination of treatments. The responsible official will also determine whether Forest Plan amendments are necessary and will identify which mitigation measures will apply to project implementation.

The responsible official will consider the following factors in making his decision:

1. How well the alternative meets the project purpose and need for action
2. How well does the alternative respond to the key issue(s); and have public comments been considered in the analysis?
3. What are the likely environmental effects of the proposed actions, and in particular, the short and long-term effects to habitat of federally-listed threatened and endangered species?

PUBLIC INVOLVEMENT

The proposal was listed in the Schedule of Proposed Actions in Spring 2013. The proposal was provided to the public and other agencies on March 26, 2014 for comment during scoping. Seven scoping letters were received. Comments were received from the Sisters Forest Products, INTERFOR (a forest products industry), Cascadia Wildlands, Oregon Wild, Central Oregon Land Watch, Blue Mountain Biodiversity Project, and one individual.

A scoping letter was provided to the tribal chairs for the Burns-Paiute Tribe, Klamath Tribe, and the Confederated Tribes of the Warm Springs, Oregon on February 24, 2014. The Tribes did not express any concerns regarding the project.

Comments addressed a wide range of issues including roads and invasive plants, dwarf mistletoe treatments, group opening treatments, carbon storage, wildland-urban interface treatments, citizen-identified unroaded areas, fire hazard and fire regimes, and construction of temporary roads.

Using the comments from the public, the interdisciplinary team developed a list of key issues to address. The key issues resulted in the development of an alternative to the proposed action.

PROJECT RECORD

This environmental assessment herby incorporates by reference the Project Record (40 CFR 1502.21). The project record contains the Specialists Reports and other technical documentation used to support the analysis and conclusions in this environmental assessment. A summary of the Specialists reports in adequate detail to support the decision rationale and appendices provide supporting documentation for the effects analysis are contained in this environmental assessment.

Incorporating these Specialists Reports and the project record implement the Council on Environmental Quality (CEQ) Regulations that agencies should reduce NEPA paperwork (40 CFR 1500.4), that the document shall be "analytic rather than encyclopedic," and that the document "shall be kept concise and no longer than absolutely necessary" (40 CFR 1502.0). The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Sisters Ranger District office, Pine Street and Highway 20, Sisters, Oregon, Monday through Friday 8:00 a.m. to 4:30 p.m.

ISSUES

The Forest Service separated the issues into two groups: Key and non-Key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Non-Key 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) NEPA regulations require 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-Key issues and reasons regarding their categorization as non-significant may be found at Sisters Ranger District office in the project record.

As for key issues, the Forest Service identified three different topics raised during scoping.

Key Issue 1: Do Not Construct any Temporary Roads: A scoping comment suggested the development of an action alternative that did not require the use of temporary roads. The indicator would be the number of miles of temporary road construction.

Key Issue 2: Do Not Include Group Openings in the Mixed Conifer Plant Association: A scoping comment suggested the development of an action alternative that did not include group openings in the Mixed Conifer plant association group. Group openings were not considered an appropriate silvicultural tool for this plant association. Areas that would have received a group opening treatment were converted to thinning. The indicator would be the number of acres of group openings.

Key Issue 3: Do Not Remove Large Diameter Ponderosa Pine Trees with Dwarf Mistletoe: A scoping comment suggested the development of an alternative silviculture prescription in areas with dwarf

mistletoe that did not remove large diameter trees. These mistletoe areas were converted to an understory thinning. The indicator would be the number of large diameter trees removed by timber harvest.

The district IDT evaluated these potential key issues during the review of public scoping comments. The IDT concluded that these key issues could be best combined into a single action alternative; this created Alternative 3.

Analysis Issues

In addition to the Key Issue, other environmental components will be addressed in the effects analysis section of this document as a way to compare alternatives, though they did not result in differing design elements between alternatives. These analysis issues are important for providing the responsible official with complete information about the effects of the project. See individual sections of this environmental assessment for more detailed effects analysis.

Soils

Issues: The action alternatives have the potential to increase the amount and distribution of soil disturbance within individual activity through the use of ground based logging equipment. The resulting soil disturbance from ground-based equipment operations and prescribed fire in activity areas may have the potential to negatively affect key soil functions by harvesting trees in the project area.

Hydrology

Issue: The action alternatives have the potential to affect water quality, water yield, peak flows, and hydrologic function and condition by harvesting trees in the project area. Specifically, actions could affect stream flow, sedimentation, water temperature, and water body condition by harvesting trees the project area.

Fisheries and Aquatic

Issue: The action alternatives have the potential to affect streamflow, sedimentation, stream temperature, waterbody condition, wetland condition, riparian vegetation, large wood recruitment, fish populations, and fish habitat by harvesting trees in the project area.

Forest Vegetation

Issue: The action alternatives have the potential to affect stand structure and composition by harvesting trees in the project area.

Wildlife

Issue: The action alternatives have the potential to affect nesting, denning and foraging habitat for some wildlife species and connectivity of habitat harvesting trees in the project area.

Fire, Fuels and Air Quality

Issue: The action alternatives have the potential to affect fire hazard by harvesting trees in the project area. The action alternatives could reduce the production of particulate matter associated with a wildfire in the project area.

Botany

Issue: The action alternatives have the potential to impact plants through ground disturbance, wildfire, or prescribed fire by harvesting trees in the project area. The action alternatives have the potential to increase the risk of spread of invasive plants by harvesting trees in the project area.

Recreation

Issue: The action alternatives have the potential to affect recreation resources by harvesting trees in the project area.

Scenic Resources

Issue: The action alternatives have the potential to affect scenic quality by harvesting trees within the project area.

Heritage

Issue*:* The action alternatives have the potential to affect archaeological resources by harvesting trees in the project area.

Potential Wilderness Areas

Issue: The action alternatives have the potential to affect areas meeting the inventory for potential wilderness by harvesting trees in the project area.

Citizen Identified Unroaded Areas

Issue: The action alternatives have the potential to affect areas identified as unroaded in the Oregon Wild unroaded forest inventory by harvesting trees in the project area.

Inventoried Roadless Areas

Issue*:* The action alternatives have the potential to affect Inventoried Roadless Areas (IRA) located adjacent to the project area.

Climate Change

Issue: The action alternatives have the potential to affect climate change through changing local greenhouse gas (GHG) pools. Effects of climate change may also have the potential to affect the action alternatives by creating unprecedented climatic conditions in the future.

Transportation

Issue: The action alternatives have the potential to affect an increase in road maintenance on roads not currently maintained; increase industrial truck traffic, and increase motorized vehicle access by harvesting trees in the project area.

Economics

Issue: The action alternatives have the potential to have associated economic costs and benefits. The alternatives may have a negative net present value (higher expenditures than cash inflows), but may create local jobs and provide revenue to the government by harvesting trees in the project area.

CHAPTER 2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This section describes and compares the alternatives considered for the Melvin Butte Vegetation Management project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear 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.

ALTERNATIVES

Alternative 1 - No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. Ongoing management activities such as fire suppression would continue as well as other public uses such as firewood cutting and dispersed recreation activities. No vegetation management activities as proposed in the action alternatives would occur. There would be increase overtime in stand densities across the project landscape, putting large old trees at risk to insects and disease, as well as competition for site resources such as nutrients and water. There would also be an increase in fire hazard due to the lack of treatment in the Wildland-Urban interface; this would affect public health and safety as well as a heightened risk to wildland firefighters entering the project area. The no action alternative serves as a comparative baseline to analyze the action alternatives.

Alternative 2 – Proposed Action

The Sisters Ranger District has identified treatment units on 4,469 acres within the project area to meet the purpose and need for action. Alternative 2 incorporates the *Wildlife Habitat Retention Strategy* and the *Wildlife Fire Urban Interface Strategy* as described on pages 17-18.

Treatment Descriptions

The following treatments are proposed. Potential treatment units are displayed on Figure 4.

Lodgepole Pine Improvement Treatment (249 acres): *The goal is to create a mosaic of even aged stands with natural appearing openings within the lodgepole pine, while providing a fuel break adjacent to Forest Road 16.*

Improvement cutting activities (thinning and group openings) are proposed in lodgepole pine stands that were affected by the mountain pine beetle outbreak of the 2000s. Improvement cutting is the removal of less desirable trees of any species in a stand of poles or larger trees, primarily to improve composition and quality. The proportion of their overstory that exhibit poor crowns and/or heavily-infected mistletoe would also be removed. These trees have poor growth rates and potential for infecting the understory with mistletoe is high. These stands would have fewer remaining overstory trees than in those stands that are thinned. The existing understory would contribute considerably to future growth.

A series of patch cuts (up to approximately 3 acres) would also occur across the area, where appropriate, to break up the continuity of the stands, creating a mosaic of even aged stands. No snags would be removed except for OSHA defined danger trees.

This treatment in the lodgepole pine plant association would provide a discontinuous fuel bed east of Forest Road 16 to support of the Wildland Urban Interface strategy. Within the Wildland Urban Interface stands would be continually thinned to maintain a fuel break along the road.

Plantation Treatment (1,174 acres): *The goal is to create more structurally diverse forests*.

Plantations in the Melvin Butte area are a result of clear cutting or group selection harvest practices. Plantation treatments could include small tree thinning, pruning to remove mistletoe, mowing of shrubs, and prescribed burning. The edges of adjacent stands would be treated to remove dwarf mistletoe infestations (e.g. pruning, small tree thinning, and girdling) to avoid infection of smaller trees. Tree planting would occur in areas heavily infected with mistletoe where the majority of trees are removed.

Thinning treatments would be based on variable density thinning sometimes referred to as a "gappy/patchy/clumpy" treatment. About 500 acres of plantations could be thinned within the next five year period.

Ponderosa Pine infected with Dwarf Mistletoe Treatment (160 acres): *The goal is to maintain and restore ponderosa pine stands relatively free of mistletoe while recognizing the role that mistletoe plays in ecosystem function*.

These areas occur primarily in the lower elevations of the project area. All dwarf mistletoe treatments would include removal of the infected pine understory while leaving as many uninfected or lightly infected understory trees as possible. Secondary treatments may include shrub mowing, prescribed burning, pruning, and planting ponderosa pine in understocked areas. In some areas, dwarf mistletoe is not evenly distributed throughout a particular stand; portions of these areas would be thinned as in the thinning treatment described below. Overstory treatment types are based on the number of trees per acre and include:

Treatment Type: Stands with 4-14 trees per acre that are greater than 21 inches dbh (147 acres):

- Girdle the overstory trees to meet wildlife habitat requirements; harvest the remaining overstory trees as wood products

This treatment type is based on recommendations from the Deschutes Collaborative. The focus would primarily be on treating areas infected with dwarf mistletoe. However, there may be areas within the stands which may require a thinning-only treatment.

Prescribed Fire Only Treatment (809 acres): *The goal is to manage in-growth of trees, reduce fuels, and reintroduce fire back into the ecosystem*.

This treatment would be applied to 1) areas that have been previously harvested and that require understory maintenance burning; 2) areas not conducive to mechanical treatment such as mowing and where fire would be used to meet stand objectives; and 3) areas where prescribed fire would be used to maintain fire climax ponderosa pine stands.

The Pechman Exemption (d) was used to treat about 541 acres under the Prescribed Fire Treatment prescription. This is about 67% of the of the total treatment acres. The exemption allows for some small tree thinning (less than 8" dbh) and/or mowing, where appropriate, to reduce ladder fuels that reach into the crowns of old large trees and to meet fire management objectives. Fire effects would range from light to moderate burn intensities. See the Botany section of this environmental assessment for a discussion of the use of the Pechman Exemptions.

Thinning Treatment (998 acres): *The goal is to maintain fire climax ponderosa pine*.

Thinning would occur in the Ponderosa Pine and Mixed Conifer Dry plant association groups. These areas have a predominance of older pine or second growth ponderosa pine in the overstory with some small diameter ponderosa pine and white fir in the understory. Thinning is intended to move multi-story late old structure stands to single story late old structure stands. This change in stand structure is intended to move conditions to where larger trees are more likely to survive stand replacement wildfires, lower susceptibility to bark beetle attack, and extend the lifespan of large trees.

Treatment Type 1: Treatments within the old growth stands would include thinning from below, mowing of shrubs, and prescribed burning. This would move multi-story, late old structure stands toward single-story, late old structure stands.

Treatment Type 2: Thinning treatments in the second growth ponderosa pine would be based on variable density thinning ("gappy/patchy/clumpy"). Thinning in the second growth would include removal of some larger trees, mainly white fir, to change the current spatial arrangement of the trees and prepare the stand for future treatments such as prescribed fire that would move it toward the desired condition for fire climax ponderosa pine.

Thinning with Group Openings Treatment (839 acres): *The goal is to maintain and restore fire climax ponderosa pine stands*.

These treatment areas are predominately located in the mixed conifer wet plant association and are dominated by white fir. The two treatment types proposed are based on the relative presence or absence of ponderosa pine in the overstory.

Treatment Type 1: These areas have a moderate amount of residual ponderosa pine in the overstory with young white-fir/ponderosa pine ladder fuels in the understory. Treatments would include thinning from below, mowing of shrubs, and prescribed burning.

Treatment Type 2: These are areas where currently ponderosa pine is widely scattered, or absent and had been present in the past. Many of these areas had the overstory pine harvested with an objective of managing the white-fir understory or where pine was lost due to insects and disease.

To restore areas where pine is absent, group openings ranging from 1-3 acres in size would be created and planted to ponderosa pine. Created openings could be up to 30% in area of a stand. Where there is some scattered residual ponderosa pine, small diameter trees would be thinned to protect the remaining overstory pine from inter-tree competition and western pine beetle attack. Residual areas between groups and pine overstory treatments would not be thinned and would serve as dispersal and foraging habitat for various wildlife species.

Scenic Views Enhancement Treatment (240 acres): *The goal is meet the direction for the Scenic Views management area.*

Due to the stand replacement fire that occurred during the 2012 Pole Creek Fire along a Scenic Views - Foreground management area adjacent to and west of Forest Road 16, scenic quality standards and guidelines are not being met. The recreating public travels on Forest Road 16 to recreation sites in the area.

In order to meet the long-term goals for the Scenic Views – Foreground management area that is classified as *High Scenic Integrity – SMS* (Retention – VMS), green trees and scattered clusters of fire killed trees would remain in order to slowly transition the area to become scenic once again in the future. Removal of some of the dead trees would create a random cluster grouping and feathered edge instead of a uniformed shape and straight edge of trees when viewed from the road. Newly planted trees in the open areas surrounding the scattered clusters of dead trees would eventually change the appearance of this edge

of the forest over time from burned to green. Logging debris would be lopped and scattered adjacent to Forest Road 16 to meet scenic quality standards and guidelines.

Alternative 2 contains two non-significant Forest Plan amendments.

See Table 5 for a summary of proposed treatments. Table 7 provides a stand-by-stand summary of proposed treatments.

Table 5 Summary of proposed treatments

Treatment Type	Acres
Lodgepole Pine Improvement	249
Plantation	1,174
Pondarosa Pine infected with Dwarf Mistletoe	160
Prescribed Fire	809
Thinning	998
Thinning with Group Openings	839
Scenic Views Enhancement	240
Total	4,469

A number of connected actions are associated with the Proposed Action:

- About 8 miles of Forest Roads would be decommissioned
- About 6 miles of Forest Roads would be administratively closed
- About 0.80 miles of temporary roads maybe necessary to access stands for treatment. If these roads are needed they would be closed and restored after use

Logging Systems for Alternative 2

The Table 6 outlines the type of logging systems that would be used in Alternative 2.

Table 6 Logging systems and activity fuels treatments for Alternative 2

Ground-based Logging Systems – Both Action Alternatives (Lodgepole Pine Improvement, Ponderosa Pine infected with Dwarf Mistletoe, Thinning, Thinning with or without Group Openings, and Scenic Views Enhancement)	Ground based logging systems would be used (a combination of harvesters that cut and accumulate trees in combination with skidders that pull cut trees back to a landing area where are processed and loaded onto trucks). Cut trees would be sorted into sawlogs, chip logs, or as biomass at landings. Only slopes less than 30% slope are included in timber harvest. Minor inclusions of slopes greater than 30% slope could exist within the interior of units. These areas could either be long-lined to remove cut trees (no equipment would be allowed) or left as uncut areas. Because cut trees would be whole-tree yarded it is anticipated there would be little to no activity fuel (slash) left in the harvest units.
Plantations – Both Action Alternatives	Ground based logging systems would be used (a combination of harvesters that cut and accumulate trees in combination with skidders that pull cut trees back to a

	landing area where are processed and loaded onto trucks). Slash generated by variable density thinning would lopped and scattered and/or hand piled.
Prescribed Fire – Both Action Alternatives	Based on existing levels of shrubs and small diameter trees, prescribed burning units could be masticated (mowed) to reduce surface fuels to avoid impacts to overstory trees during burning operations.

Post-harvest Treatments Associated with Alternative 2

A number of post-harvest treatments are associated with the proposed action based on the treatment type. Post-harvest treatments could include the following: mowing and/or mastication to reduce scrubs; prescribed fire; planting of trees; pruning trees infected with dwarf mistletoe; road closures; and road

decommissioning.

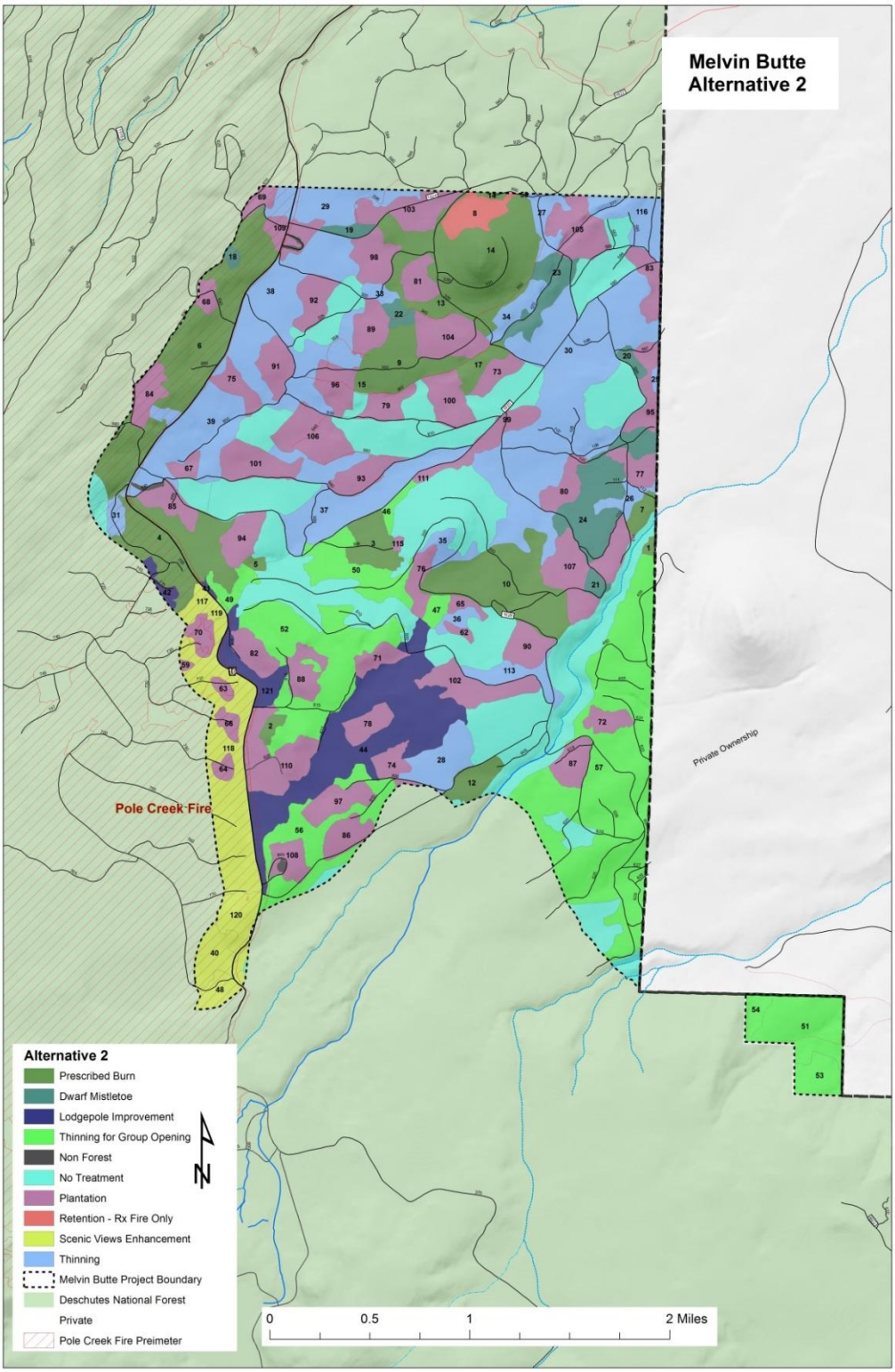


Figure 4 Alternative 2

Table 7 Stand table for Alternative 2

Unit	Treatment	Secondary	NWFP	LRMP	Acres
1	Prescribed Fire	None	Matrix	M18	3.0
2	Prescribed Fire	None	Matrix	M9	6.9
3	Prescribed Fire	None	Matrix	M18	34.9
4	Prescribed Fire	None	Matrix	M18	13.4
	Prescribed Fire	None	Matrix	M9	146.2
5	Prescribed Fire	None	Matrix	M9	1.2
	Prescribed Fire	None	Matrix	M18	3.0
6	Prescribed Fire	None	Matrix	M18	3.8
	Prescribed Fire	None	Matrix	M9	132.3
7	Prescribed Fire	None	Matrix	M18	12.0
8	Retention (RX FIRE)	None	Administratively Withdrawn	M15	29.8
9	Prescribed Fire	None	Matrix	M18	54.6
10	Prescribed Fire	None	Matrix	M18	126.5
12	Prescribed Fire	None	Matrix	M18	22.3
13	Prescribed Fire	None	Matrix	M18	56.5
	Prescribed Fire	None	Administratively Withdrawn	M15	25.0
14	Prescribed Fire	None	Administratively Withdrawn	M15	111.8
15	Prescribed Fire	None	Matrix	M18	5.7
17	Prescribed Fire	None	Matrix	M18	19.5
18	Dwarf Mistletoe	MMPB	Matrix	M18	0.2
	Dwarf Mistletoe	MMPB	Matrix	M9	4.3
19	Dwarf Mistletoe	MMPB	Matrix	M9	0.8
	Dwarf Mistletoe	MMPB	Matrix	M18	7.9
20	Dwarf Mistletoe	MMPB	Matrix	M18	7.1
21	Dwarf Mistletoe	MMPB	Matrix	M18	7.6
22	Dwarf Mistletoe	MMPB	Matrix	M18	9.9
23	Dwarf Mistletoe	MMPB	Matrix	M18	35.8
24	Dwarf Mistletoe	MMPB	Matrix	M18	85.4
25	Thinning	MMPB	Matrix	M18	2.7
26	Thinning	MMPB	Matrix	M18	14.0
27	Thinning	MMPB	Matrix	M18	21.0
28	Thinning	MMPB	Matrix	M18	44.4
29	Thinning	MMPB	Matrix	M9	31.0
	Thinning	MMPB	Matrix	M18	26.5
30	Thinning	MMPB	Matrix	M18	326.3
31	Thinning	MMPB	Matrix	M18	6.2
	Thinning	MMPB	Matrix	M9	3.8
33	Thinning	MMPB	Matrix	M18	8.4
34	Thinning	MMPB	Matrix	M18	20.4
35	Thinning	MMPB	Matrix	M18	15.8
36	Thinning	MMPB	Matrix	M18	9.1

Unit	Treatment	Secondary	NWFP	LRMP	Acres
37	Thinning	MMPB	Matrix	M18	112.4
38	Thinning	MMPB	Matrix	M9	108.6
	Thinning	MMPB	Matrix	M18	75.3
39	Thinning	MMPB	Matrix	M9	89.8
	Thinning	MMPB	Matrix	M18	13.6
40	Scenic Views Enhancement	MMPB	Matrix	M9	33.4
41	Lodgepole Pine Improvement	MMPB	Matrix	M9	1.8
42	Lodgepole Pine Improvement	MMPB	Matrix	M9	6.4
	Lodgepole Pine Improvement	MMPB	Matrix	M18	2.1
44	Lodgepole Pine Improvement	MMPB	Matrix	M9	39.7
	Lodgepole Pine Improvement	MMPB	Matrix	M18	168.8
46	Thinning with Group Openings	MMPB	Matrix	M18	7.6
47	Thinning with Group Openings	MMPB	Matrix	M18	9.8
48	Scenic Views Enhancement	MMPB	Matrix	M9	19.0
49	Thinning with Group Openings	MMPB	Matrix	M9	15.6
50	Thinning with Group Openings	MMPB	Matrix	M18	57.6
51	Thinning with Group Openings	MMPB	Matrix	M18	74.4
52	Thinning with Group Openings	MMPB	Matrix	M9	48.4
	Thinning with Group Openings	MMPB	Matrix	M18	107.5
53	Thinning with Group Openings	MMPB	Matrix	M18	26.9
54	Thinning with Group Openings	MMPB	Matrix	M18	13.2
56	Thinning with Group Openings	MMPB	Matrix	M9	36.8
	Thinning with Group Openings	MMPB	Matrix	M18	49.5
57	Thinning with Group Openings	MMPB	Matrix	M18	392.3
58	Plantation	MMPB	Matrix	M18	0.3
59	Plantation	MMPB	Matrix	M18	1.9
62	Plantation	MMPB	Matrix	M18	4.3
63	Plantation	MMPB	Matrix	M9	5.5
64	Plantation	MMPB	Matrix	M9	7.0
65	Plantation	MMPB	Matrix	M18	7.0
66	Plantation	MMPB	Matrix	M9	8.5
67	Plantation	MMPB	Matrix	M9	9.3
68	Plantation	MMPB	Matrix	M18	0.8
	Plantation	MMPB	Matrix	M9	8.6
69	Plantation	MMPB	Matrix	M18	0.2

	Plantation	MMPB	Matrix	M9	9.8
70	Plantation	MMPB	Matrix	M9	13.9
	Plantation	MMPB	Matrix	M18	0.2
71	Plantation	MMPB	Matrix	M18	15.0
72	Plantation	MMPB	Matrix	M18	15.1
73	Plantation	MMPB	Matrix	M18	16.1
74	Plantation	MMPB	Matrix	M18	16.7
75	Plantation	MMPB	Matrix	M9	17.4
	Plantation	MMPB	Matrix	M18	0.3
76	Plantation	MMPB	Matrix	M18	18.5
77	Plantation	MMPB	Matrix	M18	18.8
78	Plantation	MMPB	Matrix	M18	18.8
79	Plantation	MMPB	Matrix	M18	19.3
80	Plantation	MMPB	Matrix	M18	20.9
81	Plantation	MMPB	Matrix	M18	20.6
82	Plantation	MMPB	Matrix	M9	21.2
83	Plantation	MMPB	Matrix	M18	21.5
84	Plantation	MMPB	Matrix	M9	22.6
85	Plantation	MMPB	Matrix	M9	21.8
86	Plantation	MMPB	Matrix	M18	22.7
87	Plantation	MMPB	Matrix	M18	22.9
88	Plantation	MMPB	Matrix	M9	5.1
	Plantation	MMPB	Matrix	M18	19.0
89	Plantation	MMPB	Matrix	M18	24.6
90	Plantation	MMPB	Matrix	M18	24.8
91	Plantation	MMPB	Matrix	M9	19.9
	Plantation	MMPB	Matrix	M18	4.9
92	Plantation	MMPB	Matrix	M9	9.0
	Plantation	MMPB	Matrix	M18	15.8
93	Plantation	MMPB	Matrix	M18	25.4
94	Plantation	MMPB	Matrix	M9	8.5
	Plantation	MMPB	Matrix	M18	17.2
95	Plantation	MMPB	Matrix	M18	26.3
96	Plantation	MMPB	Matrix	M18	26.3
97	Plantation	MMPB	Matrix	M9	1.6
	Plantation	MMPB	Matrix	M18	25.8
98	Plantation	MMPB	Matrix	M18	29.8
99	Plantation	MMPB	Matrix	M18	21.6
100	Plantation	MMPB	Matrix	M18	31.0
101	Plantation	MMPB	Matrix	M18	36.0
102	Plantation	MMPB	Matrix	M18	41.7
103	Plantation	MMPB	Matrix	M18	40.1
104	Plantation	MMPB	Matrix	M18	43.4

Unit	Treatment	Secondary	NWFP	LRMP	Acres
105	Plantation	MMPB	Matrix	M18	44.4
106	Plantation	MMPB	Matrix	M18	46.8
107	Plantation	MMPB	Matrix	M18	65.8
108	Plantation	MMPB	Matrix	M9	19.3
	Plantation	MMPB	Matrix	M18	0.3
109	Plantation	MMPB	Matrix	M9	22.2
110	Plantation	MMPB	Matrix	M9	56.6
	Plantation	MMPB	Matrix	M18	2.4
111	Plantation	MMPB	Matrix	M18	8.7
113	Thinning	MMPB	Matrix	M18	26.7
115	Plantation	MMPB	Matrix	M18	2.2
116	Thinning	MMPB	Matrix	M18	42.4
117	Scenic Views Enhancement	MMPB	Matrix	M9	11.9
	Scenic Views Enhancement	MMPB	Matrix	M18	0.1
118	Scenic Views Enhancement	MMPB	Matrix	M8	1.1
	Scenic Views Enhancement	MMPB	Matrix	M9	129.9
	Scenic Views Enhancement	MMPB	Matrix	M18	13.0
119	Scenic Views Enhancement	MMPB	Matrix	M9	3.6
120	Scenic Views Enhancement	MMPB	Matrix	M9	28.7
121	Lodgepole Pine Improvement	MMPB	Matrix	M9	30.6
				Total	4469

Note: MMPB = Mowing and/or mastication and prescribe burn.

Alternative 3

Alternative 3 was created based on key issues identified during public scoping. About 4,405 acres would be treated. Key issues used in alternative development include not constructing temporary roads to access treatment units; not creating group opening treatments in the Mixed Conifer plant association; and not removing large ponderosa pine in the dwarf mistletoe treatment. The IDT determined these key issues could be best addressed in a single action alternative.

This action alternative would convert group openings in the Mixed Conifer plant association to a thinning treatment; covert the dwarf mistletoe treatment into a thinning treatment; and does not require temporary road construction. The Lodgepole Pine Improvement Treatment, Plantation Treatment, Prescribed Fire Treatment, and Wildlife Habitat Retention Areas would remain the same as Alternative 2.

Treatment Descriptions

The following treatments are proposed. Potential treatment units are displayed on Figure 5.

Lodgepole Pine Improvement Treatment (249 acres): *The goal is to create a mosaic of even aged stands with natural appearing openings within the lodgepole pine, while providing a fuel break adjacent to Forest Road 16.*

This treatment description is the same as Alternative 2.

Plantation Treatments (1,174 acres): *The goal is to create more structurally diverse forests*.

This treatment description is the same as Alternative 2.

Prescribed Fire Only Treatment (809 acres): *The goal is to manage in-growth of trees, reduce fuels, and reintroduce fire back into the ecosystem*.

This treatment description is the same as Alternative 2.

Thinning (1,164 acres): *The goal is to maintain fire climax ponderosa pine*.

Thinning would occur in the Ponderosa Pine and Dry Mixed Conifer plant association groups. These areas have a predominance of old growth or second growth ("black bark pine") ponderosa pine in the overstory with some small diameter ponderosa pine and white fir in the understory. In many cases thinning would move multi-story late old structure stands to single story late old structure stands.

1) Treatments within the old growth stands would include thinning from below, mowing of shrubs, and prescribed burning.

2) Thinning treatments in the second growth ponderosa pine would be based on variable density thinning ("gappy/patchy/clumpy In some cases thinning would include removal of some larger trees, predominantly white fir, to create uneven aged stands to provide for the long term sustainability.

Thinning *without* Group Openings Treatment (769 Acres)**:** *The goal is to maintain and restore fire climax ponderosa pine*.

This treatment is similar to the Thinning with Group Openings as described in Alternative 2 but does not include group openings. While 820 acres are identified for treatment the amount of effective treated acres is expected to be 10%-30% less based on the lack of group openings. The effective acres treated would range from 574 to 738 acres. Specific stand conditions would ultimately guide the effective acres treated.

In mixed conifer stands that are dominated by white fir, thinning would occur adjacent to residual overstory ponderosa pine. Treatments would include thinning from below, removing young white fir/ponderosa pine ladder fuels from around the overstory ponderosa pine, mowing of shrubs and/or prescribed burning.

The total number of acres that would be thinned under Alternative is about 1,933 acres, but the IDT wanted to track the Thinning without Group Openings treatment separately as this treatment type was an issue raised during scoping. For simplicity of analysis, the thinning acres were combined in the Forest Vegetation section of the environmental assessment.

Scenic Views Enhancement Treatment (240 acres): *The goal is meet the direction for the Scenic Views management area.*

This is the same treatment as Alternate 2. Alternative 3 contains two non-significant Forest Plan amendments.

Table 8 provides a summary of proposed treatments. Table 9 provides a stand-by-stand summary of proposed treatments.

Table 8 Summary of proposed treatments

Treatment Type	Acres
Lodgepole Pine Improvement	249
Plantation	1,174
Prescribed Fire	809
Thinning	1,164
Thinning without Group Openings	769
Scenic Views Enhancement	240
Total	4,405

A number of connected actions are associated with Alternative 3:

- About 8 miles of Forest Roads would be decommissioned
- About 6 miles of Forest Roads would be administratively closed

Logging systems and post-harvest treatments are the same as Alternative 2 (Proposed Action).

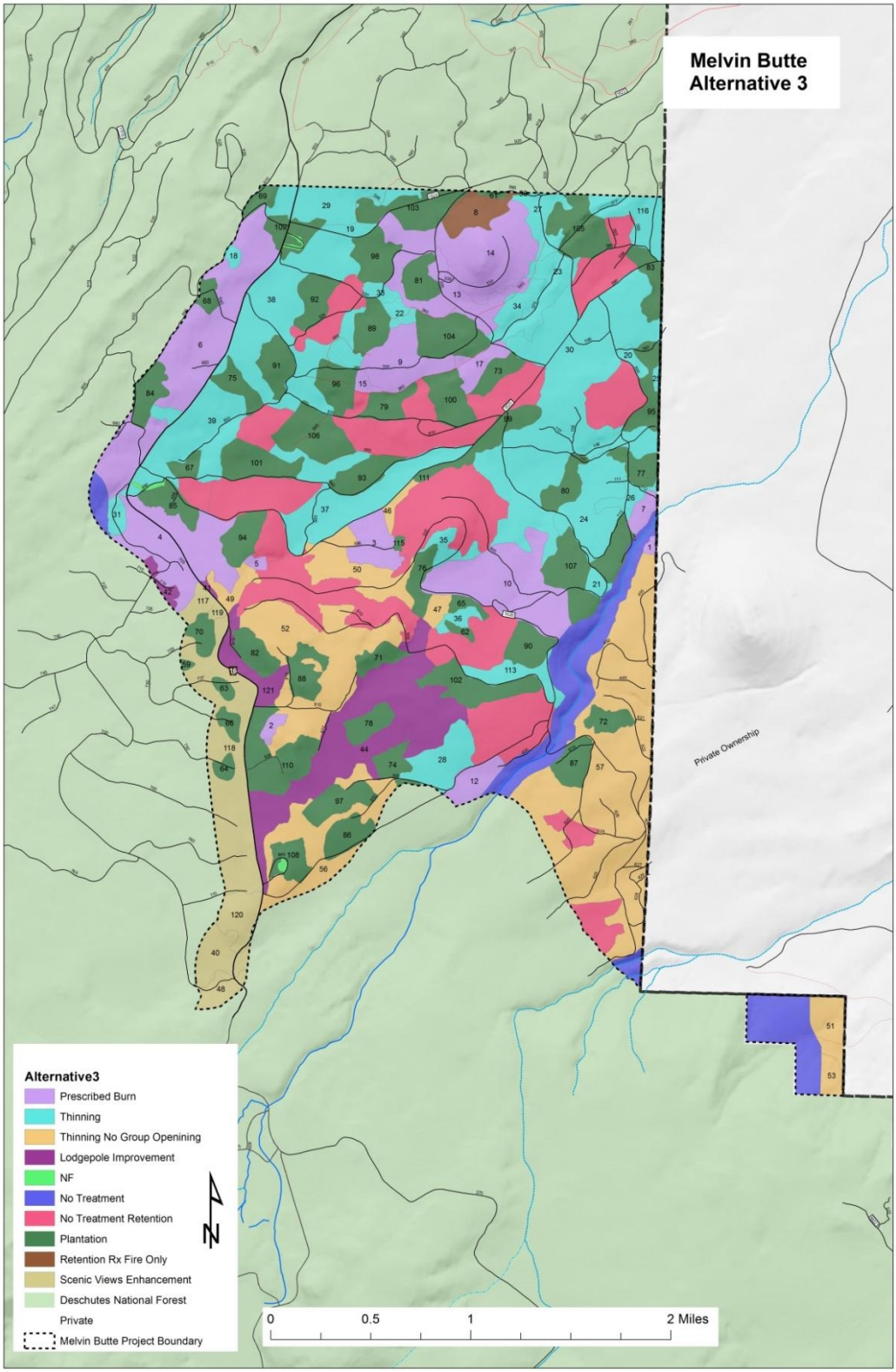


Figure 5 Alternative 3

Table 9 Stand table for Alternative 3

Unit	Treatment	Secondary	NWFP	LRMP	Acres
1	Prescribed Fire	None	Matrix	M18	3.0
2	Prescribed Fire	None	Matrix	M9	6.9
3	Prescribed Fire	None	Matrix	M18	34.9
4	Prescribed Fire	None	Matrix	M18	13.4
	Prescribed Fire	None	Matrix	M9	146.2
5	Prescribed Fire	None	Matrix	M9	1.2
	Prescribed Fire	None	Matrix	M18	3.0
6	Prescribed Fire	None	Matrix	M18	3.8
	Prescribed Fire	None	Matrix	M9	132.3
7	Prescribed Fire	None	Matrix	M18	12.0
8	Retention - Rx Fire Only	None	Administratively Withdrawn	M15	29.8
9	Prescribed Fire	None	Matrix	M18	54.6
10	Prescribed Fire	None	Matrix	M18	126.5
12	Prescribed Fire	None	Matrix	M18	23.3
13	Prescribed Fire	None	Matrix	M18	56.5
	Prescribed Fire	None	Administratively Withdrawn	M15	25.0
14	Prescribed Fire	None	Administratively Withdrawn	M15	111.8
15	Prescribed Fire	None	Matrix	M18	5.7
17	Prescribed Fire	None	Matrix	M18	19.5
18	Thinning	MMPB	Matrix	M18	0.2
	Thinning	MMPB	Matrix	M9	4.3
19	Thinning	MMPB	Matrix	M9	0.8
	Thinning	MMPB	Matrix	M18	7.9
20	Thinning	MMPB	Matrix	M18	7.1
21	Thinning	MMPB	Matrix	M18	7.6
22	Thinning	MMPB	Matrix	M18	9.9
23	Thinning	MMPB	Matrix	M18	35.8
24	Thinning	MMPB	Matrix	M18	85.4
25	Thinning	MMPB	Matrix	M18	2.7
26	Thinning	MMPB	Matrix	M18	14.0
27	Thinning	MMPB	Matrix	M18	21.0
	Thinning	MMPB	AWD	M15	7.2
28	Thinning	MMPB	Matrix	M18	44.4
29	Thinning	MMPB	Matrix	M9	31.0
	Thinning	MMPB	Matrix	M18	26.5
30	Thinning	MMPB	Matrix	M18	326.3
31	Thinning	MMPB	Matrix	M18	6.2
	Thinning	MMPB	Matrix	M9	3.8
33	Thinning	MMPB	Matrix	M18	8.4

34	Thinning	MMPB	Matrix	M18	20.4
35	Thinning	MMPB	Matrix	M18	15.8
36	Thinning	MMPB	Matrix	M18	9.1
37	Thinning	MMPB	Matrix	M18	112.4
38	Thinning	MMPB	Matrix	M9	108.6
	Thinning	MMPB	Matrix	M18	75.3
39	Thinning	MMPB	Matrix	M9	89.8
	Thinning	MMPB	Matrix	M18	13.6
40	Scenic Views Enhancement	MMPB	Matrix	M9	33.4
41	Lodgepole Pine Improvement	MMPB	Matrix	M9	1.8
42	Lodgepole Pine Improvement	MMPB	Matrix	M9	6.4
	Lodgepole Pine Improvement	MMPB	Matrix	M18	2.1
44	Lodgepole Pine Improvement	MMPB	Matrix	M9	39.7
	Lodgepole Pine Improvement	MMPB	Matrix	M18	168.8
46	Thinning without Group Opening	MMPB	Matrix	M18	7.6
47	Thinning without Group Opening	MMPB	Matrix	M18	9.8
48	Scenic Views Enhancement	MMPB	Matrix	M9	19.0
49	Thinning without Group Opening	MMPB	Matrix	M9	15.6
50	Thinning without Group Opening	MMPB	Matrix	M18	57.6
51	Thinning without Group Opening	MMPB	Matrix	M18	31.0
52	Thinning without Group Opening	MMPB	Matrix	M9	48.4
52	Thinning without Group Opening	MMPB	Matrix	M18	59.7
52	Thinning without Group Opening	MMPB	Matrix	M18	47.8
53	Thinning without Group Opening	MMPB	Matrix	M18	13.1
56	Thinning without Group Opening	MMPB	Matrix	M9	36.8
	Thinning without Group Opening	MMPB	Matrix	M18	49.5
57	Thinning without Group Opening	MMPB	Matrix	M18	392.3
58	Plantation	MMPB	Matrix	M18	0.3
59	Plantation	MMPB	Matrix	M18	1.9
62	Plantation	MMPB	Matrix	M18	4.3
63	Plantation	MMPB	Matrix	M9	5.5
64	Plantation	MMPB	Matrix	M9	7.0
65	Plantation	MMPB	Matrix	M18	7.0
66	Plantation	MMPB	Matrix	M9	8.5
67	Plantation	MMPB	Matrix	M9	9.3
68	Plantation	MMPB	Matrix	M18	0.8
	Plantation	MMPB	Matrix	M9	8.6
69	Plantation	MMPB	Matrix	M18	0.2
	Plantation	MMPB	Matrix	M9	9.8
70	Plantation	MMPB	Matrix	M9	13.9
	Plantation	MMPB	Matrix	M18	0.2
71	Plantation	MMPB	Matrix	M18	15.0
72	Plantation	MMPB	Matrix	M18	15.1

73	Plantation	MMPB	Matrix	M18	16.1
74	Plantation	MMPB	Matrix	M18	16.7
75	Plantation	MMPB	Matrix	M9	17.4
	Plantation	MMPB	Matrix	M18	0.3
76	Plantation	MMPB	Matrix	M18	18.5
77	Plantation	MMPB	Matrix	M18	18.8
78	Plantation	MMPB	Matrix	M18	18.8
79	Plantation	MMPB	Matrix	M18	19.3
80	Plantation	MMPB	Matrix	M18	20.9
81	Plantation	MMPB	Matrix	M18	20.6
82	Plantation	MMPB	Matrix	M9	21.2
83	Plantation	MMPB	Matrix	M18	21.5
84	Plantation	MMPB	Matrix	M9	22.6
85	Plantation	MMPB	Matrix	M9	21.8
86	Plantation	MMPB	Matrix	M18	22.7
87	Plantation	MMPB	Matrix	M18	22.9
88	Plantation	MMPB	Matrix	M9	5.1
	Plantation	MMPB	Matrix	M18	19.0
89	Plantation	MMPB	Matrix	M18	24.6
90	Plantation	MMPB	Matrix	M18	24.8
91	Plantation	MMPB	Matrix	M9	19.9
	Plantation	MMPB	Matrix	M18	4.9
92	Plantation	MMPB	Matrix	M9	9.0
	Plantation	MMPB	Matrix	M18	15.8
93	Plantation	MMPB	Matrix	M18	25.4
94	Plantation	MMPB	Matrix	M9	8.5
	Plantation	MMPB	Matrix	M18	17.2
95	Plantation	MMPB	Matrix	M18	26.3
96	Plantation	MMPB	Matrix	M18	26.3
97	Plantation	MMPB	Matrix	M9	1.6
97	Plantation	MMPB	Matrix	M18	25.8
98	Plantation	MMPB	Matrix	M18	29.8
99	Plantation	MMPB	Matrix	M18	21.6
100	Plantation	MMPB	Matrix	M18	31.0
101	Plantation	MMPB	Matrix	M18	36.0
102	Plantation	MMPB	Matrix	M18	41.7
103	Plantation	MMPB	Matrix	M18	40.1
104	Plantation	MMPB	Matrix	M18	43.4
105	Plantation	MMPB	Matrix	M18	44.4
106	Plantation	MMPB	Matrix	M18	46.8
107	Plantation	MMPB	Matrix	M18	65.8
108	Plantation	MMPB	Matrix	M9	19.3
	Plantation	MMPB	Matrix	M18	0.3

109	Plantation	MMPB	Matrix	M9	22.2
110	Plantation	MMPB	Matrix	M9	56.6
	Plantation	MMPB	Matrix	M18	2.4
111	Plantation	MMPB	Matrix	M18	8.7
113	Thinning	MMPB	Matrix	M18	26.7
115	Plantation	MMPB	Matrix	M18	2.2
116	Thinning	MMPB	Matrix	M18	42.4
117	Scenic Views Enhancement	MMPB	Matrix	M9	11.9
	Scenic Views Enhancement	MMPB	Matrix	M18	0.1
118	Scenic Views Enhancement	MMPB	Matrix	M8	1.1
	Scenic Views Enhancement	MMPB	Matrix	M9	129.9
	Scenic Views Enhancement	MMPB	Matrix	M18	13.0
119	Scenic Views Enhancement	MMPB	Matrix	M9	3.6
120	Scenic Views Enhancement	MMPB	Matrix	M9	28.7
121	Lodgepole Pine Improvement	MMPB	Matrix	M9	30.6
				Total	4405

Note: MMPB = Mowing and/or mastication and prescribe burn.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL_____

Three comments were received during public scoping that suggested alternatives to the proposed action but were not analyzed in detail. In addition, one alternative was considred by the IDT but was not analyzed in detail as discussed below.

Do not treat stands in the Mixed Conifer plant association group

It was suggested that no silviculture treatments occur in the mixed conifer plant association. This alternative would not meet the intent of increasing stand resiliency to insects, disease or wildfire or maintain existing old growth ponderosa pine in the mixed conifer plant association group. The Whychus Watershed Analysis shows a deficit of large ponderosa pine on the landscape resulting from past logging practices, disease and insects and past fires. The remaining large ponderosa pine would continue to be at risk and could eventually be replaced by white fir as forest succession continues, lost to high intensity wildfire or mortality from bark beetle attack. The action alternatives would conduct understory thinning around old growth trees to remove ladder fuels and provide for more site resources such as water. It is felt that understory thinning would help maintain old large ponderosa trees over the long term. This alternative would not meet the purpose and need for action.

Do not remove trees larger than 9, 12, or 15 inches in diameter

It was suggested that varying levels of diameter cutting limits be applied to the project. The IDT evaluated these suggestions and concluded that these diameter limits were arbitrary. Arbitrarily applying a diameter limit would limit the ability to address site specific conditions and the silviculture needs of the individual stand. For example, removing trees up to 12 inches in diameter may be suitable for fire risk reduction, again dependent on the site density, but may not reduce stand densities to provide for the long term maintenance of large old trees over time. This alternative would not meet the purpose and need for action.

Only treat second growth ponderosa pine

It was suggested to only treat second growth ponderosa pine in the project area. This would reduce the project area available for treatment by about 80%. This alternative would forego fuels reduction treatments in the Wildland-Urban Interface and the potential fire risk in the project area would be similar to the No Action Alternative. This suggestion would have similar effects as described for the "do not treat stands in the Mixed Conifer plant association group" alternative. This alternative would not meet the purpose and need for action.

Consider an action alternative that did not contain site-specific Forest Plan amendments

An action alternative that didn't contain site-specific amendments to the Forest Plan for the Scenic Views (MA-9) land allocation was considered by the district interdisciplinary team. This alternative would use Scenic Views standards and guidelines M9-27 and M9-90 as currently outlined in the Deschutes National Forest Land and Resource Management Plan (pages LRMP 4-125 and LRMP 4-131).

M9-27 *(LRMP 4-125) states: In Retention Foregrounds slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In partial retention foregrounds, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.*

District experience has shown that visual impacts to the casual forest visitor from thinning, tree removal, and prescribed burning in Retention and Partial Retention Foreground areas in the Timber/Mixed Conifer type can often last up to a five year period. In addition, logging residues can often take up to two years to cure (dry out) and subsequent slash burning must often be staggered over a period of time contingent on such factors as weather and smoke dispersal requirements. Given these factors, coupled with the more urgent need to reduce fuels in the Wildland Urban Interface, the IDT felt that an action alternative that incorporated M9-27 as currently written wasn't operationally feasible and that a period of time greater than one to two years was more realistic to achieve the goals of the Scenic Views land allocation and the *Greater Sisters Country Community Wildfire Protection Plan*.

M9-90 *(LRMP page 4-131*) states: *Low intensity prescribed fires will be used to meet and promote the Desired Visual Condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a high intensity fire. In foreground areas, prescribed fire will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered.*

The Scenic Views land allocation in the Melvin project area is embedded in a designated Wildland Urban Interface. One goal of treatments in the WUI is to reduce fuel loadings adjacent to Forest Road 16 which is the main travel artery to the highly popular Three Creeks Lakes basin. The IDT also considred the requirements of M9-90 in the context of restoring Scenic Views in foreground areas impacted by the 2012 Pole Creek fire.

Foreground areas in the Timber/Mixed Conifer type adjacent to Forest Road 16 were impacted by the fire and fireline suppression techniques such as mowing, felling of snags, and back burning operations. Allowing some prescribed burn areas greater than five acres in size in foreground areas would facilitate fuels reduction adjacent to Forest Road 16 and help blend evidence of fire suppression activities with the existing surrounding vegetation. The district also has considerable experience in using mechanized equipment to limit bole scorch by thinning understory trees and shrubs but under the best conditions fire may scorch boles greater than 1/3 of the tree. Prescribed burning would adhere to fuel and weather parameters outlined in Burn Plans to minimize bole scorch. Given these factors the IDT felt that an action alternative that incorporated M9-90 as currently written wouldn't facilitate the goal of restoring scenic

quality in foreground areas impacted by the 2012 Pole Creek fire or adequately address fuels reduction in a Wildland Urban Interface.

For the reasons stated above the IDT did not consider an action alternative that used the standards and guidelines M9-27 and M9-90 as currently written because they wouldn't provide the necessary flexibility to meet the purpose and need for action for the Melvin Butte Vegetation Management Project.

RESOURCE PROTECTION MEASURES COMMON TO THE ACTION ALTERNATIVES

The action alternatives would meet direction in all relevant laws and policies, and the standards and guidelines in the Deschutes National Forest Land and Resource Management Plan, as amended by individual site-specific amendments described in this environmental assessment. Resource protection measures are project design criteria and best management practices that would reduce or eliminate unwanted effects and ensure project activities are implemented to comply with all necessary Forest Plan standards and guidelines.

Resource protection measures are an integral part of project design and would be carried out through project implementation. The effectiveness of each resource protection measure is rated as ***high***, ***moderate***, or ***low*** to provide a qualitative assessment of the expected effectiveness the management activity could have on preventing and/or reducing impacts to resources. Effectiveness ratings are based on the following criteria: (i) literature; (ii) administrative studies (local or within similar ecosystems; and (iii) professional judgment.

- ***High***: Practice is highly effective (greater than 90%), meets one or more rating criteria, and documentation is available.
- ***Moderate***: Documentation shows that the practice is 75 to 90 percent effective; or logic indicates that the practice is highly effective, but there is no documentation. Implementation and effectiveness of this practice need to be monitored and the practice will be modified if necessary to achieve resource protection objectives.
- ***Low*****:** Effectiveness is unknown or unverified, and there is little to no documentation; or applied logic is uncertain and the practice is estimated to be less than 60 percent effectiveness. The practice is speculative and needs both effectiveness and validation monitoring.

The effects analysis in Chapter 3 is based on resource protection measures being implemented.

Resource protection measures include, but are not limited to, the following: Forest Plan goals, objectives, or standards and guidelines; project design criteria; best management practices; and Invasive Plant Prevention Practices.

Soils

BMP Veg-4. Ground-based Skidding and Yarding Operations

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use ground-based yarding systems only when physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources (BMP Veg-4).
    - Avoid equipment operations on slopes greater than 30 percent (LRMP SL-2) *(Highly Effective – Entire Sale)*.
    - Assess sensitive soils to determine if equipment operations can occur without causing excessive soil disturbance (LRMP SL-3) *(Moderately Effective – Entire Sale)*.
- Use suitable measures during felling and skidding operations to avoid or minimize disturbance to soils and water bodies to the extent practicable (BMP Veg-4).
    - Use directional felling techniques from pre-approved skid trails, and suspend the leading end of logs during skidding operations *(Highly Effective – Entire Sale)*.
    - On steep pitches within a harvest unit (slopes of 30 percent or steeper) and less than 100 feet long, directional felling of trees to skid trails and/or line pulling should be utilized to harvest trees. This method applies to harvest units with small areas of steeper slopes (e.g. less than 5 percent of the unit area) *(Highly Effective – Entire Sale)*.
    - Stop harvest operations when soils become too wet to operate on without causing excessive soil disturbance *(Highly Effective – Entire Sale)*.
- Use existing roads and skid trail networks to the extent practicable (BMP Veg-4).
    - Use old landings and skidding networks whenever possible. Assure that water control structures are installed and maintained on skid trials that have gradients of 10 percent or more. Ensure erosion control structures are stabilized and working effectively (LRMP SL-1) *(Highly Effective – Entire Sale)*.
- Design and locate skid trails and skidding operations to minimize soil disturbance to the extent practicable (BMP Veg-4).
    - In all proposed activity areas, locations of new yarding and transportation systems will be designated prior to the logging operations. This includes temporary roads, spur roads, log landings, and primary (main) skid trail networks (LRMP SL-1 & SL-3) *(Highly Effective – Entire Sale)*.
    - Designate locations for new trails and landings so that they properly fit the terrain and minimize the extent of soil disturbance (LRMP SL-3) *(Highly Effective – Entire Sale)*.
    - Restrict skidders and tractors to designated areas (i.e., roads, landings, designated skid trails), and limit the amount of traffic from other specialized equipment off designated areas. Harvester shears will be authorized to operate off designated skid trails at 30 foot intervals and make no more than two equipment passes on any site specific area to accumulate materials *(Highly Effective – Entire Sale)*.
    - When using conventional harvest equipment that include harvester shears and rubber tired or tracked skidders, maintain spacing of 100 to 150 feet for all primary skid trail routes, except where converging at landings. Closer spacing due to complex terrain must be approved in advance by the Timber Sale Administrator and Soil Scientist. Main skid trails have typically been spaced 100 feet apart (11% of the unit area). For larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trails be increased to 150 feet to reduce the amount of detrimentally disturbed soil to 7% of the unit area (Froehlich 1981) *(Highly Effective – Entire Sale)*.
    - When using harvester forwarder equipment space trails a minimum of 60 feet apart. Make use of ghost trails as much as possible on which the harvester makes only one pass and positions harvested materials so they can be reached from alternate harvester forwarder trails *(Highly Effective – Entire Sale)*.
- Use suitable measures to stabilize and restore skid trails after use (BMP Veg-4).
    - Evaluate soil conditions and identify soil restoration opportunities (subsoiling) on skid trails post-harvest *(Highly Effective – Entire Sale)*.

BMP Veg-6. Landings

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of log landings.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Minimize the size and number of landings as practicable to accommodate safe, economical, and efficient operations (BMP Veg-6) *(Highly Effective – Entire Sale).*
- Avoid locating landings near any type of likely flow or sediment transport conduit during storms, such as ephemeral channels and swales, where practicable (BMP Veg-6) *(Moderately Effective – Entire Sale).*
- Locate landings to minimize the number of required skid roads (BMP Veg-6) *(Moderately Effective – Entire Sale).*
- Re-use existing landings where their location is compatible with management objectives and water quality protection (BMP Veg-6) *(Highly Effective – Entire Sale).*

BMP Veg-7. Winter Logging

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from winter logging operations.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct winter logging operations when the ground is frozen or snow cover and depth is adequate to avoid or minimize unacceptable rutting or displacement of soil (BMP Veg-7) *(Highly Effective – Entire Sale).*
- Suspend winter operations if ground and snow conditions change such that unacceptable soil disturbance, compaction, displacement, or erosion becomes likely (BMP Veg-7) *(Highly Effective – Entire Sale).*

BMP Fire-2. Use of Prescribed Fire

Objective: Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris.

Practices: A burn plan addressing compliance with applicable DES LRMP standards and guidelines and BMP's will be completed before the initiation of prescribe fire treatments in planning activity areas. Prescribed burn plans need to include the following to protect soils and water quality.

- Conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives.
    - Manage fire intensity to maintain target levels of soil temperature, duff, and residual vegetation cover within the limits and at locations described in the prescribed fire plan (BMP Fire-2) *(Highly Effective – Entire Sale).*
- Consider alternatives to ground-disturbing fireline construction such as using existing roads or other already existing suitable features for firelines.

- If fireline construction is necessary, construct line to the minimum size and standard necessary to contain the prescribed fire and meet overall project objectives (BMP Fire-2) *(Moderately Effective – Entire Sale).*

Hydrology and Fisheries

Vegetation Management Planning

Objective: Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.

Practices: Evaluate and field verify site conditions in the project area to design mechanical vegetation treatment prescriptions that avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

- Through the project planning and design process, the following areas are excluded from treatment to protect water quality and riparian resources:
  - No treatments are proposed in Riparian Reserves except for 0.1 miles of road closure and decommissioning (*Highly Effective – Entire Sale Area*)
  - No new roads or new temporary roads will be constructed in Riparian Reserves (*Highly Effective – Entire Sale Area*)

Ground-Based Skidding and Yarding Operations (FSM 2409.15)

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations by minimizing site disturbances and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Practices: Specific design elements for ephemeral channels and ditches to protect the integrity of channel banks and reduce sedimentation. Some ephemeral channels have been identified below but others may be found during implementation and restrictions would apply. Implement standard logging BMPs to protect water quality.

- Modify mechanical vegetation treatment prescriptions and operations as needed to maintain ecosystem structure, function, and processes.
  - Mechanical treatment and equipment is not allowed within 30 ft. on either side of the ephemeral channels, unless approved by a hydrologist or fisheries biologist. (*Moderately Effective –Units 10, 17, 23, 30, 37, 44, 76, 79, 80, 95, 99, 100, 105, 116*)
  - Removal of trees within 30 ft. on either side of ephemeral channels is not allowed unless approved by a hydrologist or fisheries biologist. (*Moderately effective – Entire Sale Area and Units 10, 17, 23, 30, 37, 44, 76, 79, 80, 95, 99, 100, 105, 116*)
  - Do not pile slash in swales, washes, or depressions. (*Moderately Effective –Units 10, 17, 23, 30, 37, 44, 76, 79, 80, 95, 99, 100, 105, 116*)
  - Ditches and channelized streams that are functioning as a stream should be buffered based on the class of stream for which they are functioning (i.e. Class 4 buffer if the ditch is intermittent, etc.). (*Highly Effective – Entire Sale Area*)
  - Ditches that do not connect back to a stream (i.e. they feed out into a pasture or irrigation device) should be buffered 30 ft to protect the integrity of the channel. No mechanized equipment is allowed within the buffer. Hand-thinning or reaching in with equipment is permitted but cutting of trees within the channel or on the banks is not permitted. Do not

fell or yard any trees across the channel in order to protect channel integrity. (*Highly Effective – Entire Sale Area*)

- Locate transportation facilities for mechanical vegetation treatments, including roads, landings, and skid trails outside Riparian Reserves and ephemeral draws to the extent practicable.
    - Crossing of designated ephemeral draws will be limited and approved by a hydrologist or fisheries biologist(*Moderately Effective – Entire Sale Area*)
    - Landings will be located at least 30ft from ephemeral draws and outside of Riparian Reserves. (*Moderately Effective – Entire Sale Area*)
- Implement Best Management logging practices that will reduce erosion and potential water quality effects.
    - Installation of waterbars on skid trails where needed. (*Moderately Effective – Entire Sale Area*)
    - Construction of new landings and skid trails would be minimized. (*Highly Effective – Entire Sale Area*)
    - No ground-based harvest on slopes over 30%. (*Moderately Effective – Entire Sale Area*)
    - See soils BMP document for additional specific measures to minimize effect of ground-based skidding and yarding operations.

Hauling Operations

Objective: Avoid, minimize, or mitigate adverse effects to water quality and riparian resources during hauling operations by minimizing road erosion and maintaining proper road drainage to reduce the introduction of sediment and increased overland flow to waterbodies.

Practices: Limit timing of haul and maintain proper drainage to reduce sediment delivered to Three Creek from hauling operations.

- No haul on hydrologically connected roads or roads within riparian reserves when conditions are wet and can cause sedimentation to reach Three Creek. (*Moderately Effective – Entire Sale Area*)
- No haul across stream fords when streams are flowing. (*Moderately Effective – Entire Sale Area*)
- Improve drainage on unstable hydrologically connected roads before haul can occur and implement regular preventative maintenance. (*Moderately Effective – Entire Sale Area*)
- Consult with a hydrologist or soil scientist to determine if roads are too wet for haul.
- Roads that may need maintenance or that should be monitored for excessive wetness in hydrologically connected areas are (other roads may be identified in the field):
    - 1620-377 – adjacent to ephemeral draw, decommission after use;
    - 1620-570 – adjacent to ephemeral draw, close after use;
    - 1620-880 – adjacent to ephemeral draw;
    - 1624-360 – adjacent to ephemeral draw, decommissioning after use.
- Obliterate all temporary roads. (*Moderately Effective – Units 4, 51, 56*)

Wildlife

Objective: Avoid, minimize or mitigate adverse effects to wildlife and wildlife habitat during ground-based skidding, yarding operations, and location of log landings.

Practice: Develop site-specific BMP prescriptions using Forest Service regional guidance, land management plan direction, and professional judgment.

- Disruptive work activities will not take place within ¼ mile of any newly discovered nest sites for the species listed below. Haul restrictions will be assessed on a case-by-case basis. This condition may be waved in a particular year if nesting or reproductive success surveys reveal that the species indicated in non-nesting or that young are present that year. Waivers are valid only until

the start date of the restriction of the following year (Table 10). (*Highly Effective – Entire Sale Area)*

Table 10 Buffer restrictions for nesting raptors

Species	Restriction Period	Buffer Distance Around Nest
Northern spotted owl	March 1 – September 30	¼ mile
Northern goshawk	March 1 – August 31	¼ mile
Cooper's hawk	April 15 – August 31	¼ mile
Sharp-shinned hawk	April 15 – August 31	¼ mile
Red-tailed hawk	March 1 – August 31	¼ mile
Great gray owl	March 1 – June 30	¼ mile
Osprey	April 1 – August 31	¼ mile

- To avoid potential nest destruction and loss of broods, schedule harvest and post-harvest activities outside of nesting season in appropriate habitats (Table 11).(*Highly Effective – Entire Sale Area)*

Table 11 Species nesting season

Species	Dates
Lewis woodpecker	March 15-June 30
White-headed woodpecker	March 15-June 30
Pygmy huthatch	March 15-June 30
Olive-sided flycatcher	March 15-June 30
Pileated woodpecker	March 15-June 30
Northern flicker	March 15-June 30
Blue grouse	March 15-June 30

Goshawk

- Disruptive work activities will not take place within ¼ mile (1/2 mile for helicopter) of newly discovered nest sites from March 1 through August 31. The project will not be operating within any habitat or known nest sites.

Cooper and Sharp shinned hawk

- Restrict disturbance activities within ¼ mile of any newly discovered nests from April 15 through August 31. Haul restrictions will be assessed on a case by case basis. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that the species indicated is non-nesting or that no young are present that year. Waivers are valid only until the start date of the restriction of the following year.

Red-tailed hawk

- Disruptive work activities will not take place within ¼ mile (1/2 mile for helicopter) of any newly discovered nest sites from March 1 through August 31. Haul restrictions will be assessed on a case by case basis. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that the species indicated is non-nesting or that no young are present that year. Waivers are valid only until the start date of the restriction of the following year.

Snags and Down Wood

- EA Unit 57, when down logs densities need to be reduced to provide access for thinning, maintain down log densities at 120 lineal feet per acre with a minimum of 16 inches diameter and 16 feet long (NWFP C-40).
- Where incidental removal of snags occurs to meet objectives for fuel loading within LPI units and scenic views management all snags >21 inches dbh will be retained.

Botany

Objective: Avoid, minimize or mitigate adverse effects to botanical resources and prevent invasive plants during ground-based skidding, yarding operations, and location of log landings.

Practice: Develop site-specific BMP prescriptions using Forest Service regional guidance, land management plan direction, and professional judgment.

- Discuss invasive plant prevention practices at force account crew or contractor pre-work session. (*Highly Effective – Entire Sale Area)*
- Minimize ground disturbance to the extent practicable. (*Highly Effective – Entire Sale Area)*
- Make sure equipment is clean (weed free). (*Highly Effective – Entire Sale Area)*
- Insure any materials brought to the site are weed free (gravel, rocks, or soil). (*Highly Effective – Entire Sale Area)*
- Minimize disturbance of existing vegetation. If needed, revegetate with local native plant species. (*Highly Effective – Entire Sale Area)*
- Protect any unmapped Whitebark pine discovered during thinning. (*Highly Effective – Entire Sale Area)*

Heritage

Objective: Avoid, minimize or mitigate adverse effects to Heritage resources during ground-based skidding, yarding operations, and location of log landings.

Practice: Develop site-specific BMP prescriptions using Forest Service regional guidance, land management plan direction, and professional judgment.

- Ground disturbing activities within all eligible or potentially eligible sites will be avoided with a 30 meter buffer placed around the sites. If any cultural resources are discovered during project implementation, all project related activities in that area will cease immediately. Workers must immediately notify the onsite supervisor who will contact a Forest Archaeologist. One of the Forest archaeologists will initiate the consultation process as outlined in Section 800.13 of the Advisory Council on Historic Preservation's regulations 36 CFR Part 800.(*Highly Effective – Entire Sale Area*)

Recreation

Objective: Avoid, minimize, or mitigate adverse effects to recreation resources during tree marking, tree felling, and ground-based skidding and yarding operations.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

To avoid significant disruption of the current valued scenery and recreation experience

- Whenever possible, landings, slash piles, and other discordant visual evidence of harvest and treatment activities should not be visible from sno-parks facilities following completion of operations. *(Highly Effective Units 109 and 39)*
- Do not approve long-term storage of bundles or decks where they will affect the function or use of the sno-parks. *(Highly Effective Units 109 and 39)*

To avoid, minimize or reduce impact to recreational use and safety

- Avoid creating sharply diverse vegetation conditions immediately adjacent to sno-parks. Emphasize a "natural" look of the forest as viewed from the sno-parks. Sno-parks (*Highly Effective Units 109 and 39)*
- Do not approve slash piles or storage of decks along trails that may create a hazardous situation for snowmobile users. For example, a slash pile covered by snow may appear to be a small hill/obstacle to a snowmobile user, not an unstable slash pile. Mitigate these hazards as necessary. (*Highly Effective - Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114)*
- During tree-marking, or tree or brush removal activities within 300 feet of sno-parks, coordinate with recreation staff to emphasize retention and improvement of natural site-defining features. Site boundaries for designated sno-parks are defined by trees, brush, rocks, or down logs. This helps define the edge of where parking is allowed. Maintaining this vegetation entirely or partially or replacing these site-controlling features is critical to future effective site management. *(Highly Effective Units 109 and 39)*
- Retain trees that hold signs (including diamonds that mark winter trails). Replace trail signs that may be damaged or removed during project operations. *(Highly Effective Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114)*
- Whenever possible, in accordance with this EA, remove hazard trees within a tree length near sno-parks. *(Highly Effective - Units 109 and 39)*

To avoid indirect, unintended disruption or modification of recreation activities or unintended impact from recreation activities on other resources following completion of treatment activities

- Painted trees should not be visible from sno-parks within a reasonable time period following completion of project activities. Techniques to accomplish could include, but are not limited to, favoring blue paint marking techniques where possible to mark 'take' trees rather than 'leave' trees for units containing or adjacent to sno-parks, or removing leave tree paint within sight of sno-parks. *(Highly Effective - Units 109 and 39)*
- Avoid creating vegetative conditions that would facilitate creation of unauthorized trails, or that would facilitate unauthorized motorized access from FSR 16 or Sno-parks. *(Highly Effective - Units 109 and 39)*
- Place boulders (preferred) or other natural features bounding sno-parks to deter cross-country travel. (*Highly Effective – Forest Road 16)*
- Obliterate unauthorized travel ways adjacent to the sno-parks. (*Highly Effective - Units 109 and 39)*
- Ensure that temporary roads used for project administration do not become future unauthorized trails by effective obliteration after use. *Highly Effective Applies to Alternative 2 only)*

To ensure that there is no inadvertent effect to use of designated snowmobile routes, to the extent that snowplowing is needed during the operating period

- Assure snow berms created by snowplowing activities do not coincide with winter recreationist routes that create a hazard for snowmobile groomers or recreational users. Coordinate trail

closures with the recreation staff. (*Highly Effective – Forest Road 16 and Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114)*

In order to avoid surprises to recreational users of the area:

- Provide information about timing and location of treatments on websites and at the sno-parks, including information on specific trail or area closures. *(Highly Effective Units 109 and 39)*

To avoid, minimize or reduce impact to special use operations:

- Coordinate with the special use administrator to identify recreation events permitted for the season. Coordinate conflicts with timing and location. *(Highly Effective Forest Road 16 and Units 109 and 39)*
- Do not use Upper Three Creek Sno-Park as a staging area as it receives heavy use and serves as a temporary office location for Three Creeks Backcountry outfitter/guides under special use permit by the Forest Service. *(Highly Effective - Units 109 and 39)*

To avoid significant disruption of the Three Creek recreation area south of the project area:

- Implement traffic control and safety measures on FSR16 during summer recreation use as necessary. Do not close FSR 16 access to recreational sites. *(Highly Effective Forest Road 16)*

Transportation

Objective: Avoid, minimize or mitigate adverse effects to transportation infrastructure during ground-based skidding, yarding operations, and location of log landings.

Practice: Develop site-specific BMP prescriptions using Forest Service regional guidance, land management plan direction, and professional judgment.

Road-1. Travel Management Planning and Analysis

Objective: Use the travel management planning and analysis processes to develop measures to avoid, minimize or mitigate adverse effects to soil, water quality, and riparian resources during road management activities.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Operations

- Use existing roads when practicable *(Highly Effective –Entire Sale Area)*
- Use system roads where access is needed for long-term management of an area or where control is needed in the location, design, or construction of the road to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. *(Highly Effective – Entire Sale Area)*
- Consider placing roads in storage (Maintenance Level 1) when the time between intermittent uses exceeds 1 year and the costs of annual maintenance (both economic and potential disturbance) or potential failures due to lack of maintenance exceed the benefits of keeping the road open in the interim (See BMP Road-6 [Road Storage and Decommissioning]). *(Highly Effective – Entire Sale Area limited to current Level 1 roads)*

Road-4. Road Operations and Maintenance

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Operations

- Designate season of use to avoid or restrict road use during periods when use would likely damage the roadway surface or road drainage features. *(Highly Effective –Entire Sale Area)*
- Use suitable measures to communicate and enforce road use restrictions. *(Highly Effective-Entire Sale Area)*
- Adjust maintenance to handle the traffic while minimizing excessive erosion and damage to the road surface. *Highly Effective-Entire Sale Area)*
  - Ensure that drainage features are fully functional on completion of seasonal operations.
  - Shape road surfaces to drain as designed.
  - Construct or reconstruct drainage control structures as needed.
  - Ensure that ditches and culverts are clean and functioning.
  - Remove berms unless specifically designed for erosion control purposes. *(Highly Effective – Entire Sale Area)*
- Use suitable road surface stabilization practices and dust abatement supplements on roads with high or heavy traffic use (See FSH 7709.56 and FSH 7709.59) *(Moderately Effective – Collector Roads)*

Inspections

- Periodically inspect system travel routes to evaluate condition and assist in setting maintenance and improvement priorities. *Highly Effective – Entire Sale Area)*
- Inspect roads frequently during all operations.
  - Restrict use if road damage such as unacceptable surface displacement or rutting is occurring. *(Highly Effective – Entire Sale Area)*

Maintenance Activities

- Maintain the road surface drainage system to intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces. *(Highly Effective – Entire Sale Area where required)*
- Clean ditches and catch basins only as needed to keep them functioning. (*Highly Effective –Entire Sale Area where required)*
- Do not undercut the toe of the cut slope when cleaning ditches or catch basins. (*Highly Effective – Entire Sale Area where required)*
- Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby water bodies. (*Highly Effective –Entire Sale Area where required)*
- Identify diversion potential on roads and prioritize for treatment.
  - Minimize diversion potential through installation and maintenance of dips, drains, or other suitable measures. *(Highly Effective – Entire Sale Area where required)*
- Maintain road surface treatments to stabilize the roadbed, reduce dust, and control erosion consistent with anticipated traffic and use. *(Moderately Effective – Entire Sale Area)*

- Grade road surfaces only as necessary to meet the smoothness requirements of the assigned operational maintenance level and to provide adequate surface drainage. *(Highly Effective – Entire Sale Area)*
- Do not undercut the toe of the cut slope when grading roads. *(Highly Effective – Entire Sale Area where required)*
- Do not permit side casting of maintenance-generated debris within the AMZ to avoid or minimize excavated materials entering water bodies or riparian areas. *(Highly Effective – Entire Sale Area where required)*
- Avoid over widening of roads due to repeated grading over time, especially where side cast material would encroach on water bodies. *(Highly Effective – Entire Sale Area where required)*
- Use potential side cast or other waste materials on the road surface where practicable. *(Highly Effective – Entire Sale Area)*
- Dispose of unusable waste materials in designated disposal sites. *(Highly Effective – Entire Sale Area where required)*
- Remove vegetation from swales, ditches, and shoulders, and cut and fill slopes only when it impedes adequate drainage, vehicle passage, or obstructs necessary sight distance to avoid or minimize unnecessary or excessive vegetation disturbance. *(Highly Effective – Entire Sale Area)*
- Maintain permanent stream crossings and associated fills and approaches to reduce the likelihood that water would be diverted onto the road or erode the fill if the structure becomes obstructed. *(Highly Effective – Entire Sale Area)*
- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) for maintenance and management of Maintenance Level 1 roads. *(Highly Effective – Entire Sale Area where required)*
- Ensure the necessary specifications concerning prevail maintenance, maintenance during haul, and post haul maintenance (putting the road back in storage) are in place when maintenance level 1 roads are opened for use on commercial resource management projects or other permitted activities. *(Highly Effective – Entire Sale Area)*
- Require the commercial operator or responsible party to leave roads in a satisfactory condition when project is completed. *(Highly Effective – Entire Sale Area)*

Road-5. Temporary Roads

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of temporary roads.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Schedule construction activities to avoid direct soil and water-disturbance during periods of the year when heavy precipitation and runoff are likely to occur. *(Highly Effective – Where Applicable)*
- Routinely inspect temporary roads to verify that erosion and storm water controls are implemented, functioning, and appropriately maintained. *(Highly Effective – Where Applicable)*
- Maintain erosion and storm water controls as necessary to ensure proper and effective functioning. *(Highly Effective – Where Applicable)*
- Use suitable measures in compliance with local direction to prevent and control invasive species. *(Highly Effective – Entire Sale Area)*
- Use temporary crossings suitable for the expected uses and timing of use (See BMP Road-7 [Stream Crossings]). *(Highly Effective – Entire Sale Area where required)*

- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) to obliterate the temporary road and return the area to resource production after the access is no longer needed. *(Highly Effective – Entire Sale Area where required)*

Road-6 Road Storage and Decommissioning

Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by storing closed roads not needed for at least 1 year (Intermittent Stored Service) and decommissioning unneeded roads in a hydrologically stable manner to eliminate hydrologic connectivity, restore natural flow patterns, and minimize soil erosion.

Practice: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

Implement suitable measures to close and physically block the road entrance so that unauthorized motorized vehicles cannot access the road.

- Remove the road from the Motor Vehicle Use Map (MVUM) to include the change in the annual forest wide order associated with the MVUM. *(Moderately Effective – Only Roads Designated for Decommissioning)*
- Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss. *(Highly Effective – Where Applicable)*

Road Storage

- Evaluate all stream and water body crossings for potential for failure or diversion of flow if left without treatment. *(Highly Effective – Where Applicable)*
- Use suitable measures to reduce the risk of flow diversion onto the road surface. *(Highly Effective – Where Applicable)*
- Consider leaving existing crossings in low-risk situations where the culvert is not undersized, does not present an undesired passage barrier to aquatic organisms, and is relatively stable. *(Highly Effective – Where Applicable)*
- Remove culverts, fill material, and other structures that present an unacceptable risk of failure or diversion. *(Highly Effective – Where Applicable)*
- Reshape the channel and stream banks at the crossing-site to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of stream banks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site. *Highly Effective – Where Applicable)*
- Use suitable measures to avoid or minimize scour and down cutting. *(Highly Effective – Where Applicable)*
- Use suitable measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance. *(Highly Effective – Where Applicable)*
- Use suitable measures to stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists. *(Highly Effective – Where Applicable)*
- Close road by means of using natural resource materials such as down logs, boulders, and brush for the first 300’ or line of site to its adjacent intersection, whichever is shortest. *(Highly Effective – Where Applicable)*

Road Decommissioning

- Use existing roads identified for decommissioning as skid roads in timber sales or land stewardship projects before closing the road, where practicable, as the opportunity arises. *(Highly Effective – Where Applicable)*
- Evaluate risks to soil, water quality, and riparian resources and use the most practicable, cost effective treatments to achieve long-term desired conditions and water quality management goals and objectives. *(Highly Effective – Where Applicable)*
- Implement suitable measures to re-establish stable slope contours and surface and subsurface hydrologic pathways where necessary to the extent practicable to avoid or minimize adverse effects to soil, water quality, and riparian resources. (Requires Evaluation)
- Remove drainage structures. *(Highly Effective – Where Applicable)*
- Recontour and stabilize cut slopes and fill material. *(Requires Evaluation)*
- Reshape the channel and stream banks at crossing sites to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of stream banks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site. *(Requires Evaluation)*
- Restore or replace streambed materials to a particle size distribution suitable for the site. *(Requires Evaluation)*
- Restore floodplain function. *(Requires Evaluation)*
- Implement suitable measures to promote infiltration of runoff and intercepted flow and desired vegetation growth on the road prism and other compacted areas. *(Highly Effective – Where Applicable)*
- Use suitable measures in compliance with local direction to prevent and control invasive species. *(Highly Effective – Where Applicable)*
- Uncompact road bed soils using mechanical means to encourage natural vegetative growth and increase water infiltration. *(Highly Effective – Where Applicable)*

Road-7. Stream Crossings

Objectives: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Crossings

- Plan and locate surface water crossings to limit the number and extent to those that are necessary to provide the level of access needed to meet resource management objectives as described in the RMOs. *(Highly Effective – Where Applicable)*
- Use crossing structures suitable for the site conditions, the RMOs and design and locate crossings to minimize disturbance to the waterbody. *(Highly Effective – Where Applicable)*
- Use suitable measures to locate, construct, and decommission or stabilize bypass roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. *(Highly Effective – Where Applicable)*
- Use suitable surface drainage and roadway stabilization measures to disconnect the road from the waterbody to avoid or minimize water and sediment from being channeled into surface waters and to dissipate concentrated flows. *(Highly Effective – Where Applicable)*

- Use suitable measures to avoid, minimize, or mitigate damage to the waterbody and banks when transporting materials across the waterbody. *(Highly Effective – Where Applicable)*

Culverts

- Align the culvert with the natural stream channel and cover culvert with sufficient fill to avoid or minimize damage by traffic; construct at or near natural elevation of the streambed to avoid or minimize potential flooding upstream of the crossing and erosion below the outlet and install culverts long enough to extend beyond the toe of the fill slopes to minimize erosion. *(Highly Effective – Where Applicable)*
- Use suitable measures to avoid or minimize water from seeping around the culvert and to avoid or minimize culvert plugging from transported bedload and debris. *(Highly Effective – Where Applicable)*
- Regularly inspect culverts and clean as necessary. *(Highly Effective – Where Applicable)*

Low-Water Crossings

- Consider low-water crossings on roads with low traffic volume and slow speeds, and where water depth is safe for vehicle travel; consider low-water crossings to cross ephemeral streams, streams with relatively low base flow and shallow water depth or streams with highly variable flows or in areas prone to landslides or debris flows. *(Highly Effective – Where Applicable)*
- Locate low-water crossings where stream banks are low with gentle slopes and channels are not deeply incised and design low-water crossing structures to maintain the function and bedload movement of the natural stream channel; locate unimproved fords in stable reaches with a firm rock or gravel base that has sufficient load-bearing strength for the expected vehicle traffic. *(Highly Effective – Where Applicable)*
  - Construct the low-water crossing to conform to the site, channel shape, and original streambed elevation and to minimize flow restriction, site disturbance, and channel blockage to the extent practicable. *(Highly Effective – Where Applicable)*
  - Use suitable measures to stabilize or harden the streambed and approaches, including the entire bankfull width and sufficient freeboard, where necessary to support the design vehicle traffic; use vented fords with high vent area ratio to maintain stream function and aquatic organism passage. *(Highly Effective – Where Applicable)*
  - Construct the roadway-driving surface with material suitable to resist expected shear stress or lateral forces of water flow at the site. *(Highly Effective – Where Applicable)*
  - Consider using temporary crossings on roads that provide short-term or intermittent access to avoid, minimize, or mitigate erosion, damage to streambed or channel, and flooding. *(Highly Effective – Where Applicable)*
  - Design and install temporary crossings suitable for the expected users, loads, and timing of use and to pass a design storm determined based on local site conditions and requirements. *(Highly Effective – Where Applicable)*
  - Install and remove temporary crossing structures in a timely manner as needed to provide access during use periods and minimize risk of washout. *(Highly Effective – Where Applicable)*
  - Use suitable measures to stabilize temporary crossings that must remain in place during high runoff seasons; monitor temporary crossings regularly while installed to evaluate condition. *(Highly Effective – Where Applicable)*
  - Remove temporary crossings and restore the waterbody profile and substrate when the need for the crossing no longer exists. *(Highly Effective – Where Applicable)*

Road-8. Snow Removal and Storage

Objectives: Avoid or minimize erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use existing standard contract language (C5.316# or similar) for snow removal during winter logging operations to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. *(Highly Effective – Entire Sale Area)*
- Move snow in a manner that will avoid or minimize disturbance of or damage to road surfaces and drainage structures. *(Highly Effective – Entire Sale Area)*
- Conduct frequent inspections to ensure road drainage is not adversely affecting soil or water resources. *(Highly Effective – Entire Sale Area)*
- Control areas where snow removal equipment can operate to avoid or minimize damage to riparian areas, floodplains, and stream channels. *(Highly Effective – Entire Sale Area)*
- Install snow berms where such placement will preclude concentration of snowmelt runoff and will serve to dissipate melt water. *(Highly Effective – Entire Sale Area)*
- Provide frequent drainage through snow berms to avoid concentration of snowmelt runoff on fill slopes and other erosive areas, to dissipate melt water, and to avoid or minimize sediment delivery to water bodies. *(Highly Effective – Entire Sale Area)*

Fire and Fuels

Air Quality

- Reduce particulate emissions through utilization to the extent practical by considering biomass removal wherever feasible (*Highly Effective – Entire Sale Area*)

Fire and Fuels

- Reduce and maintain hazardous fuel loadings to levels conducive to low intensity fire behavior. Where hazardous fuels are being treated, retain a percentage of debris and larger dead material for soil protection, establishment of trees, and small mammal habitat. Coordinate with District Resource Specialists and refer to BMPs to determine appropriate thresholds. (*Highly Effective – Entire Sale Area*)

Air Quality

- All prescribed fire operations will adhere to the *Oregon Smoke Management Plan* to manage air quality. (*Highly Effective – Entire Sale Area*)
- Human-caused visual impacts to the Three Sisters Wilderness area, a federally mandated Class I airshed will be restricted during the period of July 1 – September 15 (*Highly Effective – Entire Sale Area*)
- Human-caused visual impacts to the city of Bend, a state of Oregon designated smoke sensitive receptor area, will be avoided. Prescribed burning operations would occur only when winds and atmospheric conditions are conducive to limiting smoke intrusions within city boundaries. (*Highly Effective – Entire Sale Area*)
- Warning signs will be posted at prominent road junctions to inform the public of prescribed burning operations, and will remain in place until there is no visible smoke. If feasible, roads may

be temporarily closed for the protection of public safety. *(Moderately Effective – Entire Sale Area)*

- Interested parties will be notified prior to burning season and on the day of planned prescribed burning operations to mitigate potential negative economic effects and health effects to sensitive populations. *((Moderately Effective – Entire Sale Area)*

Prescribed Fire

Conduct the prescribed fire in such a manner as to achieve the burn objectives outlined in the Prescribed Fire Burn Plan. *(Moderately Effective – Entire Sale Area)*

- Use applicable practices of Project Planning and Analysis and Aquatic Management Zone Planning when planning prescribed fire treatments.
- Consider prescription elements and ecosystem objectives at the appropriate watershed scale to determine the optimum and maximum burn unit size, total burn unit size, total burn area, burn intensity, disturbance thresholds for local downstream water resources, area or length of water resources to be affected, and contingency strategies.
    - Consider the extent, severity, and recovery of fire disturbance a watershed has experienced in the past to evaluate cumulative effects and re-entry intervals.
- Identify environmental conditions favorable for achieving desired condition or treatment objectives of the site while minimizing detrimental mechanical and heat disturbance to soil and water considering the following factors. *(Moderately Effective – Entire Sale Area)*
    - Existing and desired conditions for vegetation and fuel type, composition, structure, distribution, and density.
    - Short and long term site objectives.
    - Acceptable fire weather parameters.
    - Desirable soil, duff, and fuel moisture levels.
    - Existing duff and humus depths.
    - Site factors such as slope and soil conditions.
    - Expected fire behavior and burn severity based on past burn experience in vegetation types in the project are
    - Extent and condition of roads, fuel breaks, and other resource activities and values.
- Develop burn objectives that avoid or minimize creating water repellent soil conditions to the extent practicable considering fuel load, fuel and soil moisture levels, fire residence times, and burn intensity. *(Moderately Effective – Entire Sale Area)*
    - Use low-intensity prescribed fire on steep slopes or highly erodible soils when prescribed fire is the only practicable means to achieve project objectives in these areas.
- Set target levels for desired ground cover remaining after burning based on slope, soil type, and risk of soil and hillslope movement. *(Moderately Effective – Entire Sale Area)*
- Plan burn areas to use natural or in-place barriers that reduce or limit fire spread, such as roads, canals, utility rights-of-way, barren or low fuel hazard areas, streams, lakes, or wetland features, where practicable, to minimize the need for fireline construction. *(Moderately Effective – Entire Sale Area)*
    - Identify the type, width, and location of firebreaks or firelines in the prescribed fire burn plan.
- Use fire initiation techniques, control methods, and access locations for ignition and control (hold versus escape conditions) that minimize potential effects to soil, water quality, and riparian resources. *(Moderately Effective – Entire Sale Area)*
- Use prescribed fire in the Aquatic Management Zone (AMZ) only when suitable to achieve long-term AMZ-desired conditions and management objectives *(Moderately Effective – Entire Sale Area)*

- Locate access and staging areas near the project site but outside of AMZ's, wetlands, and sensitive soil areas. *(Moderately Effective – Entire Sale Area)*
    - Keep staging areas as small as possible while allowing for safe and efficient operations.
    - Store fuel for ignition devices in areas away from surface water bodies and wetlands.
    - Install suitable measures to minimize and control concentrated water flow and sediment from staging areas.
    - Collect and properly dispose of trash and other solid waste.
    - Restore and stabilize staging areas after use (see BMP Veg-6 [Landings]).
- Conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives. *(Moderately Effective – Entire Sale Area)*
    - Manage fire intensity to maintain target levels of soil temperature and duff and residual vegetation cover within the limits and at locations described in the prescribed fire burn plan.
- Construct fire line to the minimum size and standard necessary to contain the prescribed fire and meet overall project objectives. *(Moderately Effective – Entire Sale Area)*
    - Locate and construct fireline in a manner that minimizes erosion and runoff from directly entering waterbodies by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
    - Consider alternatives to ground-disturbing fireline construction such as using wet lines, rock outcrops, or other suitable features for firelines.
    - Establish permanent fireline with suitable water and erosion control measures in areas where prescribed fire treatments are used on a recurring basis.
    - Maintain firebreaks in a manner that minimizes exposed soil to the extent practicable.
    - Rehabilitate or otherwise stabilize fireline in areas that pose risk to water quality.
- Alter prescribed fire prescriptions and control actions in the AMZs as needed to maintain ecosystem structure, function, and processes and onsite and downstream water quality. *(Moderately Effective – Entire Sale Area)*
    - Pretreat AMZ's and drainage ways to reduce excessive fuel loadings.
    - Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life, property, or wetlands.
    - Construct any essential fireline in the AMZ in a manner that minimizes the amount of area and soil disturbed.
    - Keep high-intensity fire out of the AMZ unless suitable measures are used to avoid or minimize adverse effects to water quality.
    - Avoid or minimize complete removal of the organic layer when burning in riparian areas or wetlands to maintain soil productivity, infiltration capacity, and nutrient retention.
    - Rehabilitate fireline in the AMZ after prescribed fire treatment is complete.
    - Remove debris added to stream channels as a result of the prescribed burning unless debris is prescribed to improve fisheries habitat.
- Conduct prescribed fire treatments, including pile burning, for slash disposal in a manner that encourages efficient burning to minimize soil impacts while achieving treatment objectives. *(Moderately Effective – Entire Sale Area)*
    - Pile and burn only the slash that is necessary to be disposed of to achieve treatment objectives.
    - Locate slash piles in areas where the potential for soil effects is lessened (meadows, rock outcrops, etc.) and that do not interfere with natural drainage patterns.
    - Remove wood products such as firewood or fence posts before piling and burning to reduce the amount of slash to be burned.
    - Minimize the amount of dirt or other noncombustible material in slash piles to promote efficient burning.
    - Construct piles in such a manner as to promote efficient burning

  - Avoid burning large stumps and sections of logs in slash piles to reduce the amount of time that the pile burns.
  - Avoid burning when conditions will cause the fire to burn too hot and damage soil conditions.
  - Avoid piling and burning for slash removal in AMZs to the extent practicable.
  - Minimize effects on soil, water quality, and riparian resources by appropriately planning pile size, fuel piece size limits, spacing, and burn prescriptions in compliance with State or local laws and regulations if no practical alternatives for slash disposal in the AMZ are available.
- Evaluate the completed burn to identify sites that may need stabilization treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site. *(Moderately Effective – Entire Sale Area)*
  - Provide for rapid revegetation of all denuded areas through natural processes supplemented by artificial revegetation where necessary.
  - Use suitable measures to promote water retention and infiltration or to augment soil cover where necessary.
  - Use suitable species and establish techniques to stabilize the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention control of invasive species.
  - Clear streams and ditches of debris introduced by fire control equipment during the prescribed fire operation.
  - Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

Mechanical Mowing and Mastication

Develop site specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment. *(Moderately Effective – Entire Sale Area)*

- Evaluate multiple site factors, including soil conditions, slope, topography, and weather, to prescribe the most suitable mechanical treatment and equipment to avoid or minimize unacceptable impacts to soil while achieving treatment objectives.
  - Consider the condition of the material and the site resulting from the treatment in comparison to desired conditions, goals, and objectives for the site when analyzing treatment options (e.g., a mastication treatment will result in a very different condition than a grapple pile and burn treatment).
  - Use land management plan direction, or other local guidance, to establish residual ground cover requirements and soil disturbance limits suitable to the site to minimize erosion.
  - Consider offsite use options for the biomass material to reduce onsite treatment and disposal.
- Use applicable practices of BMP Veg-3 (Aquatic Management Zones) when conducting mechanical treatments in the AMZ. *(Moderately Effective – Entire Sale Area)*
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion. *(Moderately Effective – Entire Sale Area)*
  - Conduct mechanical activities when soil conditions are such that unacceptable soil disturbance, compaction, displacement, and erosion would be avoided or minimized.
  - Consider using low ground-pressure equipment to minimize soil disturbance.
- Operate mechanical equipment so that furrows and soil indentations are aligned on the contour. *(Moderately Effective – Entire Sale Area)*

- Scarify the soil only to the extent necessary to meet reforestation objectives. *(Moderately Effective – Entire Sale Area)*
    - Use site-preparation equipment that produces irregular surfaces.
    - Avoid or minimize damage to surface soil horizons to the extent practicable.
- Conduct machine piling of slash in such a manner to leave topsoil in place and to avoid displacing soil into piles. *(Moderately Effective – Entire Sale Area)*
- Re-establish vegetation as quickly as possible. *(Moderately Effective – Entire Sale Area)*
    - Evaluate the need for active and natural revegetation of exposed and disturbed sites.
    - Use suitable species and establish techniques to revegetate the site in compliance with local direction and requirements per FSM2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

COMPARISON OF ALTERNATIVES

This section 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. Table 12 provides a summary of project effects by resource area.

Table 12 Comparison of the alternatives

Resource	Alternative 1	Alternative 2	Alternative 3
Timber Volume			
	No timber volume would be produced	6.6 MMBF 20,371 CCF	6.3 MMBF 19,274 CCF
Employment			
	No jobs would be created	64 jobs	60 jobs
Total Revenue			
	No revenue would be generated	$212,297	$79,386
Soils			
Identifying Soils that can Sustain Management. Objectives	No management actions would take place	Incorporates inherent soil capability into project design	Incorporates inherent soil capability into project design
Soils Disturbance	No management actions would take place. Natural erosional processes are expected to continue	Harvest operations would meet the Regional Standards for Acceptable Soil Condition Soils	Same as Alternative 2.
Probable Success in Project Design and Implementation	No management actions would take place	BMPs/PDCs/Resource Protection Measures would avoid or minimize potential adverse impacts to the soil resource	Same as Alternative 2
Hydrology			
Streamflow	No management actions would take place	0 acres impacted in Riparian Reserves; 0 acres impacted in hydrologically connected areas. 6.4 miles of road closed or decommissioned.	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3
Sedimentation	No management actions would take place	0 acres impacted in Riparian Reserves; 0 acres impacted in hydrologically connected areas. 6.4 miles of road closed or decommissioned	Same as Alternative 2
Water Temperature	No management actions would take place	No effect on 303(d) listed streams. 0 acres impacted in Riparian Reserves	Same as Alternative 2
Waterbody Condition	No management actions would take place	0 acres impacted in floodplain; 0 acres harvested in Riparian Reserves; 0 acres alteration of stream/lake bank	Same as Alternative 2
Fisheries			
Threatened Species: Bull Trout and Critical Habitat	No management actions would take place	No effect	Same as Alternative 2
R6 Sensitive – Redband Trout and Mid-Columbia River Steelhead Trout	No management actions would take place	No impact and no effect	Same as Alternative 2
A Caddisfly	No management actions would take place	No effect	Same as Alternative 2
Aquatic Conservation Strategy (ACS)	No management actions would take place	Complies with the ACS	Same as Alternative 2
Wildlife and Wildlife Survey and Manage Species			
Gray Wolf	No management actions would take place	No effect	Same as Alternative 2
Wolverine	No management actions would take place	No effect	Same as Alternative 2
Pacific Fischer	No management actions would take place	No effect	Same as Alternative 2
Northern Spotted Owl	No management actions would take place	May effect but not likely to adversely effect	Same as Alternative 2
Great Gray Owl	No management actions would take place	No habitat in project area	Same as Alternative 2
Oregon Spotted Frog	No management actions would take place	No effect	Same as Alternative 2
Townsend's big-eared bat, fringed myotis, and Pallid bat	No management actions would take place	No impact	Same as Alternative 2
White-headed woodpecker and Lewis' woodpecker	No management actions would take place	May impact but will not lead to a trend towards federal listing	Same as Alternative 2
Western bumblebee, Johnsons' hairstreak, Silver-bordered fritillary, Crater Lake tightcoil, Evening fieldslug, Columbia spotted frog, American peregrine falcon, bald	No management actions would take place	No impact	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3
eagle, greater sage grouse, bufflehead, northern water thrush, harlequin duck, horned grebe, tricolor blackbird, yellow rail, and tule white-fronted goose			
Snags	No management actions would take place	Consistent with the Forest Plan; Deschutes Wildlife Tree and Snag Strategy; and Northwest Forest Plan. <1% reduction in overall snag habitat within the Whychus and Deep Creeks watersheds	Same as Alternative 2
Silviculture			
Stand Structure and Species Composition	Stand structure remains at high risk to stand replacement fires. Species composition remains high in fire intolerant trees species	Thinning and fuels treatments would moves stands towards the reference condition. The presence of early seral species (ponderosa pine) in improved on the number of acres treated	Same as Alternative 2
Stand Density	Density remains high and will increase over the next 30 years. Large pines would decrease across the area due to competition, mistletoe, and bark beetles	Thinning reduces the area above the upper management zone from 88% to 44% and improves forest health vis-à-vis insects and disease	Thinning reduces the area above the upper management zone from 88% to 48% and improves forest health vis-à-vis insects and disease
Insects and Disease	88% of the area is above the upper management zone. Mortality from insects and disease are expected to increase.	Stands are moved closer to the reference condition and improves tree resilience to bark beetle and dwarf mistletoe	Same as Alternative 2
Fire and Fuels			
Fire Hazard	No management actions would take place : 45% of project area is rated high	With treatments: 7% of the project area is rated high	With treatments: 8% of the project area is rated high
PM Production	Wildfire Conditions: 6,204 tons of PM 2.5; 7,320 tons of PM10	Prescribed Fire Conditions: 2,868 tons of PM 2.5; 3,385 tons of PM 10	Same as Alternative 2
Botany			
Sensitive Plant Species	No known populations or potential habitat in the project area. No management actions would take place	No effect	Same as Alternative 2
Survey and Manage	No known populations	No effect. Pechman' s	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3
Species	or habitat in the project area. No management actions would take place	exemptions are required (a and d).	
Invasive Plants	No management actions would take place	Risk is moderate for introduction or spread. Mitigation measures are required.	Same as Alternative 2
Recreation			
Recreation use and Special Use Permit (SUP) Authorizations	No change in level of recreation use or SUPs. Greatest threat from wildfires.	Some short-term effects to Sno-Parks, winter trails, and dispersed recreation use.	Same as Alternative 2
Scenic Resources			
Scenic Views	No management actions would take place	Two site specific amendments the Forest Plan are necessary to meet the purpose and need for the project.	Same as Alternative 2
Heritage			
Cultural Resources Sites	No management actions would take place	No effect. All known sites would be avoided during harvest operations	Same as Alternative 2
Potential Wilderness Areas			
PWA Polygon Inventory	No management actions would take place. About 7,395 acres of PWA are located in the *analysis area.*	16 acres that meet the FSH 1909.12 Chapter 71 evaluation criteria would be affected by timber harvest.	Same as Alternative 2
Citizen Unroaded Areas			
Oregon Wild GIS Inventory	No management actions would take place	46 acres would be affected by timber harvest.	Same as Alternative 2
Inventoried Roadless Areas			
Inventoried Roadless Areas Inventory	No management actions would take place	No IRA acres would be affected by timber harvest.	Same as Alternative 2
Climate Change			
Global Scale	No management actions would take place	Effects would be negligible; effects on greenhouse gases and climate change would be negligible.	Same as Alternative 2
Transportation			
Road Decommissioning	No roads would be decommissioned	7.71 miles would be decommissioned	Same as Alternative 2
Road Closures	No roads would be closed	5.58 miles would be closed	Same as Alternative 2
Temporary Road Construction	No temporary roads would be constructed	0.08 miles of temporary roads would be constructed	No temporary roads would be constructed

CHAPTER 3 ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above. The information presented in this chapter cites the specialist's reports found in the project analysis file (40 CFR 1502.21). The specialist's reports are incorporated by reference and are available at the Sisters Ranger District office, Sisters, Oregon.

CUMULATIVE EFFECTS OF PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS

The project IDT identified past, present, and reasonably foreseeable action that might have cumulative impacts with the proposed action early in the analysis process. These actions are listed in the table below. Each resource area considered different mixes of these actions, depending on the cumulative effects boundary for the resource area and the resources affected. Only those past, present and reasonably future foreseeable actions are considered, and only if those action are expected to have environmental effects that accumulate with the other project effects.

Table 13, Table 14, and Table 15 are merely a listing of past, present, and future foreseeable actions that have the potential to overlap the project area. Because a project appears in this table it does not necessarily mean it has an additive effect because it may not be applicable for all resources. If there is a past, present, or foreseeable effect, it is disclosed in the individual resource area in the environmental consequences section of this environmental assessment.

Table 13 Past actions and events that have contributed to the current conditions on the project area

Type of Action	General Description	Status/Timing
Past Vegetation and Fuels Management		
Numerous Timber Sales and Thinning	Many regeneration harvest (clear-cuts) and shelterwood cuttings and overstory removal of large trees. Management by thinning has dominated since the mid-1990s	1930s to present
Prescribed Fire	Associated with vegetation management projects as a fuels reduction treatment	Since 1990's
Fire Suppression	Suppression of fire starts from lightning and human caused fires (average 15 starts/year in the project area)	1910- to present
Pole Creek Fire Timber Salvage	About 962 acres of the 26,119 acre fire were salvaged for timber products. Sisters Ranger District.	Ongoing. Decision signed November 19, 2013. Sale is completed.
Wildfires		
Pole Creek	26,119 acres	2012
Grazing		
Whychus (Squaw) Creek Cattle and Horse Allotment	A 25,050 acre allotment. Closed in the mid-1980s; formally closed in 2009.	1920's to 1980s
Road Construction		

Road Network on National Forest System Lands	53 miles of road construction within the project area	Generally completed by the 1970's
Recreation Developments		
Upper Three Creeks Sno-Park	Used by skiers and snowmobiles and special uses	Created in the 1990s
Winter Trails	10.55 miles of groomed snowmobile and cross-country trails	Created in the 1990s
Dispersed Recreation Sites	No inventoried dispersed sites are located in the project area.	Managed since 2004
Specials Uses		
Permits	Occasional use of trails, outfitters, recreation events, and group events	Permits currently within project area
Watershed Restoration		
Forest Road 16 Culvert replacement	A culvert was replaced adjacent to the Upper Sno-Park	Completed June 2014

Table 14 Ongoing or reasonably future foreseeable action in the project area and Deep Creek and Whychus 5th field watersheds

Type of Action	General Description	Status/Timing
Vegetation Management		
Timber sales- Orion KH Nova Quasar	Associated with the Sisters Area Fuels Reduction (SAFR) Project; thinning, mastication, and prescribed burning. About 2,955 acres are proposed for treatment. Sisters Ranger District.	Ongoing. Decision signed November 29, 2008
Pole Creek Fire Danger Tree Abatement	Danger trees were felled along about 42 miles of roads in the Pole Creek fire area. Some trees were recovered as timber products. Sisters Ranger District.	Ongoing. November 19, 2013
Pole Creek Fire Reforestation	About 6,000 acres would be reforested in the fire area over a five-year period.	Ongoing. Decision signed December 16, 2012
Pole Creek Firewood Cutting	79 acre commercial firewood cutting area. Sisters Ranger District.	Ongoing
Three Creeks Firewood Cutting	Public firewood cutting along Forest Road 16. Sisters Ranger District.	Ongoing
Ursus	Thinning, mastication, and prescribed fire. About 5,900 acres are prposed for treatment. Located on the Bend-Ft. Rock Ranger District	Reasonably foreseeable
Bear Wallow Mastication	Mastication of downed fuels along portions of Forest Roads 4601 and 4602. About 11 miles of road are prposed for treatment. Located on the Bend-Ft. Rock Ranger District	Reasonably foreseeable. Decision not yet signed
BMW Fuel Break	Hazardous fuels reduction along 12 miles of Forest Road 370. Located	Reasonably foreseeable

	on the Bend-Ft. Rock Ranger District	
Travel Management		
Travel Management Rule	Motorized travel on public lands is restricted to designated routes	Ongoing
Road Maintenance	*Whychus Creek Watershed*: Forest Service Roads: 670 miles State Roads: 30 miles County Roads: 29 miles *Deep Creek Watershed* Forest Service Roads: 197 miles State Roads: 10 miles County Roads: < 1 mile	Ongoing
Recreation Management		
Sno-Parks	Two Sno-parks	Maintenance is ongoing
Campgrounds	No developed campgrounds are located in the project area	Not applicable
Trails	Snowmobile: 9.53 miles Nordic Skiing: 4.05 miles	Maintenance is ongoing
Trailheads	None	Not applicable
Invasive Plant Control		
Deschutes and Ochoco NF Invasive Plant EIS	Would allow treatment of existing invasive plant sites and use the Rapid Detection Early Response method for new weed sites.	Ongoing
Special Uses		
Three Sisters Backcountry	Outfitter/Guide.	Ongoing
Snow Creek irrigation Ditch	Ditch still exists but no longer in use. No valid water rights on file.	
Watershed Restoration		
Three Creeks Dam Maintenance	The dams at Three Creeks and Little Three Creeks Lake would be maintained. Sisters Ranger District.	Reasonably foreseeable

Table 15 Past wildfire occurence by decade in the Deep Creek and Whychus Creek 5th field watersheds

Decade	Acres
1900-1909	66
1910-1919	468
1920-1929	0
1930-1939	22
1940-1949	1,270
1950-1959	833
1960-1969	657
1970-1979	453
1980-1989	110
1990-1999	4,950
2000-2009	12,883
2010-2012	33,289 (includes the 2012 Pole Creek fire)

EFFECTS ANALYSIS FOR THE MELVIN BUTTE VEGETATION MANAGEMENT PROJECT

The effects analysis section is organized by resource area.

SOILS

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Soils specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

The formation of different soil types are a result of five dominant, soil-forming processes, including climatic influences, soil and surface organisms, local topography/geomorphology, geology/parent materials, and time for soil development (Jenny 1941). The resulting soil characteristics uniquely integrate these local environmental influences and reflect the soil's inherent capacity for performing a variety of soil functions. These inherent soil qualities normally are not significantly altered by management activities and thus can be mapped and described in soil resource inventories. An understanding of the different inherent soil qualities, or soil potentials within a planning area, can be used to match different resource objectives to soils that have a high potential for achieving and sustaining those objectives over time. This in turn assures that management actions and the desired vegetation responses are both achievable and sustainable over time.

Dynamic soil quality, on the other hand, reflects how the soils functional capacity may be altered in response to natural or human caused disturbances (Seybold et al. 1999). Unlike inherent soil attributes, the dynamic characteristics of the soil are more vulnerable to changes from management actions that disturb soils. The long term sustainability of forest ecosystems depends on the maintenance of soil productivity and soils proper hydrologic functioning. Ground disturbing management activities that result from timber harvest and the treatment of fuels can directly affect soil properties, and may adversely change the natural functioning capacity of soils and their potential responses to use and management.

This analysis focuses on both inherent soil potentials as they relate to management objectives identified in the Melvin Butte project file and dynamic soil changes that have the potential to result in undesirable changes in key soil functions following vegetation management operations.

Issue Statement

Different soils vary in their inherent capacity for performing a variety of soil functions. Identification of the different inherent qualities of different soils within the Melvin Butte planning area can be used to help assure that planed management actions such as different stocking densities and amounts of retention are matched to soils that have a high potential for achieving the desired ecosystem functions (Issue Measure 1).

Issue Measure:

1. Recognition of the inherent soil qualities of different soil types and the ability to match different resource objectives such as stocking density prescriptions, amount of wildlife retention area, and prescribed fuel treatment prescriptions to soils that have a high potential for achieving and sustaining those objectives over time.

Issue Statement: The proposed use of ground based harvest equipment can potentially increase the amount and distribution of soil disturbance within individual activity areas proposed for vegetation treatments. The resulting soil disturbance from ground-based equipment operations and prescribed fire in activity areas may have the potential to negatively affect key soil functions (Issue Measure 2 and 3).

Issue Measures:

2. Change in degree, extent, distribution and duration of soil disturbance following proposed timber harvest and fuel treatments within individual activity areas proposed for mechanical treatments and assessment of effects of those disturbances on key soil functions.

3. The probable success in project design, implementation of management requirements, and mitigation measures that would be applied to minimize adverse impacts that may alter the soils ability to function in a desirable manner.

Regulatory Framework / Management Direction

Deschutes Land and Resource Management Plan

The Deschutes Land and Resource Management Plan (LRMP) specifies that management activities are prescribed to promote maintenance or enhancement of soil productivity potential following land management activities (US Forest Service LRMP, 1990 page 4-70, SL-1 and SL-3). Forest-wide standards and guidelines ensure that soils are managed to provide sustained yields of managed vegetation without impairment of the productivity of the land.

LRMP 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. LRMP Standard and Guideline (SL-5) limits the use of mechanical equipment in sensitive soil areas such as slopes greater than 30 percent. Operations would also be restricted to existing logging facilities (i.e., skid trails, landings) and roads whenever feasible.

Regional Soil Quality Standards and Guidelines

In addition to the LRMP Standards and Guidelines, the Pacific Northwest Region developed Regional Soil Quality Standards and Guidelines that limit detrimental soil disturbances associated with management activities (FSM 2520, R6 Supplement No. 2500-98-1). This Regional guidance supplements LRMP Standards and Guidelines and is designed to further protect or maintain soil productivity.

US Forest Service, Region 6, Regional Soil Quality Standards

When initiating new activities:

- Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system).
- In activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration.
- In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a new improvement in soil quality.

Detrimental soil impacts are defined as those that meet the criteria described in the Soil Quality Standards listed below.

- Detrimental Soil Compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.
- Detrimental Soil Puddling occurs when the depth of ruts or imprints is six inches or more.
- Detrimental Soil 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.

The Regional supplement to the Forest Service Manual (FSM 2520, R6 Supplement No. 2500-98-1) also provides policy for planning and implementing management practices which maintain or improve soil quality. This Regional guidance is consistent with interpretations for LRMP Standards and Guidelines SL-3 and SL-4 that limit the extent of detrimental soil conditions within activity areas.

Analysis Methods

Method of analysis

Field observations and measurements of existing soil conditions within activity areas proposed for timber harvest and fuel treatments under this project were conducted during the fall field season of 2013.

Temporal scope of the analysis

The temporal scope of the analysis defines short term effects as being changes to soil properties that would generally revert to pre-existing conditions within 5 years or less. The analysis also considers the effectiveness and probable success of implementing project design criteria, mitigation measures, and Best Management Practices (BMPs) that are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

Rational for geographic area of analysis

An activity area is defined as “the total area of ground impacted activity and its feasible unit for sampling and evaluating” (FSM 2520, R6 Supplement No. 2500-98-1 and Deschutes NF LRMP, page 4-71). For this analysis, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. Where appropriate and relevant, the effects discussion is expanded to the planning area to provide additional context and intensity.

Information sources used to support analysis

Quantitative analysis, literature reviews, and professional judgment were used to evaluate the issue measures by comparing existing conditions to the anticipated conditions that would result from implementing the proposed actions.

Measure #1: Identifying soils that have a high potential for achieving and sustaining different management objectives

Existing Condition

Soil types within the planning area are described and mapped in the Deschutes National Forest Soil Resource Inventory (Larsen 1976). A variety of different soils and landscapes occur within the planning area. These include limited areas of cinder cone buttes (SRI soil map units 80, 81, and 83). These buttes

consist of very deep soils that developed in volcanic ash over cinder or fractured rock and occur on steep slopes (greater than 40%). The relatively high site productivity of these areas along with aspect changes result in a variety of vegetation types and different habitat potentials that are of limited extent in the planning area.

The remainder of the planning area consists of well drained soils derived from a moderately thick layer of volcanic ash over glacial till or bedrock. Surface soils are typically loamy sands, and subsoil's are cobbly to boulder sandy loams. A compact zone of glacial till is often encountered at a depth of 40 to 60 inches. These soils support a vegetation component of conifers including primarily white fir, ponderosa pine, and lodgepole pine. Understory shrubs and groundcover include snowbrush, manzanita, currant, snowberry, Oregon grape, sedges, pinegrass, and a variety of forbs (Figure 6).

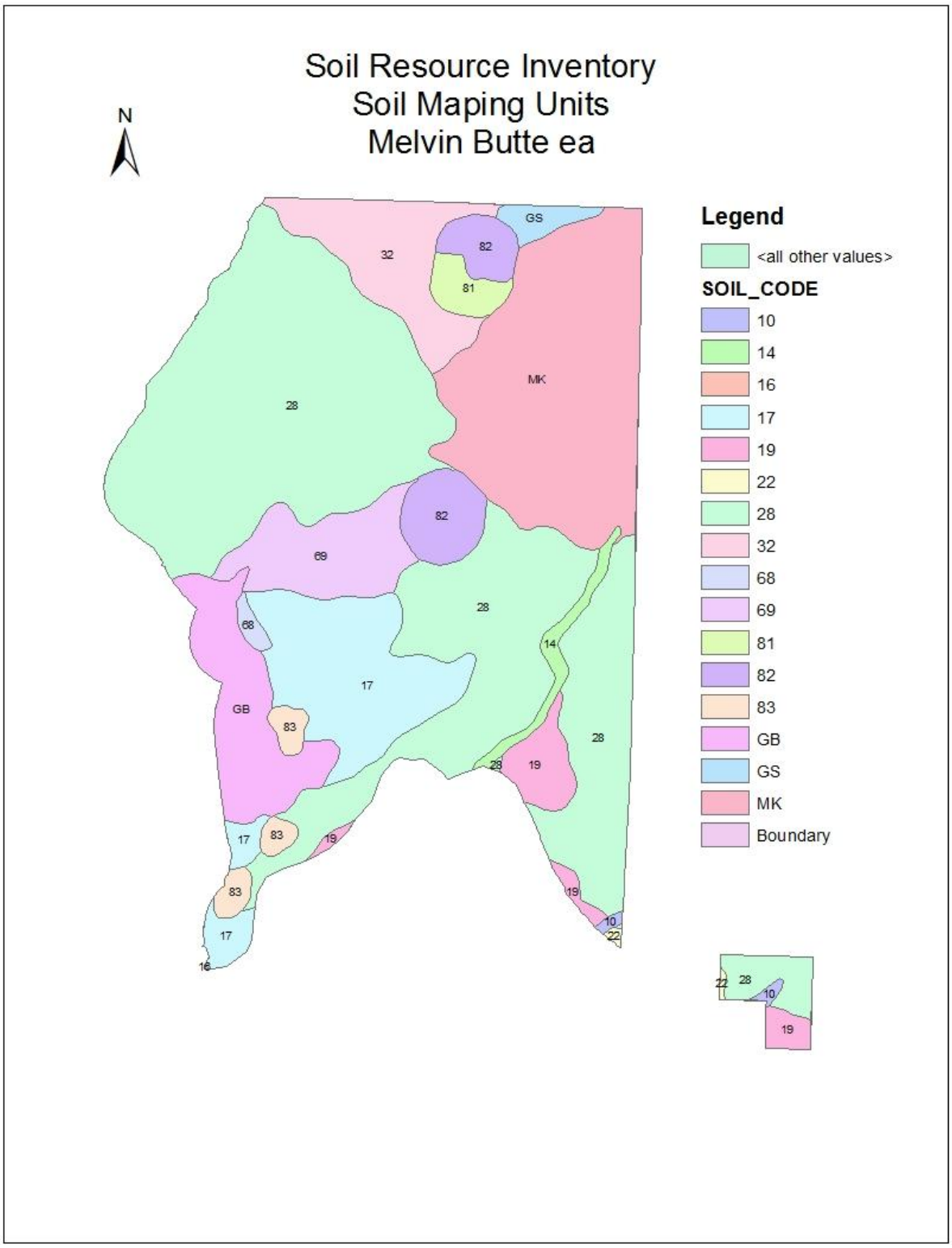


Figure 6 Soil types in the Melvin Butte planning referenced in the Deschutes National Forest soil resource inventory (Larsen 1976)

In areas of ponderosa pine and mixed conifer species site productivity is estimated at a cubic foot Site Class 4 to 5 (50 to 120 cubic foot/year) mean annual increment, and a Site Index of 70 to 100 for ponderosa pine (Larsen 1976; Barrett 1978). In these dry east side forest types, water is the most limiting site factor limiting site productivity and site index (Larsen 1976). Figure 7 shows the increase in site index as a function of precipitation for several SRI soil types in the planning area. Site productivity also generally increases with elevation due to increasing precipitation (Larsen 1976).

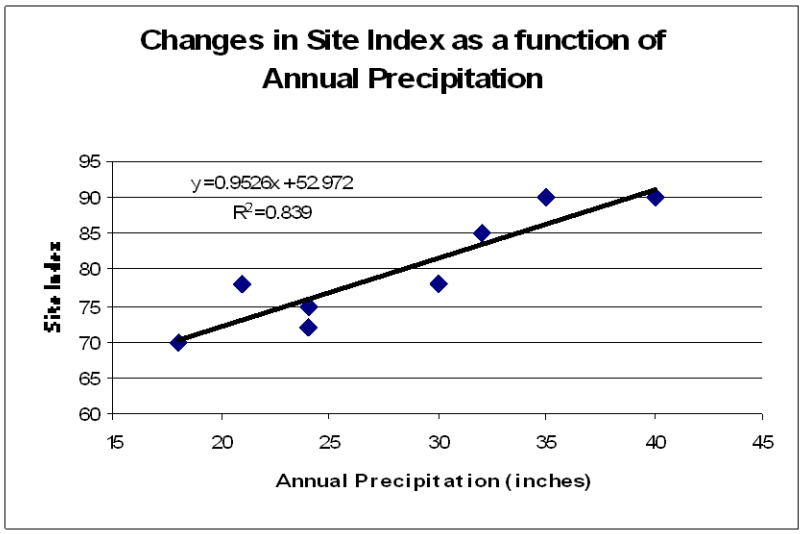


Figure 7 The relationship between mean annual precipitation and site index for selected SRI soil mapping units within the Melvin Butte planning area (Larsen 1976)

Lower Site Index Ponderosa pine Vegetation Potentials

Lower site index ponderosa pine soils include SRI soil map units 32,69, GS, MK, and 68 (Figure 8). These soils have a lower site index compared to other ponderosa pine soils in the planning area due to both lower precipitation in these areas and a lower soil water holding capacity of these soils. Soil mapping unit 32 is underlain by glacial till while soil units 69, GS, MK, and 68 are underlain by basalt bedrock. Areas with basalt bedrock have a highly variable in soil depths ranging from shallow to very deep. This variability in soil depth also has a strong influence on the pattern of tree clumps and gaps in these areas.

Higher Site Index Ponderosa pine Vegetation Potentials

SRI soil mapping unit 28 supports both ponderosa pine and mixed conifer vegetation types. These soils have a high site index due to a higher soil water holding capacity compared to other soils supporting ponderosa pine in the planning area. Productivity of areas of soil mapping unit 28 are also influenced by the increase in mean annual precipitation from north to south within the planning area. Higher precipitation in the southern portion of the planning area results in a higher productivity of soil type 28 compared to areas of soil type 28 in the northern portion of the planning area (Figure 8).

Frost Pocket Lodgepole pine Vegetation Potentials

SRI soil mapping units 17, 19, and GB occur in lower landscape positions compared to adjacent areas creating frost pockets that support lodgepole pine vegetation (Figure 8). Productivity is estimated to be a site index of 30 to 40 for lodgepole pine. Much of this area has been used for firewood cutting areas over the past couple of decades.

Applications to Project Planning

The different inherent soil productivities identified above were used to help in the design of the wildlife retention strategy for Melvin Butte planning area. This retention strategy is based upon increasing the amount of retention as site productivity increases. The planning strategy identifies ten percent retention in areas of lower ponderosa pine site index, fifteen percent retention in areas of high site index ponderosa pine, and 20 percent retention in areas of high site index ponderosa pine that also have higher precipitation.

During the project implementation phase silviculture prescriptions in treated areas and the resulting tree densities may also be adjusted slightly to reflect the above differences in inherent soil and site productivity.

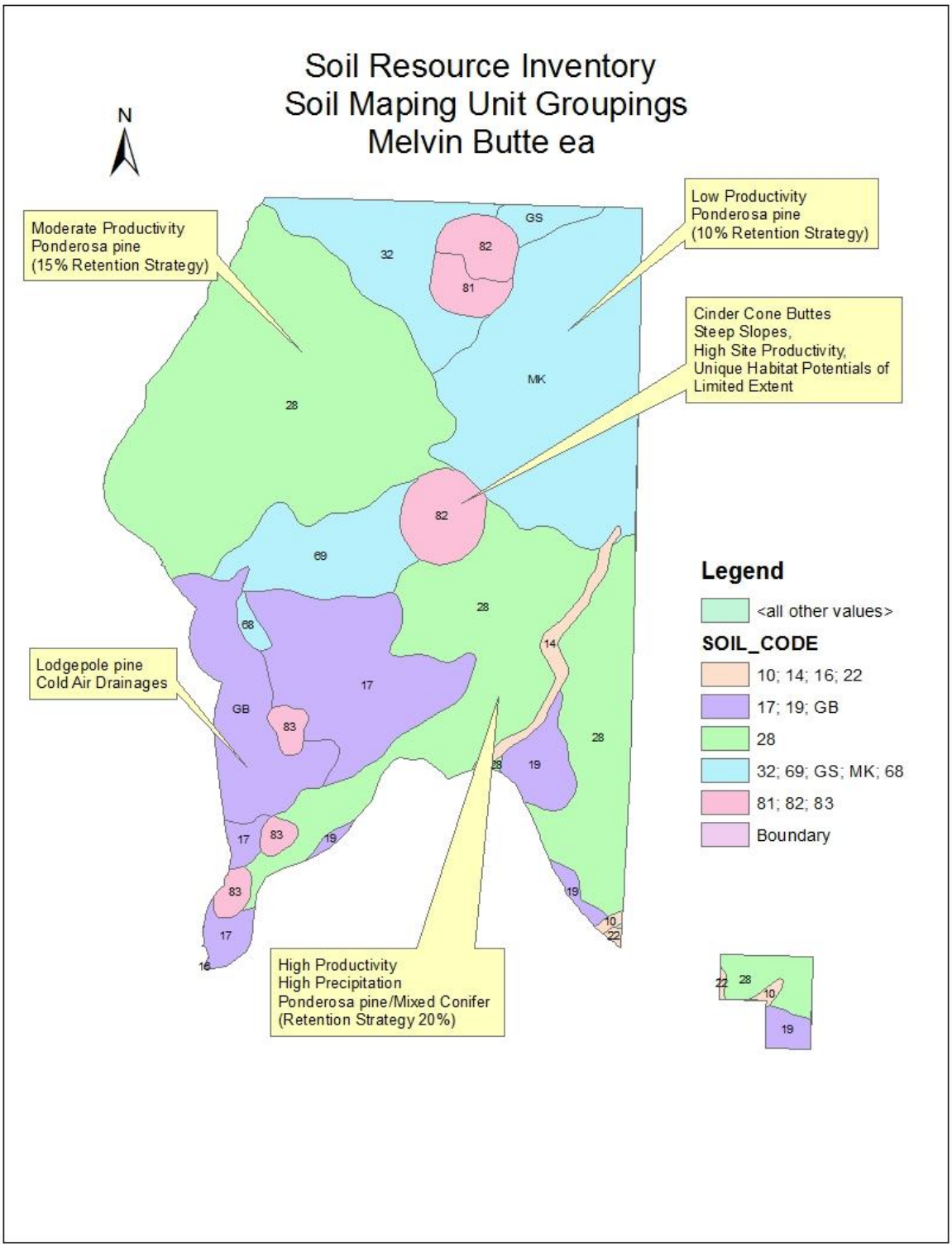


Figure 8 Deschutes National Forest soil resource inventory soil mapping unit groupings indicting differnt vegetation types and the wildlife retention strategy based on site carrying capacity (Larsen 1976)

Measure #2: Soil Disturbance

Existing Condition

The current condition of soils in the Melvin Butte planning are directly related to soil porosity, soil strength, and the quantity and quality of surface organic matter within the project area (Powers and Avery 1995). Ground-disturbing management activities (i.e., timber harvest, road building, recreation use and livestock grazing) have all caused some adverse changes to soil quality in previously managed areas, especially where mechanical disturbances removed vegetative cover, displaced organic surface layers, or compacted soils. The following measures were used to evaluate the existing and predicted amounts of detrimental soil conditions for each individual activity area planned for treatment.

Alternative 1 Ecological Trends

Natural Events: There is currently no evidence of detrimental soil conditions from natural disturbance events within the Melvin Butte planning area. In 2012 the Pole Creek fire burned adjacent to the Melvin Butte planning area; however, no recent large wildfires have occurred within the planning area. Although fires have occurred in the planning area in the past enough time has passed since their occurrence that existing vegetation and forest litter are providing adequate source of ground cover to protect mineral soil from water and wind erosion. There are no recent natural or management related landslides within the planning area. Therefore, natural soil disturbances were not included as existing sources of detrimental soil conditions within any of the activity areas proposed for this project.

Management Related Soil Disturbances: The degree, extent, distribution and duration of soil disturbance can vary with the size and type of equipment used for forest vegetation management, the volume and type of material being removed, frequency of entries, soil type and the soil conditions when the activity takes place (Froehlich 1976, Adams and Froehlich 1981, Gent et al. 1984, Snider and Miller 1985, Clayton et al. 1987, Miller et al. 1986, Page-Dumroese 1993). Soil monitoring on local land types and similar soils have shown that typically around 15 to 20 percent of an activity area can be detrimentally disturbed by ground-based harvest systems (Craigg, 2000).

The primary sources of existing detrimental soil conditions are associated with the transportation systems used for timber harvest and yarding activities. Temporary roads, log landings, and the primary skid trails that were constructed and used to access individual harvest units of past timber sales. Most project related impacts to soils occurred on and adjacent to these heavy use areas. Mechanical disturbances include the removal of vegetative cover, displacement of organic surface soils, or compaction of the soil. Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground based logging operations (Page-Dumroese 1993, Geist 1989, Powers 1999).

While prescribed burning does remove some of the surface organic matter, this process is a natural part of these ecosystems that historically experienced low intensity fire (Busse et al. 2014). These types of treatments also help to reduce the risk of impacts to the soil resource that can result from a high intensity uncharacteristic fire that could occur as a result of lack of active management.

Important Interactions

Harvest Operations: The proposed management activities include commercial and non-commercial harvest of forest stands combined with fuel reduction treatments to reduce stand densities and hazardous fuels. Types of mechanical harvest equipment used in thinning operations vary with the different logging companies doing the work and by the types of materials being removed. Thinning would include predominately trees in the smaller diameter classes. This may be accomplished manually using chainsaws or with the use of specialized low ground pressure machinery. Low ground presser machinery

would only be allowed to make a limited number of equipment passes to transport material to roads or landings. In many cases created logging slash will be utilized as a source of biomass. In other cases created logging slash will be piled and burned. Management activities also include mechanical shrub and small tree treatments (mowing or mastication) and the use of prescribed fire to reduce fuel loadings and treat the shrub layer.

There would be no new construction of roads that would remain as classified system roads. Estimated distances of temporarily roads needed to allow access to some of the activity areas proposed for mechanical vegetation treatments are listed under the proposed action. Many of these spur roads would consist of reopening short segments (100-10,000 feet) of old access roads from previous entries. These roads would be closed and in some cases may be obliterated upon completion of the vegetation management activities.

The effects of ground based logging disturbances on soil productivity vary based on the soil type, types of silvicultural treatments, and the resulting amounts of ground disturbance. The cumulative amount of soil impacts also depends on the 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. Soil productivity monitoring on the forest has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment. Even with careful planning and implementation of project activities, the extent of soil disturbance has been shown to increase by 5 to 10 percent with each successive entry into a stand (Craigg, 2000).

Soil condition assessments for similar soils and types of harvest equipment, research references, local monitoring reports, planning area field surveys, and observation were used to predict the potential extent of detrimental soil disturbance associated with this project proposal (Craigg 2000; Craigg 2007). Estimates for predicted amounts of detrimental soil conditions account for the expected amount of volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials.

<u>Fuel Reduction Activities:</u> A combination of treatments including thinning trees from below, mechanical treatment of slash resulting from tree thinning operations, mechanical treatment of small trees and brush, biomass utilization, and prescribed burning would be used to reduce the fuel loading in the planning area.

Much of the slash generated from commercial harvest will be utilized for biomass. Common practices for removing biomass from harvest units include whole tree yarding and processing materials at the landing, and the removal of generated slash on forwarder trailers when harvester processers are used. If slash is not utilized for biomass it may be hand piled or machine piled and burned on log landings and/or main harvester trails. Machine piling on temporary roads or main harvest trails would not be expected to result in additional detrimental soil disturbance because equipment would operate on existing skid trails and landings.

Mechanical treatment of brush and small trees (mowing and mastication) is not expected to cause detrimental soil disturbances. The primary factors limiting soil compaction are the low ground pressure of the tractor and mowing heads, the limited amount of traffic (one equipment pass), and the cushioning effect of materials being treated. These types of activities have been monitored in the past, and results show that increases in soil displacement and soil compaction do not meet the criteria for detrimental soil conditions (Soil Monitoring Report, 1997).

Prescribed fire would be used to reduce fuel accumulations in some of the activity areas proposed for mechanical harvest and non-commercial thinning as well as other activity areas where prescribed burning would be used exclusively to treat the shrub layer and reduce natural fuels. Prescribed burning activities are conducted at times and under conditions that maximize benefits while reducing the risk of resource

damage (Busse et al. 2014). The degree of soil heating depends upon fuel type (grass, brush, trees), fuel density, nature of the litter and duff layers (thickness, moisture content), and burn conditions at the time of ignition. For the treatment areas proposed with this project, natural fuel accumulations consist mainly of fine fuels (i.e., decadent brush, tree branches, and needle cast litter) that typically do not burn for long duration and cause excessive soil heating. Therefore, it is expected that there would be no detrimental changes in soil properties from prescribed burning activities in timber stands because soil moisture guidelines would be included in burn plans to minimize the risk for intense ground-level heating.

Prescribed burn plans would comply with all applicable LRMP standards and guidelines and Best Management Practices (BMP's) prior to initiation of burn treatments. Soil heating during spring burns would be negligible because higher moisture levels at this time of year generally result in cooler burns with lower potential for causing severely burned soil. Fall burning would be conducted following brief periods of precipitation. Prescribed underburns in timber stands would be accomplished under carefully controlled conditions to minimize damage to standing trees. These activities are planned to meet fuel and visual management objectives without removing all of the protective surface cover. It is expected that adequate retention of coarse woody debris and fine organic matter (duff layer) would still exist for protecting mineral soil from erosion and supplying nutrients that support the growth of vegetation and populations of soil organisms. The successful implementation of these proposed activities would likely result in beneficial effects by reducing fuel loadings and wildfire potential as well as increasing soil moisture and nutrient availability in burned areas.

The extent of disturbed soil resulting from the construction of control lines would be limited to the minimum necessary to achieve prescribed burning objectives. In most cases existing roads and other existing fuel breaks would be used to effectively control the spread of prescribed fire within treatment units.

<u>Soil Restoration Treatments on Roads and Logging Facilities:</u> Although equipment traffic during harvest operations can cause decreases in soil porosity and increases in soil resistance to root penetration. Compacted sites can be mitigated physically by tillage with a winged subsoiler (Powers, 1999). Many of the soils within the project area are well suited for tillage treatments due to their naturally low bulk densities and the absence of rock fragments within soil profiles. These sandy-textured soils have little or no structural development within the principal root development zone (4 to 12 inches in depth) where changes in soil compaction (bulk density) are assessed according to Regional direction (FSM 2521.03).

Under the action alternatives soil restoration treatments may be applied with a self-drafting winged subsoiler to reclaim and stabilize detrimentally compacted soil on specific roads and some of the primary skid trails and log landings following post-harvest activities. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage and pulling available logging slash and woody materials over the treated surface.

The winged subsoiling equipment used on the Deschutes National Forest has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craigg, 2000). Subsoiling treatments have been implemented with good success due to the absence of rock fragments on the surface and within soil profiles. Although rock fragments can limit subsoiling opportunities on some landtypes, hydraulic tripping mechanisms on this specialized equipment help reduce the amount of subsurface rock that could potentially be brought to the surface by other tillage implements. Most of the surface organic matter remains in place because the equipment is designed to allow adequate clearance between the tool bar and the surface of the ground for allowing smaller logging slash to pass through without building up. Any mixing of soil and organic matter does not cause detrimental soil displacement because these materials are not removed off site. Since the winged subsoiler produces nearly complete loosening of compacted soil layers without causing substantial

displacement, subsoiled areas on this Forest are expected to reach full recovery within the short-term (less than 5 years) through natural recovery processes.

Although the biological significance of subsoiling is less certain, these restoration treatments likely improve subsurface habitat by restoring the soils ability to supply moisture, air, and nutrients that support soil microorganisms. Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000).

Alternative 2 and 3 - Direct and Indirect Effects

The use of ground-based equipment for vegetation management treatments would increase the amount and distribution of soil disturbance within the proposed activity areas. However, through implementation of project design criteria intended to minimize soil disturbance and through the application of appropriate soil mitigation measures intended to protect soils, none of the activities areas are expected to exceed the Forest plan standard of 20% detrimental soil disturbance following proposed treatment (Appendix A). The development and use of temporary roads, log landings, and skid trail systems are the primary sources of new soil disturbance that would result in adverse changes to soil productivity. Most soil impacts would occur on and adjacent to these heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Mitigation and resource protection measures would be applied to avoid or minimize the extent of soil disturbance in random locations between main skid trails and away from log landings. Non-commercial thinning by hand felling small-diameter trees with chainsaws would not cause additional soil impacts because machinery would not be used for yarding activities.

Soil displacement from harvest activities occurs when soil organic layers are scraped or pushed 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. In order to avoid soil displacement disturbance, activity area boundaries would be adjusted to prohibit equipment operations in portions of activity areas that contain extensive areas with slopes steeper than 30 percent (see project design criteria for description of operations within small areas of slopes greater than 30%). It is expected that many of these sensitive areas will be included as untreated patches within and adjacent to the proposed units to meet wildlife objectives. The majority of proposed activity areas are located on gentle to moderately sloping terrain where the maneuvering of equipment generally does not remove soil surface layers in areas that are at least 5 feet in width (FSM 2520). Smaller areas of soil displacement or the mixing of soil and organic matter would not constitute detrimental soil displacement. There would be no new construction of temporary roads or logging facilities on steep slopes or sensitive soils.

Mechanical shrub and slash treatments would be accomplished using low ground-pressure machinery and soil disturbance from these activities are not expected to qualify as a detrimental soil condition. The depth of compaction from only one or two equipment passes would not increase soil resistance and/or reduce soil porosity to levels that would require subsoiling mitigation to restore soil physical properties. The dominant sandy-textured soils within the project area are not susceptible to soil puddling damage due to their lack of plasticity and cohesion.

Prescribed burn plans would comply with all applicable LRMP standards and guidelines and Best Management Practices (BMPs) prior to initiation of burn treatments. Soil moisture guidelines would be included in burn plans to minimize the risk of intense ground-level heating. Duff moisture levels of approximately 50 percent are typical during light intensity underburns. Soil heating during spring burns would be negligible because higher moisture levels at this time of year generally result in cooler burns with lower potential for causing severely burned soil. Fall burning would be conducted following brief periods of precipitation. Prescribed underburns in timber stands would be accomplished under carefully controlled conditions to minimize damage to standing trees.

The amount of disturbed area associated with temporary roads and logging facilities would be limited to the minimum necessary to achieve management objectives. None of the temporary road locations would require excavation of cut-and-fill slopes because they are located on nearly level to gentle slopes. These temporary road segments would be closed and in some cases obliterated upon completion of the vegetation management activities.

Alternative 2 and 3 - Cumulative Effects

Cumulative levels of existing and predicted amounts of soil disturbance need to be considered to determine whether soil quality standards (DNF LRMP 1990; FSM 2520, R-6 Supplement No. 2500-98-1) were met following project implementation. Based on the proportionate extent of overlap of previously disturbed areas and areas proposed for treatments, percentages of existing and predicted detrimental soil conditions were determined and are displayed in Appendix A of the soils specialist report.

Implementation of Alternatives 2 or 3 would cause some new soil disturbances where ground-based equipment is used for mechanical harvest and yarding activities during the current entry. The combined effects of past and current disturbances and those anticipated from implementing the proposed actions were previously addressed under existing conditions and in the discussion of direct and indirect effects. The primary source of detrimental soil conditions from past management are associated with existing roads and ground-based logging facilities which were used for past harvest activities. Likewise, the majority of project-related soil impacts from this entry would also be confined to known locations in heavy use areas (such as roads, log landings, and main skid trails). The net change in detrimental soil conditions is associated with additional logging facilities that would be retained following harvest or post-harvest soil restoration treatments.

Mechanical shrub and slash treatments would be accomplished using low ground-pressure machinery and soil disturbances from these activities are not expected to qualify as a detrimental soil condition. Slash disposal by hand piling and burning would not cause a measurable increase in detrimental soil conditions because machinery would not be used and burning small concentrations of slash materials is not expected to cause severely burned soil. Fuel reductions achieved through prescribed underburning in timber stands are conducted at times and under conditions that result in low-to-moderate intensity burns that do not cause detrimental changes in soil properties. No other projects are on-going or planning in the reasonable foreseeable future that may contribute to additional cumulative effects to soils.

Measure #3: Probable Success in Project Design and Implementation

Resource Protection Measures Common to the Action Alternatives

Best Management practices (BMPs) apply to all ground disturbing management activities, as described in the National Core BMP Technical Guide (US Forest Service BMP, 2012). The Deschutes National Forest Land Resource Management Plan (US Forest Service LRMP, 1990) states that BMPs will be selected and incorporated into project design criteria in accordance with the Clean Water Act for protection of waters of the State of Oregon (LRMP 4-69). The following guidelines will be used during project design to develop site-specific BMP prescriptions for harvest operations as appropriate or when required. These BMPs are referenced to the Soil and Water Conservation Practices (SWCP) Handbook (US Forest Service FSH 2509.22), which contains conservation practices that have proven effective in protection and maintaining soil and water resource values. In addition, they are referenced to the LRMP direction, BMP monitoring information, and professional judgment.

Alternative 2 and 3 - Direct and Indirect Effects

Best management practices (BMPs), project design criteria (PCD), and resource protection measures common to the actions alternatives are all designed to avoid or minimize potentially adverse impacts to

the soil resource during the implementation of management actions. Compliance with LRMP Standard and Guideline SL-5 is addressed by excluding heavy equipment from driving on sensitive soils on steeper slopes (greater than 30 percent). BMPs for timber management and road systems would be applied to protect the soil surface and control erosion on and adjacent to roads and logging facilities used during harvest operations. Soil disturbance resulting from proposed activities would be mitigated within the project area through the design of designated skid trails and limited off trail travel by equipment.

Alternative 2 and 3 - Cumulative Effects

Cumulative effects for soils have incorporated past actions in the existing condition description as evidenced by the soil disturbance table (Soils Appendix A). The zone of influence for cumulative effects is limited to the harvest units. Effects are expected to be within allowable limits set by US Forest Service Region 6 Soil quality Standard Guidelines (FSM 2520, R6 Supplement No. 2500-98-1) and the Deschutes National Forest LRMP Standards and Guidelines (US Forest Service LRMP, 1990) for protecting and maintaining soil productivity within each of the proposed salvage units. There are no reasonable foreseeable future actions that would occur within the harvest units (effects from reforestation are not measureable); therefore there are no future cumulative effects.

Project Design Criteria and Best Management Practices

Project design criteria provide operational guidelines for equipment use in vegetation management operations and other ground disturbing activities, including prescribed fire. These operation guidelines include options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to locations and ground conditions that are less susceptible to soil impacts. During the design of this project, these guidelines were discussed with operations personnel help ensue feasibility for implementation and design effectiveness.

US Forest Service, Region 6 provides Regional Soil Quality Standards (US Forest Service, 1991) that limit allowable detrimental soil disturbances associated with management activities. This Regional guidance supplements LRMP Standards and Guidelines and is designed to further protect or maintain soil productivity. Implementation of the project design criteria listed below will help ensure these standards are met.

In addition, Best Management practices (BMPs) apply to all ground disturbing management activities, as described in the National Core BMP Technical Guide (US Forest Service BMP, 2012). The Deschutes National Forest Land Resource Management Plan (US Forest Service LRMP, 1990) states that BMPs will be selected and incorporated into project design criteria in accordance with the Clean Water Act for protection of waters of the State of Oregon (LRMP 4-69). The following guidelines will be used during project design to develop site-specific BMP prescriptions for harvest operations as appropriate or when required. These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (US Forest Service FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. They are also tiered to the LRMP direction, BMP monitoring information, US Forest Service Region 6 Soil Quality Standards, and best available science.

See the section Resource Protection Measures Common to the Action Alternatives for the Soils best management practices.

HYDROLOGY

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Hydrology specialist report and other technical documentation used to support the analysis and conclusions of this

environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

The existing condition and environmental effects for the hydrology issues in the hydrology analysis area are described in this section of the environmental assessment. Project treatments are located within the Deep Canyon watershed in portions of three subwatershed (SWS): Three Creek, Deep Canyon Dam-Deep Creek, and Snow Creek Ditch (Table 16). Two recent fires occurred in the Three Creek subwatershed, the Pole Creek Fire (2012) and the Rooster Rock Fire (2010). A very small portion of the Pole Creek fire area west of Forest Road 16 is included in the Melvin Butte Vegetation Management Project area. The Deep Canyon watershed was analyzed in the Sisters/Whychus Watershed Analysis (USDA Forest Service 1998) and the Whychus Watershed Analysis Updates (USDA Forest Service 2009, 2013b).

Table 16 Acres by subwatershed (SWS) for subwatersheds that are in the Melvin Butte analysis area

SWS Name	SWS number	SWS Acres	Acres in Project Boundary	% of SWS in Project Area
Deep Canyon Dam – Deep Creek	170703010604	31,923	267	0.8
Snow Creek Ditch	170703010602	14,636	129	0.8
Three Creek	170703010601	18,790	4060	22

Action alternatives have the potential to affect the following hydrology resources in the project area: streamflow, sedimentation, water temperature, and channel condition. Specific parameters assessed for waterbody condition will be streamflow, sedimentation, riparian vegetation and large wood.

Regulatory Framework / Management Direction

All federal land management activities must follow standards and guidelines (S&Gs) listed in the Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 1990), as amended by the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), and any applicable Wild and Scenic River Plans. Project treatments must comply with all applicable best management practices (BMPs) (USDA Forest Service 2012b) and the Clean Water Act. The majority of National Forest lands in the project are managed under NWFP and are located within the Matrix land allocation.

Deschutes National Forest Land and Resource Management Plan

The following standards and guidelines from the Deschutes LRMP are applicable to this project (USDA Forest Service 1990):

RP-3: Give preference to riparian area dependent resources

RP-8: Evaluate the cumulative effects of proposed projects on water quality, runoff, stream channel conditions fish habitat and adopt measures to avoid adverse effects to these resources.

RP-10: Manage woody debris and vegetation to: 1) maintain or enhance stream channel and bank structure.

RP-39: Large organic material which is beneficial to fish, wildlife or water quality will be preserved in riparian areas, stream or river channels and lakes adjacent to summer homes. Streambank erosion or

esthetic enhancements are not adequate reasons for its removal. The material may be altered if it creates a safety hazard, however its contribution to riparian resources will be preserved.

Northwest Forest Plan

The Deschutes National Forest LRMP was amended in 1994 by the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan (NWFP)) (USDA Forest Service and USDI Bureau of Land Management 1994). The Aquatic Conservation Strategy (ACS) is an essential part of the NWFP that "was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands" (USDA Forest Service and USDI Bureau of Land Management 1994). The Melvin Butte Vegetation Management Project is compliant with the ACS because only minimal activity would occur within Riparian Reserves and it would maintain or restore the ACS objectives. Compliance with the ACS is discussed in the Management Direction section of the Fisheries Report.

The NWFP provides standards and guidelines for Key Watersheds, Riparian Reserves and various management activities that prohibit or regulate activities that "Prevent further degradation of aquatic ecosystems and to restore and maintain habitat and ecological processes responsible for creating habitat over broad landscapes of public lands" (Reeves et al. 2006). Standards and guidelines for Key Watersheds, Riparian Reserves, and management activities associated with the Melvin Butte Vegetation Management Project are listed in the Management Direction section of the Fisheries Report. All proposed actions in the Melvin Butte Vegetation Management Project comply with standards and guidelines in the NWFP.

Within the project area, a portion of the Three Creek SWS is Tier 2 Key watershed under the NWFP. Tier 2 Key watersheds may not contain at risk fish stocks, but provide sources of high quality water. Three Creek subwatershed was designated a Tier 2 Key Watershed with long-toed salamander, cascade frog, and western toad as aquatic focal species in the Three Creek drainage (USDA Forest Service 2013; USDA Forest Service 1995; USDA Forest Service 2001). There are no Tier 1 Key watersheds in the project area.

Aquatic Conservation Strategy Compliance

The Melvin Butte Vegetation Management Project is compliant with the ACS because very little activity would occur within Riparian Reserves. No vegetation treatments would occur in the Riparian Reserve and only haul of harvest trees would occur on existing roads. In addition, 0.14 miles of road would be decommissioned or closed in the outer edge of the Three Creek Riparian Reserves.

Restricting haul to existing roads and implementing Project Design Criteria (see Project Design Criteria section of this report) such as regular preventative road maintenance and restricting haul on hydrologically connected segments of road to drier periods would maintain ACS objectives. Decommissioning and closing 0.14 miles of road in the outer edge of the Riparian Reserve would allow the road surface to revegetate and downwood to accumulate. The revegetation of the road surface would help dissipate overland flow energy and reduce the risk of increasing peak flows and sedimentation; therefore, restoring the ACS objectives. Based on the evaluation of the short-term, long-term, and cumulative impacts, the Melvin Butte Vegetation Management Project is designed to "contribute to maintaining or restoring the fifth-field watershed over the long-term."

Riparian Reserve and Ephemeral Draw Buffer Widths

The Whychus Watershed Analysis refined Riparian Reserves as defined by the NWFP based on average maximum tree height, the 100-year floodplain, extent of riparian vegetation, and unstable and potentially

unstable lands (USDA Forest Service 1998). Site specific assessment of ephemeral draws was used to prescribe additional buffers (which are not considered Riparian Reserves) where needed to reduce potential erosion and ground disturbance in the Melvin Butte Vegetation Management area. Riparian Reserve and ephemeral draw buffer widths for the project are shown in Table 17.

Ephemeral channel buffer widths were prescribed primarily as a means to preserve draw stability and keep potentially soil disturbing activities away from the channel. Ephemeral channels are not considred Riparian Reserves under the NWFP. Forested ephemeral channels act as sediment sinks during the dry season, and are potential sources of sediment during storm events (Daniels and Gilliam 1996). Ephemeral draw buffers are not designated as Riparian Reserves and are specific to the Melvin Butte Vegetation Management project only.

Table 17 Riparian reserve and ephemeral draw buffer widths for the Melvin Butte Vegetation Management Project

Category	Stream Class	Description	Riparian Reserve width (slope distance (ft) from edge of channel)	Buffer Width (slope distance (ft) from edge of draw)
1; 3	1 & 2; n/a	Fish-bearing streams; natural lakes and ponds	300 ft	See Riparian Reserve width column
2	3	Permanently flowing non-fish bearing streams	150 ft	See Riparian Reserve width column
3	n/a	Constructed ponds, reservoirs, and wetlands > 1 acre	150 ft	See Riparian Reserve width column
4	4	Seasonally flowing or intermittent streams, wetlands < 1 acre, unstable or potentially unstable areas, springs	150 ft	See Riparian Reserve width column
n/a	n/a	Hydrologically connected ephemeral draw features	n/a	30 ft

Clean Water Act

The Clean Water Act (CWA) is a federal law in the United States governing point and non-point source water pollution. In Oregon, the United States Environmental Protection Agency (EPA) has designated authority for compliance with the CWA to the Oregon Department of Environmental Quality (ODEQ). The CWA requires the development of water quality standards to protect beneficial uses of waters of the United States. Beneficial uses for the Deschutes River Basin include public, private, and industrial water supply, irrigation, livestock watering, anadromous fish spawning, salmon spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality.

The Forest Service's responsibilities under the CWA are defined in a 2014 Memorandum of Understanding (MOU) with Oregon DEQ (ODEQ and USDA Forest Service 2014). The MOU designates the Forest Service as the responsible agency for meeting the Clean Water Act on National Forest System (NFS) lands and recognizes best management practices (BMPs) as the primary mechanism for control of non-point source pollutants on NFS lands. It recognizes that BMPs are developed by the Forest Service as part of the planning process and includes a commitment by the Forest Service to meet or exceed standards. Hydrology BMPs that apply to the Project are discussed in the Project Design Criterial and BMP section of this report. To meet Clean Water Act responsibilities, the Forest Service developed a draft Water Quality Restoration Plan (USDA Forest Service 2004). The Melvin Butte Vegetation Management EA complies with both the draft Water Quality Restoration Plan and 2014 MOU.

303(d) Listed Streams

The State of Oregon is required under Section 303(d) of the Clean Water Act to identify waters that do not meet water quality standards. None of the streams in the Melvin Butte analysis area are on the Oregon 303(d) list. States are required to develop Total Maximum Daily Load allocations, which include Water Quality Management Plans for 303(d) listed waters. The Upper Deschutes River Subbasin Total Maximum Daily Load and Water Quality Management Plans are being planned and cover all the subwatersheds in the Melvin Butte Vegetation Management Project boundary.

Watershed Condition Framework

The Watershed Condition Framework (WCF) was developed as a nationally consistent, science-based approach to classify the condition of all National Forest System lands (Potyondy and Geier 2010) as a means to consistently prioritize watersheds for improvement and track condition change over time. The WCF is a 6-step process, step 1 of which includes the classification of watershed condition using 24 watershed condition "attributes" to rate 12 watershed "indicators" and produce an overall Watershed Condition Class Rating. Within this context, the three watershed condition classes are directly related to the degree or level of watershed functionality and are classified as follows: Class 1 = Functioning Properly; Class 2 = Functioning at Risk; and Class 3 = Impaired Function. Watersheds are classified using attributes that quantify aquatic physical, aquatic biological, terrestrial physical and terrestrial biological condition. Steps 2 and 3 of the WCF process include prioritization of watersheds for restoration and the development of watershed action plans outlining essential projects to improve watershed condition. Steps 4-6 include implementation of essential projects within priority watersheds, monitoring of watershed restoration efforts, and aggregation of program performance data for national reporting.

All SWSs that intersect the Deschutes National Forest were analyzed during the National Watershed Condition Framework process and ranked in 2011. Through this process, the Upper Whychus Creek SWS was identified as a priority for restoration. The 2011 Upper Whychus Creek Action Plan outlines essential projects to improve watershed condition from functioning at risk to functioning properly within the next 5 years (USDA Forest Service 2011b).

As part of the 2013 Whychus Watershed Analysis update, subwatersheds included in the analysis area were re-evaluated using the WCF process to include changes from the Pole Creek Fire, and other watershed changes that could affect condition. Watershed condition ratings from the 2011 and 2013 analyses for the subwatersheds in the Whychus Watershed Analysis area are shown in Table 18. The Melvin Butte Vegetation Management Project would not result in a change in watershed condition for any SWS within the Hydrologic Analysis Area; as discussed in the Effects Analysis of this report there would be no significant effect to hydrologic parameters from the project.

Table 18 SWS rating using the watershed condition framework. A portion of the subwatershed in bold is within the Melvin Butte Vegetation Management Project area

Subwatershed	2011 WCF rating	2013 WCF rating	Comments
Headwaters Whychus Creek	Functioning properly	Functioning at risk	Change in rating from Pole Creek fire effects
Lower Trout Creek	Functioning at risk	Functioning at risk	
Three Creek	**Functioning at risk**	**Functioning at risk**	
Upper Trout Creek	Functioning properly	Functioning properly	
Upper Whychus Creek	Functioning at risk	Functioning at risk	National Priority Subwatershed

Analysis Methods

The hydrologic analysis area for analysis of direct, indirect, and cumulative effects of the Melvin Butte Vegetation Management Project is the Three Creek SWS. Three Creek goes subsurface before exiting the SWS; therefore, SWSs downstream of the project area were not included in project analysis. The potential effects of the Project are no longer relevant or quantitatively or qualitatively meaningful at a scale larger than the SWSs where treatments are located because there are no treatments proposed near streams or within Riparian Reserves, and additional BMPs and project design criteria would avoid treatments in other hydrologically connected and sensitive areas. Although two intermittent streams (equaling 0.2 miles) within the Snow Creek Ditch SWS are within the Project area, only 129 acres of the SWS are within the Project area. Given that no treatment would occur in Riparian Reserves and very little of the SWS is within the Project area (less than 1%), Snow Creek Ditch SWS was not included in the hydrology analysis area; however, effects to the intermittent streams are discussed. Deep Canyon Dam SWS was not included in the hydrology analysis area because only 267 acres (less than 1% of the SWS) are in the Project area and there are no waterbodies near the Project area.

Activities in areas that contribute water, shade, or sediment to streams or wetlands can affect water quality or quantity; therefore, activities within Riparian Reserves and potentially hydrologically connected areas (roads and hydrologically connected ephemeral draws) are the focus of this analysis. Various federal plans identify riparian buffers in order to protect water quality, channel stability, and large wood debris recruitment (NWFP, DLRMP, INFISH). A compilation of studies on effectiveness of riparian buffers (Belt et al. 1992) concluded that non-channelized sediment rarely travels more than 300 feet, and that 200-300 foot riparian “filter strips” are generally effective at protecting streams from sediment from non-channelized flow (USDA Forest Service and USDI Bureau of Land Management 1995).

Treatment alternatives will be analyzed based on their potential effects to the hydrology issues of streamflow, sedimentation, water temperature, and waterbody condition. These hydrology issues will be analyzed through the measures outlined in Table 19. Past, present and reasonably foreseeable projects within the hydrology analysis area were evaluated to determine potential cumulative effects from the project. Activities in the cumulative effects analysis area for all resources are shown in Chapter 2 of this EA and individual activities in the hydrology cumulative analysis area discussed in the Cumulative Effects section of this report.

Table 19 Measures for evaluating the effects of these treatments on the aquatics resource are:

Issue	Measures
Streamflow	• Acres of soil detrimentally impacted in Riparian Reserves. • Acres of soil detrimentally impacted in potentially hydrologically connected areas (ephemeral draws). • Miles of hydrologically connected road closed or decommissioned. • Percent of project area with a high or moderate fire hazard rating.
Sedimentation	• Acres of soil detrimentally impacted in Riparian Reserves. • Acres of soil detrimentally impacted within 30 ft of potentially hydrologically connected areas (ephemeral draws). • Miles of hydrologically connected road closed or decommissioned. • Miles of hydrologically connected temporary road constructed or used. • Percent of project area with a high or moderate fire hazard rating.
Water Temperature	• Acres harvested in Riparian Reserves. • Percent of project area with a high or moderate fire hazard rating.
Waterbody Condition	• Alteration of stream/lake bank and bed stability measured by changes in sedimentation, and water yield using measures described above.

	• Acres treated in floodplain. • Acres harvested in potential large wood recruitment areas in Riparian Reserves. • Percent of project area with a high or moderate fire hazard rating.

Acres of treatment for the Action Alternatives within each SWS within the hydrology analysis area are shown in Table 20. For each hydrology measure, effects for Alternatives 2 and 3 are analyzed together because effects are not expected to differ between the two Alternatives. Although in Alternative 3 there are less acres treated than in Alternative 2, these acres all occur outside of Riparian Reserves and in the Snow Creek Ditch SWS and would not affect hydrology parameters. The other difference between Alternative 2 and 3 is that under Alternative 3 the mistletoe treatments change to thinning prescriptions and the mixed conifer treatments would not have small group openings. The effects of changing these treatment prescriptions do not change the effects to any hydrology measure; the same areas would be treated, and the same infrastructure including haul roads, skid trails, and landings would be needed for each Action Alternative.

Table 20 Watershed hierarch, and project and treatment acres for the Melvin Butte Vegetation Management Project.

SWS name	SWS acres	Alt. 2 Treatment acres	Alt. 2 Treatment acres	Road Decommissioning Alt. 2 & 3	Road Closures Alt. 2 & 3
Deep Canyon Dam – Deep Creek	31,923	267	267	0.3	0
Snow Creek Ditch	14,636	129	57	0	0
Three Creek	18,790	4060	4060	7.7	6
Total	N/A	4456	4384	8.0	6

No treatments, including prescribed burning, would occur in Riparian Reserves. The only activities that would occur in Riparian Reserves would be the closure and decommissioning of 0.14 miles of road in the outer extent of the Riparian Reserve and hauling on existing roads. Approximately 0.8 miles of temporary roads would be constructed in Alternative 2 but no new temporary roads would be constructed nor would any temporary roads be located in Riparian Reserves. Project Design Criteria and Best Management Practices designed to protect the hydrology resource are discussed in the next section.

Within the Melvin Butte Project Area about 8 miles of road would be decommissioned and about 6 miles would be closed under the Action Alternatives. All the roads proposed for decommissioning and closure would help reduce open road densities, which was addressed as an aquatic concern in the Whychus Watershed Analysis and Update (USDA Forest Service 1998, 2009). Approximately 2.3 miles of road proposed for decommissioning (Roads 1620-377, 1624-360, 1628-113, 626, 629) and 4.1 miles that are proposed for closure (Roads 1620-570, 1628-106, 107, 200, 500, 605) are within the Riparian Reserve or interact with an ephemeral channel. Decommissioned roads have no long term needs, are not planned to be used again and will be removed from the transportation system status. Treatment would involve "hydrologically closing" roads and could potentially include subsoiling/ripping or recontouring the road surface. Closed roads are inactivated or operational maintenance level 1 roads. While remaining on the transportation system they are managed in a storage or closed category, and only non-motorized vehicles or USFS vehicles receiving special permission are allowed. A closed road is "hydrologically closed," even though the landscape is not restored to its original shape. Hydrologically closing a road is intended to leave the road in a "self-maintaining" state and would include repairing any drainage problems, potentially removing culverts from stream crossings, and installing a closure device (i.e. barricade, earth berm, logs, gates, etc.). Neither decommissioned roads nor closed roads would be on the Motorized Vehicle Use Map and motorized access would not be allowed on these roads.

Project Design Criteria and Best Management Practices - Aquatics

Best Management Practices (BMPs) and Project Design Criteria (PDC) were developed for the Melvin Butte Vegetation Management Project using the National Core BMP Technical Guide (USDA Forest Service 2012b) based on recommendations in the 2013 Whychus Watershed Analysis Update (USDA Forest Service 2013b), field verification, and the best available science. The BMP and PDC that provides the most protection for the hydrology resource in the Melvin Butte Project area is restricting ground disturbance within Riparian Reserves to road closure and decommissioning. Any springs, wetlands, or ephemeral channels found during Project implementation that were not originally mapped or identified should be protected by using the Riparian Reserve and ephemeral channel buffers identified in this EA (Table 21). BMPs and PDC were discussed with operations personnel to ensure feasibility for implementation effectiveness. BMPs and PDC are discussed throughout the effects analysis of this report and are the primary mechanism to mitigate potential hydrologic effects from the project.

BMP implementation and effectiveness has been systematically monitored across National Forest Lands in California since 1992. From 2008-2010, randomized monitoring showed 91% of BMPs were implemented, and 80% of implemented BMPs were rated effective. BMPs for timber harvests, fuels treatments, and vegetation management were consistently highly effective, while BMPs for other activities, including roads, range management, recreation, and mining, were less effective (USDA Forest Service 2013a). At sites where BMPs were not implemented or effective the monitoring program includes a strong feedback loop to take corrective action on non-compliance scenarios.

At the national scale, a consistent program to monitor BMP implementation and effectiveness has been in development for several years. Monitoring of BMP implementation and effectiveness using the national BMP protocols has taken place on the Deschutes National Forest since 2011. Monitoring results from vegetation management projects indicate that BMPs intended to minimize effects to water, aquatic and riparian resources were successfully implemented, and BMPs intended to minimize effects from landings and ground-based mechanical harvest were successfully implemented, including landing location, spacing of skid trails, and retention of cover (USDA Forest Service 2011a, 2012a). Select BMPs, PDC, and project design elements are shown in Table 21.

Table 21 Select project design considerations, BMPs, and PDC for the Melvin Butte Vegetation Management Project.

Practice	Initial Project Design Element	BMP/PDC
No harvest, mowing or prescribed fire in Riparian Reserves	X	X
Buffer ephemeral draws and limit designated crossings (see specifics below)		X
Buffer ditches according to Forest ditch guidance (see specifics below)		
No new road construction	X	X
No temporary road or landing construction or use in Riparian Reserves		X
No haul on hydrologically connected roads or roads within riparian reserves when conditions are wet and can cause sedimentation to reach Three Creek (see specifics below)		X
No haul across stream fords when streams are flowing		X
Improve drainage on unstable hydrologically connected roads before haul can occur and regular preventative maintenance (see specifics below)		X
Closure of 6.2 miles of road upon project completion	X	
Planned decommission of 6.4 miles of road	X	
Obliterate all temporary roads		X

Installation of waterbars on skid trails where needed		X
Construction of new landings and skid trails would be minimized		X
No ground-based harvest on slopes over 30%	X	

Initial project design elements were included in the development of the Proposed Action. BMPs were developed using recommendations in the National Core BMP Technical Guide (USDA Forest Service 2012b), and site-specific analysis of the project area

Project Specific Design Criteria

Ephemeral Channels -

- The intent of this design element is to protect the integrity of the channel banks, provide for wood recruitment, reduce sedimentation, and dissipate stream energy.
- Mechanical treatment, including mowing, is not allowed within 30 ft. of ephemeral channels, unless approval is granted by a hydrologist or fish biologist to allow some treatment in low risk areas. Underburning is allowed.
- Hand-thinning or minimal reaching in with equipment is permitted but cutting any trees within the channel or on the banks is not allowed.
- Allow crossings of channel at designated areas during dry season or unless approval is granted by a hydrologist or fish biologist
- Do not locate slash or burn piles in swales, washes, or depressions.

Ditches

- The intent of this design element is to protect the integrity of the ditch and protect stream water quality.
- Ditches and channelized streams that are functioning as a stream should be buffered based on the class of stream for which they are functioning (i.e. Class 4 buffer if the ditch is intermittent, etc.).
- Ditches that do not connect back to a stream (i.e. they feed out into a pasture or irrigation device) should be buffered 30 ft. to protect the integrity of the channel. No mechanized equipment is allowed within the buffer. Hand-thinning or reaching in with equipment is permitted but do not cut any trees within the channel or on the banks. Do not fell or yard any trees across the channel in order to protect channel integrity.
- Abandoned ditches with no active water rights to use the water in the future do not need a buffer.

Haul Roads

The intent of this design element is to reduce sedimentation to Three Creek caused from hauling.

- Consult with a hydrologist or soil scientist to determine if roads are too wet for haul.
- Roads that may need maintenance or that should be monitored for excessive wetness in hydrologically connected areas are (other roads may be identified in the field):
    - 1620-377 – adjacent to ephemeral draw, decommission after use;
    - 1620-570 – adjacent to ephemeral draw, close after use;
    - 1620-880 – adjacent to ephemeral draw;
    - 1624-360 – adjacent to ephemeral draw, decommissioning after use.

Streamflow

Existing Condition

Precipitation in the analysis area ranges from 50 inches a year near Three Creek Lake to 15 inches a year near Sisters, OR. However, the range in precipitation in the project area is only 40 in/yr. to 25 in/yr. with a mix of snow and rain. Elevations in the project area range from 4200 ft. to 6200 ft.; therefore, approximately 50% of the project area is within the rain-on-snow zone (approx. 3500-5000 ft.) which includes the lower 0.7 miles of the Three Creek Riparian Reserve. Although a portion of this subwatershed experiences a significant amount of precipitation and some high intensity storms, there is very little surface channel flow, as is seen by the low drainage density. Surface drainage in the hydrology analysis area is low because the predominately volcanic soils are highly permeable. Overland flow rarely occurs in soils within the hydrology analysis area because infiltration rates generally exceeded typical rainstorm rates by an order of magnitude (Litton 2006). Increases in overland flow can lead to increases in high flows which are the more erosive streamflows. The mechanisms with the potential to increase overland flow include reduction in canopy cover and attendant reduction in evapotranspiration and canopy interception of rain and snowfall. These mechanisms can increase the amount of precipitation available for runoff as streamflow. Within the hydrology analysis area, overland flow does not generally occur from a reduction in evapotranspiration when trees are harvested or killed by fire or insects and disease because infiltration and permeability rates often still exceed precipitation rates (Craigg 2009). However, overland flow can occur in areas where infiltration rates are reduced, such as rain-on-snow zones and road surfaces.

Roads in the project area continue to be a source for increasing overland flow in the project area. The Whychus Watershed Analysis 2013 Update analyzed road density and riparian road miles (USDA Forest Service 2013b). Overall road density (including known non-system roads) and road-stream crossings are high in Three Creek subwatershed. According to the document, “Determining Risk of Cumulative Watershed Effects Resulting from Multiple Activities”, road densities above 4.6 are considered high in relatively low relief subwatersheds (USDA Forest Service 1993). Although road density is high, mostly roads adjacent to streams, crossing streams, or hydrologically connected to streams via road ditches have an influence on streamflow or water quality.

Three Creek subwatershed was analyzed during the Forest Watershed Condition Framework (WCF) process. A component of the classification is the evaluation of the “terrestrial physical” condition and includes evaluation of open road density, road maintenance, proximity to water, mass wasting potential. Each of these are scored based on if they are functioning properly (good), functioning at risk (fair), or have impaired function (poor) and then averaged to give an overall roads indicator value. The Three Creek subwatershed was rated as fair for the roads indicator value; however, the rating may be worse because it assumed open road densities are low in these systems but many closed roads are still physically open and used by the public. The Travel Management Rule was implemented in October 2011 and it restricts motorized vehicle use to Level 2 or greater (i.e. open roads) roads, which, over time, may allow level 1 (closed roads) to actually function as closed roads.

Roads throughout the Pole Creek Fire area were damaged by increased runoff in two October storms following the Pole Creek Fire. Under the Pole Creek Burned Area Emergency Response (BAER) in 2012 and 2013 various road improvements were conducted to reduce streamflow and sedimentation effects caused by the fire (USDA Forest Service 2012c). In the Three Creek SWS a new culvert was installed under the 16 Road at an ephemeral draw that started flowing after the fire and the 1600-700 road was reconstructed after it washed out. Both of these road improvements occurred within the Melvin Butte Project area in 2013.

Three Creek is the only perennial stream in the Project area and it becomes intermittent within a half a mile of the upstream boundary near the 1628-600 road. There are two intermittent unnamed streams in the southern tip of the project area (Snow Creek Ditch SWS) and a few ephemeral channels throughout the project area (Table 22). All channels flow southwest to northeast and infiltrate before connecting with a major stream network or the Deschutes River. Melvin Spring is outside the project area but within the analysis area on the west side. It is a perennial spring that historically drained into the Three Creek drainage downstream of the private land, but now flows a half mile then is ditched to the east for irrigation on private land. In addition, an intermittent tributary to Three Creek flows into Three Creek just upstream of the Project boundary.

The Pole Creek Fire (2012) occurred upstream of the Project area and only burned 8% of the Three Creek subwatershed and no land directly adjacent to Three Creek. The Rooster Rock Fire (2010) occurred downstream of the Project area mostly on private land and also only burned 8% of the subwatershed. Approximately 6.2 miles of Three Creek ran through the Rooster Rock fire area (5.5 mi on private land and 0.7 mi on USFS land) and adjacent lands experienced a mostly moderate severity burn.

Table 22 Streams and their flow regime in the Melvin Butte subwatershed analysis areas.

Subwatersheds	Perennial stream miles in SWS	Intermittent stream miles in SWS	Primary stream	Within Project Area	Flow Regime
Deep Canyon Dam-Deep Canyon	0	25	Intermittent streams	N	Snow-melt
Three Creek	6.6	9.4	Three Ck	Y	Snow-melt/lake controled
			Melvin Spring	N	Spring
			Intermittent trib	N	Snow-melt
Snow Creek Ditch	0	24.4	Intermittent streams	Y	Snow-melt
Total in Analysis Area	6.6	58.8			

Three Creek has a snow-melt flow regime but it is controlled by Three Creek Lake and Little Three Creek Lake in the headwaters (outside of the project area) and is influenced by numerous springs; therefore, it has a more stable flow regime. In the headwaters, Three Creek is low gradient with many small perennial tributaries. Downstream of the 16 Road and through the Project reach, Three Creek flows through a steep, confined canyon and becomes intermittent downstream of the 1628-600 road, near the abandoned Snow Creek Irrigation District Ditch. Based on the LiDAR image, it appears that historically Three Creek flowed, most likely intermittently, past Highway 20 and into McKenzie Canyon. It's unlikely that it ever reached the Deschutes River. Due to irrigation diversions that began as early as 1886, Three Creek only flowed to approximately the 1612 road (4 miles downstream of the Project boundary); however, in 2004 irrigation rights were cancelled and now Three Creek has been flowing all the way to the Mainline Rd (USFS 4606 rd), then down the Plainview Ditch (both ditches divert water from Whychus Creek) because there is no culvert under the Harrington Loop Road or Highway 20 to allow the flow to remain in the historic channel (Griffin 2011). Based on the Burned Area Emergency Response reports for both fires and the Whychus Watershed Analysis Update, increases in peak flows in Three Creek could occur because 16% of the subwatershed was burned, 11% of which occurred in the rain-on-snow zone (USDA Forest Service 2010, 2012c, 2013b).

The intermittent stream in the Snow Creek Ditch subwatershed originates from drainage off of Tam McArthur Rim. It flows intermittently through the southeast corner of the project area and is joined by

two other small tributaries before leaving the project area. These streams begin flowing subterranean before they reach Highway 20 and never reach another larger surface connection.

Fire behavior modeling within the Melvin Butte Project area shows that under the existing condition 68% of the project area has a high or moderate fire hazard rating. Moderate and high hazard areas would require heavy equipment such as dozers, and/or aerial methods to effectively suppress a wildfire (NWCG 2006). As stated in the Fuels report for this project, "Moderate and high hazard areas also have an increased likelihood of negative resource and social effects from wildfire such as fire fighter safety, public safety concerns, resource damage, and smoke production." Acres with high or moderate fire hazard have a higher potential for stand mortality due to wildfire and would be more difficult to suppress than low hazard areas, however, this does not mean that low hazard areas are "fire-proof" or have a reduced likelihood of future fire occurrence (see Fire/Fuels report). Fires burning in the high and moderate fire hazard areas within Riparian Reserves or outside Riparian Reserves but within stream drainages could have impacts on stream flow, sedimentation, channel condition, and stream shade.

Alternative 1 – Direct and Indirect Effects

The effect to streamflow under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Roads in poor condition would continue to intercept flow and could contribute to slight increases in peak flows. The hydrologic effects of roads and the interaction between road and fire effects would continue. Hydrologically connected roads that are not physically closed or hydrologically stable may continue to supply overland flow to streams because these road would not be decommissioned or closed under the Project. Effects of both the recent fires and tree mortality from insects and disease could increase peak flows. These effects are discussed in detail in greater detail in the Whychus Watershed Analysis Update (USDA Forest Service 2013b). Fire hazard modeling shows 68% of the project area and more than 80% of the area directly draining into Three Creek has a high or moderate fire hazard rating. Given that much of the drainage area of Three Creek has a high or moderate fire hazard rating, it's likely that much of the vegetation in the Three Creek drainage could be denuded and other destructive activities associated with fire suppression such as fireline construction, staging areas and safety zones could occur if a wildfire were to ignite. Therefore, effects from a moderate to high vegetation mortality fire in this drainage could temporarily increase high flows and sedimentation. Increased high flows could exacerbate the flooding issue downstream in the Plainview area. Issues and measures to assess effects to streamflow are shown in Table 23.

Table 23 Issues and measures to analyze effects to streamflow

Issue	Measures	No Action	Alternative 2 & 3
Streamflow	Acres of soil detrimentally impacted in Riparian Reserves.	0	0
	Acres of soil detrimentally impacted in potentially hydrologically connected areas.	0	0
	Miles of hydrologically connected road closed or decommissioned	0	6.4
	Percent of project area rated as a high or moderate fire hazard rating	(H) 45% (M) 23%	(H) 7% (M) 13%

Alterantive 2 and 3 - Direct and Indirect Effects

The Action Alternatives would not negatively affect streamflow because no treatments would occur in Riparian Reserves or hydrologically connected ephemeral channels. A potential beneficial effect to streamflow from the Action Alternatives includes closing or decommissioning 6.4 miles of road in hydrologically connected areas. Also, reducing the percent of the project area threatened by wildfire ultimately results in a reduction of threat to the Riparian Reserves.

As mentioned earlier, overland flow in the project area does not generally occur from a reduction in evapotranspiration when trees are harvested because infiltration and permeability rates often exceed precipitation rates. In addition, the majority of vegetation treatments are understory removal in over-stocked stands; therefore, thinning would help move the stand toward more historic conditions. Vegetation treatments outside of the Riparian Reserves that could affect overland flow due to the amount of live vegetation removed are ponderosa pine dwarf mistletoe treatments and mixed conifer with group opening treatments. These treatments, which would only occur under Alternative 2 and would total 1051 acres, could create small openings between 1 and 3 acres which would reduce the amount of vegetation interception and evapotranspiration and may trap more snow. Although small openings would be created in the lodgepole pine treatment areas, these openings would occur in dead stands that are already more open and no longer evapotranspiring. The hydrologic processes of reduced interception and evapotranspiration and increased snow retention could increase overland flow and potentially more erosive high streamflows if these areas drain to streams.

Neither of these silvicultural treatments are located within 300 ft. of the perennial reach of Three Creek, 150 ft. of intermittent channels, or 30 ft. of ephemeral channels. In the dwarf mistletoe treatments (only Alt. 2) only infested trees would be killed and/or removed. In the mixed conifer with group openings treatments (only Alt. 2), openings would be scattered and less than 3 acres. Given that none of treatments are located within Riparian Reserves or hydrologically connected areas, overland flow effects from these treatments would not affect streamflow.

Closing and decommissioning 6.4 miles of road in hydrologically connected areas such as 0.1 miles in Riparian Reserves and 6.3 miles that parallel or cross ephemeral channels would reduce overland flow effects caused by compaction and lack of down wood or vegetation. Fracturing the road surface, installing water bars, and allowing the road to revegetate and maintain down wood would reduce overland flow contribution to stream channels during high flow periods.

Fire hazard modeling shows that the high and moderate fire hazard rating was reduced from 45% to 7% and 23% to 13%, respectively, under Alternatives 2 and 3 (Table 8). The likelihood that a wildfire could cause stand replacement mortality in the Three Creek drainage is estimated to be reduced and may not lead to significant streamflow changes if a wildfire were to occur under the Action Alternatives because fire suppression effectiveness would be increased.

Sedimentation

Existing Condition

The amount of fine sediment transported to or eroded within a stream channel can affect the beneficial uses of water and is frequently used as a measure of overall water quality. Oregon administrative rules addresses sediment through a turbidity standard that states, “No more than 10 percent cumulative increases in natural streams turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity-causing activity” (OAR 340-041-0036; ODEQ 2011). For this report, sedimentation, including turbidity and fine sediment in substrate, will be analyzed because of the effects on channel morphology and aquatic species. The Sisters Ranger District has monitored turbidity, percent fine sediment in spawning gravels, cobble embeddedness, and bank stability, all of which are parameters associated with fine sediment.

Pebble counts performed in 2007 show that fine sediment in Three Creek is generally low with the highest concentration in the reaches downstream of the 16 road. The number of stream crossings is high in the Three Creek subwatershed and the higher concentration of fines may be a result of sediment running off from the road. Fine sediment may have increased temporarily downstream of the Project area in the Rooster Rock fire area, but is likely close to pre-fire conditions since ground vegetation has been

recovering for the last 4 years and downwood has been increasing. Due to generally low fine sediment concentration, substrate embeddedness is likely low. Streambank stability is high and is probably a result of a lake controlled flow regime, floodplain connection, and lack of roads in the steeper reaches of Three Creek (see Fisheries Report). Although the 16 road crosses Three Creek and parallels it in the upper reach, the stream and floodplain gradient is flat and there is a highly functioning riparian/wetland buffer. The culvert appears to the appropriately sized for the discharge and channel bankfull width. Sedimentation in Three Creek Lake and Little Three Creek Lake is likely elevated due to the intensive recreation impacts to the shore. Much of the ground has been compacted from vehicles and/or camping and riparian vegetation has been denuded in most high use areas.

Alternative 1 - Ecological Trends

The effect to sedimentation under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Measures used to analyze the potential sedimentation effects and compare alternatives of the Melvin Butte Vegetation Management Project are shown in Table 24.

Hillslope erosion may increase from a reduction in live canopy and consumption of organic material on the forest floor from the recent fires, especially in stands that burned at high intensity. This could increase sedimentation in stream reaches adjacent to high intensity burned Riparian Reserves. Down wood from falling dead trees would increase over the next 3-7 years and provide surface roughness to help trap and store sediment.

The hydrologic effects of roads and the interaction between road and fire effects would continue. Roads in unstable condition would continue to deteriorate, and sediment delivery would continue to occur, especially on hydrologically connected roads that were impacted from increased runoff following the recent fires. In addition, hydrologically connected roads that are not physically closed or hydrologically stable may continue to supply sediment to streams when overland flow occurs because these road would not be decommissioned or closed under the Project.

Over 80% of the Three Creek drainage area has a high or moderate fire hazard rating. Given that much of the drainage area has a high or moderate fire hazard rating, it's likely that much of the vegetation in the Riparian Reserves could be denuded, even in the low hazard areas. Despite high to moderate vegetation mortality from wildfire, soil burn severities in these soil types are generally low to moderate, with approximately 2% in the high burn severity category based on data from the Black Crater, Lake George and GW Fires (see Soils Report). In addition, the soil types found in the project area tend to show an increase in infiltration after they've been burned despite burn severity and generally do not show increased signs of hydrophobicity from fire. Although infiltration generally increases in these soil types after a fire, during high intensity storms, erosion could increase because there is less ground cover. In addition, other destructive activities to ground vegetation associated with fire suppression such as fire line construction, staging areas and safety zones could occur if a wildfire were to ignite. Therefore, bare ground near Three Creek could be exposed, which increases the risk of sedimentation in Three Creek if a wildfire were to occur.

Table 24 Issues and measures to analyze effects to sedimentation.

Issue	Measures	No Action	Alternative 2 & 3
Erosion and Sedimentation	Acres of soil detrimentally impacted in Riparian Reserves.	0	0
	Acres of soil detrimentally impacted within 30 ft of potentially hydrologically connected areas (ephemeral draws).	0	0

	Miles of hydrologically connected road closed or decommissioned	0	6.4
	Miles of hydrologically connected temporary road constructed or used.	0	0
	Percent of project area with a high or moderate fire hazard rating	(H) 45%% (M) 23%	(H) 7% (M) 13%

Alternative 2 and 3 - Direct and Indirect Effects

Sedimentation from activities associated with the Action Alternatives in the streams in the project area would be negligible because no detrimental soil acres would occur in Riparian Reserves or hydrologically connected areas and project design elements would reduce sedimentation from haul roads.

Vegetation treatments outside of the Riparian Reserves that could affect sedimentation are the same as the ones discussed in the Streamflow Effects section of this report for overland flow. As discussed, the ponderosa pine dwarf mistletoe treatments and mixed conifer with group opening treatments (Alt. 2 only) would reduce the amount of vegetation interception and evapotranspiration and may trap more snow. All of these processes could increase overland flow, hillslope erosion, and potentially sedimentation and more erosive high streamflows if these areas drain to streams. Given that none of treatments are located within Riparian Reserves or hydrologically connected areas, overland flow effects from these treatments would not affect sedimentation. Any potential hillslope erosion caused from these activities would be trapped in the ground vegetated buffer between the treatments and the streams.

Project design elements would reduce sedimentation from log haul (see Project Design Criteria and BMP section). Sedimentation from haul would be minimal because no new roads would be constructed, no temporary roads would be used in Riparian Reserves, no haul roads would ford any creeks when they are flowing, no landings would be constructed in Riparian Reserves, haul would be restricted to drier conditions when sedimentation to streams would not occur, and regular drainage maintenance would be conducted.

Closing and decommissioning 6.4 miles of road in hydrologically connected areas such as 0.1 miles in Riparian Reserves and 6.3 miles that parallel or cross ephemeral channels would reduce overland flow effects that could cause erosion and subsequent sedimentation. Fracturing the road surface, installing water bars, and allowing the road to revegetate and maintain down wood would reduce sediment contribution to stream channels. Roads proposed for decommissioning maybe sub-soiled if physically possible to restore soil infiltration. Subsoiling or ripping could cause some localized, short-term sedimentation effects; however, sedimentation would not likely reach Three Creek because treatments are adjacent to ephemeral channels and not directly near Three Creek.

Fire hazard modeling shows that the combined high and moderate fire hazard rating was reduced from 68% to 21% under Alternatives 2 and 3 (Table 24). Therefore, after vegetation treatments, the likelihood that much of the vegetation in the riparian Reserves would be denuded from a wildfire would be reduced as would the risk of sedimentation in Three Creek.

Water Temperature

Existing Condition

No waterbodies in the Melvin Butte Vegetation Management Project area are listed on the Oregon 303(d) list for water temperature exceedances above the State standard. There is only a half mile of perennial channel within the Project area and it's located at the upstream project boundary in Three Creek. Water temperature has been measured in Three Creek during stream inventories and has ranged between 9 ^{o}C to 20 ^{o}C using a hand held thermometer, with highest temperatures in August. Water temperature is elevated

because surface water from the Three Creek and Little Three Creek Lake is thermally heated and is the primary water sources during the summer months. The State temperature standard for Three Creek is the 7-day average maximum water temperature standard for salmon and trout rearing and migration which is 18° C (ODEQ 2011). It is unclear if Three Creek exceeds the water temperature standard. It's unlikely that the Pole Creek Fire or the Rooster Rock Fire affected stream temperature because the Pole Creek fire only burned a small portion of the Riparian Reserve that was not immediately adjacent to the perennial reach of Three Creek and the Rooster Rock Fire occurred along the intermittent reach of Three Creek that is already dry during the hot period. The intermittent tributaries in the Snow Creek Ditch subwatershed are dry during the hot season and are thought to not exceed State water temperature standards.

Alternative 1 - Ecological Trends

The effect to water temperature and 303(d) status under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Over 80% of the Three Creek drainage area as well as the Riparian Reserves has a high or moderate fire hazard rating. Given that much of the Riparian Reserves along Three Creek has a high or moderate fire hazard rating, it's likely that much of the shade producing vegetation in the Riparian Reserves could be denuded, even in the low fire hazard areas, resulting in increased water temperature. Measures for analysis of temperature effects of the Melvin Butte Vegetation Management are shown in Table 25.

Table 25 Issues and measures analyzing effects to water temperature.

Issue	Measures	No Action	Alternative 2 and 3
Water Temperature/303(d) listings	Acres harvested in riparian reserves.	0	0
	Percent of project area with a high fire hazard	45%	23% and 13%

Alternative 2 - Direct and Indirect Effects

The Action Alternatives would not affect water temperature because no activities would occur within the Riparian Reserve of any streams. For the same reason, there would be no effect on the 303(d) listing status of streams listed for exceeding State temperature standards. Only activities within the shade producing area (usually within 50-100 ft. of a stream) of perennial streams, have the potential to affect shade and associated stream temperature. Intermittent streams in the project area do not contribute to high temperatures because they are dry during the hottest period of the year. Only a half mile of Three Creek is perennial in the Project area and no activities are planned within the shade producing area. In addition, no changes to channel condition are predicted; therefore, morphological channel changes which could affect stream temperature would not occur. Given that only a half mile of stream is perennial, any beneficial effects from reducing the fire hazard in the project area would not have an effect on stream temperature.

Channel Condition

Existing Condition

Riparian Reserves upstream of the Project area around Three Creek, tributaries and wetlands near the Forest Road 16, and Three Creek Lake are within the intensive recreation area, and vegetation is primarily composed of Lodgepole pine. Riparian vegetation is mostly confined to the first 10 to 20 ft. from the stream/lake bank or within the wetlands. Most of the lodgepole pine in this area is dead and very dense and jack-strawed as a result of the bug kill. Some regeneration of small lodgepole pine (approx. 6 ft. tall) is present especially along the Forest Road 16. As a result, small instream woody debris or future instream small woody debris loads are high but large and medium instream woody debris loads are low. The upper reach is in a wetland meadow and only a few trees are available for recruitment; therefore, instream woody debris loads were low. In this area, approximately 60 acres of Riparian Reserve were

burned during the Pole Creek fire, none of which were adjacent to the channel and half were only underburned.

Driftwood Campground is along the north shore of Three Creek Lake and there are numerous dispersed campsites along Little Three Creek Lake. Three Creek Meadow campground and numerous hiking and horse trails are located off the 1600-800 road and are adjacent to the wetlands surrounding Three Creek. The campsites have increased compaction around the lakes and wetland and have reduced lakeside vegetation in some areas. Also, many of the dead trees along the 16 road and in the campgrounds in the Riparian Reserves have been felled and left to mitigate the safety risk.

Downstream of the Forest Road 16 Corridor where Three Creek and its intermittent tributary become confined and higher gradient, hillslopes in the Riparian Reserve are still predominately lodgepole pine with very little riparian vegetation. The Project area lies within this landscape. The 2007 stream survey report stated that pieces of medium and large sized woody debris per mile in Three Creek were high only in reach 1 (intermittent reach in Project area) and 4 (perennial reach upstream of Project area near lake). This is most likely due to larger ponderosa pine and spruce in reach 1 and larger spruce and white fire in reach 4 (see Fisheries Report). Reaches 2 (perennial reach in Project area) and 3 (perennial reach upstream of Project area) were dominated by lodgepole pine and white fir. Approximately 80 acres of Riparian Reserve were burned during the Rooster Rock fire which burned 6.2 miles along the intermittent reach of Three Creek, most of which was mixed mortality (25-75% tree mortality) and most ground vegetation burned.

Riparian Reserves of the two intermittent streams in the Snow Creek Ditch subwatershed are composed of Lodgepole pine, much of which is dead. Down wood in-stream and in the Riparian Reserve is high but future recruitment is low until new vegetation establishes.

Alternative 1 - Ecological Trends

The effect to channel conditions under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Within the analysis area, but outside the Project area, 140 acres of Riparian Reserves and 6.2 miles of stream were burned in recent fires. In-stream wood is expected to increase significantly as standing dead trees in riparian areas fall; however, long-term large wood recruitment would be reduced as riparian vegetation recovers. In-stream wood would help mitigate potential increases in peak flows and sedimentation from the Pole Creek Fire by dissipating stream energies, creating new pools, and trapping sediment.

Given that much of the Three Creek Riparian Reserve has a high or moderate fire hazard rating, effects of a wildfire could reduce bed and bank stability by increasing peak flow and sedimentation. In addition, Riparian Reserves would not be providing important shade, nutrients, and cover for many years. In-stream wood would increase in the short-term but long-term recruitment would be reduced, thus prolonging channel stability

Measures for analysis of channel condition effects of the Melvin Butte Vegetation Management Project are shown in Table 26.

Table 26 Issues and measures for channel condition.

Issue	Measures	No Action	Alternative 2 and 3
Channel Condition	Alteration of stream/lake bank and bed stability measured by changes in streamflow and sedimentation using measures shown in Tables 8 and 9.	0	0
	Acres treated in floodplain.	0	0

	Acres harvested in potential large wood recruitment areas in Riparian Reserves.	0	0
	Percent of project area with a high or moderate fire hazard rating.	(H) 45% (M) 23%	(H) 7% (M) 13%

Alternative 2 and 3 - Direct and Indirect Effects

The Action Alternatives would not negatively affect channel condition because no undesirable effects to streamflow, sedimentation, riparian vegetation, and large woody debris recruitment would occur within riparian protection areas (includes Riparian Reserves and ephemeral drainages) (Table 11). Channel stability would not be compromised by the proposed activities because no trees would be felled within 300 ft. of perennial water, 150 ft. of intermittent streams, or within or along the banks of ephemeral channels to protect the tree root influence area. Closing and decommissioning 6.4 miles of road in hydrologically connected areas would improve channel stability and near channel vegetation. Streamflow and sedimentation effects are not predicted because no activities besides haul on existing roads would occur under the Action Alternatives (see Streamflow and Sedimentation Effect sections in this report). Riparian vegetation would not be affected because no treatments would occur within the Riparian Reserve. However, ephemeral channel conditions may improve as a result of road closure and decommissioning and may help reduce the downstream streamflow and sedimentation effects. In addition, the likelihood that a wildfire could cause stand replacing mortality in the riparian Reserves would be reduced by the upland treatments under the Action Alternatives.

Large wood recruitment would not be negatively affected because no treatments would occur within the potential large wood recruitment area. Because there are no debris slide or landslide prone areas outside of Riparian Reserves within the Project area, the primary wood recruitment areas in the Melvin Butte project area are approximately 100 ft on each side of a channel (Benda et al. 2002). Haul on system roads in the Riparian Reserve would not affect streamflow, sedimentation, riparian vegetation, or large wood recruitment. This is because all haul would be on existing roads and would not reduce riparian vegetation or large wood recruitment.

Alternatives 2 and 3- Cumulative Effects

Hydrology effects from the activities proposed in the Melvin Butte Vegetation Management Project would not incrementally add to cumulative effects because no effects to any hydrology parameters are predicted. In addition, there is the potential that upland vegetation treatments could reduce undesirable effects to hydrology resources if a wildfire were to occur.

The hydrology cumulative effects analysis area for the Melvin Butte Project is the same as the analysis area used for existing condition and direct and indirect effects because it encompasses all the areas upstream and downstream of the Project area that are hydrologically connected to the Project area (see Analysis Methods section). Cumulative hydrology effects different from natural conditions would continue as a result of past or on-going activities or events such as fire suppression, roads in riparian areas, and compaction in riparian areas from past logging and recreation use (i.e. dispersed camping, off-road vehicle use). Cumulative effects from bug kill and recent fires would continue to have the greatest potential effect on hydrology. Cumulative hydrology effects from past activities would be the same as those discussed in the No Action Alternative. Although activities proposed in the Melvin Butte Project could occur in areas that have had past activities, the proposed activities are not predicted to cause any hydrology effects; therefore, the project would not incrementally add to cumulative effects. The only potential cumulative effect to the hydrology resource are beneficial effects from reducing hydrologically connected roads and the fire hazard rating in the project area.

The only on-going or future foreseeable activities in the Melvin Butte Project area are the Pole Creek Fire Salvage (20 ac of overlap), firewood cutting in the Three Creek Firewood cutting area (2834 ac of

overlap), implementation of the Travel Management Rule, and management of invasive plants (Cumulative Effects Table X). No changes to the existing firewood cutting area would occur under this proposal. Travel management legally restricts motorized access to designated open roads but no physical road closures or decommissioning occur under this rule; therefore, no physical changes occur on the ground and roads that were already closed will remain closed. Management of invasive plants which includes pulling weeds and, potentially in the future, use of herbicide, will continue. Future herbicide treatments, if necessary, would be localized and would meet strict soil and water guidelines.

On-going or future foreseeable projects that overlap the Melvin Butte hydrology analysis area are the Pole Creek Salvage (55 ac of overlap), Sisters Area Fuels Reduction (SAFR) Project (2,126 ac of overlap), and infrastructure removal in the Three Creek Lake area (Cumulative Effects Table X). Salvage of burned timber from the Two Bulls Fire is proposed to occur on the private land of Skyline Forest to the east of the Project area. These activities would not affect hydrology resources in the Melvin Butte hydrology analysis area because the Two Bulls Fire area is outside of the hydrology analysis area. Environmental Analyses have been completed for the timber projects in the Melvin Butte hydrology analysis area and no negative hydrology effects were predicted. As a result of the Pole Creek Salvage, SAFR and the Melvin Butte Project up to 33 percent of the Three Creek subwatershed could receive vegetation treatments in the next 5 years. However, none of the projects would treat Riparian Habitat Conservation Areas or Riparian Reserves in the Three Creek drainage. Hydrology effects are not expected from the vegetation, salvage, and fuels projects because activities are focused outside of riparian protection areas, no new roads are proposed, harvest within the Three Creek subwatershed would focus on dead tree and small tree removal (i.e. thinning), and soils and precipitation patterns in these project areas do not usually result in overland flow. Although, evapotranspiration could be reduced in the watershed by the cutting of trees, it would not be at a magnitude or in a location that would have an effect on streamflow or sedimentation. Likewise, streamflow in these project areas is not highly sensitive to reduction in evapotranspiration due to high infiltration rates and low annual precipitation. All cutting or harvest of live trees would be for stand health and fuels reduction, thereby leaving the majority of trees.

Infrastructure removal would include removing the Three Creek Lake Dam, Little Three Creek Lake Dam, and obliterating the ditch that connects the Lakes and the ditch below Three Creek Lake. These activities are proposed to alleviate the risk of dam failure on structures that are no longer needed nor safe. Removal of these features would benefit aquatic resources by restoring natural channel flow and improving aquatic organism passage.

FISHERIES AND AQUATICS

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Fisheries and Aquatics specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This section documents the review and findings of the Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) as Threatened or Endangered; or (2) designated by the Pacific Northwest Regional Forester as Sensitive; or (3) required consultation with the National Marine Fisheries Service (NMFS) under the Magnuson-Stevens Fishery Conservation Act (MSA). It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, and the Endangered Species Act of 1973, as amended (ESA) (Subpart B; 402.12, Section 7 Consultation).

The following analysis addresses the potential effects of the Melvin Butte Vegetation Management Project on threatened, endangered, and sensitive fish and other aquatic species. This determination, required by the Interagency Cooperation Regulations (Federal Register, January 4, 1978), ensures compliance with the ESA. Changes to the R-6 Regional Forester's Sensitive Species List were instituted in 2011. Sensitive aquatic invertebrate species were identified in the 2011 list on the Deschutes National Forest and are covered in this report.

Regulatory Framework/Management Direction

A number of Forest planning documents and assessments guide the development of the purpose and need and the proposed action. All federal land management activities in the Melvin Butte Vegetation Management Project area must follow standards and guidelines listed in the 1990 Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990), as amended by the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), and in accordance with Best Management Practices (WT-5; USDA Forest Service 1998a) and the Clean Water Act (WT-1). All National Forest lands in the Melvin Butte Vegetation Management Project area fall under the guidance of the NWFP. Additional guidance is provided by the Whychus Watershed Analysis (USDA Forest Service 1998b), the Whychus Late Successional Reserve Assessment (USDA Forest Service 2001), and the Whychus Watershed Analysis Update (USDA Forest Service 2013b, Press 2009, Dachtler 2009). In addition, the Greater Sisters Country Community Wildfire Protection Plan was consulted in developing the proposed action.

Deschutes National Forest Land and Resource Management Plan

The following standards and guidelines from the Deschutes Land and Resource Management Plan are applicable to the project:

RP-3. Give preference to riparian area dependent resources.

RP- 8. Evaluate the cumulative effects of proposed projects on water quality, runoff, stream channel conditions and fish habitat and adopt measures to avoid adverse effects to these resources.

RP- 10. Manage woody debris and riparian vegetation to: 1) maintain or enhance stream channel and bank structure, and, 2) provide structural fish habitat to meet the objective for resident fish populations provided for in the Forest Plan.

RP-39. Large organic material which is beneficial to fish, wildlife or water quality will be preserved in riparian areas, stream or river channels and lakes adjacent to summer homes. Streambank erosion or esthetic enhancements are not adequate reasons for its removal. The material may be altered if it creates a safety hazard, however its contribution to the riparian resources will be preserved.

Northwest Forest Plan

The Deschutes National Forest LRMP was amended in 1994 by the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan) (USDA Forest Service and USDI Bureau of Land Management 1994).

The entire Melvin Butte project area is managed under the direction of the Northwest Forest Plan.

The Riparian Reserve land allocation was established as a key element of the Aquatic Conservation Strategy where riparian-dependent resources receive primary emphasis. The Matrix land allocation consists of lands outside other designated areas; it was intended in the Northwest Forest Plan that most

timber harvest and other silvicultural activities would occur in the Matrix areas that have suitable forest lands.

The action alternatives meet all the applicable standards and guidelines in the Deschutes National Forest LRMP (USDA Forest Service 1990) (LRMP) as amended by the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan) (USDA Forest Service and USDI Bureau of Land Management 1994). All riparian areas within the project area are located within the Northwest Forest Plan Area. No acres in Riparian Reserves would be treated under any of the Action Alternatives.

The Melvin Butte Vegetation Management Project complies with the following four requirements for projects within Riparian Reserves as directed in the ROD (USDA Forest Service and USDI Bureau of Land Management 1994): "1) review projects against the ACS objectives at the project or site scale, rather than only at the watershed scale, 2) evaluate the immediate (short-term) impacts, as well as long-term impacts of an action, 3) provide a description of the existing condition, including the importation physical and biological components of the 5th field watershed; and 4) provide written evidence that the decision maker considered relevant findings of watershed analysis" (USDA Forest Service and USDI Bureau of Land Management 2007). There are no activities associated with the Melvin Butte Vegetation Management Project that are planned within Riparian Reserves. The Melvin Butte Vegetation Management Project meets the four requirements by: 1) providing an analysis of the ACS objectives in the Environmental Assessment, 2) discussing the effect of the proposed Melvin Butte Vegetation Management Project and other past, present and future foreseeable projects on the existing condition in the hydrology report, 3) referencing the Sisters/Whychus Watershed Analysis (USDA Forest Service 1998b), and the Whychus Watershed Analysis Update (USDA Forest Service 2013b) which describe the existing condition for the portion of Whychus watershed on the Sisters Ranger District.

The NWFP provides standards and guidelines for Key Watersheds and Riparian Reserves (RRs) that prohibit or regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) Objectives at the project-level and watershed scale. Key watersheds under the NWFP contribute directly to the conservation of the threatened bull trout and resident fish populations. They also have the highest priority for watershed restoration and watershed analysis is required to set priorities for restoration. Tier 1 Key watersheds under the NWFP contribute directly to the conservation of the threatened bull trout, anadromous fish populations and resident fish populations. Tier 2 Key Watersheds may not contain at risk fish stocks but are important sources of high quality water.

Currently only the Three Creek and Headwaters Whychus Subwatersheds are considered Tier 2 Key Watersheds. Three Creek subwatershed was designated a Tier 2 Key Watershed for the long-toed salamander population that lives in the pond off the 1600-370 road and other unique amphibian habitats in the Three Creek drainage. The Melvin Butte Project is within portions of that Tier 2 Key Watershed and also within areas that are not designated as Key Watersheds.

<u>Northwest Forest Plan Standards and Guidelines</u>

The NWFP (USDA Forest Service and USDI Bureau of Land Management 1994) provides standards and guidelines for Timber Management, Roads Management, Fire Fuels Management, Key Watersheds and Riparian Reserves (RRs) that prohibit or regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) Objectives at the watershed scale (see below). All proposed actions in the Melvin Butte Vegetation Management Project comply with the Key Watershed and Riparian Reserve standards and guidelines in the NWFP. The following NWFP standards and guidelines apply to the project:

Key Watersheds and Roadless Areas

- Inside Roadless Areas - No new roads will be built in remaining unroaded portions of inventoried (RARE II) roadless areas.
- Outside Roadless Areas - Reduce existing system and non-system road mileage. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds.
- Key Watersheds are highest priority for watershed restoration.
- Watershed analysis is required prior to management activities, except minor activities such as those Categorically Excluded under NEPA (and not including timber harvest). Watershed analysis is required prior to timber harvest.

Standards and Guidelines

Roads Management

RF-1. Federal, state, and county agencies should cooperate to achieve consistency in road design, operation, and maintenance necessary to attain Aquatic Conservation Strategy objectives.

RF-2. For each existing or planned road, meet Aquatic Conservation Strategy objectives by:

a. minimizing road and landing locations in Riparian Reserves.
b. completing watershed analyses (including appropriate geotechnical analyses) prior to construction of new roads or landings in Riparian Reserves.
c. preparing road design criteria, elements, and standards that govern construction and reconstruction.
d. preparing operation and maintenance criteria that govern road operation, maintenance, and management.
e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.
f. restricting sidecasting as necessary to prevent the introduction of sediment to streams.
g. avoiding wetlands entirely when constructing new roads.

RF-5. Minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.

RF-7. Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the Aquatic Conservation Strategy objectives. As a minimum, this plan shall include provisions for the following activities:

a. inspections and maintenance during storm events.
b. inspections and maintenance after storm events.
c. road operation and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources.
d. traffic regulation during wet periods to prevent damage to riparian resources.
e. establish the purpose of each road by developing the Road Management Objective.

Fire/Fuels Management

FM-1. Design fuel treatment and fire suppression strategies, practices, and activities to meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation.

Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function.

FM-4. Design prescribed burn projects and prescriptions to contribute to attainment of Aquatic Conservation Strategy objectives.

FM-5. Immediately establish an emergency team to develop a rehabilitation treatment plan needed to attain Aquatic Conservation Strategy objectives whenever Riparian Reserves are significantly damaged by wildfire or a prescribed fire burning outside prescribed parameters.

Watershed and Habitat Restoration:

WR-2. Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans or other cooperative agreements to meet Aquatic Conservation Strategy objectives.

Whychus Watershed Analysis

The Whychus Watershed Analysis and the update include portions of the Deep Canyon Watershed that includes Three Creek and the Melvin Butte Vegetation Management Project area. Recommendations from the Whychus Watershed Analysis and update (USDA Forest Service1998, 2013b) that relate to Riparian Reserves and apply to this project are as follows:

- Restore Forest Habitats through Vegetation Management (page 227).
- Aggressively thin plantations to accelerate large tree development, especially next to Riparian Reserves.
- Promote large tree character in ponderosa pine, mixed conifer dry and wet areas along Riparian Reserves to enhance connectivity.
- Protect springs in the Three Creeks (formerly Melvin) subwatershed from vehicle and foot traffic.

Riparian Reserve Buffer Distances

The Sisters/Whychus Watershed Analysis refined Riparian Reserve widths under the Northwest Forest Plan (NWFP) based on average maximum tree height, 100 year floodplain, extent of riparian vegetation, and unstable and potentially unstable lands (USDA Forest Service 1998b) (Table 27). These distances meet those as defined by the NWFP. Ephemeral channels or draws are not defined and do not have established buffers under the NWFP.

Table 27 Riparian reserve (RR) widths in the Melvin Butte Vegetation Management Project area.

Category	*Stream Class*	*Description*	*RR width (slope distance (ft) from edge of channel)*
1	1 & 2	Fish-bearing streams	300 ft
2	3	Permanently flowing non-fish-bearing streams	150 ft
3	NA	Ponds, lakes, reservoirs, and wetlands > 1 ac	150 ft
4	4	Seasonally flowing or intermittent streams, wetlands < 1 ac, unstable or potentially unstable areas	150 ft

Site specific assessments should be applied by qualified personnel when delineating Riparian Reserves on the ground. As a minimum include these factors:

- Floodplains- In most cases narrow areas along stream margins and wetlands. However several locations within the watershed have broad floodplains and an intricate network of flood prone channels.
- Riparian vegetation- Connect wet meadows to nearby streams where not directly connected. Examples include Three Creek meadow.
- Stream terraces, benches, and the inner gorge- Should be included to the outer edge with adequate protection for the slopes leading to the waterbody.
- Unstable land- The majority of the area is not prone to slope failures. Areas with highly or moderately erodible soils will not be treated under the action alternatives (see Soils report). Also areas over 30% slope with seeps, example: near Rd 1514 on Whychus Creek, cinder slopes near Snow Creek, and Three Creek.
- Saturated soil and seeps- Provides areas for wetland vegetation to grow and serve as wildlife and amphibian habitat. Several riparian meadows exist in Upper Whychus Creek and Three Creek. Several of the meadows are of a fen peat nature and have unique wetland plant species (see Melvin Butte botany report)
- Rock outcrops- included because of their importance for amphibians and other species.
- Create Riparian Reserve complexes- Where Riparian Reserve boundaries are very close or overlapping consolidate into one large reserve. Consolidate complexes of meadows, intermittent streams, seeps, wetlands, ponds, rock outcrops, and other unique or special habitats.

Project Design Criteria and Best Management Practices – Aquatics

Best Management Practices (BMPs) and Project Design Criteria (PDC) were developed for the Melvin Butte Vegetation Management Project using the National Core BMP Technical Guide (USDA Forest Service 2012b) based on recommendations in the 2013 Whychus Watershed Analysis Update (USDA Forest Service 2013b), field verification, and the best available science. The BMP and PDC that provides the most protection for the hydrology resource in the Melvin Butte Project area is restricting treatment within Riparian Reserves to road closure and decommissioning. Any springs, wetlands, or ephemeral channels found during Project implementation that were not originally mapped or identified should be protected by using the Riparian Reserve and ephemeral channel buffers identified in this EA (Table 1). BMPs and PDC were discussed with operations personnel to ensure feasibility for implementation effectiveness. BMPs and PDC are discussed throughout the effects analysis of this report and are the primary mechanism to mitigate potential hydrologic effects from the project.

BMP implementation and effectiveness has been systematically monitored across National Forest Lands in California since 1992. From 2008-2010, randomized monitoring showed 91% of BMPs were implemented, and 80% of implemented BMPs were rated effective. BMPs for timber harvests, fuels treatments, and vegetation management were consistently highly effective, while BMPs for other activities, including roads, range management, recreation, and mining, were less effective (USDA Forest Service 2013a). At sites where BMPs were not implemented or effective the monitoring program includes a strong feedback loop to take corrective action on non-compliance scenarios.

At the national scale, a consistent program to monitor BMP implementation and effectiveness has been in development for several years. Monitoring of BMP implementation and effectiveness using the national BMP protocols has taken place on the Deschutes National Forest since 2011. Monitoring results from vegetation management projects indicate that BMPs intended to minimize effects to water, aquatic and riparian resources were successfully implemented, and BMPs intended to minimize effects from landings and ground-based mechanical harvest were successfully implemented, including landing location, spacing

of skid trails, and retention of cover (USDA Forest Service 2011a, 2012a). Select BMPs, PDC, and project design elements are shown in Table 28.

Table 28 Select project design considerations, BMPs, and PDC for the Melvin Butte Vegetation Management Project.

Practice	Initial Project Design Element	BMP/PDC
No harvest, mowing or prescribed fire in Riparian Reserves	X	X
Buffer hydrologically connected ephemeral draws and limit designated crossings (see specifics below)		X
Buffer ditches according to Forest ditch guidance (see specifics below)	X	
No new road construction	X	X
No temporary road construction or use in Riparian Reserves		X
No haul on hydrologically connected roads or roads within riparian reserves when conditions are wet and can cause sedimentation to reach Three Creek (see specifics below)		X
No haul across stream fords when streams are flowing		X
Drainage improvement on unstable hydrologically connected roads before haul can occur and regular preventative maintenance (see specifics below)		X
Closure of 6.2 miles of road upon project completion	X	
Planned decommissioning of 6.4 miles of road.	X	
Decommission all temporary roads		X
Installation of waterbars on skid trails where needed		X
Construction of new landings and skid trails would be minimized		X
No ground-based harvest on slopes over 30%	X	

Initial project design elements were included in the development of the Proposed Action. BMPs were developed using recommendations in the National Core BMP Technical Guide (USDA Forest Service 2012b), and site-specific analysis of the project area

Project Specific Design Criteria

Ephemeral Channels -

- The intent of this design element is to protect the integrity of the channel banks, provide for wood recruitment, reduce sedimentation, and dissipate stream energy.
- Mechanical treatment, including mowing, is not allowed within 30 ft. of ephemeral channels, unless approval is granted by a hydrologist or fish biologist to allow some treatment in low risk areas. Underburning is allowed.
- Hand-thinning or minimal reaching in with equipment is permitted but cutting any trees within the channel or on the banks is not allowed.
- Allow crossings of channel at designated areas during dry season or unless approval is granted by a hydrologist or fish biologist
- Do not locate slash or burn piles in swales, washes, or depressions.

Ditches

- The intent of this design element is to protect the integrity of the ditch and protect stream water quality.

- Ditches and channelized streams that are functioning as a stream should be buffered based on the class of stream for which they are functioning (i.e. Class 4 buffer if the ditch is intermittent, etc.).
- Ditches that do not connect back to a stream (i.e. they feed out into a pasture or irrigation device) should be buffered 30 ft. to protect the integrity of the channel. No mechanized equipment is allowed within the buffer. Hand-thinning or reaching in with equipment is permitted but do not cut any trees within the channel or on the banks. Do not fell or yard any trees across the channel in order to protect channel integrity.
- Abandoned ditches with no active water rights to use the water in the future do not need a buffer.

Haul Roads

- The intent of this design element is to reduce sedimentation to Three Creek caused from hauling.
- Roads that may need maintenance or that should be monitored for excessive wetness in hydrologically connected areas are (other roads may be identified in the field):
    - 1620-377 – adjacent to ephemeral draw, decommission after use;
    - 1620-570 – adjacent to ephemeral draw, close after use;
    - 1620-880 – adjacent to ephemeral draw;
    - 1624-360 – adjacent to ephemeral draw, decommissioning after use.

Existing Condition

Within the project area, Three Creek and Three Creek Lake were historically fishless and now contain non-native brook trout and hatchery rainbow trout. Over two miles outside of the project area Whychus Creek has native redband trout, and chinook salmon and steelhead have recently been reintroduced up to the Three Sisters Irrigation District (TSID) diversion dam. There is no surface flow connection from the project area to Whychus Creek. Redband trout are on the USFS Region 6 sensitive species list. Steelhead and chinook populations being reintroduced are considered experimental populations. Figure 9 displays stream survey reaches for Trout Creek.

Bull trout and bull trout critical habitat are documented over 27 miles away in the lower 5 miles of Whychus Creek and no historical records exist of them farther upstream. It is possible some bull trout use once existed above Sisters but runs may have been lost during the early 1900's when major water diversions began to occur. The following sections describe general hydrology, flow regimes and current and historical fish populations for all major streams within and downstream of the project area.

Three Creek

Three Creek originates from Three Creeks Lake which has a small earthen dam built in the early 1900's to increase water storage. Three Creek Lake, Three Creek and Little Three Creek Lake were originally fishless with no surface connection to other waterbodies. Three Creek disappears and goes subsurface before reaching highway 20 near Plainview. Three Creek was historically almost entirely diverted for agricultural purposes approximately 3.8 miles downstream from the lake. Three Creek Lake receives additional flow via a ditch from Little Three Creek Lake. The channel from Little Three Creek Lake historically went back into Three Creek near the 16 road crossing but was diverted to Three Creek Lake for additional water storage. Three Creek goes dry on certain years even with additional storage provided by ditches that come from Little Three Creek Lake. Another ditch once carried water from Snow Creek to Three Creek Lake but this ditch has not been used for some time. Irrigation diversions and water rights from Three Creek appear to be no longer used. Restoration opportunities may exist for restoring flow to wetlands and streams that once flowed from Little Three Creeks Lake. The Three Creek Lake dam has been determined to be unstable and is no longer used to store water.

Habitat surveys were performed on Three Creek during 1992 and 2007. Data presented in this report is primarily from the 2007 habitat survey and reaches are displayed in Figure 1. Stocking of rainbow trout and brook trout began in the early 1900's. A self-sustaining population of brook trout exists and most likely spawns wherever they can find suitable areas, which may include a few small tributaries and the shoreline. Brook trout have been observed spawning in Three Creek below the Lake and in the ditch that comes over from Little Three Creek Lake. Large numbers of catchable hatchery rainbow trout are still stocked on a yearly basis in Three Creek Lake.

Some small springs fed streams enter Three Creek Lake but most flow comes from snow melt in the spring. A lush riparian meadow with willows and sedges is located from the dam down to the 16 road. This section of stream is highly sinuous, has several side channels and some deeper pools with undercut banks. A flow of 1.4 cfs was recorded during the 2007 stream survey. Most of the streams brook trout population is located in this section of stream. Downstream of the 16 road the stream is more entrenched, higher gradient and has fewer pools. Several small waterfalls and cascade sections are also located in this area.

Other Unnamed Perennial and Intermittent Streams

One intermittent stream and several small spring fed streams occur within the project area that drains into Three Creek. Another intermittent stream flows out of the project area with no surface connection to waterbodies. This goes subsurface and disappears before reaching highway 20 near Plainview. There may be additional springs, perennial streams and intermittent streams that are not mapped within the project area. If these are discovered during the course of the project fisheries or hydrology specialists will evaluate them and determine appropriate protections for these areas.

Ephemeral channels are not defined under the Northwest Forest Plan. For this project ephemeral channels are defined as those that run water on occasion but do not run water on an annual basis during years with normal or average amounts of precipitation. Typically ephemeral channels lack evidence of scour for most of their length.

Water Temperature

Water temperature is a fundamental parameter affecting a waterbodies ecology (Minshall 1978, Vannote et al. 1980). As a stream moves from headwaters to mouth exposure to solar radiation increases and water warms to near the ambient air temperature (Bartholow 1989). Water temperature is used as a stimulus to salmonid migration, spawning and habitat selectivity.

Land management activities can significantly affect water temperature. Vegetation manipulation by overstory removal can affect the shade cover and the amount of solar radiation input into the water surface. The water table can be altered by allowing encroachment of upland vegetation into the riparian zone. Creating large openings within the riparian zone canopy along streams can lead to increased water temperatures.

Water temperatures in Three Creek vary depending on flow and time of year. Water temperatures are elevated because surface water from the lakes is the primary water sources during the summer months. Water temperatures in Three Creek during the 2007 stream inventory ranged from 9 ^{o}C to 20 ^{o}C using a hand held thermometer, with highest temperatures in August.

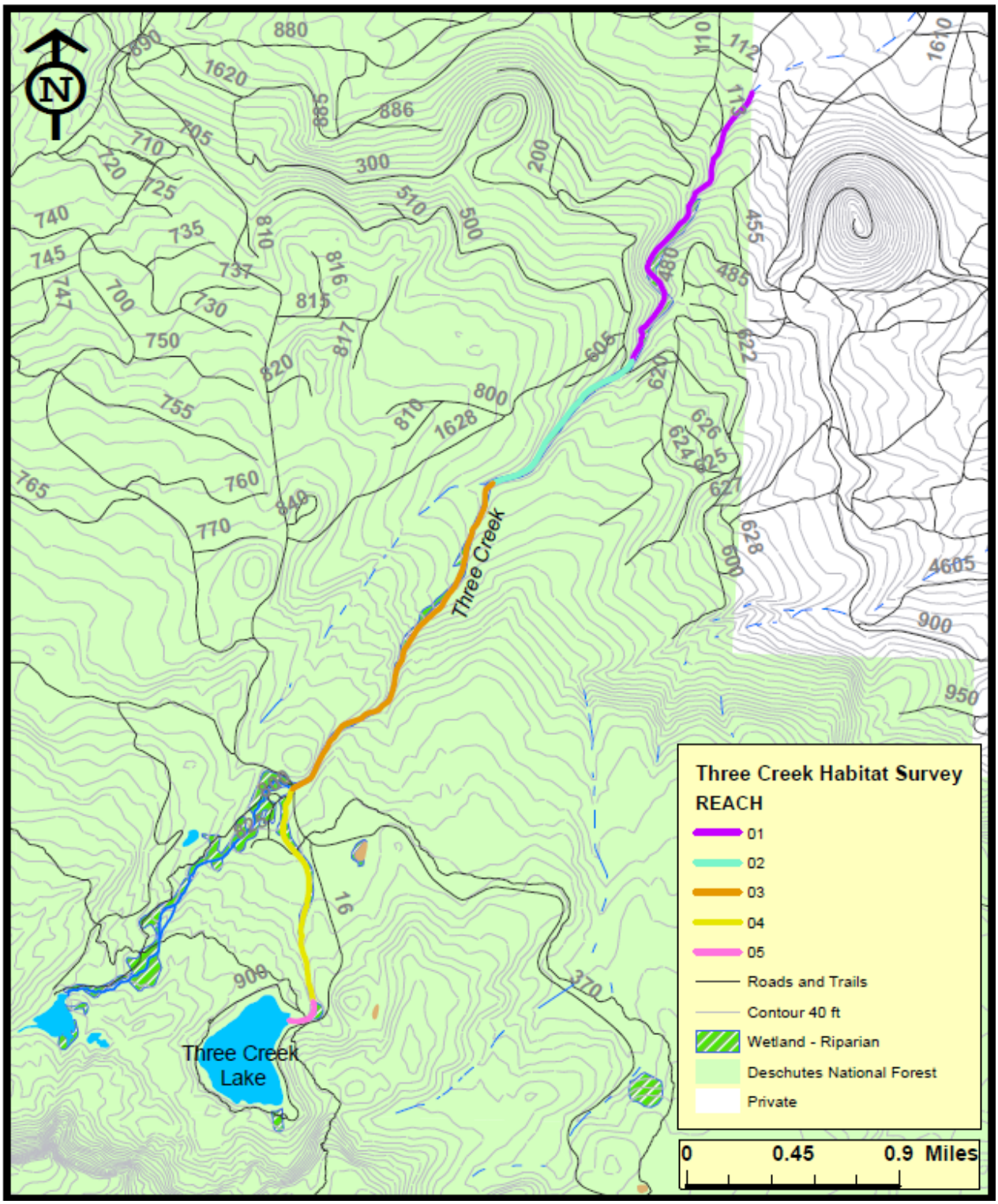


Figure 9 Steam habitat survey reaches for the Three Creek in 2007.

Streambed Embeddedness

High embeddedness can restrict winter rearing habitat for juvenile trout and salmon by filling in spaces between rocks in the streambed that could be used as cover for fish. Also, macroinvertebrates use the gravel for hiding and feeding and the more fine sediment the less habitat for macroinvertebrates.

Streams in the project area have not been sampled for embeddedness but during older stream surveys (previous to 1995) embeddedness was estimated as a yes or no if more than 35 % of the cobble or gravel substrate in a habitat unit was embedded with fine sediments. More recent stream surveys (post 1995) used pebble counts in riffles to sample surface substrate at two riffles approximately 1/3 and 2/3 through each reach. The pebble counts were done within the bankfull channel which often reflects more fine sediments than what are on the bottom of the wetted channel. This is because stream banks are often made up of mostly finer silt and sand sized particles. High embeddedness can restrict winter rearing habitat for juvenile trout and salmon by filling in spaces between rocks in the streambed that could be used as cover for fish. Also, macroinvertebrates use the gravel for hiding and feeding and in general, the more fine sediment the fewer habitats there is for macroinvertebrates.

Three Creek was not measured for embeddedness during the 2007 or 1992 stream inventories. Pebble counts performed in 2007 within the bankfull channel of riffle habitats found the highest amounts (23-31 %) of fine sediments (<2mm) in the upper half of reach 2 and reach 3. However, the other 8 pebble counts found amounts of fine sediments less than 20 % and this indicates that substrate embeddedness would be unlikely for Three Creek.

Large Wood

Large wood is an important habitat feature for bull trout, chinook salmon and other salmonids. Wood also has a great impact on channel morphology and hydrologic stability (Abbe and Montgomery 1996) and is important for pool formation and pool volume. Wood can also influence the contribution and retention of organic matter and sediment (Fausch and Northcote 1992; Angermeier and Karr 1984; Beechie and Sibely 1997). The importance of these functions enhances fish and invertebrate biomass and production (Dudley and Anderson1982; Bilby and Ward 1989; Fausch and Northcote 1992). Large wood is used as cover for all stages of fish and promotes a more complex environment that produces increased fisheries biomass (Fausch and Northcote 1992; Bisson et al. 1988) and greatly increases the resiliency and resistance of fish species to floods and droughts (Pearsons et al. 1992).

The primary wood recruitment zone for streams which gain most of their wood from tree mortality is within 100ft slope distance from the stream bank (Benda et al. 2002). Benda and others studied wood recruitment rates for streams based on dominant process (i.e. tree mortality, bank erosion or landslide). On a coastal stream in an old growth forest in Northern California, the primary source of wood was found to be bank erosion and mortality. Over 90% of the wood entered the channel from within 30 m slope distance of the stream edge. In the Three Creek subwatershed, the trees are much shorter and bank erosion is not active in many locations. Wood recruitment prediction for streams in which 100% of the wood is recruited to the channel in less than 100ft (Benda et al. 2002).

Pieces of medium and large sized woody debris per mile in Three Creek were high only in reach 1 and 4 and this is most likely due to larger ponderosa pine and spruce in reach 1 and larger spruce and white fire in reach 4 (Table 29). Reaches 2 and 3 were dominated by lodgepole pine and white fir. Lodgepole pine seldom grows to large or medium sizes. Reach 3 was noted as having a lot of blow down that was not countable because it was located across and above the bankfull channel. Reach 5 is in a wetland meadow and only a few lodgepole pine trees are available for recruitment. Management activities in this area have not significantly altered amounts of available wood for the stream. Amounts of small sized woody debris were moderate in all reaches except for reach 5 which had none due to the wet meadow.

Table 29 Three Creek large wood attributes from the 2007 stream inventory.

STREAM	REACH	Pieces of Med. and Large LWD Per Mile	Pieces of Small LWD Per Mile	Frequency of Med. and Large LWD	Frequency of Small LWD
Three Creek	1	51.7	47.7	0.083	0.077
	2	2.2	31.1	0.006	0.084
	3	1.1	28.8	0.002	0.049
	4	31.5	12.6	0.033	0.013
	5	5.9	0.0	0.005	0.000

Pool Frequency/ Pool Quality

Pools provide rearing areas for both juvenile and adult fish. Spawning often occurs in the tail-outs of pools. Pool frequency is based on average bankfull width and not adjusted for channel type and local conditions. Pools per mile are also a good measure of pool habitat but do not take into account stream size as pool frequency does. In general larger streams have larger and deeper pools which account for fewer pools in a given mile of stream while small streams generally have more numerous smaller and shallower pools for a given mile of stream. Stream gradient, geology, and instream wood can all have a large effect on the formation and quality of pools. Pool quality for fish is described as large pools with greater than 3 ft. in depth and pools with abundant large wood.

Pools in Three Creek were generally shallow and only reach 3 had any pools over three feet deep (Table 30). This is most likely due to the small size of the stream which was 1.4 cfs (cubic feet per second) during the stream inventory.

Table 30 Three Creek pool habitat attributes from the 2007 stream inventory.

STREAM	REACH	Pools Per Mile	Pool Residual Depth (feet)	Pools >3ft Deep Per Mile	# of Pools Frequency
Three Creek	1	71.8	1.0	0.0	0.116
	2	32.2	1.1	0.0	0.086
	3	24.5	1.1	0.5	0.042
	4	28.8	0.8	0.0	0.030
	5	17.7	0.6	0.0	0.016

Off-Channel Habitat

Backwaters and side channels provide important habitat for juvenile redband trout, steelhead and other salmonids in spawning tributaries. Streams with stable flow regimes provide alcove and backwater areas during all seasons. Natural recruitment of trees into unconfined stream sections will increase side channels. Log jams and the flooded areas that result can create side channels and provide important salmonid rearing habitat. Off channel habitat is also created during high flow events in the floodplain. Side channels were the only form of off-channel habitat inventoried through stream surveys.

Side channels were found in reaches 1, 3 and 4 of Three Creek during the 2007 stream inventory. Side channels accounted for 1.7 %, 2.0 % and 0.9 % of the habitat area in these three reaches, respectively. In reaches 1-3 side channel formation is restricted by a narrow flood plain and valley bottom.

Spawning Gravel Quality

Aquatic habitat is developed and persists around varieties of and scales of disturbances (Swanston 1991). These watershed disturbances recruit and remove a variety of material within the channel acting as resetting and recycling mechanisms. Fine sediment production is one type of respondent of watershed or channel disturbance such as wildfire (Beaty 1994; Minshall et. al 1997; Benda et al 2003; Wondzell and King 2003) floods (Houslet and Riehle 1998) and clear cutting (Hall and Lantz 1969). The amounts of fine sediments in spawning areas can affect the survival of salmonid eggs and alevins during incubation in redds.

Pebble counts in Three Creeks performed in 2007 within the bankfull channel of riffle habitats found the highest amounts (23-31 %) of fine sediments (<2mm) in the upper half of reach 2 and reach 3. However, the other 8 pebble counts found amounts of fine sediments less than 20 %. Amounts of gravel from pebble count data in all reaches ranged from 43 % to 77 % of the streambed substrate. Smaller sized gravel suitable for brook trout spawning exists in all reaches.

Fish Passage

Culverts on Three Creeks under the 1600-800 road 1600-900 roads are fish passage barriers under certain condition. The dam on Three Creeks Lake is a full time upstream barrier. Natural fish passage barriers also exist at several small falls and chutes in reaches 1-3 of Three Creek. The largest falls is located in reach 3 and is 15 to 20 feet tall.

Refugia

Refugia as it relates to fish are areas that provide high quality habitat or excellent water quality and often provide an area where fish can escape poor habitat or water quality conditions for part of the year. At a larger scale refugia relates to watersheds that contain high quality habitat and populations of TE listed fish species. These watersheds are often designated as Key watersheds under the Northwest Forest Plan.

In Three Creek the main area of refugia is in reach 5 up near the dam which usually has water flowing all year. This is where the self-sustaining brook trout population is located. Portions or all of reaches 1-3 go dry depending on the yearly precipitation and snowpack. Access to refugia is limited to areas upstream of fish barriers located in reach 3.

Streambank Condition and Floodplain Connectivity

Stream surveys after 1995 have measured feet of unstable stream bank located above bankfull. Floodplain connectivity is not measured with stream surveys but is the streams ability to access the floodplain and associated habitats during high flow events.

Three Creek had small amounts of instability in the lower and middle reach with none recorded in the last reach just below Three Creek Lake (Table 31).

Table 31 Percent bank instability for major fish bearing streams within and downstream of the Melvin Butte Vegetation Management Project.

STREAM	REACH	Percent Bank Instability Above Bankfull
Three Creek (2007)	1	3.2 %
	2	0.7 %
	3	2.5 %
	4	0.4 %

	5	0.0 %

Effects Analysis Aquatic Species

The proposed project potential treatment would occur on 5,115 acres in the Whychus and Deep Canyon Watersheds. Only a small portion of the project is located in the Whychus Watershed and there is no surface water connection from the project to Whychus Creek. The Whychus Watershed has habitat for bull trout *Salvelinus confluentus*, a federally listed threatened species, and interior redband trout *Oncorhynchus mykiss*, which is on the Regional Forester's sensitive species list. Redband trout occur outside the project boundary and bull trout occur outside of the project area near the Whychus Creek confluence with the Deschutes River. Mid-Columbia steelhead trout (listed threatened below Pelton Round Butte Dams, were also native to Whychus Creek and reintroduction of fry below the TSID diversion dam started in 2007. A few adult returns have been confirmed in lower Whychus Creek. These species will be used to analyze the effects to aquatic fish habitats, including habitat of other native species associated with similar habitats. No native fish species exist within the project area.

Issues and Measures – Aquatics

No treatments are proposed in the Riparian Reserve to help protect riparian structure, terrestrial and aquatic habitat, and connectivity corridors in the watershed. Fuel levels are high in most of these areas due to fire suppression and/or disease. Actions proposed outside the Riparian Reserves are primarily hand thinning, mowing, piling burning, and underburning.

The following paragraph discusses potential detrimental effects from the proposed activities, however these effects are not expected from the Melvin Butte Vegetation Management Project: Hand thinning and underburning could affect the aquatic resource if shade producing trees or trees located near channels were felled or killed. Harming these trees could affect stream temperature or channel morphology. Mowing, pile burning, and underburning could cause some detrimental soil impact, and depending on the location, this could lead to sedimentation entering a waterbody. Pile burning and underburning could alter soil properties by reducing soil nutrients necessary for reestablishing vegetation where soil burn severity is high. Hydrophobicity from burning is not a concern because soils in the project area generally do not develop a hydrophobic layer from low intensity fire and generally become more porous after a burn.

Measures used to assess changes to fish populations and their habitats will assess changes to measures 1-7 (Table 32) and the magnitude, amount, duration and timing of these effects.

Table 32 Meaures used for evaluating the effects of these treatments on the aquatic resources.

Measure Number	Parameters	Measures
1	Streamflow	Acres compacted in Riparian Reserve
2	Sedimentation	Acres of soil detrimentally impacted in Riparian Reserve
3	Stream Temperature	Number of trees felled in the primary shade zone
4	Waterbody Condition	Alteration of stream/lake and bed stability measured by changes in streamflow, sedimentation, riparian vegetation, and large wood recruitment
5	Wetland Condition	Acres compacted within the wetland; Acres of riparian vegetation converted to other species or no vegetation
6	Riparian vegetation	Trees killed along streambanks
7	Large wood recruitment	Acres of tree > 12"dbh harvested within primary wood recruitment area (100 ft. of a stream)
8	Fish populations	Distance to fish populations from project activities and hydrologic connections from those areas.
9	Fish habitat	Changes to instream habitat or riparian habitat that is in close enough in

		proximity to influence instream habitat. Parameters 1-7 would be used to determine these changes

Threatened Endangered and Sensitive Species

Alternative 1 –Ecological Trends -

Redband trout a USFS Region 6 Sensitive Species inhabit Snow Creek and Whychus Creek approximately 2 miles outside the project area and there is no surface water connection from the project area to Whychus Creek. Three Creek in the project area contains hatchery rainbow trout or non-native brook trout and was once fishless. Steelhead have been reintroduced in Whychus Creek outside of the project area and access is currently restricted by natural and manmade barriers but this may change in the future. Bull trout have been found over 25 miles away from the project near where Alder Springs enters Whychus Creek. Under the No Action Alternative there would be no direct impacts from vegetation or fuel treatments on redband trout, bull trout, bull trout critical habitat, steelhead or other fish species, though there could be a high risk of direct and indirect impacts should a severe wildfire occur.

The no action alternative would not cause any short-term impacts, however some areas could 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 with excessive amounts of brush, unthinned stands of timber and stands of dead 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). The effects of high severity wildfires on runoff and erosion are generally much more severe than the effects of prescribed fires (Robichaud et al. 2010). 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 should a large wildfire occur.

No action would maintain the habitat conditions that currently exist for fish and other aquatic species. The habitat of the Snow Creek and Whychus Creek would continue to provide good growing conditions for redband trout and future steelhead populations. Instream habitat would continue to develop in complexity from dense stands of ponderosa pine, Engelmann spruce, mountain hemlock, lodgepole pine and white fir. Certain roads in riparian area would continue to deliver low levels of fine sediment after heavy rains or rain on snow events. Amounts of sediment entering streams in runoff is predicted to be low because of the low density of ephemeral and intermittent channel that carry runoff all the way to fish bearing streams, primarily due to the high soil permeability and high infiltration rates.

The risk to long term shade, instream wood, streambank stability, and fine sediment loading increases with the increased risk of intense large scale wildfire. Without fuel treatments, the risk of stand replacement wildfire increases. The lack of upland treatments leaves the riparian areas at greater risk. Any increases in fine sediment from tributaries within a large intense wildfire may be stored in the bed of lower gradient or spring-fed reaches and may recover more slowly than higher gradient or snowmelt driven reaches with flashy flow regimes.

There are no 303(d) listed streams within the project area or in close enough proximity that they could be influenced by no action in the project area. As previously mentioned, the no action Alternative would not reduce the risk of catastrophic wildfire in large areas with excessive amounts of brush, unthinned stands of timber and stands of dead 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 possibly decreased dissolved oxygen levels in streams. Without active restoration of upland forests and riparian reserves the risk of a large high intensity wildfire would continue to exist along streams in the project area. There would be no direct impacts to water temperatures or 303 (d) streams under Alternative 1.

The Whychus Creek Wild and Scenic area is located adjacent to the project area on Snow Creek and Whychus Creek. Fisheries and hydrology are both Outstandingly Remarkable Values (ORVs) for the Wild and Scenic Area. There would be no direct effect on the ORVs of the Whychus Creek Wild and Scenic Corridor under the No Action Alternative. Fisheries and fish habitat would be protected through current management of the corridor that protects large wood and riparian streambank conditions.

Alternatives 2 and 3 - Direct and Indirect Effects

All action alternatives will be analyzed for effects in one analysis because no treatments are proposed in Riparian Reserves (RRs). Treatments such as mistletoe treatments, thinning with group openings and temporary roads are eliminated in Alternatives 3, All analysis of upland treatments will tier to alternative 2 Alternative 2 has slightly more treatment acres (See Proposed Action for description of alternatives).

Bull trout, Bull Trout Critical habitat, redband trout and steelhead in the Whychus Creek Watershed will not be affected by the project because the majority of the project drains to Three Creek which is closed system and only has non-native fish. There is only a small portion of the project within the Whychus Watershed and there is no surface flow connection to Whychus Creek which is over two miles away. Impacts or effects to native fish species would not occur.

Forest management practices can potentially affect salmonid habitat. The following is a review of the potential effects from these types of management practices and how they are applicable to this project: Large woody debris in streams is a fundamental building block for creating and maintaining trout and salmon habitat in forested areas. Physical processes associated with debris in streams includes the formation of pools (important to both juvenile and adult salmonids) and other important rearing areas, control of sediment and organic matter storage, and modification of water quality. Biological properties of debris-created structures can include blockages to fish migration, protection from predators and high streamflow, and maintenance of organic matter processing sites within the benthic community (Bisson et al. 1987). Changes in the distribution and abundance of large woody debris in streams have resulted from timber harvest (Hicks et al. 1991). Timber harvest has reduced the amount and size of large woody debris compared to that in unharvested areas (Ralph *et al.* 1994). In the Melvin Butte Vegetation Management Project no large trees will be removed that could reach the stream and no instream wood will be removed and no effects are expected to current or future instream wood amounts.

The relative magnitude of forest practices on sediment delivery depends on factors such as soil type, topography, climate, vegetation, the aerial extent of the disturbance, the proximity of forestry activities to the stream channel, and the integrity of the riparian zone (Spence *et al.* 1996). Poor road location, construction, and maintenance, as well as inadequate culverts result in forest roads contributing more sediment to nearby streams than any other forest activities. Site disturbance and road construction can increase sediment delivered to streams through road stream interactions and surface erosion (Spence *et al.* 1996). This can elevate the level of fine sediments in spawning gravels and fill substrate interstices that provide habitat for aquatic invertebrates. Salmonid egg survival in both finer and coarser sediment types was found to be inversely related to the percentage of sediments within the incubation gravel with smaller sediments (<0.84mm) being the most detrimental to incubating eggs (Rieser and White 1988). Increases in fine sediments as a result of roads used for the Melvin Butte Vegetation Management Project is not expected as no new roads will be constructed in the RRs, haul will only occur during the dry season, Intermittent stream crossing will only be used when dry and no temporary roads will be used in the RRs.

The removal of riparian canopy reduces shading and increases the amount of solar radiation reaching the streams. The result is higher maximum stream temperatures and increased daily stream temperature fluctuations (Beschta et al. 1987). Even small increases in temperature (1-2 ºC) can result in shifts in the timing of life history events such as spawning and incubation. The cumulative effects of stream temperature changes downstream of logged areas are not well documented. Increases in stream temperature are not expected as a result of the Melvin Butte Vegetation Management Project as no cut buffers will be used to protect waterbodies, all larger shade producing trees will be maintained in Riparian Reserves. Prescribed fires are not planned in the Riparian Reserve and they will be of low intensity which will not lead to significant mortality in the canopy.

Biological Effects Assessment

Redband Trout - USFS Region 6 Sensitive Species

Existing Condition

Three Creek is the main perennial stream within the project area and it is a closed system that was historically fishless. Today Three Creek contains naturally reproducing brook trout and stocked rainbow trout that find their way out of Three Creek Lake.

Outside the project area redband trout are found in Snow Creek up to River Mile 1.6 where a barrier falls exists. Steelhead or chinook were not historically documented in Snow Creek but it is potential habitat. Steelhead and chinook fry have been in released in Whychus Creek.

Alternative 1– Ecological Trends

There are no expected changes to a redband trout or their habitat from current conditions and they are not expected to be present except in perennial spring creek habitats. No in-stream work will be done and no individuals will be disturbed or harmed. No effects to water quality and streamflow flow would occur and habitats would remain unchanged for this species. Redband trout do not exist in the project area and the area waterbodies in the project area were historically fishless.

Alternatives 2 and 3 - Direct and Indirect Effects

No direct effect will occur because no in-channel work or work in Riparian Reserves will occur in areas known to contain redband trout or potential steelhead habitat. There is the potential for steelhead and chinook to someday utilize Whychus Creek and lower Snow Creek. There is also currently a natural fish barrier below the project on Whychus Creek at river mile 27.4 formed by a debris jam that has trapped bedload behind it and created a 12 ft. high waterfall (Photos on file 2011 Sisters R.D.). However this barrier has not always existed and could be washed out during a large flood event, which frequently occur on Whychus Creek.

Effects to instream flow or overland flows that could increase fine sediments are not expected because compaction and soil disturbances will not occur in Riparian Reserves. Overland flow from upland treatments which mostly consist of understory thinning is not expected as a majority of the forest canopy and down wood will remain.

Litschert and MacDonald (2009) found that timber harvest alone rarely initiated large amounts of runoff and surface erosion, particularly when newer harvest practices were utilized. Sediment delivery from timber harvest will be further reduced by locating skid trails away from streams, maintaining high surface roughness downslope of water bars, and promptly decommissioning skid trails following harvest. The Melvin Butte Vegetation Management Project will utilize newer harvest practices, locate skid trails away from streams, maintain surface roughness downslope of waterbars and decommission skid trails following

harvest. Roads within the project area used for harvest and haul activities are not expected to add measurable amounts of fine sediments to fish bearing streams by adhering to the following PDCs and mitigations: Vegetated buffers will be in place between roads and streams in most areas, no new temporary roads will be constructed in Riparian Reserves, stream fords on roads will not be crossed when water is flowing, log haul will occur during dry or frozen periods, landings will not be allowed in RRs, except in some already compacted areas near Three Creek, temporary roads will be obliterated and subsoiled (if needed) following harvest and drainage features and road maintenance will occur previous to use and when roads are obliterated following the project.

Buffers on all perennial intermittent and ephemeral streams in areas where ground disturbing activities take place will greatly reduce or eliminate fine sediment delivery to streams following falling, skidding and yarding activities. An assessment of surface erosion and sediment routing in Washington State by Rashin et al. (2006) done during the first two years following harvest indicated that a 10 m (33 ft.) setback for ground disturbance can be expected to prevent sediment delivery to streams from about 95 percent of harvest-related erosion features. A six year study by De Groot et al. (2007) in B.C. found that after carefully logging 27 % of the headwaters in a watershed no changes in fish numbers, fish condition or instream habitat were observed. In this study all riparian canopy trees were removed while leaving shrubs, keeping equipment 5 m (16 ft.) away from streams and falling trees away from streams. Habitat variables sampled by De Groot et al. (2007) in four streams following removal of the forest canopy included pool depth, fine sediment, channel exposure, undercut banks and bankfull width.

Mowing would not occur in the Riparian Reserves and effects from mowing in the uplands would be minimal because the equipment would be low impact and the ground would be mostly buffered because the equipment would drive over the brush (Sussmann 1995). Mowing would be restricted to areas outside the Riparian Reserve.

Burning will maintain current streamflow amounts and patterns as burns would be of primarily low intensity and would occur outside the Riparian Reserves(see Fuels report).

Robichaud (2000) found that initial infiltration rates in the areas burned at low severity fell within the upper end of the range from the areas left unburned and undisturbed. Several studies have documented the absence of any change in water yield when low severity burns are conducted that consume little of the duff and kill only a small portion of the live trees (Gottfried and DeBano 1990, Douglass and Van Lear 1983, Heard 2005). Experimental studies that looked at prescribed fire influences on riparian vegetation found no changes in composition of species in plots that were burned when compared to unburned plots (Bêche et al. 2005, Elliott et al. 1999). Another study that sampled a prescribed burn area found no detectable changes in periphyton, macroinvertebrates, amphibians, fish, and riparian and stream habitats compared to data collected over the same time period in four unburned reference streams (Arkle and Pilliod 2010). Prescribed fires at low intensity often do not have the same detrimental effects as wildfires. In Washington dry mixed conifer stands that were thinned and then prescribed burned had 73 % large tree survival following a wildfire compared to stands that were not treated which only had 29 % large tree survival (Pritchard et al. 2010).

Shade and instream wood will remain intact as larger trees and snags will be maintained with only the smaller trees (<12”) thinned in plantations and other limited areas in the Riparian Reserves. The large tree shade and instream wood providing component along all perennial streams will remain intact by retaining buffers along all streams. Groom et al. (2011) found that Oregon state forest practices maintained existing stream temperatures with a 52 m (171ft) buffer for clearcuts, which allowed limited harvest (thinning) within 30 m (98 ft.) and a no cut zone within 8 m (26 ft.) of fish bearing streams. These buffer distances are less than what the NWFP requires and what will be used along the majority of stream miles in the Melvin Butte Vegetation Management Project area.

In prescribed burn areas buffers will be used to protect waterbodies and fires will be of low enough intensity that mortality of larger trees is not expected. No instream wood will be removed from streams and downed wood and riparian vegetation will be actively protected from being consumed during prescribed burns. No detrimental direct effects are expected as a result of the Melvin Butte Vegetation Management Project mainly because no treatment will occur in or near native fish bearing streams and protective buffers and mitigation measures will be used to eliminate detrimental effects to waterbodies and wetlands in the project area.

There will be no indirect effects to redband trout or potential steelhead habitat in Whychus Creek or Snow Creek. The project will not change stream temperature, instream wood, or sediment delivered to these streams. Since no measurable change in stream shade, sediment or instream wood will result from the project, there are no direct effects to redband trout steelhead or potential steelhead habitat. One study that sampled a prescribed burn area found no detectable changes in periphyton, macroinvertebrates, amphibians, fish, and riparian and stream habitats compared to data collected over the same time period in four unburned reference streams (Arkle and Pilliod 2010). Beche et al. (2005) found no prescribed fire effects on instream wood and V* (residual volume of a pool comprised of fine sediment), but did observe short-term effects on the concentrations of four ions and periphyton biomass. Beche et al. (2005) also observed an immediate (10–19 day) effect on macroinvertebrate community composition, but no effects on benthic macroinvertebrates thereafter. These effects would not be long lasting enough to affect fish food supply and most likely not have any impact on macroinvertebrates.

There will be no change to current composition and amounts of algae or macroinvertebrates in streams or waterbodies from this project. No detrimental indirect effects that could result in effects to native fish are expected as a result of the Melvin Butte Vegetation Management Project mainly because no treatment will occur in or near native fish bearing streams and protective buffers and mitigation measures will be used to eliminate effects in all Riparian Reserves.

Cumulative Effects

The cumulative effects analysis area includes all subwatersheds that streams in the project area drain into and the subwatersheds of tributaries that connect to these drainages via surface flow. The Melvin Butte Vegetation Management Project analysis area includes the subwatersheds associated with Whychus Creek but does not include subwatersheds associated with Trout Creek or Indian Ford Creek, both of which are tributaries to Whychus Creek. These subwatersheds were excluded because they only have a very ephemeral connection to Whychus Creek and are approximately 9 miles downstream of the project area. The Melvin Butte Vegetation Management Project analysis area also includes subwatersheds associated with the Three Creeks drainage. Other subwatersheds in the Deep Creek watershed are excluded because there is very little surface flow and these channels do not connect to any streams that drain out of the project area. The Melvin Butte fisheries analysis area includes portions of the following subwatersheds: Upper Whychus Creek, Middle Whychus Creek, Three Creek, Deep Canyon subwatersheds (See Hydrology Report for subwatershed acres).

No cumulative effects are expected that would detrimentally affect redband trout, potential steelhead habitat or EFH because no direct or indirect effects are resulting from the project. Past management actions in the project area and watershed may have had detrimental effects and many of those have recovered due to natural and planted revegetation growth over time. Some already existing roads or trails may contribute some sediment to streams but this amount is estimated to be very low. No major culvert or road issues were noted as contributing fine sediments to streams during the field reconnaissance for the Melvin Butte Vegetation Management Project which covered the majority of know areas with road and stream interactions. The project will not cumulatively add to increases in flow, sediment or stream temperature or subtract from current and future instream wood at levels that would have adverse effects on fish habitat.

Determination

There will be **No Impact (NI)** to redband trout populations. The project will meet NWFP Standards and Guidelines, and/or all Project Design Criteria and minimization measures found in this document and the Melvin Butte Vegetation Management Project EA.

Effects Assessment - Bull Trout and Bull Trout Critical Habitat

USFWS Threatened Species

Existing Condition

The nearest documented bull trout populations and critical habitat are located in Whychus Creek over 27 miles away from the project. There is no surface flow connection between the subwatersheds in the project area to lower Whychus Creek where bull trout exist. Bull trout in Whychus Creek are part of the Metolius River/ Lake Billy Chinook Population. This population is considered on the healthiest in the state and in 2012 had a spawning population estimated at 1,251 adults (ODFW 2012).

Alternative 1 - Ecological Trends

There are no expected changes to bull trout or critical habitat from current conditions and they are not expected to be present in or near the project area. No in-stream work will be done and no individuals will be disturbed or harmed. No effects to water quality and streamflow would occur and habitats would remain unchanged for this species where they do exist.

Alternatives 2 and 3 - Direct and Indirect Effects

No direct effects to bull trout or critical habitat will occur as no in-channel work or work in Riparian Reserves will occur in areas known to contain bull trout. There will be no direct effects to bull trout from the project because there is no surface connection from stream in the project to those with bull trout and the nearest known bull trout population is over 27 miles away. Effects from the project itself on Riparian Reserves and streams within the project area are expected to be insignificant. Therefore there will be no detrimental effects that could carry downstream to where bull trout and critical habitat are located.

Indirect effects will not occur to bull trout as they are currently found only in the lower reaches of Whychus Creek, over 27 miles away from where work is expected to occur. Since no measurable or detectable changes in streamflow, shade, sediment or instream wood will result from the project. No impacts to algae or aquatic insect populations are expected to occur where bull trout reside or critical habitat is located. There are no anticipated indirect effects to bull trout or critical habitat.

Cumulative Effects

The cumulative effects analysis area includes all subwatersheds that streams in the project area drain into and the subwatersheds of tributaries that connect to these drainages via surface flow. The Melvin Butte Vegetation Management Project analysis area includes the subwatersheds associated with Whychus Creek but does not include subwatersheds associated with Trout Creek or Indian Ford Creek, both of which are tributaries to Whychus Creek. These subwatersheds were excluded because they only have a very ephemeral connection to Whychus Creek and are approximately 9 miles downstream of the project area. The Melvin Butte Vegetation Management Project analysis area also includes subwatersheds associated with the Three Creeks drainage. Other subwatersheds in the Deep Creek watershed are excluded because there is very little surface flow and these channels do not connect to any streams that drain out of the project area. The Melvin Butte fisheries analysis area includes portions of the following subwatersheds: Upper Whychus Creek, Middle Whychus Creek, Three Creek, Deep Canyon subwatersheds (See Hydrology Report for subwatershed acres).

No cumulative effects are expected to occur to bull trout or critical habitat because no direct or indirect effects will occur as a result of the Melvin Butte Vegetation Management Project. This is mainly due to the far proximity of bull trout and critical habitat which is located over 27 miles from the project.

Determination

There will be **No Effect (NE)** to bull trout critical habitat or bull trout populations. The project will meet NWFP Standards and Guidelines, and/or all Project Design Criteria and minimization measures found in this document and the Melvin Butte Vegetation Management Project EA.

Aquatic Conservation Strategy

An essential piece of the Northwest Forest Plan is the ACS (Aquatic Conservation Strategy) which "was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands" (USDA Forest Service and USDI Bureau of Land Management 1994, B-9). Management activities proposed for watersheds must meet the nine ACS objectives as specified in the Northwest Forest Plan (pages C31-C38). Actions that could affect the ACS objectives are: vegetation treatments, haul on roads in hydrologically connected areas, and road closures and decommissioning in hydrologically connected areas. For each alternative no vegetation treatments are proposed in Riparian Reserves, so the ACS objective discussion will not address each alternative separately. Each ACS objective and how the project would maintain these objectives is discussed below (USDA Forest Service and USDI Bureau of Land Management 1994):

ACS 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.

The Melvin Butte Project would not alter watershed or landscape scale features that could affect aquatic resources in the Deep Canyon Watershed. Proposed silvicultural treatments are located in areas outside of Riparian Reserves that would not cause landslides, increased overland flow and associated hillslope erosion, or changes to channel morphology (see Hydrology Report). No new roads or temporary roads would be constructed that could alter watershed and landscape-scale features. Haul would occur on existing roads and Project Design Criteria would be implemented on haul roads in Riparian Reserves to reduce sedimentation effects. Under the Action Alternatives, 7.71 miles of road would be decommissioned and 5.85 miles would be closed under the Action Alternatives. Of these 12.6 miles, 0.1 miles are located in the outer extent of the Riparian Reserve and 6.3 miles parallel or cross hydrologically connected ephemeral channels. Closure and decommissioning of hydrologically connected roads would help restore the distribution, diversity, and complexity of watershed-scale ephemeral draws by allowing them to revegetation and accumulate downed wood. The Whychus Watershed analysis identified road closures and decommissioning as needed actions to help restore the watershed.

Fire behavior modeling indicates that upland treatments would reduce the threat of a wildfire that could cause stand mortality in the Project. Reducing the threat of wildfire and associated fire suppression effects would help maintain landscape-scale features. Hand thinning plantations would help restore this objective by increasing large trees over time. Thinning small trees, mowing, and burning would reduce vegetation competition and the risk of stand replacement wildfire. Large trees are an important ecosystem component that provide both terrestrial and instream wood habitat for riparian species. There has been a loss of the historic large trees in Melvin Butte Project area. Restoring large trees and associated habitats would help restore the distribution, diversity, and complexity of vegetation across the watershed. The Action Alternatives would maintain or slightly restore the distribution, diversity, and complexity of watershed and landscape-scale features.

ACS 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.

The Melvin Butte Project would maintain spatial and temporal connectivity within the Deep Canyon Watershed and between adjacent watersheds. Proposed silvicultural treatments are located in areas outside of Riparian Reserves and are not at a magnitude that would cause channel morphological effects or changes to the Riparian Reserve (see Hydrology Report). Fire behavior modeling indicates that upland treatments would reduce the threat of a wildfire that could cause stand mortality in the Project area. Reducing the threat of wildfire and associated fire suppression effects would help maintain vegetation in Riparian Reserves and other drainage network connections. Thinning small trees, mowing, and burning would reduce the threat of stand mortality from a wildfire. Stand mortality could affect cover in travel corridors for terrestrial and aquatic species. In addition it could reduce long-term large wood recruitment which is important for providing refugia in stream corridors. Therefore, vegetation treatments would maintain spatial and temporal connectivity within and between watersheds.

Hauling on existing road surfaces and using PDCs for haul in the Riparian Reserves would maintain spatial and temporal connectivity between watersheds. No temporary roads would be located in the Riparian Reserve and no new roads would be constructed because existing system roads would be used. By using existing roads in the Riparian Reserve of the project area and not crossing any live channels, there would be no effect to stream network connections from hauling.

Closure and decommissioning of hydrologically connected roads (0.1 miles of which are within the outer extent of the Three Creek Riparian Reserve) would help restore spatial connectivity within drainage networks by restricting use and allowing them to revegetation and accumulate downed wood. Connectivity would be restored for riparian-dependent species and aquatic species that use this riparian reserve or intermittent channel because the road in the Riparian Reserve, which may be an obstruction for some species, would be removed. The Whychus Watershed analysis identified road closures and decommissioning as needed actions to help restore the watershed. The Action Alternatives would maintain or slightly restore the spatial and temporal connectivity within the Deep Canyon Watershed and between adjacent watersheds.

ACS Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The physical integrity of the aquatic system would be restored and/or maintained by the Action Alternatives under the Melvin Butte Project. The physical integrity of channels would be maintained by the proposed activities because no management activities would occur within 300 ft. of perennial streams, 150 ft. of intermittent streams, or within or along the banks of ephemeral channels to protect the tree root influence area. Large wood recruitment, which helps maintain the integrity of aquatic systems, would be maintained because no treatments would occur within the potential large wood recruitment area. Because there are no debris slide or landslide prone areas outside of Riparian Reserves within the Project area, the primary wood recruitment areas in the Melvin Butte project area are approximately 100 ft. on each side of a channel (Benda et al. 2002). Haul on system roads in the Riparian Reserve would not affect streamflow, sedimentation, riparian vegetation, or large wood recruitment, all parameters that can affect channel condition (see Hydrology Report). This is because all haul would be on existing roads and Project Design Criteria would be implemented on haul roads in hydrologically connected areas. Closure and decommissioning of hydrologically connected roads (0.1 miles of which are within the outer extent of the Three Creek Riparian Reserve) would help restore the physical integrity of the aquatic system removing roads in ephemeral draws and allowing them to revegetation and accumulate downed wood.

ACS 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.

The two primary measures of water quality effects from the Melvin Butte Project are increases in fine sediment (or turbidty) and a reduction of shade to waterbodies within the project area. The reduction of shade is related to potential increases in water temperature while increased erosion and sedimentation are likely to affect turbidity and total dissolved solids. The transport of nutrients to the streams as a result of sediment delivery can also affect water quality. Nutrients in streams can also change following a fire for a period of time.

Three Creek is currently not on the Oregon 303(d) for water quality exceedences above the State standards and the Action Alternatives would not affect it's status. Neither water temperature or sedimentation would be affected by the Action Alternatives because ground-disturbing and shade disturbing activities would not occur near streams. No harvest activities would occur within Riparian Reserves; therefore, no shade producing vegetation would be removed.

Sedimentation effects are not predicted because ground-disturbing treatments are outside of vegetated riparian buffers that serve to filter any hillslope erosion before entering water ways. Reintroducing fire back into portions of the project area would help maintian this fire adapted ecosystem (See fuels report). The prescribed burn would help reduce fuel loading and reduce risk of future large-scale wildfires. Sedimentation effects from prescribed fire is not expected because consumption of ground fuels with fire would be patchy and of low intensity in most areas. Likewise, hydrophobic soils would not be expected as a result of the low intensity underburn. In addition, no firelines would be constructed within the Riparian Reserve which would limit soil distrubance. Some sedimentation and nutrients are not expected to reach the stream through runoff due to filtering by vegetation and downed woody debris in the Ripaian Reserve..

Activities such as road use and ground disturbance from timber harvest has been assesed for the potential to increase sedimentation and turbidity. The assesment found management activities as a result of the Melvin Butte Project would be indistinguishable from background levels (see Hydrology report). The topography has minimal drainage features and high infiltration rates which minimizes potential overland flows capable of detaching sediment and carrying it directly into stream channels. Also, project design criteria such as preventative road maintenance and restricting haul times on haul roads in hydrologically connected areas, no new road construction, and locating landings outside of Riparian Reserves help prevent sedimentation to streams. In addition, over the long-term, proposed road decommissioning would help restore water quality by reducing sediment input to the stream from roads in the Riparian Reserve and uplands.

Detrimimental effects to riparian, aquatic, and wetland ecosystems are not expected to occur as a result of this project. Water quality would remain within the range that maintains the biological, physical, and chemical integrity of the Deep Canyon Watershed. The reproduction and migration of individuals composing aquatic and riparian communities would not be detrimentally effected by this project.

ACS 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.

The proposed actions would maintain the sediment regime and may help restore it. Sedimentation in streams is not expected from harvest, mowing, burning, because these activities would not occur in Riparian Reserves and project BMPs and PDC will be followed. Very little erosion is expected from haul

or road decommissioning and closure in the Riparian Reserve because road PDCs would be implemented and riparian buffers would allow sediment generated to be trapped in the vegetated area before reaching the stream. Underburning would occur outside Riparian Reserves and no fireline would be constructed in Riparian Reserves. Haul would occur on existing road surfaces and in areas adjacent to the stream and would be restricted to the dry season. In addition, haul across intermittent stream fords would be restricted to periods when the stream is dry.

Closure and decommissioning of hydrologically connected roads (0.1 miles of which are within the outer extent of the Three Creek Riparian Reserve) would help restore the sediment regime by reducing overland flow and fine sediment that is transported from the road to the streams by decompacting the road surface, restoring drainage, and/or adding roughness to the road bed.

ACS 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.

The Action Alternatives would not negatively affect streamflow because no treatments would occur in Riparian Reserves or hydrologically connected ephemeral channels. Harvest of trees outside the Riparian Reserve would not likely have an effect on streamflow because overland flow in the project area does not generally occur from a reduction in evapotranspiration when trees are harvested because infiltration and permeability rates often exceed precipitation rates. In addition, the majority of vegetation treatments are understory removal in over-stocked stands; therefore, thinning would help move the stand toward more historic conditions

Underburning would not affect streamflow because no new fire line would be constructed within Riparian Reserves, ignition would not be planned in Riparian Reserves and burn severity would not be at a level to cause hydrophobic soils (soils which repel water). In addition, mortality of brush and small trees from the underburn would not alter streamflows because geology and soils are the primary influence of overland flow in the project area and not evapotranspiration.

Potentially the Action Alternatives could help restore the timing, magnitude, duration and spatial distribution of peak or high flows by reducing the acres threatened under the Fire Model in the Riparian Reserve. Closing and decommissioning of roads in hydrologically connected areas such as 0.1 miles in Riparian Reserves and roads that parallel or cross ephemeral channels would reduce overland flow effects caused by compaction and lack of downed wood or vegetation. Fracturing the road surface, installing water bars, and allowing the road to revegetate and maintain down wood would reduce overland flow contribution to stream channels during high flow periods.

ACS Objective 7: Maintain and restore timing, variability, and duration of flood plain inundation and water table elevation in meadows and wetlands.

The action alternatives would maintain variability and duration of floodplain inundation and may help restore timing of floodplain inundation. The project would maintain the floodplain inundation regime because it would not negatively affect streamflow. Compaction and/or hydrophobicity would not be significant and it would not occur in areas likely to flow to any streams (see Hydrology report). Underburning would not affect streamflow because no new fire line would be constructed within Riparian Reserves, ignition would not occur in Riparian Reserves and burn severity would not be at a level to cause hydrophobic soils (soils which repel water). In addition, mortality of brush and small trees from underburns would not alter streamflows because geology and soils are the primary influence of overland flow in the project area and not evapotranspiration (see Hydrology report).

A potential benefit to streamflow from the action alternatives include a reduction of acres threatened by wildfire in the Riparian Reserve. Large-scale wildfire in Riparian Reserves can lead to increases in erosive peak flows which could cause channel incision and a reduction of floodplain inundation. Vegetation treatments would reduce the possible severity of a wildfire. Therefore, after vegetation treatments, the threat of a wildfire that could cause stand mortality in the Riparian Reserves would be reduced and may not lead to streamflow changes if a wildfire were to occur.

Road decommissioning and closure would maintain this objective and possibly help restore the variability of floodplain inundation. Decommissioning and closure of roads in Riparian Reserve or hydrologically connected areas would not affect the timing or duration of floodplain inundation or wetland and meadow water tables because the flow regime would not significantly change. However, decompacting the road surface by subsoiling or natural revegetation of the road surface would help prevent floodwaters from being concentrated on the floodplain and causing erosion; thus, helping restore floodplain variability.

ACS 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.

The action alternatives would not result in any significant detrimental changes to riparian habitats as buffers are being maintained on all stream channels. There are no planned project activities in Riparian Reserves.

Instream wood recruitment from lodgepole and white fir has been increasing in areas of high tree mortality. Areas dominated by Ponderosa Pine and other species have had normal rates of tree mortality with low amounts of mortalitly in plantations and second growth. Instream wood levels or future recruitment would not be detrimentally effected by the project as no large trees or snags will be harvested that could reach streams and no wood will be removed from streams.

None of the action alternatives are expected to negatively affect base flow conditions, nor would affect instream flows to an extent that would inhibit riparian, aquatic and wetland habitats. The timing, magnitude, duration, and spatial distribution of flows contributed by storm events and associated overland runoff from areas within the project area would not be affected by active management associated with this project.

The action alternatives would contribute to the restoration of Objective 8 at the project and watershed scale by restoring the composition and structural diversity of riparian vegetation by reducing fuels in the uplands and associated fire threat and decommissioning and closing hydrologically connected roads. Vegetation treatments would promote the maintenance and development of late-successional forest characteristics in second growth stands and old growth stands and road treatments would provide more area for vegetation to grow.

The action alternatives require no cut buffers along all riparian corridors and wetlands that are perennial or intermittent. These buffers encompass diverse plant communities, protect current shading levels for thermal regulation, protect stream banks from operational disturbances and ensure that soil disturbance does not get routed to waterbodies or wetlands. Designated no cut buffers along units in the planning area, would also protect channel migration processes. The proposed road decommissioning would initiate restoration in the uplands and to lesser extent in riparian corridors. The proposed thinning treatments are designed to accelerate the development of late-successional characteristics and to provide heterogeneity in the landscape by the retention of larger and healthier trees in a gappy, patchy, clumpy manner. The prescription provides retention of larger diameter trees such as ponderosa pine and mountain hemlock.

ACS Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

The action alternatives have been designed to restore and enhance habitat conditions for species associated with late and old structure forests. The modeling of fire behavior has been used to show how silvicultural and fuels activities would reduce the potential risk of large scale loss of forest vegetation.

This project contributes to maintaining this ACS objective through restoring habitat for riparian-dependent species by not treating areas within Riparian Reserves. Closing and decommissioning some existing roads in riparian areas and uplands will help to achieve this also. The closure of these roads would create areas free of motorized disturbance to wildlife species as they travel within the riparian corridor. The road decommissioning would not prevent the attainment of this objective and may in the long-term help restore habitat to support native species by removing vehicle use and associated disturbance within the Riparian Reserve. Native amphibians and aquatic invertebrates associated with the stream would benefit from restored natural runoff and sediment inputs.

There is no timber harvest proposed within the riparian zones in any of the action alternatives that would eliminate or retard the development of habitat to support well distributed populations of any native, invertebrate or vertebrate riparian dependent species. Requiring no-cut buffers along all waterbodies, restricting haul to existing road surfaces, and not allowing temporary roads in Riparian Reserves would protect riparian areas from disturbance and help maintain the existing riparian conditions. The no-cut buffers along riparian areas would help maintain the existing microclimates which are especially important for species that are extremely sensitive to changes in temperature and humidity, such as amphibians and certain types of vegetation, as well as for those animals that use the riparian areas as travel corridors. These riparian areas contribute to the landscape heterogeneity of both untreated and treated stands. The retention of riparian plant species and live and dead trees provides for different stocking levels and species composition. This variety of stand conditions would create a diverse range of habitats that would continue to support a variety of species within the riparian areas and across the landscape.

The proposed action provides for the development of habitat conditions within the riparian areas and across the landscape to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species at the project and watershed scales. This is primarily due to the fact that no project activities except for a small amount of road decommissioning will occur in Riparian Reserves.

Statement of Consistency with ACS Objectives

Overall, the action alternatives would help restore riparian vegetation and aquatic conditions within the Deep Canyon fifth field watershed by promoting the development of late-successional forest characteristics in second growth and old growth stands outside of Riparian Reserves and by decommissioning and closing roads in Riparian Reserves and uplands. Fire would be reintroduced to areas that were historically maintained by fire. Because terrestrial vegetation and aquatic components and processes are so tightly inter-connected, meeting the desired future condition for these land allocations would also contribute to abundant, well dispersed, high quality habitat for riparian-dependent species.

The action alternatives would also help restore the natural sediment regime by decommissioning roads in Riparian Reserves and uplands which would restore the natural drainage pattern. Designating no-cut buffers along all waterbodies restricting haul to existing road surfaces; and implementing Best Management Practices and PDCs would protect riparian areas and maintain the existing vegetation, connectivity, water flow, water quality, and habitat within the Deep Canyon Watershed.

The action alternatives would include some activities that could result in minimal short term increases in sediment production at individual sites. For example, haul on existing roads in Riparian Reserves has the potential to create short term (a couple of hours to a couple of days) sediment movement in small amounts that would mostly be filtered out by Riparian Reserve buffers before reaching stream channels. However, any negative water quality impacts that could occur from the Melvin Butte Project are anticipated to be small, short-term, and localized. Any short-term increases in sediment production or turbidity are expected to be well within the range of what would typically occur during high winter flows or as a result of typical storm runoff. At the watershed scale, changes in water quality, turbidity or sediment production would not be detectable.

In summary, the activities described above are consistent with the ACS objectives. The proposed road closures and decommissioning are consistent with the findings of the Whychus Watershed Analysis in that it would maintain stream function and a connectivity corridor for wildlife species. The Melvin Butte Project would maintain watershed and landscape scale features such as natural stream bankfull width and normal floodplain inundation. The proposed project contributes to ACS objectives by helping maintain and/or restore landscape diversity, connectivity, streambank integrity, water quality, the natural sediment regime, floodplain variability, plant communities, and habitat in the Deep Canyon Watershed. The physical integrity of nearby aquatic systems and water quality are likely to be maintained by the proposed activities. Based on the evaluation of the short-term, long-term, and cumulative impacts, the Melvin Butte Vegetation Management Project is designed to "contribute to maintaining or restoring the fifth-field watershed over the long-term." Therefore, the Melvin Butte Project is consistent with ASC objectives.

FOREST VEGETATION

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Forest Vegetation specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

The Melvin Butte Project includes 5,376 acres within the 97,508 acre Deep Canyon watershed. The project elevation ranges 2000 foot from 4240 foot to 6280 foot with elevation highest in the southwest and lowest towards the northeast. Two buttes alter the interior elevation trend of the project area and are Melvin Butte and an unnamed butte. Common to the region, precipitation trends follow elevation gradients with higher elevations receiving higher precipitation (20-40" year Avg. with most of lower elevations receiving this as rain).

This section describes the Purpose and Need, existing forested conditions[7], trends, effects of proposed vegetation treatments and past, present and foreseeable future actions. The project area was stratified into potential treatment and retention areas based on soils information, current dominant vegetation type, density[8], trajectory, presence of abundant mistletoe, past clearcuts (plantations), wildland urban interface (WUI) and visual corridor considerations.

[7] Presented as structural and seral state, fire hazard, density, dwarf mistletoe abundance, species composition, and more.
[8] Tree density measured as the number of tree per acre (TPA), cross sectional tree area (called basal area measured in square feet per acre (BA/acre)) or canopy cover (% vertical cover).

This section also tiers to the larger scale Whychus Watershed Assessment which describes the recent disturbances and conditions present and the need for action on the watershed scale (revised in 2013[9]). The Whychus Watershed Assessment (USDA 2013) was used to shape the desired future conditions and the proposed action for active forest management within the Melvin Butte project area analysis boundary.

This section has four primary purposes:

1. To provide background information necessary to evaluate the goals and objectives of the Purpose and Need for action, and compare the effects of no action and alternatives to the proposed action on forest vegetation.
2. To disclose the existing condition of forest vegetation and fuels and likely trends relating to forest health.
3. To provide supporting evidence/analysis that the proposed action and alternatives are consistent with the Purpose and Need, Forest Plan, Watershed Analysis, laws, regulations, and policy.
4. To address key issues raised during scoping that are pertinent to active forest management.

Summary of Effects

Alternative 1 – Direct and Indirect Effects

There are no treatments under the no action alternative, and therefore no direct or indirect effects.

Forest Ecosystem Restoration

Stand Structures/Species Composition

Structures remain at a high risk for a large proportion of the area to have stand replacement fire. Species composition remains disproportionally askew to fire intolerant species (when compared to HRV) due to interactions of past management (fire suppression/exclusion and past timber practices). Plantations lack spatial heterogeneity and are beginning to show various levels of dwarf mistletoe.

The no action fails in moving structure or species composition within the project area towards the Forest Plan Standards/Guidelines (amended by Northwest Forest Plan), Watershed Analysis goals, or the desired future condition.

Stand Density

Stand densities would remain at high levels and generally increase over the next 30 years under No Action. Large old ponderosa pine would continue to attenuate with replacement challenged by interactions of inter-tree competition, dwarf mistletoe and bark beetles.

Insects and Disease

Current stand densities are at or above the upper limit of the desired range of percent of maximum SDI over 88% of the planning area. As stands remain at these high densities, mortality from insects and disease are expected to increase. Of particular concern, western dwarf mistletoe, in the planning area is expected to increase by expansion into plantations and other areas where levels are moderate to low.

[9] The 1998 Whychus Watershed Assessment was revised twice (2009 and 2013), in part, to account for large scale-changes in the watershed due to fires and insect outbreaks.

Large tree recruitment is expected to be reduced as infection levels rise in and effect height and diameter growth.

Fire Hazard

Summer precipitation and temperature play large roles in determining the effects of a given fire season. Reduced snow packs and warmer summers are expected to lead to longer fire seasons with increased severity and increases in area burned. Increased potential for type conversion and species conversion is expected as well. A two to three fold increase in area burned is projected in the eastern Cascades of Washington by 2080 (Littel et al. 2010). This threat is amplified by the observation that the entire western United States has experienced higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons since the mid-1980's (Westerling et al. 2006).

Current fire hazard analysis (herein and Fuels report) indicate a high fire hazard risk. Fuel accumulations, along the 16rd, private land, and within stands, indicate continuity and/or suppression (ease of control) challenges.

Alternative 2- Direct and Indirect Effects

Effects on Forest Ecosystem Restoration

Stand Structure and Species Composition

Alternative 2 thinning and fuels treatments would move stands towards reference conditions. All treatments would lead to a greater patchwork distribution of size/age classes rather than the current continuous vertical and horizontal distribution of trees. Early seral, fire climax ponderosa pine species composition is improved by the number of acres treated which includes areas where this is the focus strategy (i.e. mixed conifer group openings).

Stand Density

On the project (Melvin Butte landscape) level, SDI moves from 88% max SDI (pre-treatment) to 44% max SDI (after thinning). This proportion change represents movement to between the lower and upper management zones for forest health. While specific areas within the project are still above the UMZ (60% Max SDI) (Table 21,22) and has sustained risk for insects/ disease and fire, other areas near or surrounding these are within the zone predicting these factors to be less likely. Plantation stands have received greatest release and are expected to develop into large trees more rapidly.

Insects and Disease

Variable thinning to lower SDI values and move stands towards reference conditions will have a positive effect on tree resilience against bark beetles and lightly (DMR1-3) infected dwarf mistletoe ponderosa pine. On the project level, dwarf mistletoe abundance is reduced by half and in 30 years levels are approaching the no action as mistletoe spread has impacted regeneration and other under/mid-story trees. However, on the fine-scale (stand level), it is expected that strategic removal, pruning and girdling of point source locations including select large trees will aid in size development of ponderosa pine in fine-scale locations especially plantations and areas at least 100 ft. from mistletoe infected trees.

Fire Hazard

Under the proposed action, the potential for crown fire is greatly reduced across the project as a whole (treated and untreated areas) as thinning, fuels work, underburning raises CBH and decreases CBD. These changes increase the CI and reduce the potential for crown fire in all PAGs. Although, no treatment and

retention areas maintain high CBH, CBH, acres treated show a marked decrease in the likelihood for stand replacement fire. Active crown fire is predicted to occur on 10% of the project area which is primarily allocated to retention strategy and no treatment areas. Alternative 2 greatly reduces the predicted mortality within treated areas, by changing the majority of the potential fire type acres to surface and passive crown.

Alternative 3- Direct and Indirect Effects

Stand Structure and Species Composition

There would be little difference in stand structures between Alt. 3 and Alt. 2 as stands are variably thinned from below lowering stand densities and reducing competition to larger trees. Treatment acres designed to address the effects of past selective logging and fire suppression (species composition implied) in the mixed conifer PAG by improving fire-tolerant localized ponderosa pine growing areas would be dropped. As a result, and in order to maintain stocking, fire intolerant species proportions would be retained. About 30% of the 835acres (250 acres maximum) would be maintained under a fire intolerant dominated trajectory.

Stand Density

On the project (Melvin Butte landscape) level density measures for Alt 3 are similar to Alt 2, SDI moves from 88% max SDI (pre-treatment) to 48% max SDI (after thinning). The 4% increase (from Alt. 2) is a result of treatment acres being dropped and altered. As a result, 321 acres are kept at higher densities with more of a fire intolerant tree composition with 71 acres directly next to private land.

Insects and Disease

Thinning to lower SDI values and moving stands towards reference conditions will have a positive effect on tree resilience against bark beetles and lightly (DMR1-3) infected dwarf mistletoe ponderosa pine.

On the project level direct and indirect effects of dwarf mistletoe among Alt 3 and Alt 2 are similar (table 23, 32). At the project level dwarf mistletoe rating is reduced by about 1/3rd from existing levels and in 30 years those levels return to slightly below the no action for that year (table 23, 32). On the stand-scale overstory influences into plantations and small medium small trees are maintained as large trees continue to provide mistletoe point source locations. Retaining any small trees underneath or adjacent to, highly infected ponderosa pine trees decreases the likelihood for large tree development (Eglitis et al. 2014). Overtime infestations will spread down, out and within infecting more and more of the plantations and adjacent area. Under this alternative managing for young ponderosa pine or replacement near highly infected trees, of any size, is challenged by reduced height/ diameter growth.

Fire Hazard

On the landscape as a whole, crown fire potential is reduced from no action though would be slightly higher than the Proposed Action. This difference from the proposed action is due to the reduction in treatment acres and type within the ponderosa pine and mixed conifer types. Access to about 70-90 acres of restoration units would be avoided with over much of this land directly interfacing with private land (2/3rd mile). As such, potential fire behavior and influences (egress) in these areas would be less predictable as current crowns have both horizontal and vertical fuel connectivity.

Overview of Issues Addressed

Past selective and clear cutting, altered fire regimes, recent fires and insect and disease agents are the major contributors to forest health issues and the need for action within the Melvin Butte project area

(USDA 2013). These elements interact to affect the planning areas ability to be resistant and resilient to disturbances in the short- and long-term (Littel et al. 2010, Stine et al. 2014, DeRose and Long 2014, USDA 2013, Pole Creek Fire 2012).

Fire suppression/ exclusion has interrupted the low to mixed-severity fire regimes, leading to a change in forest structure, species composition, densities, fuel accumulation and increased insect and disease abundance. Past selective logging (circa 1950s and 60s) has removed a large proportion of the large tree ponderosa pine component from both the ponderosa and mixed conifer types. The recent past beetle outbreak (circa 2000s) and 2012 Pole Creek Fire has created abundant standing and down wood along the 16rd affecting visual experiences, off road travel for firewood utilization and potential fire suppression safety/challenges along a WUI escapement corridor. Regeneration cuts have created over a thousand acres in the planning area as small evenaged blocks dominated by pole-sized trees. About 2/3rd of the planning area has various fine- to broad-scale levels and locations of ponderosa pine dwarf mistletoe influencing the ability of these areas to develop large tree structures. As a whole, the project area contains a high density of ladder fuels from small trees and understory shrubs which contributes to stand replacement conditions in the event of a fire (Pole Creek Fire 2012). Species composition is a factor influencing the risk and stability of forests in the planning area.

The aforementioned items have recently (years 2002-2012) interacted (among other factors) on the landscape to influence the outcomes of the numerous fires within the watershed ((USDA 2013) (Table 33).

Table 33 Fires greater than 10 acres in the Whychus Watershed project area since the original watershed analysis of 1998.

Fire Name	Year	Total Size (acres)	Watershed Project Area (acres)
Cache Mountain	2002	4,358	43
Black Crater	2006	9,411	9,396
Lake George	2006	5,537	1,857
GW	2007	7,349	954
Steven Canyon	2008	173	76
Black Butte II	2009	578	559
Rooster Rock	2010	6,119	6,119
Alder Springs	2011	1,449	1,052
Pole Creek	2012	26,119	26,119
Total		61,093	46,175

Most of the plantations that were established after clear cutting beginning in the 1960's and 1980s, are now in need of stand tending to reduce dwarf mistletoe, improve growth and move them towards a stand structure in line with reference conditions.

High abundance of ponderosa pine western dwarf mistletoe threatens key structural components and future large ponderosa pine tree development. Lodgepole stands continue to fall apart creating large amounts of down wood and fuel continuity to adjacent stands. Outside of plantations, interruption of fire regimes has led to the dominance of late seral conditions (increased grand/white fir and/or ingrowth of ponderosa pine) with an increase of dwarf mistletoe and mountain pine beetles. Recent past regeneration (plantations) activities that were designed to reduce mistletoe levels have created reduced mistletoe "areas", but lateral spread from adjacent stands has infected into stand boundaries.

The need for forest restoration includes reducing the potential for severe wildfires, and promoting stand densities necessary to maintain desired forest conditions during drought. Restoring forest conditions in concert with ecosystem management principles would promote resistance and resilience of these areas thereby, improving their ability to recover, function and to develop in ways that were characteristic of the respective types following disturbances from fire, insects, and disease.

The need for active management will be evaluated in terms of current conceptual frameworks and historic reference conditions.

Purpose and Need Indicators

The purpose of this project is to maintain and restore resiliency and forest health in stands that provide habitat for interior forest wildlife species and present a potential hazard of large scale wildfires in the Melvin Butte area.

There is a need to reduce fuel loadings and forest vegetation density to lessen the risk of large wildfires to nearby communities and key ecosystem components, such as large old trees. Recent large wildfires have dramatically changed the landscape leaving the project area isolated and thereby increasing the urgency of protecting the remaining forest.

The project area is currently at risk of stand replacement wildfire associated with insects, disease, and overstocking and represents some of the remaining unburned forest in the area. This project would also meet a need to provide wood products to the local and regional economy as a byproduct of landscape level treatments.

This action responds to the goals and objectives outlined in the Deschutes National Forest Land and Resource Plan, and helps move the project area towards desired conditions described in that plan. The Whychus Watershed Analysis provides a framework to conduct vegetation management activities in the project area.

Objectives

- Create stand structures more consistent with reference conditions of species composition, structure, and age/size classes, and improve resistance and resilience to disturbances.
    - Indicators: Basal area per acre, percent of maximum stand density index (SDI), canopy base height, surface fuels, and species composition
- Reduce effects of insects and disease in order to increase longevity of mature and old forest and promote growth of younger age classes.
    - Indicators: percent of maximum stand density index (SDI), species composition, dwarf mistletoe rating

Methodology

Sources of Information

Vegetation Layer

The NRIS vegetation polygon layer was used as the base layer for classifying vegetation. There are 203 polygons within the planning area, with 23acres representing non-forest types.

Stand Exams

A total of 26 formal stand exams were taken in the planning area from 1998 to 2008. The majority of the stand exams were conducted in 1998. For modeling, the FVS program grows all stands to a common starting year for simulation (see Analysis Methods, below).

Walk-through Surveys

District personnel conducted walk-through surveys of most stands from 2012-2015. These personnel included doing mistletoe assessments and mapping using Hawksworth rating system (1977, Figure 10) or stocking surveys in areas that overlapped with the Pole Creek Fire 2012. Items noted included species composition, live/dead, number of canopy layers, insects/disease, plant associations, tree density, and potential treatment options.

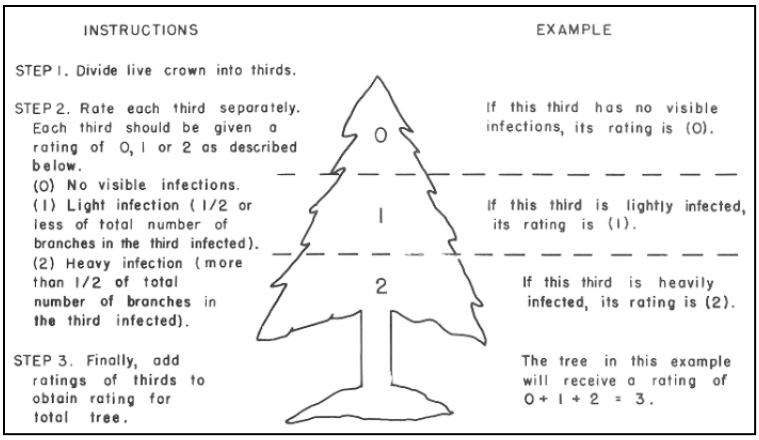


Figure 10 Determining dwarf mistletoe ratings (DMR) using the 6-class dwarf mistletoe rating system

GIS Layers

The following GIS layers were used in development of the existing condition, proposed action, and effects analysis: roads, streams, 2014 NAIP imagery, Lidar, GNN, Pole Creek BARC information and management areas.

Forest Health Protection Surveys

Formal site visits by Forest Health Protection area entomologists and pathologists occurred at different times over the summer of 2014. A report letter dated January 14th, 2015 by Andris Eglitis, Brent Oblinger and Helen Maffei can be found in the project record.

Development of Proposed Action Treatments

The stand reconnaissance information was used along with stand exam data summaries, Gradient Nearest Neighbor, GIS layers, and aerial photography to develop the proposed action treatment on a stand by stand basis. The proposed action maps (Alts 2 and 3) are the result of stands aggregated into general stand conditions and treatment types.

Analysis Methods

Nearest Neighbor/FSVeg Spatial Data Analyzer (SDA)

A computer program called Nearest Neighbor (NN) was used to assign stand exam data (reference stands) to the stands without stand exam data (Crookston et al. 2002). NN analysis uses satellite imagery (2014 LandSat TM data), spatial relationships, and topographic information to match target stands without data to the most similar reference stand with data. Tree data from the reference stand is then assigned to the target stand without data (imputation). Target stands with a statistically poor match to any reference stands were in the less well represented forest types and/or stand-types. One hundred and fifty-four reference stands were used to assign the missing data to non-examined stands. Table 34 displays the acres with adequate NN matches or reference data (NN-Ok or CSE) and the number of acres with a poor match (NN-Poor). Overall, the NN imputation quality very good at approximately 90 percent- out of 1466 imputations, 155 represented large differences between reference and target stands.

The SDA program is an ArcMap extension developed by the Forest Service that allows landscape simulations using data assigned by the NN program. The Forest Vegetation Simulator (FVS) was run within the SDA shell, and results can be viewed both visually and in summary output form.

Table 34 Data sources for forested polygons by PAG.

PAG	CSE Acres	NN-Ok Acres	NN-Poor Acres	Total Acres
Ponderosa pine wet	160	20	0	181
Ponderosa pine dry	510	433	0	942
Mixed conifer wet	319	1191	58	1568
Mixed conifer dry	729	1253	141	2123
Lodgepole pine dry	0	2	16	18
Lodgepole pine wet	0	378	134	512
Mountain Hemlock	0	0	8	8
Total Acres*	1718	3277	357**	5352

*Note 23 are in non-forest/ non-vegetated types
**A large part of poor imputed acres are a result from condition changes due to Pole Creek fire of 2012, pre-fire condition stand exams and a low number of lodgepole PAG reference stands. Stocking surveys or walk through surveys were used to fill in information that the model represented as erroneous.

Forest Vegetation Simulator

Stand Simulations

The South Central Oregon and Northeast California variant of the Forest Vegetation Simulator (FVS) (Keyser comp. 2014) was used to process stand exams to give the current stand conditions and to simulate thinning treatments and project alternatives for a 40 year time horizon. FVS is used here to compare treatment effects among alternatives and not for absolute results. The Fire and Fuels Extension (FVS-FFE) (Rebain 2010) was run to model potential fire metrics for current conditions and after thinning treatments. FVS-FFE was also used to simulate underburn fuels treatments associated with thinning as well as the stand-alone underburn treatments. Areas that did not have scheduled treatments (i.e. retention areas) were run without treatments to the end of the projection.

For modeling treatment areas, all thinning treatments (both Alts.) were scheduled in 2016 with underburning scheduled in 2018. Yardloss was scheduled with any thinning to simulate the removal of fuels (to occur by piling, lop scatter, etc.) associated with the thinning. Thinning outside of; plantations, burn only areas, lodgepole improvement area and scenic views enhancement used Thinpt keywords using

a general 80 BA target. The point-thinning method (ThinPt keyword) thins each sample point in a stand to the residual target. This means that dense areas in the stand are thinned to the target density, while areas already below the target are not thinned. This method is more representative of how stands are actually thinned in practice. The end result is that since the denser sample points are thinned to the target density the overall stand average is usually below the residual target due to sample points falling in under-stocked areas and openings. Eighty basal area was used since it corresponded to the middle of the management zone at QMD. Alt. 3 modeling was developed to respond to key issues. Alt. 3 mimicked Alt. 2 in all aspects except having mixed conifer group openings and large tree removal for dwarf mistletoe removed from the model.

Stand Density/Stand Density Index (SDI)

Current and future estimates of stand density and SDI were computed from raw stand exam data entered into the FVS program. All plots were used, and there was no manipulation of the raw data. Maximum SDI values used to model tree growth and mortality are determined by plant association and are set by GBA or CVS plot analysis (Figure 11, Volland 1988, Simpson 2007, Keyser comp. 2014). Where more than one plant association crossed a stand boundary a majority rule was used to assign the MaxSDI values. The threshold to evaluate treatment was based on the lower and upper management zone (see below for discussion).

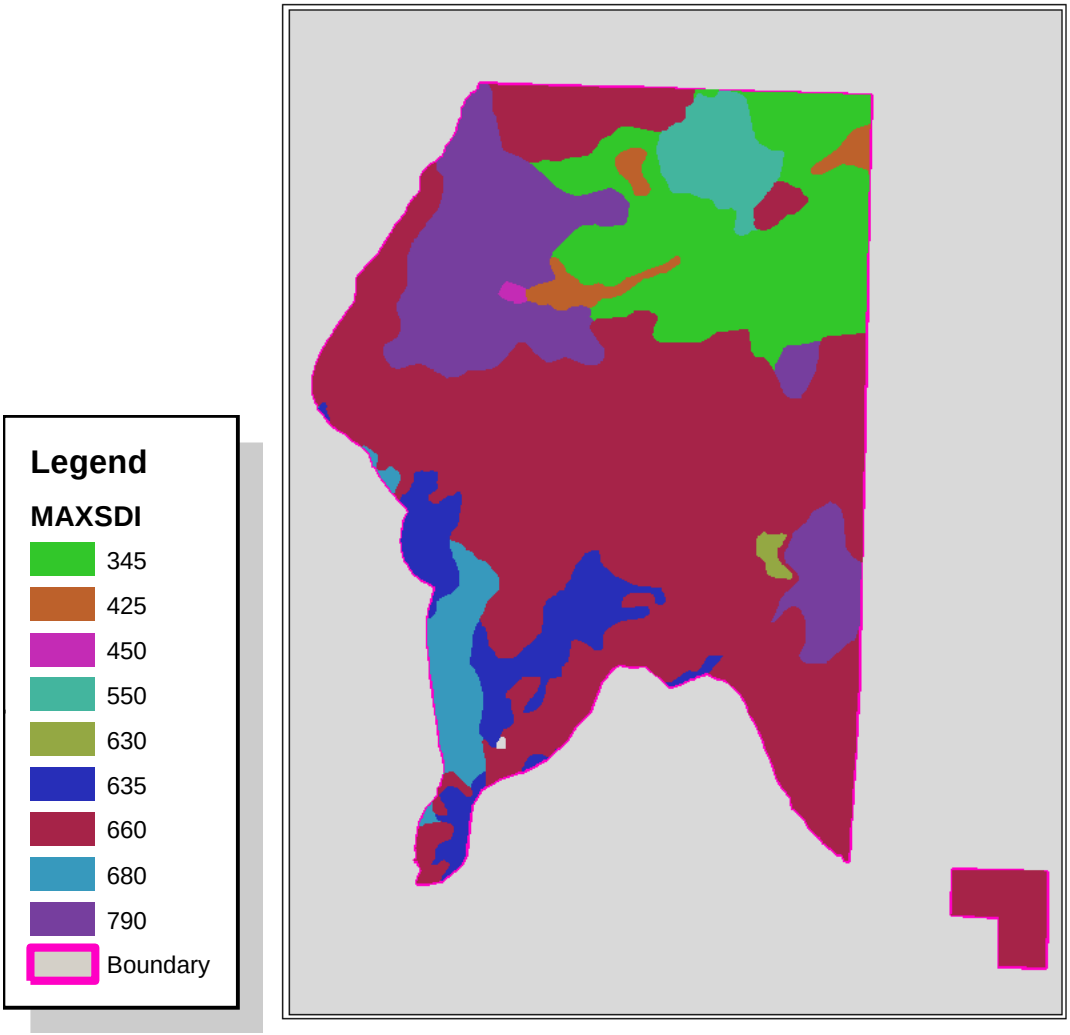


Figure 11 Map corresponding to MaxSDI values used with the forest vegetation simulator stands were adjusted to account for differing site potential and in general follows the precipitation gradient.

Fire Modeling

The Fire and Fuels Extension (FVS- FFE extension) was run using the potential fire keyword for severe (90th percentile) weather and fuel conditions (Table 35). Stand-alone underburning was scheduled in 2018. Fuel modifications were scheduled after thinning treatments in 2016.

Table 35 Fuel and weather parameters used in fire behavior modeling

Fuel Component	Percent Moisture Content	Weather Component	Value
1-hour Time lag	2	Temperature	87 Degrees F
10-hour Time lag	3	Rel. Humidity	13%
100-hour Time lag	6	Wind	14 mph
1000-hour Time lag	8		
Live woody Fuels	98		
Herbaceous	19		
Duff	20		

Output potential fire metrics from FFE included canopy bulk density, canopy base height, flame lengths, crowning index, fire type, and mortality.

Products

The following FVS output products were used in the analysis of alternatives:

1. Stand density metrics
2. Thinning results
3. Canopy height (CBH), canopy bulk density (CBD), and mortality under severe conditions (90th percentile)
4. Predicted fire type (active, crown conditional, passive, surface)

Limitations

Limitations of the FVS model in this instance include the following:

1. Limited ability to simulate desired stand conditions in terms of spatial heterogeneity
2. Modeling spatial dwarf mistletoe prescriptions, i.e. individual tree removal, in a non-spatial model.
3. Under-prediction of crowning potential versus empirical observations (Cruz and Alexander 2010)
4. Mortality[10] estimates from FVS-FFE are based on the potential fire type (surface, crown, conditional crown) and are best used as a means to compare the effects of alternatives rather than absolute values.

[10] In the context of FVS, tree mortality is derived from two main sources: exogenous (external) agents such as insects, diseases, and fire, and endogenous (internal) mortality. Endogenous mortality has two sources: background mortality and density-dependent mortality (Dixon 2009, Powell 2014).

Forest Plant Associations and Plant Association Groups (PAGs)

Plant community classification in the Pacific Northwest Region follows guidelines established in FSH 2090.11 (USDA Forest Service 1991). It is founded on the concept of "Potential Natural Communities" (PNC) (Hall 1998). PNCs are "The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfire, insects and diseases, are inherent in the development of potential natural communities which may include naturalized non-native species." (FSH 2090.11, USDA Forest Service, 1991).

In the Pacific Northwest Region, the term used for potential natural communities is "plant associations" (Hall 1998). Plant associations for the Pacific Northwest Region are described without considering disturbance caused by natural elements (as well as human-caused disturbances), including historic fire regimes/ processes (Hall 1998). Consequently, a plant association is composed of species that will be most competitive over time (climax species) and these species will prevent the establishment of less competitive species (seral species) under current climate and site conditions (Hall 1998, Volland 1988, Simpson 2007). Indicator grasses, forbs, shrubs, trees are used to evaluate the area of the plant associations. Plant associations within the Melvin Butte project area were determined through field and GIS mapping.

The associations were then grouped by their climax species, soil, site potential, temperature and moisture similarities into Plant Association Groups (PAGs), using categories listed in the Deschutes Watershed Evaluation and Analysis for Viable Ecosystems (USDA1994, Volland 1988, Powell 2007, Simpson 2007). This information also provides broad-based comparison to historical range of variability (see HRV below).

Forest Size/Structural and Seral Stages

A Viable Ecosystems analysis was conducted to determine the size/structure and seral status of the project area. The process used GNN vegetation data on a 30meter pixel and categorized and cross referenced the pixel to a match (nearest neighbor process) from Forest Inventory and Analysis data. Tree information, species dominance and density are evaluated and assigned. The pixels are stratified by plant association group and run through a filter based on species, size and density thresholds. The result is a seral and structural relationship for each pixel. This information was used to inform/ compare the project to the broad-scale HRV watershed condition (USDA 2013).

Historic Range of Variability

Historic Range of Variability (HRV) is a term used to describe the natural fluctuation in pattern of components of ecosystems over time (Stine et al. 2014). HRV serves as a framework of understanding the ecological system in question and serves as a general reference point useful for setting management goals (Landres et al. 1999). The assumption is that past conditions and processes can provide context and information (today) and that these disturbances drove variability in all ecological systems.

In this project, HRV is used as reference framework for historical estimates of forest size-classes (structure) and seral stages, tree species (or lack of) proportion dominance, that may have been present at any given point in the past 100-300 years (Oliver and Larson 1996, O'hara 2001, Franklin et al. 2013). Active forest management described herein includes knowledge-use of historic disturbance processes to evaluate the project area. The Whychus Watershed analysis (USDA 2013) provides range estimates of structure and seral status by plant association group. The Whychus Watershed Analysis (USDA 2013) determined that recent disturbances (i.e. bark beetle outbreak, wildfires) have created changes to size/structure, composition (seral status), fire hazard of the watershed outside of HRV ranges.

On the Deschutes National Forest the "Viable Ecosystems" approach is used to categorize both size/structure and seral status by plant association group useful in comparing to HRV ranges (USDA1994).

Existing Condition

Landscape Overview

The historic conditions of the vegetation in the Melvin Butte project area and surrounding landscape is described in the Sisters/Whychus Watershed Analysis and can be found on file at the Sisters Ranger District (USDA 2013). An objective identified in the Whychus Watershed Assessment is to keep species within a historic range of variability (HRV) depending on the plant association, specifically referring to the amount of fire intolerant species such as western juniper and grand/white fir in ponderosa pine and mixed conifer plant associations. HRV used within the watershed is used to assess broad forest health conditions. The watershed analysis also identified density and insect and diseases as factors to larger watershed health. Table 36 shows distribution of plant association groups in the project area compared to the Whychus watershed. Figure 12 shows the distribution of plant association groups in the project area.

Plant Association Groups (PAG)

Ponderosa Pine Plant Association Group (21% of area): In this plant association group, ponderosa pine is the main seral and climax species, growing in small, even-age groups or as fairly uniform second growth. Minor amounts of western juniper, lodgepole pine, grand/white fir and Douglas-fir may be present.

These plant associations tend to have a limited grand/white fir component and tend to be ponderosa pine dominated throughout development (Volland 1988, Johnson 1990, Powell 1999, Simpson 2007). On a broad-scale, fire clearly was an important part of large ponderosa pine tree development and played an important role in retaining low densities. Ponderosa pine plant associations were historically dominated by large ponderosa pine, which are more resistant to fire, disease, and insects than western juniper, grand/white fir and incense cedar. A reduction of western juniper, grand/white fir in this project area can help move toward species composition more within the historical range of variability.

The effects of the alternatives on species composition are difficult to quantify, but in general, the more acres treated the greater the shift will be toward fire-tolerant/adapted ponderosa pine.

Mixed Conifer Plant Association Group (69% of area): In this plant association group, ponderosa pine is the major early seral species, with grand/white fir as the main climax species. Minor amounts of lodgepole pine, Engelmann spruce may be present. Mixed conifer plant associations were historically dominated by ponderosa pine with minor amounts of grand/white fir, lodgepole pine and Douglas-fir[11]. The structure of mixed conifer patches was formed by a mixture of disturbance severities (Hessburg et.al. 2007). Ponderosa pine is more resistant to fire, disease and insects than grand/white fir and lodgepole pine. A reduction of grand/white fir and lodgepole pine in the project area can help move toward species composition more within the historical range of variability.

The effects of the alternatives on species composition are difficult to quantify, but in general, the more acres treated the greater the shift will be toward fire tolerant/adapted ponderosa pine.

[11] Douglas-fir is not a major component to the current species mixture (<0.001% of all trees). This is attributed to inherent soil properties (Pers. comm Terry Craig- soil scientist DNF).

Lodgepole Pine Plant Association Group (10% of area): Lodgepole pine plant associations are found over a minor portion of the project area. This vegetation type is found mostly along Forest Road 16. The areas where lodgepole pine is climax tend to have poor cold air drainage, or soil or moisture conditions that other species can't tolerate. Generally, in the lodgepole pine plant associations, lodgepole pine is the early and late seral species replacing itself on a boom and bust cycle of insects and fire. Currently, lodgepole pine is the dominant species on most acres, however, there are some stands that have a component of grand/white fir and mountain hemlock. Most of the area has either been burned over by the Pole Creek Fire or has a large portion attacked by mountain beetles during the 2000s. These areas coincide with visual- and/or designated wildland urban interface (WUI) escapement corridor (16rd).

The effects of the alternatives on species composition within the lodgepole pine plant associations will be minimal since the early and late seral species is lodgepole pine.

Mountain Hemlock Plant Association Group (approximately <1%): Mountain hemlock plant associations are found over a small portion of the project area at the higher elevations. In this plant association, lodgepole pine is the major early seral species and sub-alpine fir, whitebark pine, and western white pine are minor early seral species. This minor inclusion overlaps with the boundary of the Pole Creek Fire 2012 and is currently in in the grass/forb stage with high accumulations of standing and down wood along a visual and escapement corridor. These areas coincide with visual- and/or designated wildland urban interface (WUI) escapement corridor (Forest Road 16).

Meadow Plant Association Group: Meadow plant associations are found on approximately <1% of the project area and are associated with Three Creeks creek in the southern portion of the project area. The plant associations found within this type are described in Kovalchik (1987) and are grass dominated seasonally wet/dry meadows. No treatments are proposed in this association.

Table 36 Plant association groups within Melvin Butte and comparison to Whychus Watershed.

Plant Association Group (PAG)			Comparison to Whychus watershed analysis
Name	**Acres**	**% Acres**	**% Acres**
Mixed Conifer Dry	2,123	40%	6.5%
Mixed Conifer Wet	1,571	29%	10.0%
Ponderosa Pine (Wet and Dry)	1,123	21%	1.4%
Lodgepole Pine	531	10%	3.2%
Mountain Hemlock Dry	8	<1%	<0.1%
Non-forest (Meadow)	18	<1%	1.3%
Non-forest (Cinder, Rock, Water)	2	<1%	<0.0%

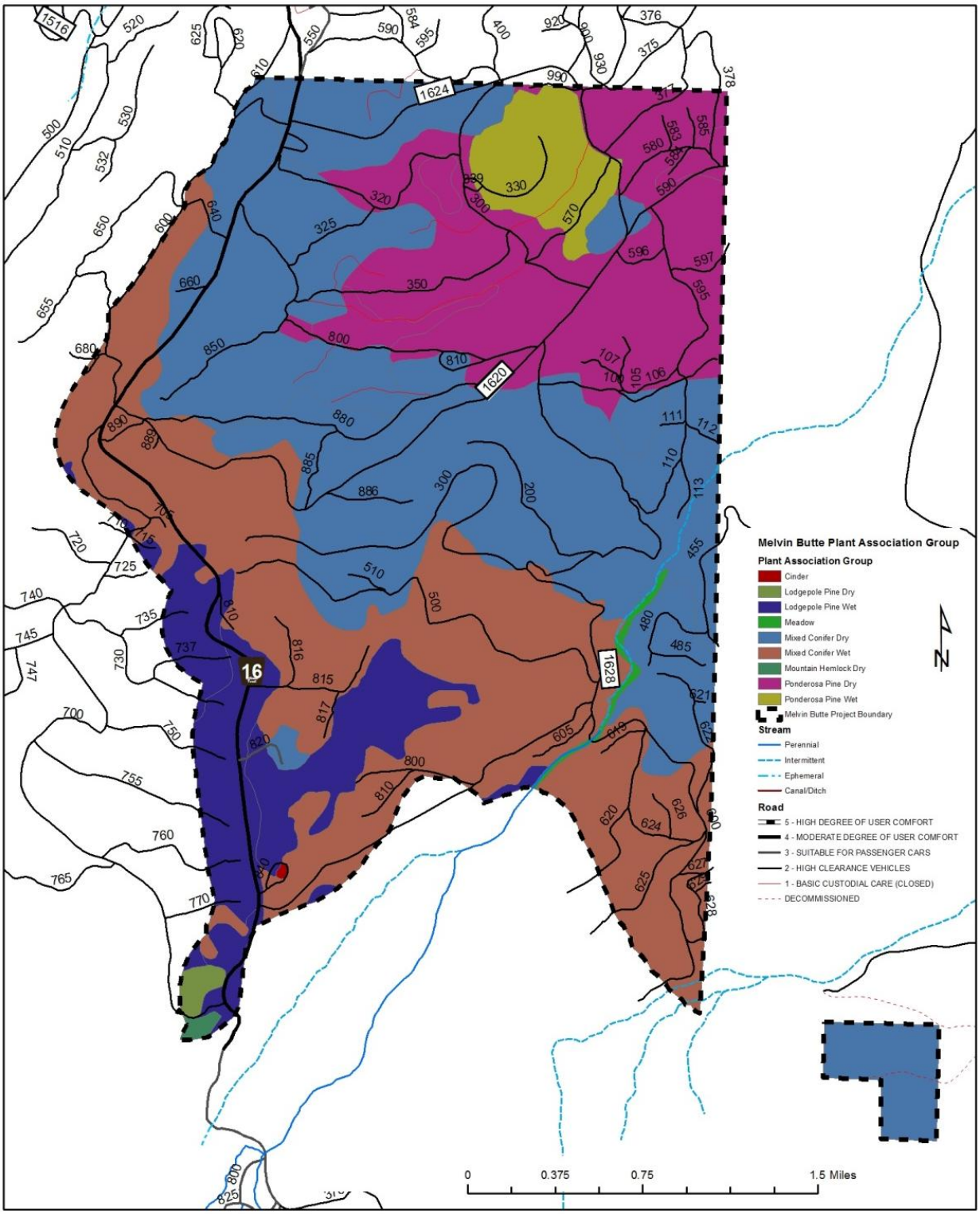


Figure 12 Plant association groups located in the Melvin Butte Project area.

Figure 13 Mixed conifer stand indicating ingrowth of under and midstory grand/white fir canopy layers.

Influences of Disturbance on Forest Vegetation

isturbances contribute to ecosystem resilience and are an important process in continuing the cycle of forest renewal. Disturbances are a "double-edged sword" in that they can be both positive and negative on forest ecosystems processes and therefore affect resistance and resiliency. Disturbances in central Oregon include but are not limited to; fire, insects, disease and wind. These biotic and abiotic elements interact on the forest to influence size, severity, intensity and patterns of disturbances and thus relate to the sustainability of forest vegetation cover over the long-term. Generally, disturbance severity increases when forest conditions are outside the historic range of variability. Figure 13 shows the ingrowth of grand/white fir in a mixed conifer stand in the project area.

Mortality from disturbances is desirable, particularly in providing roosting, nesting, foraging and hiding cover for species that are directly or indirectly associated with snags (Bull et al. 1997). However, there have been alterations in the scale of mortality inducing disturbances, and potential thereof, that are currently affecting this watershed, other adjacent watersheds and more specifically, the Melvin Butte planning area (USDA 2013).

The greater primary historic disturbance in the project area was frequent, low to mixed severity fire that helped maintain lower stand densities that maintained higher canopy base heights. Due to intrinsic species adaptations, this process contributed to stable ecosystem functions that promoted old growth development of fire resistant ponderosa pine (USDA 2013). Other important historic disturbance agents in the project area included mountain pine beetle, western pine beetle, and western dwarf mistletoe. In general, historical disturbances in the watershed and within the Melvin Butte project area caused mortality in single trees, small groups of trees, and less frequently, larger patches (ex. lodgepole PAG). These disturbances created fine-to mid-scale structural elements of diseased, dead, damaged and down trees. Many local species (wildlife, plant, insect, fungi, microorganisms, etc.) evolved with these historic disturbance cycles (Stine et al. 2014).

Currently, the primary types of disturbances on the Sisters Ranger District are uncharacteristically large, and moderately to highly severe wildfires, and larger scale insect and disease infestations (USDA 2013). These changes result in habitat condition fluctuations more extreme than historically experienced with potential loss of important habitat elements of larger old 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, invasive species, tree regeneration success and warming and drying trends (Littel et al. 2010, Spies et al. 2010, see Climate Change Report). The result is a greater impact on interior forest species which depend on the continuity of forested habitat (see Wildlife Report).

The scale of severe impacts from current and future disturbances can be reduced by maintaining and enhancing more resistant species (i.e., ponderosa pine), increasing the distribution of single or two storied-stands, reducing fuel continuity, improving or maintaining vigor, and making treatment units as large as possible (Wickman 1992).

Structural and Seral Stages

Both structural and seral stage information provides broad-based canopy layer information for determining forested conditions within an area. Frequently, these are used to identify habitat suitability of different interior forest species (avian, mammalian, botanical, etc.); fire hazard; insect and disease susceptibility; and inference to historic range of variability.

Structural stage information provides vertical and horizontal canopy information among tree layers while seral stage provides information about specific species occupying those canopies. Both interact on the landscape based on past, present and future influences (planned and unplanned).

Past management (planned and unplanned) has altered the historic proportion of structural stages within the project area in two general ways 1) by allowing fire suppression/ exclusion to favor in-growth and 2) the regeneration harvests (plantations) creating a younger (stand replacement) stage of development[12].

More than 75% of the project area consists of areas dominated with less than trees < 20”dbh (Figure 14). Much of this acreage occurs as small blocks of plantations; second growth stands; regenerated stands from wildfire; lodgepole stands; or other areas dominated by small trees. Approximately 22% of the project area is composed of plantations (installed from 1981-1993) installed to reduce or remove the abundant mistletoe in the area (Big Buck, Black Pine, Walla Bear and Melvin Butte Timber Sales). Within portions of the lodgepole PAG, structural stages have been altered by the recent past beetle outbreaks and Pole Creek fire 2012.

A study looking at historical structure and composition of ponderosa pine and mixed conifer forests in south-central Oregon stated stand densities have more than tripled over the past 90 years in these sites, while basal area has declined by greater than 50% and the abundance of large trees as a proportion of the total number of trees has decreased by more than a factor of five (Hagmann et.al. 2013).

[12] Past selective logging was not listed here since structural changes have been offset by the time since logging and ingrowth of large grand/white fir into the mid/ overstory layers. Under similar growing conditions grand/white fir are well recognized for growing at faster rates than ponderosa pine.

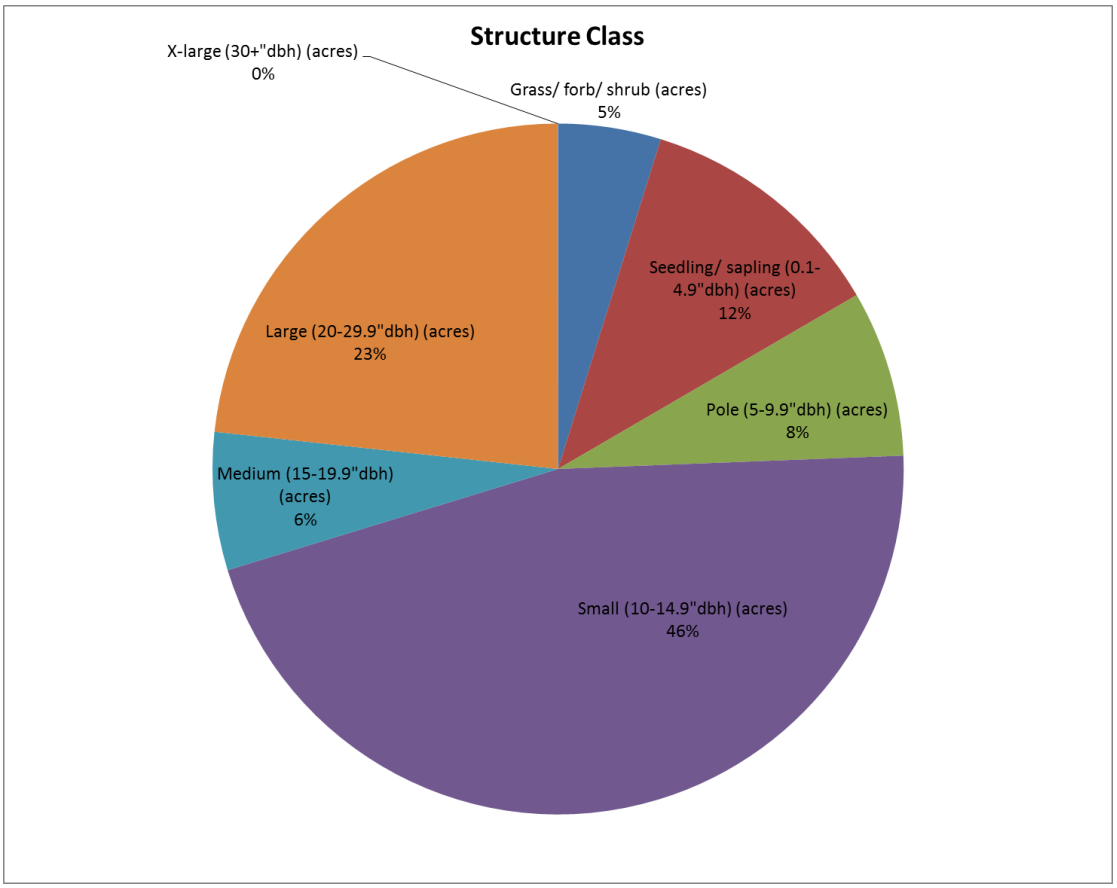


Figure 14 Structure classes of Melvin Butte as determined by Lidar.

Past management (planned and unplanned) has altered seral stage in two general ways 1) by interrupting fire regimes allowing ingrowth of grand/white fir (succession process) 2) by selective logging[13] of overstory ponderosa pine and altering species proportion (assumed more ponderosa pine = more pine seed mast).

Tree Species Composition

Major conifer trees species in the project area include ponderosa pine, grand/white fir, lodgepole pine and western juniper. Other species that are present but comprise <0.001% of all trees include Engelmann spruce, mountain hemlock, pacific silver fir, and white bark pine. These minor species occur as individuals very sporadically at >5000ft elevation. Douglas-fir may be present, but not a single observation was noted within the planning area (managed and unmanaged stands). Douglas fir may be present within the Three Creek drainage, but restoration work is excluded from riparian reserve areas.

Approximately 90% of the project area is composed of plant associations groups (PAGs) dominated by ponderosa pine which includes mixed conifer plant associations dominated by ponderosa pine during historic fire regimes (Volland 1985, Simpson 2007, Franklin 2013, Hagmann et al. 2014). Low-density and pine-dominated forests historically occupied essentially all of the forested landscape within the

[13] Selective logging changed the proportion of overstory pine about 30-60 years ago in much of the Melvin Butte project area.

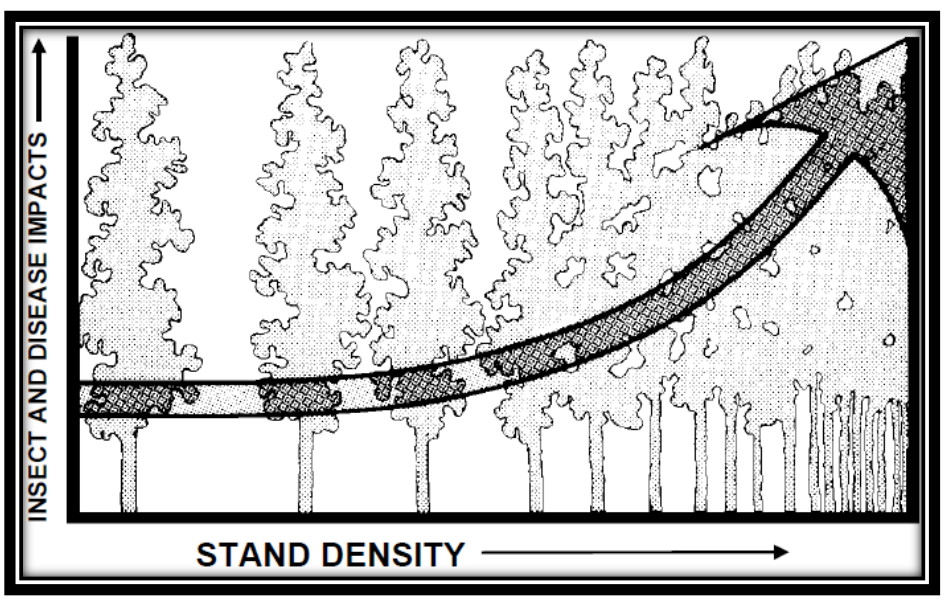
ponderosa pine and mixed conifer sites of the eastern slopes of the Cascade Mountains (Herschel et al. 2014, Hagmann et.al. 2013, Hagmann et al. 2014).

Species Composition Changes

The most dramatic changes in species composition (proportions) have occurred in the mixed conifer (dry and wet) plant association stands that have had selective overstory removal and fire suppression/exclusion (Camp 1999, Franklin 2013). These two mechanisms have interacted to advance grand/white fir persistence and abundance. In these stands, the trees per acre of ponderosa pine have decreased while grand/white fir has increased. In the mixed conifer types, the interactions of the two former conditions have resulted in dramatic pine to grand/white fir species shift when compared to reference conditions (Herschel et al. 2014, Hagmann et.al. 2013, Hagmann et al. 2014). As a result, the grand/white fir series in the project area (outside of plantations) has affectively had accelerated succession (increases of grand/white fir) due to these planned and unplanned management activities. In areas that have had their entire overstory removed (plantations in any PAG) follow up reforestation activities largely included ponderosa pine. As a result plantation stands have a significant cohort of fire adapted ponderosa pine and at this time are not threatened from grand/white fir stand succession.

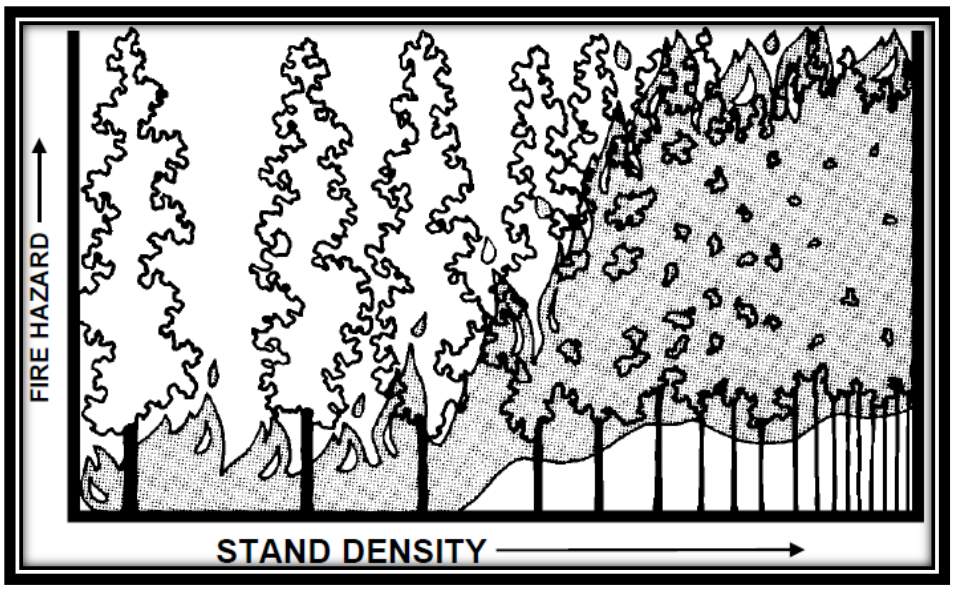
Stand Density

Different biophysical environments can support different levels of tree densities (e.g. wetter, richer soils tend to be able to support more trees per acre). Tree growth, insect and disease resistance, fire behavior, habitat, snag recruitment and more are all affected by tree densities. Stand density is a primary factor affecting growth and vigor of forest vegetation, and resilience to disturbances. Measuring stand density provides forest managers information about what can be expected to forested conditions in the face of planned or unplanned events/actions (Figure 15 and Figure 16).



Insect and disease impacts can vary with stand density (from Powell 1994). Because open stands generally have higher vigor levels than dense stands, they tend to be more resistant to insect and disease impacts. Maintaining a wide stand spacing results in a condition where the trees are not experiencing significant competition. Although not universally true, vigorous trees are better able to withstand attack from insects, pathogens and parasites (Safranyik and others 1998).

Figure 15 Insect and disease impacts and stand density.



Fire intensity can vary with stand density (from Powell 1994). When a fire moves through an open stand with widely-spaced trees, it generally stays on the ground as a low-intensity burn. But when it encounters a dense, closely-spaced stand, fire is much more likely to leave the ground and begin moving through the intermingled tree crowns as a lethal, high-severity burn.

Figure 16 Fire intensity and stand density.

Stand density index (SDI) is a measure of density and provides as an indice of forest health concerns including and not limited to; competition, fire hazard, habitat hang-time, beetles and diseases (Reineke 1933, Cochran et al.1994, Powell 1999, Jain et al. 2002, Powell 2010, Franklin et al. 2013). SDI is broken up into "zones" to assess relative growth and inter-tree competition. Full stocking (also called normal) is a zone where tree vigor is slowed to the point where trees are self-thinning and have an increased likelihood of mortality agents. This onset induces stand differentiation and facilitates structural stage alterations (Oliver and Larson 1996). Below full stocking, are the lower and upper management zones (LMZ and UMZ) where partial to full competition occurs and inter-tree competition and mortality agents are less likely. To add, different tree species respond differentially to inter-tree competition and, as such, different SDI values are calculated (Cochran 1994, Powell 1999). Managing for species with lowest SDI values on a site ensures all other trees species are accounted for. 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 analysis 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 and trees aged.

The upper management zone is a site-specific density threshold, above which forest health conditions and large tree health are likely to deteriorate. When these limits are reached, plant competition results in loss of plant growth and/or mortality. Increased tree stress reduces tree vigor and the ability to resist insects and disease. Reduced tree vigor also decreases the tree's ability to compartmentalize fire damage and recover from lost foliage, cambium damage and bud loss. Different parts of the project area can support different stand densities, depending, in part, on available water, light and nutrients. As such, it is necessary to adjust SDI maximum values for the particular biophysical location to better optimize growth and predictions (Figure 2).

With forecasted climate change, drought conditions are expected to become more common which in turn is expected to create favorable mortality conditions in the old, large trees (Spies et al. 2010, Little et al. 2010).

Old Growth Structure and Stand Density: 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, Fitzgerald et.al. 2000).

Current mortality across the Melvin Butte Project area is generally occurring as individuals and groups of trees. Of particular importance, the largest proportion of mortality is occurring from large and old ponderosa pines and is due to effects of inter-tree competition (density), bark beetles and western dwarf mistletoe. Large old trees are the key structural component of old-growth forests both for their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. In most cases these trees occur amongst an under- and midstory of ponderosa pine and grand/white fir (Figure 13). Under current conditions these high value trees[14] are declining, and will eventually become rare with replacement delayed (Eglitis et al. 2015).

Recent studies have shown that 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 (McDowell et al. 2003). 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. Table 37 and Table 38display stand density by PAG and stand density by structure in the project area.

Table 37 Stand density by PAG

PAG	Avg. BA weighted DBH (inches)	Avg. Tree per acre	Avg. BA per acre	Avg. SDI	%MaxSDI	Acres
Ponderosa pine	15.7	856	149	336	88	1123
Mixed conifer	15.5	1697	207	499	74	3693
Lodgepole	14.3	1804	208	500	77	531

Table 38 Stand density by structure

Structure	Avg. BA weighted DBH (inches)	Avg. Tree per acre	Avg. BA per acre	Avg. SDI	%MaxSDI	Acres
Plantations (pole sized)	7.2	752	125	444	75	1174
Medium to large trees areas (including old	15.9	1633	209	499	82	2509

[14] Numerous publications and Deschutes County Forest Collaborative group meetings have identified old growth ponderosa pine as both a social and ecological value. See Franklin et al. 2013.

growth)						

Reducing forest densities, simplifying stand structure and reducing fuels to resemble conditions within the natural or historic range of variability is expected to reduce the risk of severe stand-replacing wildfires and widespread insect and disease outbreaks, as well as reduce the intensity of effects when disturbances occur. Forest conditions comparable to those found in historical records, such as the timber cruise from the Warm Springs Reservation, have demonstrated that open, low density stand conditions promoted resilience and resistance to fire and drought related stressors (Hagmann et.al. 2014). Reducing stand densities could also help maintain old-growth ponderosa pine longer on the landscape by reducing competition stressors. The Whychus Watershed Assessment (2013) 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. 58).

Fire

Fire was historically the most influential disturbance agent in forests east of the Cascade Crest, with low- to mid-elevation sites dominated by a frequent/low-severity fire regime (Hessburg et al. 1994). Frequent fires in ponderosa pine maintained surface fuels at fairly low levels, kept understory vegetation and tree densities low and at low heights, preventing the formation of ladder fuels that could carry fire into the upper canopy. However, fire regimes in the dry forests have undergone a dramatic change to a less frequent, more severe regime (Everett et al. 2000). Hessburg et al. (2005) estimated that the area in the Columbia Basin with potential for low severity fire has decreased by 53 percent, while the area with potential for high severity fire has doubled.

Fire suppression/exclusion and selective logging of large, fire-resistant trees has led to the condition where high-severity fire is now common in forests such as these (Whychus Creek Watershed Analysis 2013, Metolius Watershed Analysis 2004). Alteration of disturbance processes has resulted in increased fuel loadings and connectivity (both vertically and horizontally), and increased susceptibility to insects and disease (Hessburg et al. 2005).

Fire suppression/exclusion has allowed the establishment and dominance of grand/white fir in the grand/white fir series, where ponderosa pine was historically maintained as the dominant species by frequent low to mixed severity fires. The stands originating after partial overstory removal cutting are dominated by grand/white fir due to lack of a remaining pine seed source and altered fire regimes. This has had the effect of perpetuating the dominance of this late seral species.

The historical fire regime for the ponderosa pine and dry mixed conifer series was frequent, low severity surface fires (broad- and mid-scale) (Franklin et al. 2013, Stine et al. 2014). Studies have shown that fire return intervals were very short pre-settlement and were dominated by large ponderosa pine (Everett et.al. 2000, Hessburg et al. 2005, Hagmann et al. 2014, Merschel et al. 2014, Stine et al. 2014). On a fine-scale, however, individual and group tree torching diversified stand structure into mosaic and allowed for recruitment of snags. The high live crowns and thick bark of mature trees protected them from the low-intensity wildfires common in the ponderosa pine and dry mixed conifer types. The frequent low-severity fire regime of ponderosa pine led to the most stable[15] landscape pattern of all the eastside forest vegetation types. These predominant surface fires maintained low and variable tree densities, light and patchy ground fuels, simplified broad-scale forest structure, favored fire-tolerant trees, such as ponderosa pine, and a low and patchy cover of associated fire-tolerant shrubs and herbs (Hessburg et.al. 2005). The historic landscape pattern in ponderosa/ dry mixed conifer was uneven-aged at the landscape scale but

[15] Stable here referring to consistent high proportion of ponderosa pine/time

even-aged at the stand or group scale, resulting in a landscape of open park-like stands of trees with the understory dominated by herbaceous vegetation. The even-aged patches within the landscape pattern were created when individual trees or small groups of trees died, creating gaps in which new even-aged clumps could develop.

Relative to pine/ dry mixed conifer forests, mesic forest types exhibited a wider range in fire severities with a larger area burned at mixed to high severities (Wright et.al. 2004, Hagmann et al. 2014, Stine et al. 2014). High severity fire effects were documented in historic timber cruise data at the upper elevation boundary of moist mixed conifer habitat adjacent to colder, wetter habitat types (Hagmann et.al. 2014). Lower elevation mixed conifer sites where historically dominated by ponderosa pine and experienced lower severity, frequent fire (Hagmann et.al. 2014).

Lodgepole pine has a longer fire return interval with higher severity fires resulting in more stand replacement. The historic landscape pattern in the lodgepole pine type was even-aged with large patches of even-aged stands of lodgepole pine regenerating after a stand replacing disturbance event, such as fire or a bark beetle outbreak.

Fire Regimes

Fire regimes have been identified for all plant associations occurring across the Deschutes National Forest (Volland 1988, Simpson 2007). Fire regimes are influenced by biotic and abiotic conditions including; stand conditions, fuels, weather. See Fire and Fuels report for more information on fire regimes.

Fire Hazard

Fire hazard is defined by the fuel complex, as determined by the volume, type, condition, arrangement, and location which determine the ease of ignition and resistance to control. Fire hazard expresses the potential fire behavior for a fuel type, regardless of its weather-influenced fuel moisture content (Hardy 2005). Fire hazard is discussed below in terms of the fuel profile and potential fire behavior. The Fire and Fuels Report includes additional information on fire hazard.

Fuels

Surface Fuels

Estimates of surface fuel loadings are based on existing fuels information taken during stand exams and inputted into the FVS-FFE model. Surface fuels in the project area consist mainly of shrubs (i.e. green leaf manzanita, bitterbrush), litter and duff, down logs, branches and twigs. The shrub component is variable but where it is present tends to form a continuous component of the fuel bed. Surface fuel loadings are presented in Table 39.

Table 39 Surface fuel loadings (tons/acre) and predicted flame lenghts (ft) for PAG

PAG	Acres	Avg. Surface fuel loading Total	Avg. Surface Flame Severe
Ponderosa pine	1123	17	5
Mixed conifer (dry and wet combined)	3693	21	5

Lodgepole[16]	531	22	6

Canopy Fuels

Canopy base height (CBH) is the lowest height above the ground where there is sufficient amount of canopy fuel to transition a fire from the surface fuels into the tree crowns (Scott and Reinhardt 2001), and canopy base heights are a critical factor in determining crown fire potential due to the effect of understory trees carrying fire into tree crowns via torching. Canopy base heights were determined for the project area from the Forest Vegetation Simulator (FVS-FFE) using stand exam data. The structure and species composition of the stands, with dominance by grand/white fir with low growing crowns, as well as dense understory trees, and the numerous plantations are contributing to the low canopy base heights observed (Table 40). CBH should be considerably higher than the height of expected flame lengths (Table 39) in order to avoid torching and potential crown fire initiation. The fuels continuity from the surface fuels to the crown fuels, as indicated by the CBH values in Table 41, has created the potential for surface fire to reach the crowns of the overstory trees.

Canopy bulk density (CBD) is the mass of available fuel in the form of needles, branches and twigs per unit of canopy volume (kg/m3), and is an important characteristic needed to predict crown fire potential and spread. Canopy bulk densities were estimated from FVS-FFE within the project area (Table Table 40 and Table 41). CBD affects the critical spread rate needed to sustain active crown fire. The lower the canopy bulk density, the lower the potential for active crown fire. The threshold CBD for reducing the likelihood of active crown fire depends on fire weather and rate of spread and is not well defined, but may be less than 0.10 kg/m3 (Agee 1996, Peterson et al. 2005). Across PAGs and structure types, CBD is currently above this threshold or is approaching it (Table 40 and Table 41).

Table 40 Fire metrics related to canopy fuels by PAG.

PAG	Acres	Avg. CC %	Avg. CBH (ft.)	Avg. CBD (kg/m^3)	Avg. % Mortality BA- Severe Fire	Avg. Crowning Index (mph)
Ponderosa pine	1123	56	6	0.09	45	27
Mixed conifer	3693	63	5	0.17	75	18
Lodgepole	531	25	5	0.20	83	15

Table 41 Fire metrics related to stand structures.

Structure	Acres	Avg. CC %	Avg. CBH (ft.)	Avg. CBD (kg/m^3)	Avg. % Mortality BA- Severe Fire	Avg. Crowning Index (mph)
Plantations (pole sized)	1174	62	5	0.16	69	19
Medium to large trees areas	1507	60	5	0.11	49	26

[16] Much of the lodgepole PAG has experienced a widespread beetle epidemic and/or Pole Creek Fire 2012. This material has and continues to fall down creating jack-strawed fuels near the 16rd.

Flame Lengths/ Crown Fire Potential

Surface flame lengths are a measure of how intense or severe a fire may become and a proxy for ease of fire suppression (resistance to control). Heavy surface fuel loads generally contribute to longer flame lengths. Since surface fuels consists mainly of shrubs, grass/sedge and duff, and scattered larger dead and down material, predicted average flame lengths are generally 5 feet across the project area. Canopy base height across the project area is generally also at this height (5ft) (Table 39, Table 40, and Table 41). The interaction of these two and severe fire weather are factors that have the potential to lead to crown fires and/or lethal surface fires that could kill a large proportion of the forest in the project area.

Crown fire potential, or hazard, is based on the amount of surface fuels, the amount of ladder fuels, and the density and spacing of the canopy. Heavy surface fuels generally contribute to longer flame lengths. Low canopy base heights can carry surface fires into the crowns. Once established the crown fire may persist. The more spaced the canopy, the greater the wind necessary to move fire from one crown to the next. Dense canopies require much less wind speed to support crown fire. The crowning index integrates these factors into a single value that reflects the hazard of crown fire being initiated and sustained.

FFE-FVS uses information about surface fuel and stand structure to predict whether a fire is likely to crown. Crowning index is a measure of how susceptible a stand is to developing a crown fire when a fire occurs. It depends on canopy bulk density, slope steepness, and surface fuel moisture content. As a stand becomes denser, active crowning occurs at lower wind speeds, and the stand is more vulnerable to crown fire. Lower index numbers indicate that crown fire can be expected to occur at lower wind speeds, so crown fire hazard is greater at lower index values. Current values for crowning index (wind speeds in miles per hour) in the project area are at or above the expected potential 14 mph wind speed for a fire in this area, indicating that the project area is moderate to highly susceptible to crown fires (Table 40 and Table 41). In addition, wind gusts must also be taken into consideration, and given the low CBH tree torching is likely to occur and could be sustained over with higher wind speeds. Overall, the crowning index values in Table 40 and Table 41 likely represent a moderate to high hazard of crown fire (see Fuels report for more information).

Crown fires are typically faster moving than surface fires, and result in more tree mortality and smoke production. A crown fire would loft more firebrands into the air than a surface fire due to the amount and type of fuel being consumed. A crown fire is generally more intense, thus producing more wind and convective heating. These forces acting alone or in combination would carry fire brands greater distances and increase likelihood for spotting to other areas. Crown fires are more dangerous than surface fires and are more difficult to suppress.

Predicted Fire Type and Severity

FVS-FFE was used to predict the type of fire and amount of mortality from a wildfire burning under severe (90th percentile) weather and fuel conditions. Four types of fire are recognized by the model, 1) surface fire which does not burn in the tree crowns, 2) active crown fire where the fire moves through the tree crowns killing all trees, 3) passive crown fire where individual trees or groups of trees are killed as their crowns torch, and 4) conditional crown fire where surface fuels are not heavy enough to sustain a crown fire but canopy bulk density is great enough that crown fire could be initiated from a neighboring stand. Predicted mortality is based on the amount of crowning, scorch height, species, and bark thickness.

The type of fire resulting from an ignition under severe conditions in the project area would be a combination of active, surface, passive and crown conditional fire (Table 42). Mortality is predicted to average 72 percent of the basal area. Much of this mortality would likely be from the combination of fire types associated with the different structures and ease of spread from ladder fuels and dwarf mistletoe. Of

particular importance is the large overstory ponderosa pine mortality susceptibility from ladders and root damage from buildup of bark mounds at the base of trees over time.

Table 42 Predicted fire type, severity and proportion of Melvin Butte Project area.

Predicted fire type and severity	Proportion of project area (%)
Active	22
Passive	12
Crown Conditional	27
Surface	39

Based on experience with previous wildfires, namely the Pole Creek Fire of 2012, fire behavior is expected to have moderate to severe effects on tree survival, and fire modeling with FVS-FFE substantiates this assumption. Passive or active crown fire is likely to occur wherever there are substantial amounts of understory trees that could bring fire into tree crowns, and higher wind gusts could lead to active crown fire as well. Soil heating and root damage is also likely to occur around heavier buildup of down woody fuels, leading to direct and indirect (insects/disease) mortality from fire.

Insects and Disease

The roles of insects and disease as disturbance agents in forests are very closely tied to vegetation patterns. Factors such as species composition, size structure, and density of forest stands are important in determining which agents are likely to affect that vegetation type. By their actions, forest insects and diseases can alter the vegetative patterns and set the stage for new processes to occur.

The primary mortality-inducing insects within the project area include western pine beetle, mountain pine beetle and pine engraver beetle (Eglitis et al. 2015). Mountain pine beetle are capable of causing extensive tree mortality and most often exhibit preference for larger diameter trees growing in high density stands with a high percentage of host type (Fettig et.al. 2007). When tree densities are above the upper management zone for density (see section on stand density for a definition of the upper management zone) they are considered imminently susceptible to bark beetles (Powell 1999, Eglitis et al. 2015). A study done in the Colorado Front Range illustrated that mountain pine beetle-infested plots exhibited higher basal area and stand density index (SDI) for ponderosa pine versus all tree species combined (Negron et.al. 2004). Bark beetles also tend to thin from above, killing the larger trees within the stand first. Within infested plots, infested trees were larger in diameter at breast height and in the dominant and co-dominant crown positions (Negron et.al. 2004).

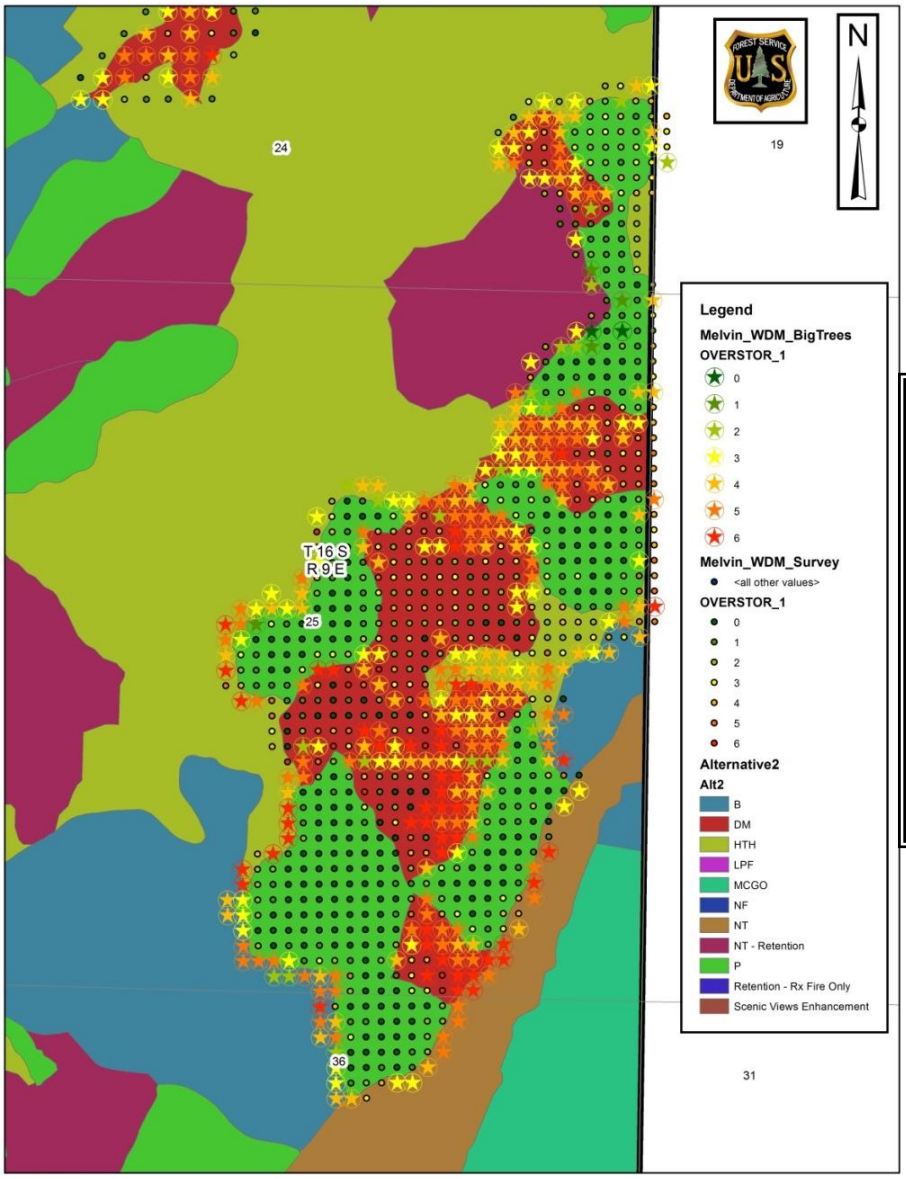
Western Dwarf Mistletoe

The primary disease found in all size/ age classes of ponderosa pine throughout the Melvin Butte project area is western dwarf mistletoe (WDM). The level of infection is largely related to PAG (Table 18) and to the incidence of past regeneration harvesting and/or pruning that has occurred. In general in the ponderosa pine PAG, the past regeneration harvest units (plantations) show the lowest level of infections. However, about 2/3 of these plantations now indicate spread interior to their stands, undermining the original purpose (Figure 17).

It is believed that incidence of dwarf mistletoe is elevated from historical conditions within the project area. Frequent, low-intensity fire played a large role in moderating the presence of mistletoe by maintaining fewer trees in lower canopy layers that would become infected and spread seed as well as ‘pruning’ lower limbs with broom-like infections on the larger trees (Bolsinger 1978, Hessburg et al. 1994, Campbell and Liegel 1996, Hessburg et al. 2008). Severely infected trees were also more likely to

torch resulting in individual tree or small group mortality. This created gaps where mistletoe spread between trees was less likely to occur.

Fire suppression/exclusion has caused increased infection in these stands by allowing susceptible understory trees to establish, become infected, and increase the incidence and rate of spread higher than historical levels (Edmonds et al. 2000). Ponderosa pine infected with WDM exhibits increased mortality due to successful western and mountain pine beetle attack (Miller and Keen 1960; Eglitis et al. 2015); reduced volume and height growth (Hawksworth 1996, Maffei and Jacobi 1986); reduced viable seed production for natural regeneration (Hawksworth 1996); and increased susceptibility to mortality from fire (Conklin and Geils 2008). These effects are proportional to increasing levels of infection (see Appendix F). A stand heavily infected with dwarf mistletoe has a decreased likelihood of developing into old forest structure (Hopkins 1992, Eglitis et al. 2015). Outbreaks of mountain pine beetle may increase the proportion of infected trees by killing the uninfected trees and increasing the rate of spread of mistletoe. Thus, management objectives for both beetles and dwarf mistletoe need to be taken into account (Edmonds, Agee and Gara 2000).



Western dwarf mistletoe ground survey of selected Melvin Butte stands (Hawksworth 1977). Green polygons represent plantations. Circled stars indicate >21”dbh ponderosa pine and small circles indicate ponderosa pine <21”dbh. Green circles and circled stars indicates no to light infection transitioning to red with severe infections.

Figure 17 Western dwarf mistletoe ground survey of selected Melvin Butte stands (Hawksworth 1977)

Project Area Insect and Disease Review and Recommendations

The project area was visited by Forest Health Protection Staff Helen Maffei, Ph.D. (Area Plant Pathologist), Brent Oblinger (Area Plant Pathologist) and Andris Eglitis Ph.D (Area Entomologist) at multiple times in summer 2014. The full reports for these visits can be found in the project record. Their conclusions and recommendations are summarized below:

Findings

Western Dwarf Mistletoe

Western Dwarf Mistletoe is a key disturbance agent influencing stand health and structure throughout parts of the project area. Severely infected trees (DMR 5 or 6; Hawksworth 1977) are adversely infected

and when they occur within large old trees their persistence is shorter than those without mistletoe. Managing for trees (replacement) underneath infected overstory is dubious at best and typically unsuccessful. Infected ponderosa pine (esp. larger ones) in adjacent stands (or parts of the same stand) can be detrimental to the effectiveness of the treatment. Thinning treatments using unevenaged silvicultural tools is complex, requires fine-scale knowledge of infection levels and extent, often time requires follow up monitoring and is often unsuccessful.

Recommendation- Prioritize dwarf mistletoe treatment areas based on fine-scale cues of infection level, location of infection and stand conditions.

Insects

Western bark beetle is the most significant beetle in the project area with scatter small pockets of ponderosa pine dead and dying. Mountain pine beetle is also present in small quantities attacking ponderosa pine and those pine weakened by western dwarf mistletoe and other areas under high stem densities. Western dwarf mistletoe is causing ponderosa pine to be more susceptible to the various pine bark beetles in the area. Adjacent and recent wildfires may contribute to population buildups of bark beetles. Legacy ponderosa pine are under extreme competition with grand/white fir throughout the understory and cannot compete successfully in the long term. White fir within the dry plant associations are not sustainable in the long-term especially at or below 20” of annual precipitation.

Recommendation- Thinning for density reduction using “management zone” as an indicator is an important predictor for likelihood of insect/ disease susceptibility (Cochran 1992, 1994).

Past Vegetation Management Activities

Vegetation management activities in the Melvin Butte project area have included timber harvest, small tree thinning, firewood cutting and prescribed fire. Table 43 summarizes the known past management activities.

Table 43 Known past management activities within the Melvin Butte Project area.

Ownership at the time of the Treatment	Management Activity	Approximate Acres
Public (Forest Service)	Overstory Removal	177
Public (Forest Service)	Regeneration Harvest	944
Public (Forest Service)	Harvest Partial Removal	261
Public (Forest Service)	Selection Harvest	590
Public (Forest Service)	Thinning	261
Public (Forest Service)	Timber Stand Improvement	1,044

Desired Future Condition

On a broad-scale, development of the desired future condition comes, in part, from the 1998 Whychus Creek Watershed analysis which outlined watershed conditions from a 178,161 acre scale. Numerous changes have occurred since this analysis resulting in renewed attention in addressing forest health issues in some of the last continuously forest acres within the watershed.

Large-scale high severity (stand replacement) fires (>10 acres) and a mountain pine beetle outbreak (>10 acres) have altered the surrounding landscape. Resultant vegetation condition changes prioritized a 2009

watershed analysis (for Popper Project area[17]) and finally a 2013 (post Pole Creek Fore 2012 and pre this analysis). This condition change recognizes an urgent need to address forest conditions that have the potential to threaten interior habitat loss and resiliency in the face of uncertainty. The project boundary encompasses Strategy Areas 1,2, and 4 and are listed as "urgent" to "moderate".

A healthy, diverse, fire-resilient forest structure can be restored in these forest types through restoration treatments that include reducing stand densities, fuel loads and western dwarf mistletoe abundance and altering late seral species proportions. Maintaining stand densities at manageable levels is essential for; promoting forest health; maintaining or creating large tree character habitats; and meeting the goals of the Whychus Watershed Analysis.

Forest health is an important consideration in the management of stands within the Melvin Butte (see Insects/Disease, above).

The Forest Service Forest Health Protection staff defines forest health as, "A condition wherein a forest has the capacity across the landscape for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services" (Twery and Gottschalk, 1996). Treatment strategies to enhance forest resilience and wildlife habitat, and to affect potential fire behavior by allowing forests to equilibrate to fire under modern conditions, and for increasing forest heterogeneity are outlined in several recent publications (Franklin et al. 2008, North et al. 2009, Franklin et al. 2013).

Desired Future Condition for Forest Vegetation

Desired future condition includes maintaining and improving habitat for interior forest species, reducing fire hazard, maintaining and enhancing a heterogeneous landscape with stand densities and species composition that favor resistance and resiliency to future unknown disturbances. The Melvin Butte project area contains different PAGs and as such desired future conditions are modified, by these PAGs to capture broad-scale variations.

Overview

A forest with medium to large ponderosa pine acting as "anchor" points to continuous forest cover over the long-term; a condition indicative of Pre-European settlement (100-300 years past). A variety of stand conditions would be distributed throughout this larger ponderosa pine tree matrix. Stand densities, species composition and fuel loads would be consistent with natural fire frequencies. Snag and down log levels would be consistent with historic levels. The forest would be resistant and resilient to fire, insects, diseases and other future unknown disturbances.

The sustainability of this condition is an important characteristic. In this desired condition, there is a balance of various vegetation conditions so that although portions might not be perfectly resistant to large-scale fire, or insect/disease outbreaks, etc., yet on the whole, the landscape would exhibit resilience, so that when these natural disturbances occur it recovers more rapidly, without entire loss of broad-scale resource values.

[17] Popper Project area was planned, had public collaboration (Deschutes County Forest Project), and was nearing Decision when on September 9th, 2012 a wildfire began in the project area (Pole Creek Fire Assessment 2012).

Ponderosa Pine

The ponderosa pine plant association is made-up of relatively open stands of ponderosa pine that have irregular distribution both as individual trees and as relatively small groups. Reproduction is often in even-aged patches up to several acres in size, and scattered grass/shrub/forb openings, 1/10 to ¼ acre in size with a few larger scattered trees. This plant association group will generally develop into a ponderosa pine climax condition, with infrequent denser stands found in riparian bottomlands and other moist ecotones. Stands are primarily one or two storied and are often less than 25% canopy closure. Understories are almost entirely ponderosa pine as scattered individuals or small ($1/10^{th}$-$1/4^{th}$ acre) even-aged groups. Shrubs and grasses are young and vigorous, reflecting the influence of frequent, low intensity fire. Low intensity fire is the primary disturbance agent, with fire return intervals ranging from 5 to 20 years.

Mixed Conifer (Dry and Wet)

The mixed conifer landscape is a mosaic of varying patch sizes and seral stages and formed from influences of adjacent areas, site productivity and disturbance regimes. Stands contain a range of small, medium and large trees. Ponderosa pine is the dominant overstory "anchor" species with sparse understories of both shade tolerant and intolerant species. Low to mixed intensity fire return intervals are 0-50 years and help maintain seral species and prevent the dominance of climax species in most stands. Snag and down log levels would be consistent with historic levels and standards in the Northwest Forest Plan. Fire severities within mixed conifer PAGs would encompass the range from low to high severities with high severity consisting < 10% of the burn area occurring as small patches distributed throughout the burn area (departure from Watershed Analysis). In wet mixed conifer, stand replacement effects were more widespread in patches than surface fire effects, while in dry mixed conifer, surface fire effects are more widespread by nearly 2:1 (Hessburg et.al. 2007). Scattered stands of climatic climax conditions exist where disturbance intervals are longer. These stands are generally older, have higher site productivities and have a higher density of the largest trees.

Mixed Conifer Dry – Generally these areas are one or two storied stands with 20% to 40% canopy closure. Understory trees and shrubs are unevenly distributed and a mix of shade tolerant and intolerant species. Grand/white fir does not comprise more than 20% of the stand. Snags present are sufficient to meet 100% MPP for wildlife focal species (usually 4 to 7 per acre). Down logs are scattered throughout the stand. Small openings exist, generally less than 10 acres in size, with 10 to 15 trees per acre (primarily ponderosa pine) and with large snags present/created.

Mixed Conifer Wet – These plant associations occur mostly in moister ecotones such as riparian bottoms, higher elevations, north slopes, or other areas with fire return intervals at the upper end of 0-50 years. These stands are multi-storied, with 30%-60% canopy closure, and include a balance between grand/white fir and "anchor" ponderosa pine. Understory trees, which are mostly shade tolerant species, are multi-aged, and well distributed. Trees (either ponderosa pine or grand/white fir) may occur as dense thickets when pioneering an opening created by insects/disease, fire or windthrow. Due to surrounding area influences, grand/ white fir does not comprise more than 30% of the area over 30 years. Snags and large down logs provide a significant amount of structural complexity.

Lodgepole Pine

These areas are influenced by cold air drainages and in general have a longer disturbance interval, but can be influenced by the surrounding landscape and changes in insect/disease abundance (Simpson 2007, Stine 2014). Moderate to high intensity fire is the primary disturbance agent with return intervals of around 35 to 100+ years. Generally these areas are a mosaic of varying textures and seral stages and patch

sizes and contain stands of generally similar aged/sized trees with few large ponderosa pine grand/white fir remnants.

The desired future condition includes safety along a travel corridor would include reduced fuel loading from recent fires and beetle epidemic thereby lowering risk to public/fire fighter safety near a visual and escapement corridor (Forest Road 16). Tree species diversity among the different stand conditions would be favored where such exists.

Environmental Consequences

Goals, Objectives, and Issues Addressed and Indicators for Assessing Effects

Goals, objectives, and issues are discussed above under Overview of Issues Addressed and Desired Condition.

Issues Addressed and Indicators for Assessing Effects

This analysis discloses the predicted effects of tree thinning and fuels reduction on forest health and sustainability. The direct factors analyzed herein, and those which influence meeting the purpose and need of the project are; forest/stand structure, stand densities, species composition and insects and disease risk. Actions that affect these factors are the type and amount of vegetation management (e.g. tree thinning, prescribed burning, and mowing), and extensive disturbances.

The primary biotic risk agents identified in the project area were tree densities, bark beetles and western 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 the upper management zone treated with density-reducing treatments.
- Western dwarf mistletoe reduction is measured in terms of the acres of stands infected with western dwarf mistletoe treated to remove/reduce infection, and the number of acres above the upper management zone treated with density-reducing treatments.

Key Issues and Analysis Issues are displayed below (Table 44 and Table 45).

Table 44 Key issues

Key Issue		Key Issue Indicator (s)
1	Temporary roads	1) Acres made assessable (by temporary road construction) 2) SDI
2	Group Opening in Mixed Conifer PAGs	1) Acres of openings 2) Past logging and fire suppression
3	Removal of large diameter dwarf mistletoe pine	1) Acres with potential large diameter heavily infested dwarf mistletoe pine tree removal.

Rationale within proposed action that resulted in Key Issue Development

Key Issue #1: No temporary roads

The proposed action of building 0.8miles of temporary road action was developed to allow access to about 70-90 acres in the project acre. About 71 of these acres allow access to land directly interfacing with private land (Skyline Forest). This temporary road construction consists of reutilizing old road beds and/or skid trails from previous harvest activities.

Key Issue #2: Do Not Include Group Openings in the Mixed Conifer Plant Association

This portion of the proposed action was developed to address the interacting effects of past logging and fire suppression/exclusion within the mixed conifer type on grand/white fir site dominance. The proposed action describes the implementation location of these openings in terms of high relative grand/white fir/ ponderosa pine proportions and retains ponderosa pine from any size class if they are healthy or have low mistletoe infection[18]. It is estimated that a maximum of 30% (range 10-30%) of a given unit would have these openings and would range in size from 1-3 acres. These areas will also have reintroduced prescribed fire to improve natural regeneration of ponderosa pine and may be planted if ponderosa pine regeneration is delayed.

Key Issue #3: Do not remove large diameter dwarf mistletoe pine

This portion of the proposed action was developed to assign specific locations where Deschutes National Forest Collaborative (DNFC) ponderosa pine dwarf mistletoe recommendations would be specifically applied. These areas represent 160 acres and would remove select large trees in strategic locations as outlined in recommendations. These recommendations would be interpreted and communicated (feed-back) before these trees are removed. Old growth ponderosa pine outside of these areas would be maintained however pruning or girdling may occur.

Table 45 Analysis issues.

Analysis Issue	Analysis Issue Indicator (s)	Measures
Forest Ecosystem Restoration	Stand density	SDI
	Old growth development	SDI
	Stand structures /species composition	Acres treated
	Insects and disease	SDI, DMR
	Fuels restoration	CBH, CBD, CI, fire type
NWFP Standard and Guideline C-44	Retention of old-growth fragments in watersheds where little remains	Percent of Retention

Spatial and Temporal Context for Effects Analysis

Spatial and Temporal Bounds

The proposed action would occur within the project boundary and within the ponderosa pine, dry/wet mixed conifer and lodgepole types. Additional treatments are proposed within lodgepole stands, but are planned more as visual enhancement, fuels reduction or to open stands up for other in situ species (ponderosa pine).

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The cumulative effects boundary includes a 1000ft buffer around the project area to account for adjacent vegetation changes/ effects. This includes eastern edge of the Pole Creek Fire and southern boundary of the SAFR project area.

[18] Relative proportion: These areas indicate current grand/white fir which was not previously the case prior to past overstory logging and fire suppression/exclusion policy. Determination of this condition was done by historic ponderosa pine stumps both through direct quantitative and qualitative assessments and through the review of literature. Mixed conifer in Melvin Butte indicates greater historic ponderosa pine proportion than current levels.

Alternative 1 – Ecological Trends Direct and Indirect Effects

There are no treatments under the no action alternative, and therefore no direct effects.

Forest Ecosystem Restoration Trends

No thinning, harvest, prescribed burning or mowing would occur within the project area under the no-action alternative. Stand structure and density under the no action alternative would continue to deviate from historical conditions in the following ways:

- Stands would continue to be dominated by small trees (<21 in. DBH).
- Stand structure of stands would consist of dense, multi-storied canopies, resulting in large areas of contiguous ladder fuels or plantations with uniform canopies under high density shrub layer.
- Dead fuel on the surface would continue to accumulate in the form of decadent brush, dead material from insect and disease mortality, limbs, and needles, adding to the fuels that have accumulated since the last burn cycle.
- There would be an increase in western dwarf mistletoe in ponderosa pine.

The shift in species composition towards fire intolerant species (lodgepole pine and grand/white fir) would continue with the following effects:

- There would be more fire-intolerant species (primarily grand/white fir) on the landscape, and there would be more ladder fuels from the fire-intolerant species in the understory.
- There would be more shorter-lived trees (i.e., lodgepole pine and grand/white fir).
- There would be more stress on overstory ponderosa pine.
- There would be an increased risk of future bark beetle outbreaks, which increases the fire hazard over the landscape.

Thinning towards historic forest conditions in order to promote sustainability and resiliency would be avoided. Stand structures, species composition, and hazardous fuels would continue to move further away from HRV proportions. Approximately 88% of the acres in the project area are above the upper management zone. These acres are considered at a higher risk for bark beetles (mountain and western pine beetle) mortality, stand replacement fire and dwarf mistletoe infection (Powell 1999). These high density areas will remain susceptible to dwarf mistletoe and bark beetle activity and the susceptibility will increase over time. High stand densities will result in the overall reduction in tree vigor among all size classes. A reduction in tree vigor will predispose those trees to the various insects and diseases that take advantage of low vigor/weakened trees (e.g. bark beetles and root diseases). The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component at a rate that is likely to be much faster than if stand densities had been reduced to lower density levels. Ponderosa pine dwarf mistletoe from all size classes would continue to spread down, out and within furthering spread within and adjacent plantations. Fuel buildup would continue contributing reductions in ponderosa pine natural regeneration. Lodgepole stands would continue to fall apart with areas within the Pole Creek fire and along the 16rd creating high down wood levels and impacting this escapement and visual corridor.

Stand Structures/Species Composition

Stand structures currently do not reflect the desired condition based on historical references, and are not likely to achieve this under no action (Youngblood 2006). Resistance and resilience to disturbance would remain low, since almost the large majority of stands are at or above the UMZ for stand density. Current fire suppression/exclusion policy and past logging has increased small trees that act to increase inter-tree competition (densities), fuel ladders and abundance and spread of dwarf mistletoe. Under the no action

the interaction of these elements will continue and contribute to delays in old growth development and attenuation of current old growth trees overtime. Since small shade-tolerant trees would continue to persist and grow under the overstory, and new regeneration of shade-tolerant species would be recruited, the stand structures would continue to be multi-layered and to succeed to grand/white fir. There would be continued loss of the larger ponderosa pine, which are the most fire-resistant trees, and which "anchor" late-successional habitat from disturbance to disturbance by providing a long-lived component with the ability to survive wildfire. At the high stand densities found in this area, the larger, older trees are often the first to die, because under stress they are unable to maintain their higher respiratory requirements compared to smaller trees, and are susceptible to bark beetles (Fettig et al. 2007).

Dense younger stands in the project area also would not benefit from thinning treatments designed to create heterogeneity and increase growth. These stands are currently very dense (some areas exceed 1000 trees per acre), and thinning would move them towards reference conditions for density and species composition. Many plantations established after clearcutting since the 1960s are dense and even-aged. Pole size lodgepole and mixed conifer stands, some of which developed after partial-cutting, would continue to be dense and relatively even-aged/sized. Given the high levels of insects and disease within the project area, not thinning these younger stands to increase growth and moving them towards desired conditions would be a lost opportunity. Thinning would provide potential replacement habitat for mortality-prone mature stands sooner than no treatment.

In the event of a wildfire it is expected that fire behavior and stand replacement conditions would occur and be similar to that of the Pole Creek Fire 2012. As such a large proportion of the area would be set back to an earlier seral and structural state therefore resulting greater and longer delays in old growth development.

The growth and crown development of the smaller trees would also be affected by No Action. Trees in the smaller size classes (<21" dbh) would remain in high density conditions that are not conducive to good growth or crown development. The types of crowns developed by historic old-growth ponderosa pine did not occur under the high densities that the majority of the small trees in the Melvin Butte project are growing under now.

Stand Density

Stand densities would remain at high levels and generally increase over the next 30 years under No Action. Whether density increases in a given stand or stand-type or not will depend on the amount of density-dependent mortality and density-independent (insect/disease related) mortality that occurs. Both types of mortality are difficult to predict, and are often triggered by drought which intensifies the competition process among trees and weakens trees so that they are less able to resist insects and pathogens. However, given that existing densities exceed thresholds based on MaxSDI (50 percent of MaxSDI) on over 4730 acres (Table 46, Table 47 and Table 48), and given that mortality is already occurring, it is highly likely that mortality would continue and increase in the future. Stand densities will remain high and continue to increase in areas where they are already high. In areas where they may not already be high they will continue to increase, eventually reaching undesirable levels. Under the No Action alternative, the large tree component, as well as smaller trees, which represent future large trees, would exhibit low resistance to bark beetle attack, and higher risk of mortality from dwarf mistletoe. With continued competition from understory trees, mortality within the large tree component would be expected to increase. Losses would be especially pronounced under drought conditions.

No action alternative would result in the slowdown of the recruitment of large trees due to the continued density-related decline in tree growth and vigor. Stands would continue to decline in growth and vigor due to increasing competition and reduced crown development. Risk to insects and disease would continue to intensify. Increased bark-beetle activity would be anticipated with the next drought cycle.

Table 46 Existing and 2045 stand metrics for mixed conifer dry PAG.

Stand Metric	Existing Condition	Year 2045
Trees/acre	1425	965
Basal Area/acre (ft.^{2})	207	221
Canopy Cover (%)	64	63
SDI	467	472
% MaxSDI	69	67

Table 47 Existing and 2045 stand metrics for mixed conifer wet PAG.

Stand Metric	Existing Condition	Year 2045
Trees/acre	1939	1464
Basal Area/acre (ft.^{2})	228	262
Canopy Cover (%)	65	66
SDI	551	586
% MaxSDI	84	89

Table 48 Existing and 2045 stand metrics for ponderosa pine PAG.

Stand Metric	Existing Condition	Year 2045
Trees/acre	1575	522
Basal Area/acre (ft.^{2})	149	167
Canopy Cover (%)	55	54
SDI	335	333
% MaxSDI	87	88

Insects and Disease

Dwarf Mistletoe

Table 49 Western Dwarf Mistletoe Ratings by PAG.

PAG	Existing Mean DMR (Avg. across all stands)	2045 Mean DMR (Avg. across all stands)
Ponderosa pine	2.02	4.08
Mixed Conifer	1.05	2.20
Lodgepole	0.80	1.35

Due to current levels of dwarf mistletoe, stand structures and densities the trends of dwarf mistletoe will increase substantially (Table 49). This can likely be explained by the numerous plantation and second growth blocks surrounded by medium to large heavily infested ponderosa pine (Figure 15). These trees would continue to spread mistletoe seeds down, within and outward filling in areas with low to medium infections. With a rate of 2-3 ft/year in even aged stands, currently infected plantations will be completely or nearly so enveloped with dwarf mistletoe in 2045. High stand densities are expected to increase large tree mortality and dwarf mistletoe infection and bark beetles interactions are expected to reduce large tree recruitment. Since dwarf mistletoe is specific to ponderosa pine, increase of grand/white fir is expected creating conditions that are further outside of reference conditions.

Re-Introduction of Fire

Re-introduction of fire for beneficial uses would be extremely difficult under the no action alternative due to the current propensity towards crown fire, mortality and adjacent private lands. Holding and suppression activities would place firefighters at risk due to dense understories which could lead to dangerous flaming fronts along potential hold lines. Anchor points would need to be established, which during suppression activities are usually done in haste as opposed to planned treatments executed by contracts.

Uncharacteristic Wildfire

Fire regimes in the ponderosa and mixed conifer PAG were historically primarily frequent/low to mixed severity regimes that consumed mostly understory fuels, vegetation with small pockets of torching. Predicted fire types now have substantial amounts of stand-replacing severity, which is considered uncharacteristic of these plant associations (Table 50, Agee 1994).

Table 50 Predicted fire type under No Action (2019).

Fire type under severe conditions	Acres	% of project boundary
Active	2441	45
Cond. Crown	217	4
Passive Crown	1009	19
Surface	1705	32

Alternative 2 – Direct and Indirect Effects

Effects on Forest Ecosystem Restoration

A total of 4,435 acres would be treated using a variety of treatment types to reduce tree and shrub density, increase average tree size, reduce fire-intolerant late-seral species, reduce abundance of mistletoe laden trees, enhance visuals and provide fuel breaks to protect people and property from wildfire from the project area. Two hundred and forty of these acres will be a visual and WUI escapement corridor “clean up” of heavy fuel loading adjacent to the 16rd (Three Creeks Lake road). The no treatment areas correspond to Three Creek while retention strategy areas correspond to different areas within the project boundary (see Wildlife report).

Stand Structures/Species Composition

Alternative 2 thinning and underburning treatments would move stands towards reference conditions. All treatments would lead to a greater patchwork distribution of size/age classes rather than the current continuous vertical and horizontal distribution of trees. Early seral, fire climax ponderosa pine species composition is improved by the number of acres treated which includes areas where this is the focus strategy (i.e. mixed conifer group openings).

Management practices aimed at maintaining vigorously growing stands can considerable reduce the potential impacts of insects and disease agents and enhance forest health (Hessburg, et.al. 1994). Under Alternative 2, thinning and harvest treatments would reduce competition stress on larger, older ponderosa pine by thinning from below. High densities and competing species (e.g. juniper and grand/white fir) can represent a considerable component of competition with older overstory pines. Reducing the small tree component and other competing species around older pines would provide needed growing space to keep overstory trees growing at rates that would allow them to be resistant to bark beetles and resilient to dwarf mistletoe.

Stand structure and species composition under Alternative 2 would be moved towards historical conditions in the following ways:

- On at least 4,201 treated acres, average diameter would be increased by cutting/removing smaller trees, increasing the resistance of those acres to fire.
- A larger increase of early seral (ponderosa pine) species proportion within the mixed conifer types by heavy thinning of fire intolerant species. This would include up to a maximum of 250 acres broken into 1-3 acre areas.
- Stand structure of most stands would still consist of multi-layered canopies, but the density and number of layers would be reduced and large areas of contiguous ladder fuels would be broken up and crown bulk densities would be reduced.
- Dead fuel on the surface in the form of decadent brush, dead material (from recent insects/disease/fire), limbs, and needles, would be treated along with activity created fuels.

The current trend, in some portions of the project area, in species composition towards fire intolerant species (juniper, lodgepole and grand/white fir) would be abated with the following effects:

- More fire- and disease-resistant species would occupy the landscape, and ladder fuels in the form of shade-tolerant trees in the understory would be reduced.
- Less fire intolerant species (juniper, lodgepole pine and grand/white fir) would occupy the landscape.
- There would be a reduction in competitive stress on overstory ponderosa pine.
- Species diversity would be maintained by retaining fire intolerant species in retention areas, no-treatment clumps/areas, riparian corridors as well as the higher productive plant associations.

Stand Density

On the project (Melvin Butte landscape) level, SDI moves from 88% max SDI (pre-treatment) to 44% max SDI (after thinning). This proportion change represents movement to between the lower and upper management zones for forest health. While specific areas within the project are still above the UMZ (60% Max SDI) (Table 51 and Table 52) and has sustained risk for insects/ disease and fire, other areas near or surrounding these are within the zone predicting these factors to be less likely. Plantation stands have received greatest release and are expected to develop into large trees more rapidly (assuming reduced mistletoe influences).

Table 51 Stand density metrics pre-and post-thinning (2016) for proposed action prescriptions.

Rx	Acres	Pre-BA	Post-BA	Pre-SDI	Post-SDI	Post % MaxSDI	Pre-QMD	Post-QMD
Prescribed fire	779	200	153	470	307	53	5.6	8.8
Retention strategy areas	775	225	225	518	518	74	5.9	5.9
Lodgepole pine improvement	249	210	73	528	159	24	4.8	6.5
Plantations	1174	103	43	327	198	23	5.6	8.5
Dwarf Mistletoe	159	174	80	400	173	35	5.7	9.3
Thinning	998	174	119	448	208	43	5.9	11.4
Thinning w/group openings	835	237	102	559	219	33	5.5	8.0
No treatment	159	221	221	542	542	81	4.9	4.9
Note: Rx acres represent what was assigned in FSVeg SDA and are approximate due to GIS slivers and non-forest polygons (not assignable); all values are averages of all treated stands (retention strategy acres displayed for								

reference) Scenic views is omitted here since it was largely stand replacement and thus is in the grass/forb state with low live tree densities.

Table 52 Stand density metrics pre- and post-thinning (2016) for predominate PAGs in project area.

PAG	Acres	Pre-BA	Post-BA	Pre-SDI	Post-SDI	Post % MaxSDI	Pre-QMD	Post-QMD
Lodgepole*	312	205	96	505	213	33	5.1	7.0
Ponderosa pine	1123	156	116	349	237	55	6.2	8.2
Mixed Conifer Dry	2123	212	129	489	276	40	5.7	7.7
Mixed conifer wet	1571	231	129	555	277	42	5.3	7.3
Note: These metrics represent stand metric averages across PAG treatment. * Lodgepole PAG metrics reported here include those areas outside the Pole Creek Fire 2012								

Insects and Disease

Variable thinning to lower SDI values and move stands towards reference conditions will have a positive effect on tree resilience against bark beetles and lightly (DMR1-3) infected dwarf mistletoe ponderosa pine. On the project level, dwarf mistletoe abundance is reduced by half and in 30 years levels are approaching the no action as mistletoe spread has impacted regeneration and other under/midstory trees. On the fine-scale (stand level), it is expected that strategic removal, pruning and girdling of point source locations including select large trees will aid in size development of ponderosa pine in fine-scale locations especially plantations and areas at least 100 ft from mistletoe infected trees.

160 acre Dwarf Mistletoe Areas-

Variable thinning under and midstory trees and strategic removal of select overstory trees within 160 acre dwarf mistletoe emphasis areas will aid in reduced spread rates to coordinating and neighboring plantations promoting these areas to develop into the overstory. Follow up pruning of other trees and underburning in these areas will help reduce other point sources into and among stands. Outside of neighboring plantations, most of these areas will maintain a mistletoe component in the short and long-term.

Outside of 160 acre Dwarf Mistletoe Areas-

Variable thinning under and midstory trees will reduce mistletoe abundance within stands and create larger distances between crowns. Follow up underburning and pruning will aid in reduced infection levels when trees are killed by fire or point source locations are reduced from pruning. Natural regeneration or any overstory trees in these areas will continue to be infected and offer infections to neighboring understory trees. Isolating and confining groups of overstory trees with a thinning buffer will help reduce spread (outside the group) in the short term, but in the long-term rates are expected to return as regeneration occurs. Strategic thinning of moderately to heavily infected small to medium sized ponderosa, pruning or girdling will help promote resource reallocation to non- or lightly-infected ponderosa pine leave trees. These trees may become more resilient to dwarf mistletoe infection if their distances are at an adequate distance from mistletoe point sources. When this is the case they will be more likely to develop into larger size classes. Table 53 displays ratings after treatments in 2019 and 2045.

Table 53 Dwarf mistletoe rating after treatments in 2019 and 2045. Averaged across all stands in PAG.

PAG	2019 Mean DMR (Avg. across all stands)	2045 Mean DMR (Avg. across all stands)
Ponderosa pine	1.03	3.50

Mixed Conifer	0.85	1.95
Lodgepole	0.51	1.28

Large tree component

Thinning stands towards reference conditions to reduce density; adjust species proportions (favoring ponderosa pine over white fir); reduce dwarf mistletoe and reintroduce fire would have short-term albeit minor reduction in large trees (Table 54). In 30 years it is expected there will be an increase in the large ponderosa pine tree component across the project area as growing conditions are improved for large ponderosa pine tree recruitment/ development.

Table 54 Large tree per acre (TPA) change of across Melvin Butte project area under Alt. 2 old growth ponderosa and large and young white/grand fir among proposed action [19].

TPA (>21"dbh across Melvin Butte project area)	TPA >21"dbh after large and young white/ grand fir removal	TPA >21"dbh across all acres after implementation of Alt 2.	TPA >21"dbh across all acres in 2045
9.95	9.57	9.46	11.13

Potential for Crown Fire

Under the proposed action, the potential for crown fire is greatly reduced across the project as a whole (treated and untreated areas) as thinning, fuels work, underburning raises CBH and decreases CBD (Table 55 and Table 56). These changes increase the CI and reduce the potential for crown fire in all PAGs (Table 57). Although, no treatment and retention areas maintain high CBH, CBH (Table 56), acres treated show a marked decrease in the likelihood for stand replacement fire. Active crown fire is predicted to occur on 10% of the project area which is primarily allocated to retention strategy and no treatment areas (Table 58).

Table 55 Potential fire metrics post-treatment under Proposed Action (2019).

PAG	Acres	Avg. CC	Avg. CBH	Avg. CBD	Avg. BA Mortality Severe Fire	Avg. CI
Lodgepole*	312	34	8	0.10	58	32
Ponderosa pine	1123	35	16	0.04	47	54
Mixed Conifer Dry	2123	36	17	0.06	58	46
Mixed Conifer Wet	1571	35	16	0.08	63	44
*** Lodgepole PAG metrics reported here include those areas outside the Pole Creek Fire 2012**						

Table 56 Potential fire metrics for treated areas under Proposed Action after treatments completed (2019).

PA Rx	Acres	Avg. CC	Avg. CBH	Avg. CBD	Avg. BA Mortality Severe Fire	Avg. CI
Prescribed fire	780	40	19	0.08	53	38
Retention strategy areas*	745	41	10	0.09	69	37
Lodgepole pine	249	23	14	0.05	48	59

[19] This included simulation removal estimates of up to 1 strategic ponderosa pine per acre from 160 acres (in dwarf mistletoe units), 1 TPA white fir from 1000 acres of thinning units and 2 TPA from 835 acres of mixed conifer thinning units.

improvement						
Plantations	1174	30	20	0.05	52	52
Dwarf Mistletoe	159	33	15	0.04	35	55
Thinning	998	38	15	0.05	53	44
Thinning w/group openings	835	30	17	0.06	55	53
No treatment areas	159	43	13	0.12	70	29
*These areas mimic no treatment areas, but were a deliberate strategy based on soils. Rx fire may occur with 30 acres of the 745 acres.						

Table 57 Predicted fire type post-treatment under Proposed Action, acres by PAG after treatments completed (2019).

PAG	Active Crown	Cond. Crown	Passive Crown	Surface	Totals
Lodgepole*	6	2	33	271	312
Ponderosa pine	0	0	399	725	1123
Mixed Conifer Dry	69	228	825	1000	2123
Mixed Conifer Wet	311**	15	685	556	1567
Note: totals may not exactly match proposed action figures due to GIS operations and rounding in SDA. * Lodgepole PAG metrics reported here include those areas outside the Pole Creek Fire 2012 **These acres are due to no treatment or retention strategy areas with the PAG					

Table 58 Predicted fire type post-treatment under Proposed Action, treated acres by Alt 2 Rx (2019).

Rx	Active Crown	Cond. Crown	Passive Crown	Surface	Totals
Prescribed fire	7	79	36	657	779
Retention strategy areas*	431	0	84	260	775
Lodgepole pine improvement	0	0	86	163	249
Plantations	3	0	139	1032	1172
Dwarf Mistletoe	0	0	114	45	159
Thinning	0	7	190	800	997
Thinning w/group openings	0	40	131	664	835
No treatment areas**	61	0	24	74	159
Note: totals may not exactly match proposed action figures due to GIS operations and rounding in SDA *These areas mimic no treatment areas, but were a deliberate strategy based on soils. Rx fire may occur with 30 acres of the 745 acres. **No treatment areas are associated with Three Creek (riparian reserve)					

Uncharacteristic Wildfire

Alternative 2 greatly reduces the predicted mortality within treated areas, by changing the majority of the potential fire type acres to surface and passive crown (73% and 16% respectively, Table 58).

Alternative 2 – Cumulative Effects

All present and reasonably foreseeable future actions are designed to reverse the trends of past actions that have led the Whychus watershed away from HRV.

For cumulative effects to occur in terms of ecosystem restoration, fire behavior/severity and resilience/resistance to disturbance, those projects need to be within the project boundary or directly adjacent to this project.

The cumulative effects boundary includes a 1000ft buffer around the project area to account for adjacent effects due to fire spread and dwarf mistletoe from these areas. This area includes a portion of the Pole Creek Fire to the west and the SAFR project to the north. It is not known whether recent projects have or are going to occur east of the project on private lands. Boundary reconnaissance and aerial imagery review indicates low stocking and widely spaced trees in this area. The present vegetation management project and reasonably foreseeable future vegetation management projects in the Whychus watershed, under the current ecosystem principles, have or will be designed to minimize the loss of large trees and enhance the recruitment of trees into the medium/large tree category by favoring growth of dominant and co-dominant trees. The cumulative effects of the SAFR and Pole Creek Fire include higher fuels loads (hazard) to the west and untreated forest blocks (some with mistletoe) to the north. These combine to provide cumulative purpose/need for the proposed action for thinning within the project boundary for forest health and fuels reduction.

Besides that described above, there are no past, present or reasonably foreseeable projects that address the dense forest conditions, species proportions, fuels, provide for safety and visuals of evacuation routes, return fire as a natural disturbance process within or adjacent to the project area.

Alternative 3 – Direct and Indirect Effects

To address scoping key issues, the proposed action was modified into Alt. 3. These prescription modifications include: the removal of small group openings (1-3ac size areas up to 30%max of 835 acres) in the mixed conifer stands; retention of select large heavily infested ponderosa pine dwarf mistletoe trees in dwarf mistletoe units (160 acres) and avoidance of temporary road construction. As such, thinning modifications treatments become lumped under the “Thinning” analysis treatment type, Chapter 2 EA). The avoidance of temp road construction automatically drops about 71 acres of “Thinning” with these acres located along private land in the southeast portion of the project. As such the direct and indirect effects in this section will be focused[20] on the “Thinning” and on the entire project as a whole.

Effects on Forest Ecosystem Restoration

The major overarching difference between Alternative 2 and Alternative 3 has to do with changes in treatments acres, effects on species proportions and abundance and spread of dwarf mistletoe. Under Alternative 3 total treatment acres are reduced by 71 acres and treatment type within 995 acres are altered.

Stand Structures/Species Composition

There would be little difference in stand structures between Alternative. 3 and Alternative. 2 as stands are variably thinned from below lowering stand densities and reducing competition to larger trees. Treatment acres designed to address the effects of past selective logging and fire suppression (species composition implied) in the mixed conifer PAG by improving fire-tolerant localized ponderosa pine growing areas would be dropped. As a result, and in order to maintain stocking, fire intolerant species proportions would be retained. About 30% of the 835acres (250 acres maximum) would be maintained under a fire intolerant dominated trajectory.

[20] Analysis indicated similar results for Alt. 2 and Alt. 3 for plantations, lodgepole pine improvement, scenic views enhancement, underburning and retention strategy areas.

Stand Density

On the project (Melvin Butte landscape) level density measures for Alternative 3 are similar to Alternative 2, SDI moves from 88% max SDI (pre-treatment) to 48% max SDI (after thinning). The 4% increase (from Alternative. 2) is a result of treatment acres being dropped and altered. As a result, 321 acres are kept at higher densities with more of a fire intolerant tree composition with 71 acres directly next to private land. See Table 59 and Table 60 for the effects of Alternative 3.

Table 59 Alt 3 stand density metrics pre-and post-thinning (2016) for those treatment acres modified by Alternative 3 Rx proposed action prescriptions.

Rx	Acres	Pre-BA	Post-BA	Pre-SDI	Post-SDI	Post % MaxSDI	Pre-QMD	Post-QMD
Thinning	1922	214	124	498	273	46	5.7	13.2
No treatment	229	220	220	535	535	81	5.0	5.0
Note: Rx acres represent what was assigned in FSVeg SDA and are approximate due to GIS slivers and non-forest polygons (not assignable); all values are averages of all treated stands. Scenic views is omitted here since it was largely stand replacement and thus is in the grass/forb state with very little tree densities.								

Table 60 Alt 3 stand density metrics pre-and post-thinning (2016) for predominate PAGs in project area.

PAG	Acres	Pre-BA	Post-BA	Pre-SDI	Post-SDI	Post % MaxSDI	Pre-QMD	Post-QMD
Ponderosa pine	1123	156	119	349	245	57	6.2	8.3
Mixed Conifer Dry	2123	212	139	489	301	44	5.7	7.1
Mixed conifer wet	1571	231	135	555	294	45	5.3	6.8
Note: These metrics represent stand metric averages across PAG treatment. * Lodgepole PAG was omitted since results are the same (see table 22).								

Insects and Disease

Thinning to lower SDI values and moving stands towards reference conditions will have a positive effect on tree resilience against bark beetles and lightly (DMR1-3) infected dwarf mistletoe ponderosa pine.

On the project level direct and indirect effects of dwarf mistletoe among Alternative 3 and Alternative 2 are similar (Table 53 and Table 61). At the project level dwarf mistletoe rating is reduced by about 1/3rd from existing levels and in 30 years those levels return to slightly below the no action for that year (Table 53, and Table 61). On the stand-scale overstory influences into plantations and small medium small trees are maintained as large trees continue to provide mistletoe point source locations. Retaining any small trees underneath or adjacent to, highly infected ponderosa pine trees decreases the likelihood for large tree development (Eglitis et al. 2014). Overtime infestations will spread down, out and within infecting more and more of the plantations and adjacent area. Under this alternative managing for young ponderosa pine or replacement near highly infected trees, of any size, is challenged by reduced height/ diameter growth.

Table 61 Alt 3 dwarf mistletoe rating in 2019 (post treatments) and 2045. Averaged across all stands within PAGs.

PAG	2019 Mean DMR (Avg. across all stands)	2045 Mean DMR (Avg. across all stands)
Ponderosa pine	1.19	3.65
Mixed Conifer	0.88	2.02
Lodgepole	0.51	1.28

Potential for Crown Fire

On the landscape as a whole, crown fire potential reduced from no action though would be slightly higher than the Proposed Action. This difference from the proposed action is due to the reduction in treatment acres and type within the ponderosa pine and mixed conifer types (Compare Table 55 though Table 58 and Table 62 to Table 65).

Table 62 Potential fire metrics post-treatments under Alterantive 3 (2019).

PAG	Acres	Avg. CC	Avg. CBH	Avg. CBD	Avg. BA Mortality Severe Fire	Avg. CI
Ponderosa pine	1123	37	16	0.04	49	49
Mixed Conifer Dry	2123	38	15	0.07	65	40
Mixed Conifer Wet	1571	40	14	0.09	69	37
Lodgepole PAG is omitted here due similar results as Alt 2 (see table 24)						

Table 63 Potential fire metrics for treated areas under Alternative 3 after treatments completed (2019).

PA Rx	Acres	Avg. CC	Avg. CBH	Avg. CBD	Avg. BA Mortality Severe Fire	Avg. CI
Thinning	1922	40	12	0.07	67	39
No treatment areas	229	44	12	0.13	75	27
Fire metrics for the remaining treatments are the same as those displayed in Table 25.						

Table 64 Predicted fire type post-treatment under Alternative 3, acres by PAG after treatments completed (2019).

PAG	Active Crown	Cond. Crown	Passive Crown	Surface	Totals
Ponderosa pine	0	0	398	725	1123
Mixed Conifer Dry	123	228	822	949	2122
Mixed Conifer Wet	311*	15	719	522	1567
Note: totals may not exactly match previous figures due to GIS operations and rounding in SDA. Lodgepole PAG is omitted here due similar results as Alt 2 * These acres are due to no treatment or retention strategy areas					

Table 65 Predicted fire type post-treatment under Alternative 3, those treatment acres modified by Alt 3 Rx (2019).

Rx	Active Crown	Cond. Crown	Passive Crown	Surface	Totals
Thinning	27	47	281	1566	1922
No treatment areas	61	27	68	74	229
Note: totals may not exactly match proposed action figures due to GIS operations and rounding in SDA. Fire metrics for the remaining treatments are the same as those displayed in Table 27.					

Uncharacteristic Wildfire

Access to about 70-90 acres of restoration units would be avoided with over ½ of this land directly interfacing with private land (2/3rd mile). As such, potential fire behavior and influences (egress) in these areas would be less predictable as current crowns have both horizontal and vertical fuel connectivity. Ongoing fire suppression/exclusion policy would continue and in the event of extreme wildfire fire behavior, related suppression tactics and existing conditions and trends; high severity sizes and

proportions would range comparable to recent past fires (Eyery Fire 2002, Rooster Rock 2010, Pole Creek Fire 2012, Green Ridge Fire 2013, Bridge 99 Fire 2014, Whychus Watershed Analysis 2013).

Alternative 3- Cumulative Effects

Cumulative effects are the same as the proposed action.

All present and reasonably foreseeable future actions are designed to reverse the trends of past actions that have led the Whychus watershed away from HRV.

For cumulative effects to occur in terms of ecosystem restoration, fire behavior and severity and resilience/resistance to disturbance, those projects need to be within the project boundary or directly adjacent to this project.

The cumulative effects boundary includes a 1000ft buffer around the project area to account for adjacent effects due to fire spread and dwarf mistletoe. This area includes a portion of the Pole Creek Fire to the west and the SAFR project to the north. It is not known whether recent projects occurred to the east on private lands. Boundary reconnaissance and aerial imagery review indicates low stocking and widely spaced trees in this area. The present vegetation management project and reasonably foreseeable future vegetation management projects in the Whychus watershed, under the current management paradigm, have or will be designed to minimize the loss of large trees and enhance the recruitment of trees into the medium/large tree category by favoring growth of dominant and codominant trees.

The cumulative effects of the SAFR and Pole Creek Fire include higher fuels loads (hazard) to the west and north side of the project and untreated forest blocks (some with mistletoe) to the north. These combine to provide cumulative purpose/need for the proposed action for thinning for forest health and fuels reduction.

Besides that described above, there are no past, present or reasonably foreseeable projects that address the dense forest conditions, species proportions, fuels, provide for safety and visuals of evacuation routes, return fire as a natural disturbance process within or adjacent to the project area.

Northwest Forest Plan Standard and Guideline C-44

Introduction

The Northwest Forest Plan contains direction in the Matrix land allocation to provide for retention of old-growth fragments in watersheds where little remains (NWFP standard and guideline (C-44)). Landscape area where little late successional forest persists should be managed to retain late successional patches. This standard and guideline will be applied in the fifth field watersheds (20 to 200 square miles) in which federal forest lands are currently comprised of 15 percent or less late successional forest.

Analysis

The Deep Canyon (1/5th field) watershed consists of a wide range of biophysical environments that include inherent soil limitations to tree growth, from alpine meadows to xeric shrub lands and as such only a portion of the watershed can support development of trees let alone large trees that develop into an assemblage that becomes old growth habitat for late successional species (Craigg et al. 2015).

The old growth fragments/ patches[21] in the Deep Canyon Watershed and Melvin Butte Project area total 1,188 acres at the watershed scale. Six hundred and sixty-two of these acres are within the Melvin Butte project boundary (Table 66 and Table 67). In addition, these old growth patches/fragments in the watershed are disproportionally located to public (primarily National Forest System lands) and/or to biophysical environments more productive in nature (Simpson 2007, Appendix F, Table 38).

Over ½ (about 56%) of the entire watershed's large tree patches/ fragments are contained within Melvin Butte project area. The large tree patches/ fragments were further analyzed among the differing Melvin Butte project treatment descriptions areas which are presented below (Table 67). This analysis was chosen in order to demonstrate meeting Standard and Guideline C-44 of the Northwest Forest Plan.

Figure 18 displays old growth areas and patches within the Deep Creek 5th field watershed.

[21] Old growth patch size/ fragment determination came from a Lidar process of using a 30meter raster in order to determine large tree assemblages (number of large (>21"dbh) trees per 30 meter grid) that meet (or exceed) the Interim Old Growth Guide1993. Areas determined by Lidar analysis and consist of a height derived diameter. See correlation variables including diameter in Appendix E.

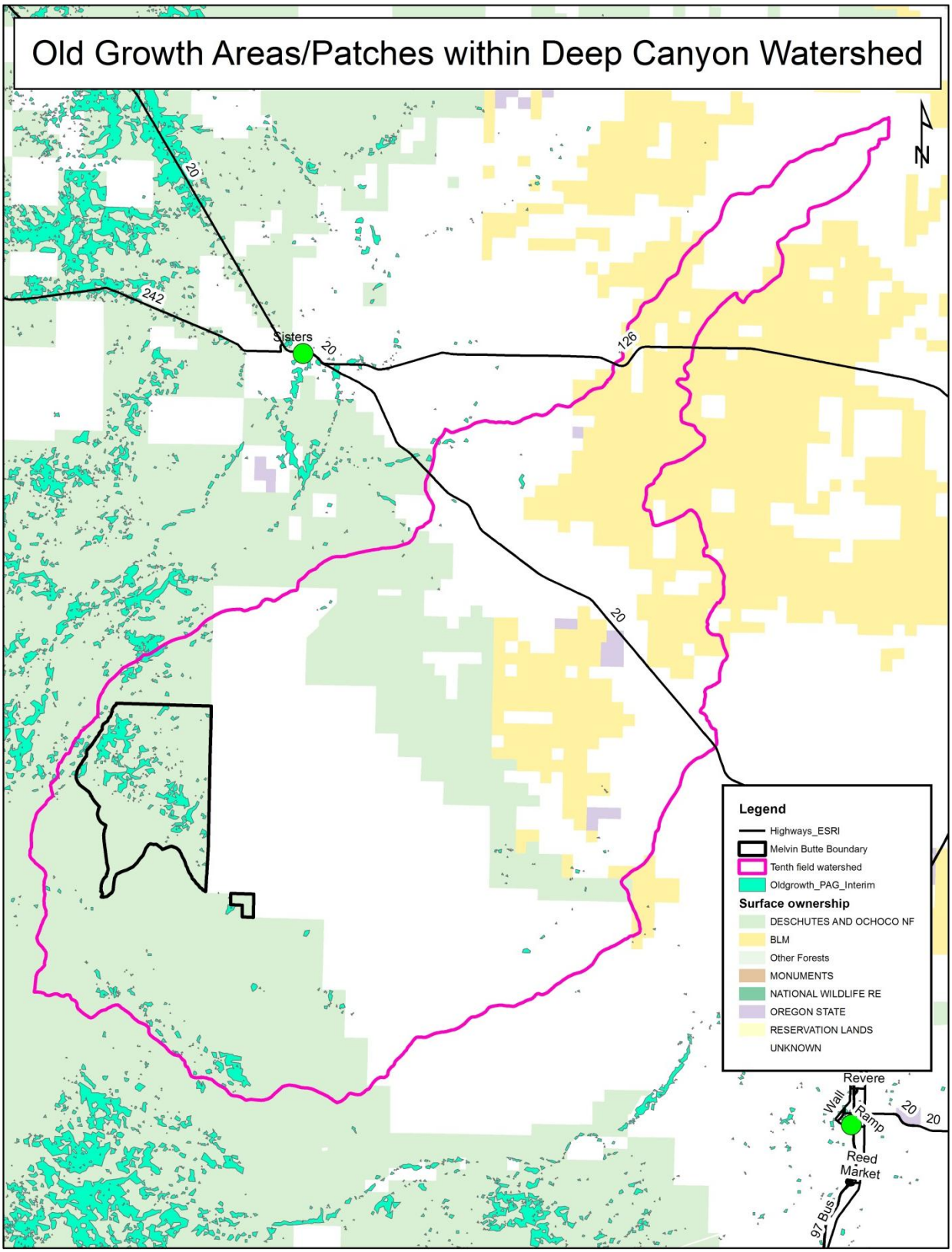


Figure 18 Old growth areas and patches within the Deep Creek 5th field watershed

Alternatives 2 and 3- Direct and Indirect Effects

Retention of Melvin Butte old growth patched/ fragments are being met in several ways under either action alternatives. See Tables 66 and 67. The below acre proportions come from the 662 acres found within Melvin Butte project area. These are broken out by Alternative 2 treatment type

1) Retention strategy and other areas (ex. Three Creek) that are absent of thinning treatment.
    a. 33% of the old growth fragments/ patches found within Melvin Butte project area are in these areas.
2) Restriction of treatments to prescribed fire and/or 8”dbh thinning limit in Prescribed Fire treatment units.
    a. 30% of the old growth fragments/patches found within Melvin Butte project area are in these treatment areas and would not be impacted due to nature of small understory tree thinning and use of low intensity prescribed fire.
3) Retention of all old growth ponderosa pine clumps/ areas within the 160 acre Dwarf Mistletoe Units when they meet clump designation quota (at least 4 old growth ponderosa pine within a connected 66ft distance between trees).
    a. Less than 1% of the old growth fragments/ patches within Melvin Butte area are contained in this treatment type and by Lidar determination process[15] (and above parameter) provides retention of old growth.
4) Unit by unit silvicultural implementation prescriptions that describe retention of old growth structure, composition (and accentuation) where present. Retention to include old growth ponderosa pine and old growth white fir and other species (where present) to a frequency that maintains large tree structure/ frequency across stands and maintains the definition as described in the Interim Old Growth Definitions (USDA 1993).
    a. 30% of the old growth patches/ fragments acres are contained in the Thinning treatment description areas.
        i. All prescriptions call for the retention and/or accentuation of old growth trees to maintain or exceed definitions (VanPelt 2008, USDA 1993).
    b. Less than 4% of the old growth patches/ fragments acres are contained in the Mixed Conifer Group Opening treatment areas.
        i. All prescriptions call for retention of old growth ponderosa pine. Any and all openings would maintain ponderosa pine tree composition and structure.
    c. Less than 2% of the old growth patches/ fragments are contained in the Plantation treatment areas.
        i. No old growth will be cut in plantations; this number represents trees detected on the boundaries of these areas. Boundary trees may be pruned if infected with dwarf mistletoe.
    d. All other treatment areas do not contain these old growth patches/ fragments

Table 66 Acres and proportions of the large tree patches/fragments among different "subareas" within the Deep Canyon watershed.

	Acres	Old growth fragments/patches acres (Lidar determined based on large trees/acre)	Proportion of area with old growth patches/fragments (%)
Deep Canyon watershed	97,509	1,188	1.2%
Applicable assessment area due to pertinent biophysical environment	60,712	1,188	2.0%
FS land with pertinent biophysical environments	49,601	1105	2.2%

Private land with pertinent biophysical environments	47,908	83	0.2%

Table 67 Acres and proportions of the large tree patches/fragments among the Melvin Butte treatment types.

	Total Acres	Old growth fragments/patches acres (Lidar determined based on large trees/acre)	Proportion of Melvin Butte old growth fragment/ patches acres by Alt 2. Treatment type[22] acres
Melvin Project	5,375	662	N/A
Retention strategy, no treatment and no thinning treatment areas	940	222	33%
Plantations	1174	13	2%
Prescribed fire (includes small tree thinning)	809	201	30%
Dwarf Mistletoe	160	2	0%
Mixed Conifer Group Openings	835	24	4%
Scenic Views Enhancement	240	0	0%
Lodgepole pine improvement	249	0	0%
Thinning	998	201	30%

Conclusion

Alternative 2 and Alternative 3 are nearly identical in retention proportions and needs and meet Standard and Guideline C-44. Difference is “Thinning Treatment” (Item 4a above in this section) increases to 35% as those old growth patches/fragments acres from Dwarf Mistletoe and Mixed Conifer treatments are reclassified to “Thinning Treatment”. Under Alternative 3, Items 3 and 4b (above in this section) are not applicable. Thus unit by unit silvicultural prescriptions (Item 4ai above in this section) describes how old growth fragment/patch retention would occur in these combined areas.

Other Effects- Action Alternatives

Contrasting Effects of Proposed Actions with Past Actions

The proposed action and other action alternative differ from previous actions in that tree removals would not be focused on the largest and most fire-resistant trees. All treatments are designed to leave the largest trees, improve heterogeneity and improve the composition of fire- and disease-resistant species. Rather than eliminating fire, prescribed fire is an integral part of these proposals.

Effects of Ongoing and Reasonably Foreseeable Actions

Similar restoration projects are being carried out within the Deschutes NF. In conjunction with these projects, it is likely that the potential for large uncharacteristic wildfires and bark beetle outbreaks in the project area would be reduced. Management options for the future would be increased. Wildland fire use may become more of an option, and the ability to implement long-term uneven-aged silviculture would be improved.

[22] NOTE-this table is identical among Alternatives EXCEPT acre contribution from Mixed Conifer Group Openings AND Dwarf Mistletoe are added to the Thinning treatment type under Alternative 3.

Combined Effects from Past, Proposed, Ongoing and Foreseeable Actions

Proposed, ongoing, and foreseeable actions are all geared towards restoring ecosystem structure and processes, and undoing the effects of most of the previous management consequences, whether they were intentional or not. It is expected that the combined effects would be positive in terms of maintaining healthy forests and the natural and human communities that depend on them.

NFMA Consistency

Suitability for Timber Production

Harvest units proposed on suitable lands have been reviewed by a certified silviculturist and determined that they are located on suitable lands and are capable of being regenerated within 5 years of timber harvest, although regeneration harvest is not being proposed in this project.

Regeneration Harvest and Even-aged Management

Treatments in this entry would provide future management options, including possibly the implementation of uneven aged systems on suitable sites. Regeneration harvest is not being proposed in this project, but rather planting of ponderosa pine and Douglas-fir would be done in alternatives 2 to help shift the composition towards these more disease-resistant and historically dominant species in the long term.

Vegetative Manipulation

NFMA provides that timber harvest and other silvicultural practices shall be used to prevent damaging population increases of forest pest organisms, and treatments shall not make stands susceptible to pest-caused damage levels inconsistent with management objectives. Harvest of trees provides social and economic benefit, reduces potential losses attributed to insects and diseases, and manipulates forest vegetation to enhance wildlife habitat and/or meet associate objectives. The silvicultural prescription which directs the vegetative management process is designed to meet Forest Plan goals, objectives, and guidelines for forest productivity and wildlife habitat improvement while achieving ecosystem-based management.

Improvement harvest and commercial thinning are proposed for some stands in order to improve tree vigor of the desired leave trees and to maintain or enhance the plant diversity. NFMA provides for these treatments where they increase the growth rate of residual trees, favor commercially valuable species, favor species valuable to wildlife, or achieve some other multiple-use objective.

Regeneration Potential

NFMA specifies, "timber would be harvested from national forest system lands only where there is assurance that such lands can be adequately stocked within five years after final harvest" (16 USC 1604). Determination of adequate stocking is based on reforestation surveys conducted within a 5-year period following harvest or site preparation. Results of these stocking surveys are compared with the desired and minimum levels identified in a site-specific silvicultural prescription written for each treatment area. Restocking is considered satisfactory when the harvest area contains the minimum number, distribution, and species composition of vegetation specified in the prescription. There is no final harvest proposed in this project, and as discussed above, planting would be done with the objective of creating patches of younger, desired species.

WILDLIFE

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Wildlife specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Threatened and Endangered Species, Regional Forester's Sensitive Species, Management Indicator Species (MIS), Species of Concern, and Survey and Manage

A Biological Evaluation has been prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3., FSM 2670-2671, FSM W.O. Amendments 2600-95-7, and the Endangered Species Act (ESA) of 1973. A Biological Assessment (BA) was prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4 and the Endangered Species Act of 1973 (Subpart B: 402.12, Section 7 Consultation, as amended) on actions and programs authorized, funded, or carried out by the Forest Service to assess their potential for effect on threatened and endangered species and species proposed for federal listing (FSM 2670.1).

Species classified as sensitive by the Forest Service are to be considered by conducting biological evaluations (BE) to determine potential effects of all programs and activities on these species (FSM 2670.32). The BE is a documented review of Forest Service activities in sufficient detail to determine how a proposed action may impact sensitive wildlife species, and to comply with the requirements of the Endangered Species Act.

The Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA 1990a) identified a group of wildlife species as management indicator species (MIS). These species were selected because they represent other species with similar habitat requirements. Management indicator species can be used to assess the impacts of management activities for a wide range of wildlife species with similar habitat needs (FSM 2620.5). Those management indicator species selected for the Deschutes National Forest include the bald eagle, northern spotted owl, golden eagle, red-tailed hawk, osprey, northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, woodpeckers (cavity nesters), peregrine falcon, California wolverine, elk, mule deer, American marten, Townsend's big-eared bat, waterfowl, snags and down wood habitat.

In addition to the above mentioned MIS species, there have been a number of wildlife species (species of concern) in which analysis is required either through the Northwest Forest Plan (e.g. bats; pg C-43) or through other directives (e.g., landbirds, see Birds of Conservation Concern section).

Survey and manage species are managed by the Deschutes National Forest Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan (NWFP). Management of these species occurs within the range of the northern spotted owl under the Northwest Forest Plan. These species were addressed where they occur under another category (i.e. TES, MIS, BCC etc.). If they did not get addressed in those sections, they were addressed individually and listed as NWFP species.

Introduction to Wildlife Effects

The following specialist reports for wildlife, Threatened, Endangered and Sensitive Species (TES), Management Indicator Species (MIS), Birds of Conservation Concern (BCC), and Big Game have been incorporated in their entirety. The Zone of Influence for discussion on cumulative effects is bounded by the project area for all species except Big Game which is bounded on a subwatershed basis. The area of influence includes overlap with existing conditions such as roads, trails, and past management activities.

This section includes discussion on data used, methods, models, general assumptions, evaluation criteria and a summary of effects. General effects are discussed in this section. General effects cover broad categories of species and those effects that are common to all alternatives including the no action alternative.

Recently completed surveys and historical data were used in determination of species occupancy within the Melvin Butte project area. Incidental species observations have also contributed to the knowledge of species presence within the project area and/or Sisters Ranger District. Potentially suitable habitat is considered to be occupied.

ACE Model (Action/Change/Effect)

The long-term sustainability of forest ecosystems and wildlife habitat is dependent on a variety of factors, but the purpose and need of this project identified that due to fire suppression and existing conditions from past management, stands are over-stocked and outside the Historic Range of Variability (HR). HRV is used to determine the desired future condition for wildlife habitat as it relates to each Plant Association group, and what management action is needed for departure from the existing condition to continue to promote future wildlife habitat. Forest thinning and fuels reduction treatments are the two main treatment types that will occur to move stands toward HRV and have the potential to impact existing wildlife habitat in the short-term. Removal of habitat from these management activities could directly or indirectly affect wildlife species and their habitat. An evaluation of the potential effects to wildlife species will be completed for the project to determine if these effects are negative or beneficial.

Duration and Degree of Impacts (Short-Term vs. Long-Term)

Under each action alternative, the project will primarily manipulate vegetation through a variety of thinning techniques. However, stands may also be treated by use of prescribed fire or a combination of thinning and prescribed fire. In addition, some treatments may not directly impact habitat, but could cause disturbance through equipment operation or smoke from prescribed fire. Effects of these treatments to habitat will be assessed as short-term and long-term impacts. Stand Density Index (SDI) is used to measure the risk of a stand's susceptibility to insect and disease as a result of stand densification. From the initial density reduction treatment, effects from the reduction occur roughly over a 30 year period. After 30 years, stands begin to put on basal area growth, height, and begin to recruit new trees into the stands, increasing SDI (Personal Communication Brian Tandy District Silviculturist). To standardize the length of time when referencing short-term and long-term impacts to wildlife habitat from forest thinning, short-term impacts are $\leq$30 years and long-term impacts are those that will occur over $\geq$30years.

Bounding Spatial and Temporal Changes within the Zone of Influence

For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential direct and indirect effects from different management practices could occur. The project area proposes treatments to ponderosa pine, mixed conifer, and lodgepole pine stands within Northwest Forest Plan Matrix Land Allocation on the Sisters Ranger District. A watershed analysis was completed in 2013 to characterize the human, aquatic riparian, and terrestrial features, conditions, processes and interactions (ecosystem elements) within the watershed. The discussion of wildlife cumulative effects will be focused on the units proposed for treatments and their incremental impacts in combination with past, present and reasonably foreseeable project within the Deep Canyon Watershed ("zone of influence"). Only National Forest system lands will be analyzed within the "zone of influence". Chapter 3 of the EA contains a list of past, present and reasonably foreseeable future projects within the Deep Canyon watershed that has the potential to contribute to cumulative effects. However, not all projects on the list impact wildlife or wildlife habitat. Therefore, Table 68 is a subset of the list from Chapter 3 of ongoing and reasonably foreseeable future actions identified as potentially contributing towards cumulative effects

to wildlife in the watershed. Habitat for each identified species associated with the project area will be discussed on a forest wide basis to address species viability as it relates to MIS.

Table 68 Ongoing or reasonably foreseeable actions in the project area and Deep Canyon 10th field watershed.

Type of Action	*General Description*	*Status/Timing*	*Acres*
Vegetation Management			
Pole Creek Fire Timber Salvage	Salvage of fire killed timber	Ongoing	54 acres
Pole Creek Fire Hazard Tree Removal	Felling and Salvage of fire killed danger trees	Ongoing	350 acres
Ursus BFR	Thinning and mastication	Reasonably foreseeable	5,900 acres
Bear Wallow Firewood BFR	Fire wood cutting along the FS Road 4601	Ongoing	11 miles of road approximately 510 acres
Bend Municipal Watershed Fuels Reduction BFR	Hazardous fuels reduction; thinning	Reasonably foreseeable	12 miles of road approximately 400 acres
Skyline Forest, BFR	Salvage of fire killed timber	Reasonably foreseeable	Approximately 250 acres.

Management Indicator Species (MIS) Analysis

A Forest wide assessment for each Management Indicator Species (MIS) identified in the Deschutes National Forest Land and Resource Management Plan (LRMP) was completed in 2012 for the entire Deschutes National Forest (NF) (USFS 2012). For this document, where USFS (2012) is cited, those individual citations associated with the analysis can be found in those documents (USFS 2012). Suitable habitat for each species was defined as habitat that could potentially be utilized for reproduction. An exception to this is associated with species specific standards and guidelines within the Deschutes LRMP, not associated with reproductive habitat, although essential to the viability of that species population within its range. An example of this exception is hiding cover standards and guidelines for mule deer summer range. An assessment was completed for each species based on the amount of potentially suitable habitat that occurs across the Deschutes NF, associated threats, and population trend data where it was available. The assessment used the best available science and guidance such as research found in books, scientific journals, and scientific websites. NatureServe, an international non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action was a major contributor to population trend data. NatureServe and its network of natural heritage programs, including the Oregon State Heritage Program, are the leading source for information about rare and endangered species and threatened ecosystems. Their website, http://www.natureserve.org/, compiles historic and current information from The Nature Conservancy and other conservation groups, U.S. government agencies, private sector partnerships, international agencies, and data cooperators. In addition, for those MIS species which are also hunted or are furbearing species (e.g. big game, waterfowl, and American marten), Oregon Department of Fish and Wildlife provided population trend data for big game, data relative to trapping for marten, and monitoring data for waterfowl. Habitat definitions were developed and modeled for each MIS species. Information from the species assessments formed the baseline for species habitat across the Deschutes National Forest. The Melvin Butte project analysis tiered to those assessments.

Modeling Methodology

Habitat for the various wildlife species was determined using district occurrence data, habitat descriptions found in scientific literature, various data sets, and professional experience. The Viable Ecosystem

Model (Viable) was used to determine the live tree component of habitat and formed the basis of acres of existing nesting/denning habitat (Viable Ecosystems Management Guide 1994). For selected species, such as the black-backed woodpecker and American marten, the snag components of habitat were determined using a variety of sources including gradient nearest neighbor (GNN) data and DecAID, as well as Viable. Because of Forest Plan standards for cover and thermal cover requiring trees per acre and height, deer and elk habitat was determined using GNN data.

Viable Ecosystems Model

The Ochoco and Deschutes Viable Ecosystems Management Guide (VEMG) was developed to classify vegetation on a landscape basis. The Viable Ecosystem model provides a process to apply ecosystem management concepts to project level planning. This system compares existing vegetation with site potential. The model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. Viable Ecosystems is a useful tool for cumulative effects analysis of broad scale changes in vegetation at a subwatershed to Forest-wide scale and subsequent changes in animal, insect, or plant communities.

Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. For example, a classification with a value of 5615**2** is white fir (56), early seral (1), medium/large structure (5), and **low density (2)** and would typically have a single story (low density) dominated by ponderosa pine (early seral in white fir) 21" diameter or greater (medium/large structure). This provides nesting habitat for white-headed woodpeckers. A value of 5635**1** would equate to white fir (56), late seral (3), medium/large structure (5), and **high density (1)** and would be a multi-storied stand dominated by white fir 21" diameter or greater and provide nesting habitat for pileated woodpeckers. All values that provide habitat for species were used. In addition to the mixed conifer value of 56152 using the white-headed woodpecker example, any seral stage dominated by ponderosa pine, medium/large structure, and low density would provide similar open ponderosa pine habitat and was used in determining amounts of white-headed woodpecker nesting habitat across the Deschutes National Forest.

The 2002 satellite imagery layer was used to develop the vegetation layer to run in the Viable Ecosystem Model. Data is mapped on a 30 meter pixel grid, meaning the map is divided up on a 30 meter grid and that every 30 meter square (pixel) is assigned a value (i.e. 56351) that relates to a stratum of size, structure, tree species composition, and relative tree density. Criteria used (vegetation, seral state, structure, and density) to determine habitat for each species is described in the existing condition of each species. Existing conditions include past actions such as timber sales which used the Forest "FACTS" database. Presenting information in this way and including those current and foreseeable future actions in cumulative effects is the most informative for the decision maker.

GIS Analysis and ArcMap

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. The information can be related to visual data (maps), tabular data (tables, spreadsheets, or data bases), and used to run models (create new data set from existing data based on criteria or specific conditions). ArcMap is a component of the ArcGIS program. The client software developed by Economic and Social Research Institute (ESRI) was used for the processing and presentation of GIS data.

Gradient Nearest Neighbor (GNN)

GNN maps consist of 30 meter pixel (grid) maps with associated data (tree size, density, snag density, canopy cover, percent down wood cover, etc.). The maps used for this analysis were developed by the

Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) team as part of the GNNPAC Pacific States Forest Vegetation Mapping project. This project involves developing detailed maps of existing forest vegetation across all land ownerships in the Pacific Coast States (Oregon, Washington, and parts of California). It is being conducted by the LEMMA team (Pacific Northwest Research Station (PNW) and Oregon State University) at the Corvallis Lab, in close collaboration with the Western Wildlands Environmental Threats Assessment Center, the Interagency Mapping and Assessment Project (IMAP), Northwest Forest Plan Effectiveness Monitoring, the Remote Sensing Applications Center, and Forest Inventory and Analysis at the PNW Research Station.

The process to create the maps involves using gradient imputation (Gradient Nearest Neighbor, or GNN). GNN uses many variables on a gradient along with satellite imagery to assign data from known field plots to pixels with no data that have the same satellite imagery signature (i.e. it "looks" the same to the computer). The species-size GNN model was used in the Melvin Butte analysis. This model uses species composition and stand structure as components for developing maps. Accuracy of the modeling depends on how "like" pixels match up based on numerous variables. Generally speaking, forest types that had more samples like white-fir were more accurate than those with fewer samples like mountain mahogany (Ohman et al. 2008). Information on GNN accuracy, the LEMMA group, IMAP and the GNNPac project is available at the project website: http://www.fsl.orst.edu/lemma/gnnpac.

DecAID

DecAID is a web-based dataset; it is not a model. It is a synthesis of all the best available research on dead wood. DecAID does not provide information on all life needs of a given species. It integrates current research/studies on wildlife use of dead wood (snags, down wood, dead portions of live trees) in various habitat types. From this, tolerance levels are generated.

Tolerance level (t.l.) is the percent of the studied population that would use a density of snags or down wood. For example, the following table shows the tolerance levels for white-headed woodpeckers. For a population of 100 individual white-headed woodpeckers, at the 50 percent tolerance level, 50 of them would use habitat with at least 1.7 snags per acre greater than or equal to10 inches in diameter. Basically, the higher the tolerance level, the more assurance that habitat is being provided to meet the needs of more individuals in the population (Mellen et al. 2006).

Tolerance intervals (t.i.) were used to determine habitat levels in the planning area. A tolerance interval includes the range of snag density between tolerance levels. Using the example below, the 30-50 percent tolerance interval would be habitat with more than 0.3 snags per acre and less than or equal to 1.7 snags per acre. The 0-30 percent category is included (where 0 values are actually greater than 0) as it provides habitat for a few individuals. A zero category is included in the analysis showing what acreage does not provide habitat. Table 69 provides and example of tolerance levels and intervals developed from DecAID.

Table 69 Example of tolerance levels and intervals developed from DecAID information.

Habitat type and Table used from DecAID: Table PPDF_S/L.sp-22; Species: White-headed Woodpecker									
Minimum DBH	**10"**					**20"**			
Tolerance Level		30%	50%	80%			30%	50%	80%
Snag Density (#/acre)		0.3	1.7	3.7			0.5	1.8	3.8
Tolerance Interval	0-30%	30-50%	50 -80%	80%+		0-30%	30-50%	50 -80%	80% +
Snag Density (#/acre)	0-0.3	0.3 - 1.7	1.7-3.7	3.7+		0-0.5	0.5-1.8	1.8-3.8	3.8+

Often times, DecAID only has one study available to base its tolerance levels on. While applying findings from a single research site to another area is not always wholly applicable, DecAID provides the

best available science to determine effects to a species at this time. Used as a comparison for effects across all alternatives, it can be a useful tool. Tolerance levels do not equate to population potential, nor imply viability, but they are assumed to indicate habitat at varying snag densities.

More information on DecAID can be found on the website at:
www.fs.fed.us/wildecology/decaid/decaid_background/decaid_home.htm

Deer and Elk Habitat

The Deschutes Forest Plan defines suitable deer hiding cover as one of the following:

a) six acre or larger stand capable of hiding 90 percent of a standing adult deer from view of a human at a distance of 200 feet, or
b) six acre or larger stand with an average height of six feet and which has not been thinned in 15 years, or
c) residual clumps of one half acre or larger stands within units with advanced regeneration (trees including small trees up to seven inches in diameter) and at least 12 greater than seven inch trees per acre remaining after harvest (LRMP, WL-54, p. 4-58). Residual clumps less than six acres in size were not modeled which likely under-represents the amount of hiding cover present in the subwatershed analysis.

Suitable elk hiding cover is similar**:**

a) six acres or larger stand capable of hiding 90 percent of a standing adult elk from view of a human at a distance of 200 feet, or
b) six acre or larger stand with an average height of 10 feet and which has not been thinned in 20 years, or residual clumps of two acres, or
c) larger stands within units with advanced regeneration (trees including whips up to seven inches in diameter) and at least 12 greater than seven inch trees per acre remaining after harvest (LRMP, WL-47, p.4-57).

To be conservative, hiding cover for both deer and elk was modeled using Gradient Nearest Neighbor (GNN) with the criteria of hiding 90 percent of a standing adult elk from view of a human at a distance of 200 feet. This condition was modeled using trees with a density of at least 469 trees/hectare (190 trees/acre or a tree every 15 ft) with a diameter of 3-25 cm (1-10 in dbh) and at least two meters (7 ft) tall across the Melvin Butte planning area. Fields containing this data in GNN and the definitions from the data dictionary include:

- TPH_3_25 – Density of live trees 2.5-25 cm dbh in trees/hectare.
- STNDHGT – Stand height, computed as average of heights of all dominant and codominant trees in meters.

Similarly thermal cover for both deer and elk was modeled using the GNN. The criteria used to model thermal cover were an average stand height of 30 feet and the stands must contain 40% crown cover.

LEMMA Data Dictionary: http://www.fsl.orst.edu/lemma/common/dataDictionary.php

An important finding from the Starkey Experimental Forest and Range studies is that road (or route) density is not the best predictor of habitat effectiveness for elk. Instead, a model based on distance bands proved to be a more spatially explicit and biologically meaningful tool for assessing effects from roads. Road densities do not provide a spatial depiction of how roads are distributed on the landscape (Rowland 2005). Hillis et al. (1991) defined elk security habitat for forested stands greater than 250 acres in size and greater than ½ mile from an open route. Rowland et al. (2000) determined that the distance of 1,969 yards (1,800 meters) is equivalent to that at which elk response to open roads diminished markedly.

Therefore, acreage greater than one mile from an open motorized route is assumed to provide greater security habitat for elk than the ½ mile distance.

Northern Spotted Owl

The analysis conducted for the northern spotted owl includes a forest-wide analysis of all nesting, roosting, foraging (NRF) and dispersal habitat, Critical Habitat Units, known home ranges, and late-successional reserves. NRF acres used are derived from the 2014 Programmatic Biological Assessment (BA) update for the 2014 Deschutes and Ochoco Programmatic Biological Assessment and reflect the most current situation. CHU refers to the area reflected in the 2013 update to the Critical Habitat Rule. An analysis of each home range has also been conducted. A 1.2 mile radius circle is used as a home range distance in the Cascade Range. This equates to approximately 2,882 acres.

R6 Sensitive Species

Sensitive species from the R6 Regional Forester's Sensitive Species list (07/13/2015) were only analyzed if they have potential habitat in the project area. Some Sensitive Species are also Management Indicator Species (MIS) identified in the Deschutes National Forest Land and Resource Management plan and were analyzed for the Forest and the project area. Surveys have not been conducted for each species. In some cases, no surveys have occurred and in others, surveys may not have been conducted on a consistent basis. Incidental observations may also contribute to known sightings.

Key Issues/Analysis Issues and Comparison Measures

Key Issues identified from public scoping, or Analysis Issues identified from Forest Plan Standards and Guidelines (as Amended) or the latest science and guidance, were developed to illustrate the effects to wildlife and how those effects differ by alternative. In this analysis, commercial thinning and fuels treatments are the major impacts to habitat quality, quantity and species life needs. Using the same units of measure allows the major impacts to be easily understood and compared, providing the Decision Maker the necessary data to make an informed decision.

Units of Measure

Suitable habitat for each MIS species analyzed in this document has been quantified for the project area, the watershed, and at the Forest level. The following measure will be used to evaluate the impacts and associated effects of the planned activities:

- Acres of potentially suitable habitat were calculated by GNN located within the Melvin Butte area and associated watershed (Deep Canyon Watershed) to complete a cumulative effects analysis.
- Potentially suitable habitat was calculated using GNN and Viable at the Forest level to compare project cumulative effects to the watershed with the overall habitat on the forest, to determine effects to habitat viability across the Forest.

Executive Summary

Summary of Effects/Impacts for TES, MIS, SOC, (landbirds and NWFP/S&M)

The biological evaluation (BE) analyzes the effects to federally threatened, endangered, proposed, and candidate species, and impacts to Region 6 Sensitive Species associated with the Melvin Butte project area on the Deschutes National Forest. Habitat occurs in the project area for two federally listed and one proposed species, designated northern spotted owl critical habitat, and five Sensitive Species. The following is a summary of the findings of this BE on the effects/impacts of the two action alternatives.

Alternatives 2 and 3 will have ***No effect*** to the federally endangered gray wolf and its habitat.

Alternatives 2 and 3 will have ***No effect*** to the proposed threatened pacific fisher and its habitat.

Alternatives 2 and 3 ***May affect but not likely to adversely effect*** the federally threatened northern spotted owl and its habitat.

Alternatives 2 and 3 ***May affect but not likely to adversely effect*** northern spotted owl designated Critical Habitat.

Alternatives 2 and 3 will have ***No effect*** to the federally threatened Oregon spotted frog and its habitat.

Alternatives 2 and 3 will have ***No effect*** to Oregon spotted frog proposed Critical Habitat.

Alternatives 2 and 3 will have ***No impact*** to the Townsend's big-eared bat, fringed myotis, and pallid bat.

Alternatives 2 and 3 ***May impact but will not lead to a trend towards federal listing*** for the sensitive white-headed woodpecker and Lewis' woodpecker.

Alternatives 2 and 3 will have **No impact** for the following Sensitive Species due to a lack of habitat: western bumblebee, Johnson's hairstreak, silver-bordered fritillary, Crater Lake tightcoil, evening fieldslug, Columbia spotted frog, wolverine, American peregrine falcon, bald eagle, greater sage grouse, bufflehead, northern waterthrush, harlequin duck, horned grebe, tricolored blackbird, yellow rail, and Tule greater white-fronted goose.

Alternatives 2 and 3 are consistent with the standards and guidelines in the Deschutes National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan for the following Management Indicator Species: Townsend's big-eared bat, White-headed woodpecker, and Lewis' woodpecker.

Alternatives 2 and 3 consistent with the Biological Objectives in the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington for the white-headed woodpecker, Lewis' woodpecker, black-backed woodpecker.

A Wildlife Report analyzes the impacts to management indicator species (MIS) and species of concern (landbirds and/or NWFP S&M species) associated with Melvin Butte project on the Deschutes National Forest.

Thirteen management indicator species on the Deschutes National Forest and/or their habitats are known or suspected to occur within the project area. In addition, 11 landbirds on the Deschutes National Forest and/or their habitats are known or suspected to occur within the project area. The following is a summary of the findings of the Wildlife Report on the impacts of the proposed alternatives.

1. Implementation of Alternatives 2 and 3 is associated with reproductive habitat for 13 management indicator species (MIS) on the Deschutes National Forest but will not contribute to a change in viability for these species.
2. Implementation of Alternatives 2 and 3 is associated with the habitat of 11 landbird species on the Deschutes National Forest, although treatments will reduce and or modify habitat, they will not preclude use of the project area by the identified landbirds.
3. Implementation of the Melvin Butte project is consistent with the Standards and Guidelines for the Deschutes Land and Resource Management Plans for MIS.

4. Implementation of Melvin Butte project is consistent with the biological objectives outlined in the Conservation Strategies for Landbirds of the East-slope Cascades. Treatments were designed to be beneficial to these species by providing long-term habitat.

Federally Listed and Proposed Species

The northern spotted owl has habitat in the Melvin Butte project area. A Joint Aquatic and Terrestrial Biological Assessment for Federal Lands within the Deschutes and John Day River Basins Administered by the Forest Service was completed in 2014 (USDA Forest Service 2013) for projects proposed on the Deschutes National Forest during 2013-2016 that may affect but would not likely adversely affect the northern spotted owl. The BA established project design criteria to simplify the consultation process with the U.S. Fish and Wildlife Service (FWS) for projects proposed from 2013 to 2016. The goal for the Forests is to fully implement the criteria to achieve conservation and recovery objectives of federally listed, proposed, and candidate species. Project design criteria are used as sideboards for the planning process and include effects from habitat alteration and noise disturbance. Two additional listed species are also included in this BE: the endangered gray wolf and the North American wolverine which was proposed for listing as a threatened species in February 2013. Table 70 lists these species, their habitats, and potential effects.

Table 70 Federally listed and proposed species under the Endangered Species Act.

Federally Listed and Proposed Species under the Endangered Species Act				
Species	**Status**	**Habitat**	**Habitat/ Presence in Project Area**	**Effect**
Gray wolf (*Canis lupus*)	Federal Endangered	Any plant association group	No denning or rendezvous habitat; low potential for dispersal habitat	No Effect
Pacific fisher (Martes pennanti)	Proposed Threatened	Mixed forests, High Elevation	No habitat	No Effect
Northern spotted owl (*Strix occidentalis caurina*)	Federal Threatened, MIS	Old growth mixed conifer forests	Nesting, roosting, and foraging habitat (NRF), dispersal in project boundary	May Effect NLAA
Northern spotted owl (*Strix occidentalis caurina*) Critical Habitat	Federal Threatened, MIS	Old growth mixed conifer forests	Nesting, roosting, and foraging habitat (NRF), dispersal habitat, and designated critical habitat within project boundary	May Effect NLAA
Oregon spotted frog (Rana pretiosa)	Federal Endangered	Shallow lakes, ponds	No habitat	No Effect
Oregon spotted frog (Rana pretiosa) proposed Critical Habitat	Federal Endangered	Shallow lakes, ponds	No habitat	No Effect

Gray wolf (Federally Endangered)

Measure: Effects to denning habitat, rendevous sites, and dispersal habitat

Existing Condition

The gray wolf usually occurs in forested habitats with some open areas such as river valleys and meadows for hunting prey including pronghorn, deer and elk, and smaller mammals. Wolf packs (usually 5-10

animals) can have very large territories—up to 400 square miles or larger. Key wolf habitat components identified in the 1987 Wolf Recovery Plan (USDI Fish and Wildlife Service 1987) include: "1) a sufficient, year-round prey base of ungulates and alternative prey, 2) suitable and somewhat secluded denning and rendezvous sites, and 3) sufficient space with minimal exposure to humans. Den sites are excavated areas in the soil but hollow logs, beaver lodges, the base of hollow trees, pit excavations, and rock caves, usually near water, are also used. Rendezvous sites are the activity sites used after the denning period and prior to the nomadic hunting period of fall and winter. They are often in open grassy areas near water or at forest edges."

The project area does not contain habitat for denning or rendezvous sites. There are no known wolf packs on the Deschutes National Forest. The closest known packs occur on the Umatilla National Forest in northeastern Oregon. Habitat for wolf prey species (elk and mule deer) is limited in the project area.

In Oregon, the gray wolf is listed as federally endangered in areas west of Highways 395, 78, and 95 which includes the Deschutes National Forest. In 2011, a single male gray wolf was documented dispersing through the southern portion of the Deschutes National Forest and subsequently traveled south into California. In 2012, it was documented traveling back and forth across the California/Oregon southern border and has established a pack in southern Oregon on the Rogue Siskiyou National Forest.

Alternative 1 -Ecological Trends

Under the No Action Alternative, no treatments will be prescribed within Melvin project area (5,375 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine and mixed conifer stands would be prolonged and the old trees within the stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for ungulate populations that provide the main prey base for the gray wolf. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees, providing a very discontinuous overstory and lacking suitable cover and forage across the project area for ungulates.

Alternatives 2 and 3 - Direct and Indirect Effects

There are no known gray wolf packs associated with the Melvin Butte project area or the Deschutes National Forest; therefore there are no direct effects associated with the action alternatives.

All action alternatives provide some level of thinning, mowing and burning in the Melvin Butte project area. Thinning will open up stands reducing crown closure, promoting the development of herbaceous plants in these areas. Thinning treatments have the potential to provide a future forage base to prey species of the wolf, such as snowshoe hare, deer, and elk. Therefore, there is No Effect to the gray wolf but could be beneficial to prey habitat under Alternative 2 or Alternative 3.

Table 71 displays the total acres of thinning from below and fuels treatments that will enhance habitat for gray wolf prey by alternative.

Table 71 Acres of thinning and fuels treatments by alternative.

Alt. 2	Alt. 3
3,808 acres	3,808 acres

Alternatives 2 and 3 - Cumulative Effects

All action alternatives have the potential to enhance habitat for gray wolf. There are no negative effects associated with the alternatives. Implementation of Alternatives 2 and 3 will have no cumulative effects to the gray wolf and their habitat.

Conclusion - Alternatives 2 and 3

There are no direct or indirect effects to the gray wolf or its habitat under Alternatives 2 or 3. There are no ongoing and reasonably foreseeable cumulative effects to the gray wolf. There would be ***No Effect*** to the gray wolf but could be beneficial to prey habitat under either Alternative 2 or 3 for the Melvin Butte project.

Pacific Fisher (Proposed Threatened, Region 6 Sensitive)

Measure: Effects to denning habitat and dispersal habitat

Existing Condition

The Pacific fisher primarily uses mature, closed-canopy coniferous forests with some deciduous component, frequently along riparian corridors (Csuti et al. 2001). In Ruggiero et al. (1994), it is suggested fishers prefer closed-canopy (greater than 60%), late-successional forests with large physical structures (live trees, snags, and logs), especially if associated with riparian areas. A 2004 Species Assessment by the US Fish and Wildlife Service documents key aspects of fisher habitat as those associated with late-successional forests (i.e. high canopy closure, large trees and snags, large logs, hardwoods, and multiple canopy layers). Distribution of fishers is limited by elevation and snow depth (Krohn et al. 1997 *in* US Fish and Wildlife Service Species Assessment). Fishers generally avoid areas of high human disturbance, primarily high road density or recreational developments. Fishers are fairly large, weighing 3 to 13 lbs and 29 to 47 inches long. This may suggest a need of larger log sizes for dens than other animals with similar needs (e.g. marten). Aubry and Raley (2006) found in southwestern Oregon, fishers were found denning and resting at 4,000 feet elevation, more than 80% canopy closure, and more than 16 snags and 67 logs at least 20” DBH per acre; supporting the suggestion that this species utilizes large to very large structure. Denning and resting sites were also observed in large live trees (mostly Douglas-fir) with mistletoe brooms, limb clumping, rodent nests, or some other deformity. They also found fishers were preying upon woodpeckers, jays, grouse, quail, squirrels, hare, porcupine, and skunks. Most of these prey species can be found in the watershed.

No habitat occurs for this species in the Melvin Butte project area; therefore no further analysis is required.

Northern Spotted Owl (Federally Threatened, MIS)

Measures: (1) Effects to nesting, roosting, and foraging habitat; (2) Effects to dispersal/connectivity habitat; (3) Effects to critical habitat primary constituent elements

Existing Condition

The project occurs within the range of the northern spotted owl. Spotted owls are primarily inhabitants of old growth and mature forests. Suitable spotted owl habitat contains adequate quantities of dead and down woody material, decadent trees, a medium to high crown closure, multiple layers in the overstory, and trees at least 200 years old or greater than 32 inches dbh (USDA Forest Service and USDI Fish and Wildlife Service 1990). Functional nesting, roosting, and foraging (NRF) habitat for the spotted owl on the Deschutes National Forest includes stands of mixed conifer, ponderosa pine with white fir

understories, and mountain hemlock with subalpine fir. The canopy cover is typically greater than or equal to 40% with an overstory comprised of at least five percent of trees greater than 21 inches diameter-at-breast- height (dbh). Habitat that meets NRF requirements also provides foraging habitat, although a wider array of forest types are used for foraging, including more open and fragmented habitat.

Suitable nest sites are generally in cavities in the boles of either dead or live trees. Platform nests may also be used (but more rarely), which include abandoned raptor nests, broken treetops, mistletoe brooms, and squirrel nests. Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and movement.

Habitat conditions that support good populations of northern flying squirrels (*Glaucomys sabrinus*), western red-backed voles (*Clethrionomys californicus*), and other nocturnal or crepuscular small mammals, birds, and insects are essential to supporting spotted owls. An analysis of local spotted owl pellets showed the primary prey species on the Deschutes National Forest is the northern flying squirrel with red-backed vole, bushy-tailed woodrat (*Neotoma cinerea*), western pocket gopher (*Thomomys mazama*), Douglas squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), voles (*Microtus spp.*), mice (*Peromyscus spp.*), and insects as secondary prey items.

Flying squirrels were once thought to be old-growth dependent but several studies have shown that densities were similar in both young and old forests, especially if old forest legacies (e.g. large decaying logs) and well-developed understories were present (Rosenberg and Anthony 1992, Carey 1995, Waters and Zabel 1995, Carey et al. 1997, Carey 2000, Carey et al. 2002, and Ransome and Sullivan 2003). Den sites have been documented in cavities in live and dead old growth trees, stick nests, moss nests, cavities in branches of fallen trees, decayed stumps, and suppressed young trees (Carey et al. 1997). Mychorrizal and epigeous fungi, in particular truffles, are an important food source for flying squirrels (Waters and Zabel 1995, Waters et al. 2000, Carey et al. 2002, and Lehmkuhl et al. 2006a) but where winter snow levels are deeper, as seen in eastside habitats more often, other foods become important such as lichens (Rosentreter et al. 1997, and Lehmkuhl et al. 2006a).

Carey et al. (1997) specifically studied dens of the northern flying squirrel. They found the majority of dens were in live trees. They recommend that management for northern flying squirrels include leaving large fallen trees, large diameter tall stumps, and large green trees with platform branching, multiple tops and/or cavities. While retaining snags in burned areas is important to provide options for the flying squirrel, retaining all snags is not. Developing closed canopy stands to provide habitat may be more important following a fire.

Legacy retention (snags and coarse woody debris) is important to prey species following a disturbance (Courtney et al. 2004). Legacy materials left on site increase the complexity of the environment of young stands by increasing horizontal and vertical structure, which provides for greater prey species diversity (Carey and Harrington 2001). Carey and Johnson (1995) suggest conservation of some coarse woody debris, woody plant species diversity, and understory promotion to enhance biodiversity for prey species. Carey (1995) recommends a range of snags from 2.8 to 8.1 snags per acre >21 inches dbh along with well-distributed patches of dense shrubs for high densities of flying squirrels. The legacy retention can accelerate habitat development for spotted owls and their prey.

Consultation History

Level 1 review streamlining was initiated on August 8, 2013 with a discussion of the project effects to spotted owl designated critical habitat. Jennifer O'Reilly Wildlife Biologist with the FWS, Lauri Turner, Deschutes National Forest Wildlife Biologist, and Monty Gregg (Sisters Ranger District Wildlife Biologist) discussed the project and proposed actions. A rationale for determination of effects to spotted owl primary constituent habitat elements in designated critical habitat was discussed at the time. A

Biological Assessment was submitted on February 24, 2015 and a Letter of Concurrence was received from the U.S. Fish and Wildlife Service on March 5, 2015.

2011 Revised Recovery Plan for the Northern Spotted Owl

The Revised Recovery Plan for the Northern Spotted Owl (Recovery Plan) was approved on June 28, 2011 (USDI Fish and Wildlife Service 2011). The Recovery Plan states that many populations of spotted owls continue to decline, especially in the northern parts of the subspecies' range, even with extensive maintenance and restoration of suitable habitat. Managing sufficient habitat for the spotted owl now and into the future is important for its recovery. However, it is becoming more evident that securing habitat alone will not recover the spotted owl. Based on the best available scientific information, competition from the barred owl (*Strix varia*) poses a significant and complex threat to the owl. Past and current habitat loss are also threats to the spotted owl, even though loss of habitat due to timber harvest has been greatly reduced on Federal lands over the past two decades (USDI Fish and Wildlife Service 2011).

The Recovery Plan recognizes the extremely complex nature of management of spotted owl habitat in dry forests. It recommends that the dynamic, disturbance-prone forests of the eastern Cascades, California Cascades and Klamath Province be actively managed to meet overlapping goals of spotted owl conservation, responds to climate change, and restores dry forest ecological structure, composition and processes, including wildfire and other disturbances (III-20). The intent of the Recovery Plan is " …to embed spotted owl conservation and recovery within broader dry forest ecosystem restoration efforts to increase the likelihood spotted owl habitat will remain on the landscape longer and develop as part of this fire adapted community instead of being consumed by uncharacteristic wildfires." (III-32). On page III-34 of the Recovery Plan, the FWS provides the following principles for dry forest restoration treatments:

- Emphasize vegetation management treatments outside of spotted owl core areas or high value habitat where consistent with overall landscape project goals;
- Design and implement restoration treatments at the landscape level;
- Retain and restore key structural components, including large and old trees, large snags and downed logs;
- Retain and restore heterogeneity within stands. (Fine scale mosaic);
- Retain and restore heterogeneity among stands. (Meso-scale mosaic); and
- Manage roads to address fire risk: use wildfires to meet vegetation management objectives where appropriate.

2013 Designated Critical Habitat

The final rule for critical habitat designation was released on December 4, 2012 and became effective on January 3, 2013 (USDI Fish and Wildlife Service 2012). Critical habitat was revised in 2013 after the 2008 Critical Habitat designation was challenged in court. The FWS encourages land managers to consider implementation of forest management practices recommended in the Revised Recovery Plan to restore natural ecological processes where they have been disrupted or suppressed and the application of "ecological forestry" management practices within critical habitat to reduce the potential for adverse impacts associated with commercial timber harvest when such harvest is planned within or adjacent to critical habitat. The FWS encourages land managers to consider the conservation of existing high quality northern spotted owl habitat, the restoration of forest ecosystem health, and the ecological forestry management practices recommended in the Revised Recovery Plan that are compatible with both the goals of spotted owl recovery and Standards and Guidelines of the Northwest Forest Plan. In fire-prone forests east of the Cascade crest, it is recognized that vegetation and fuels management may be appropriate both within and outside designated critical habitat where the goal of such treatment is to conserve natural ecological processes or restore processes such as fire where they have been modified or suppressed.

Critical habitat is defined in section 3 of the Act as (50 CFR Part 17 p. 71896):

- The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features
- Essential to the conservation of the species and
- That may require special management considerations or protection and
- Specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species

Physical and Biological Features

Physical and biological features (PBFs) are essential to the conservation of the species and may require special management considerations or protection. Physical or biological elements of habitat include but are not limited to (50 CFR Part 17 p. 71897):

- Space for individual and population growth and for normal behavior
- Food, water, air, light, minerals, or other nutritional or physiological requirements
- Cover or shelter
- Sites for breeding, reproduction, and rearing (or development) of offspring
- Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species

For the northern spotted owl, physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, and dispersing. The specific characteristics or components that comprise these features include, for example, specific ranges of forest stand density and tree size distribution, coarse wood debris, and specific resources, such as food, nest sites, cover, and other physiological requirements of spotted owls and considered essential to the conservation of the species.

Primary Constituent Elements

For the northern spotted owl, primary constituent elements (PCEs) are specific characteristics that make areas suitable for nesting, roosting, foraging, or dispersal habitat. To be essential to the conservation of the northern spotted owl, features need to be distributed in a spatial configuration that's conducive to persistence of populations, survival, and reproductive success of resident pairs and survival of dispersing individuals until they can recruit into a breeding population. There are 4 PCEs: (1) a forest type in early, mid, or late seral stages and that supports the owl across its geographical range; (2) habitat that provides for nesting and roosting; (3) foraging habitat; and (4) habitat to support the transience and colonization phases of dispersal. The PCE #1 (forest type) must be in concert with at least one other PCE to be critical habitat.

The Melvin Butte project area does not provide NRF habitat for the spotted owl because canopy closure and stand structure does not exist to provide NRF habitat. Existing stands do not provide adequate cover or shelter for owl or their prey (flying squirrels) and sites for breeding, reproduction, and rearing (or development) of offspring. Due to the amount of insects and disease in the stands, canopies are very fragmented and disjunct and do not provide canopy closure and contiguous overstory large tree structure needed for nesting and roosting, foraging (prey habitat). The Melvin Butte project area does support the transience and colonization phases of dispersal and therefore provides the minimum stand requirements to provide the security needed for dispersing birds through the project area. The Melvin Butte project area provides the PCEs for dispersal habitat.

Critical Habitat on the Deschutes National Forest

Critical habitat delineation on the Deschutes National Forest does not occur in a contiguous fashion but is instead mapped as two separate critical habitat units (CHUs) across the three ranger districts. The Deschutes National Forest lies primarily in CHU #7. In addition, there is a small portion of CHU #6, West Cascades South, on the southern end of the Deschutes National Forest on the Crescent Ranger District. Table 72 lists the acres in the CHUs and percentage of the CHUs that occur on the Deschutes National Forest. There are 250,056 acres of CHU #7 and 3,264 acres of the CHU #6 on the Deschutes National Forest.

Table 72 Acres of critical habitats units 6 and 7 on the Deschutes National Forest.

Critical Habitat Unit	Total Acres of Critical Habitat Unit	Total Acres of Critical Habitat Unit on Forest	Percent of Total CHU the Forest Occupies
Unit 7 – East Cascades North	1,345,523	250,056	18.5%
Unit 6 – West Cascades South	1,355,198	3,274	<1%
Total	2,700,721	253,321	19%

The critical habitat units are further divided into subunits. Three CHU subunits occur on the Deschutes National Forest: ECN 8, ECN 9, and WCS 5. Subunit ECN 8 is entirely on the Sisters Ranger District and Subunit WCS 5 is entirely on the Crescent Ranger District. Subunit ECN 9 lies on both the Bend-Fort Rock and Crescent Ranger Districts. It falls between the other two subunits on the Deschutes National Forest and therefore is important in providing north/south connectivity of habitat along the eastern range of the species. Connectivity within and between critical habitat subunits is necessary to provide demographic support and genetic diversity should fire, insects, disease, wind storms, and/or inclement weather significantly reduce the population in any individual subunit. Table 73 lists the number of acres in the critical habitat subunits on the Deschutes National Forest.

Table 73 Critical habitat subunits on the Deshutes National Forest. The ECN 8 subunit occurs wholly on the Sisters Ranger District.

Critical Habitat Unit (CHU) Name	CHU Number	CHU Subunit	Total CHU Acres	Total CHU Acres on Forest lands	Total CHU Acres on Private lands	Total CHU Acres on Forest lands	Percent of CHU on Forest lands
East Cascades North	**07**	**ECN 8**	**94,622**	**94,517**	**106**	**94,622**	**100%**
East Cascades North	07	ECN 9	155,434	155,405	30	155,434	100%
West Cascades South	06	WCS 5	356,415	3,274	0	3,274	<.92%
		Total	606,471	253,196	136	253,330	

Status of the Spotted Owl Including Barred Owl Detections in Subunit ECN 8

Subunit ECN 8 consists of approximately 94,622 acres in Jefferson and Deschutes counties of Federal lands managed by the Forest Service under the NWFP. Of the 94,622 acres, approximately 94,517 acres occur on the Deschutes National Forest while the remaining 106 acres occur on private lands.

Special management considerations or protection are required in this subunit to address threats from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for demographic

support to the overall population, as well as north-south connectivity between subunits. It was determined that all of the unoccupied and likely occupied areas in this subunit are essential for the conservation of the species to meet the recovery criterion that calls for the continued maintenance and recruitment of northern spotted owl habitat. The increase and enhancement of northern spotted owl habitat is necessary to provide for viable populations of spotted owls over the long term by providing for population growth, successful dispersal, and buffering from competition with the barred owl.

This subunit is divided into four areas: Green Ridge, Meadow Lakes, Bluegrass Butte, and Trout. The Green Ridge area lies at the north end of the forest on the Sisters Ranger District and runs north-south along Green Ridge, wrapping around Black Butte and Suttle Lake running north to Brush Creek. It is bounded on the west by the Mt. Jefferson wilderness and on the north by the Warm Springs Reservation. This area excludes the Metolius Basin and overlaps portions of the Metolius and Cache Late Successional Reserves. The Meadow Lakes area is small and is centered around Link and Meadow Lakes on the Sisters Ranger District and does not overlap any LSR. Bluegrass Butte is a small area bounded on the west by both the Mt. Washington and Three Sisters wilderness areas. Highway 242 runs through the center and the Belknap Crater lava flow is excluded. It overlaps a portion of the Cache and Trout LSRs. The Trout area is bounded on the west by the Three Sisters wilderness and on the east by the NWFP line. It overlaps a portion of the Trout LSR.

Approximately 15% of the subunit is classified as NRF habitat (13,964 acres) and NRF is generally distributed throughout with the majority of habitat in the eastern half of the Green Ridge and Bluegrass Butte areas. The majority of the remaining habitat is considered dispersal habitat with the exception of the stand- replacement and mixed mortality fire areas. The major plant associations are white fir with moderate amounts of Douglas-fir, mountain hemlock, Pacific silver fir, and ponderosa pine (Table 74).

Table 74 PAG acres within critical habitat Subunit ECN 8 on the Deschutes National Forest.

PAG	Acres in PAG	% of PAG
Douglas Fir	11,643	12%
Grand Fir	120	<1%
Lodgepole Pine	0	0%
Mountain Hemlock	5,872	6%
Pacific Silver Fir	1,808	2%
Parkland	190	<1%
Pinyon-Juniper	92	<1%
Ponderosa Pine	2,425	3%
Subalpine Fir	66	<1%
Western Hemlock	283	<1%
White Fir	72,124	76%
Grand Total	**94,622**	**99%**

Approximately three-quarters (76%) of this subunit is comprised of the white fir PAG that has the potential to provide suitable spotted owl habitat in the appropriate plant associations. The mountain hemlock PAG does not have the complex structure needed to provide suitable spotted owl habitat and the ponderosa pine PAG is usually too dry and open to produce suitable habitat. However, due to fire suppression, understories have grown in producing short-term marginal NRF habitat and dispersal habitat in some locations. This occurs across the subunit where large trees can be produced but due to the overstocked nature of the stands, they are at high risk of loss from insects, disease, and/or wildfire that has occurred frequently on the Sisters Ranger District over the last 20 years.

Several wildfires have occurred partially or wholly in this subunit since 2002: Cache Mtn. (2002), Eyerly (2002), RNA (2002), Link (2003), B&B (2003), Black Crater (2006), Lake George (2006), GW (2007), Summit Springs (2008), Wizard (2008), Black Butte II (2009), Shadow Lake (2011), Pole Creek (2012), Green Ridge (2013), and Bridge 99 (2014). Over 38,800 acres (41%) of this subunit have been impacted by fire (Table 75).

Table 75 Vegetation mortality due to wildfire in the ECN 8 on the Deschutes National Forest.

Acres of Low Mortality	Acres of Mixed Mortality	Acres of Stand Replacement	Total Acres
17,874	10,927	10,064	38,865

Mixed mortality and stand replacement burns generally result in the loss of NRF habitat and potential dispersal habitat if the majority of stands are comprised of true firs such as white fir. Low mortality areas are generally underburned and dispersal habitat is likely to be retained in these areas. In addition, significant insect and disease outbreaks have occurred within this subunit, most of which has been impacted by wildfire. A mountain pine beetle epidemic has impacted lodgepole pine stands in and adjacent to the Trout Creek area. As a result, approximately 90% of the lodgepole pine has been killed. This has led to the degradation of mixed conifer stands, primarily a reduction in canopy cover due to the loss of lodgepole pine. These white fir stands also contain significant levels of dwarf mistletoe which has resulted in canopy closure reductions as well and has left the area fragmented.

This subunit is expected to function primarily for demographic support to the overall population, as well as north-south connectivity between subunits. Connectivity exists down Green Ridge to Black Butte and occurs across Metolius Basin through ponderosa pine stands but becomes limited along the eastern slope of the Cascades as a result of wildfire. Impacts from large wildfires can be seen from the base of Mt. Jefferson south along the east slope of the Cascades to Three Creek Lake. The majority of these fires ranged from high elevation wilderness through the mid-slope regions where the majority of historic spotted owl home ranges were found. In addition, mortality has occurred within the high elevation lodgepole pine stands within the wilderness from the mountain pine beetle. Impacts from this outbreak occur from roughly Trout Creek Butte area south to Cultus Mountain on the Bend-Ft. Rock Ranger District. Impacts from fire and insects have limited north-south connectivity on the Sisters Ranger District primarily. Dispersal habitat occurs in the lower elevations primarily in overstocked ponderosa pine stands which are also at risk of loss. This subunit is still providing demographic support but at a reduced level due to impacts from past wildfires. In stand replacement and mixed mortality areas, it may take >300 years to produce suitable NRF habitat and >100 years to produce dispersal habitat due to the lack of a seed source for desired tree species (USDA Forest Service 2004a). In underburned areas, habitat is likely to be produced in 25-50 years and NRF in approximately 100 years due to the remaining residual trees.

Eight known spotted owl home ranges are found partially or wholly in ECN 8 subunit and all are considered viable. The Castle Rocks, Trout Creek, Davis Creek, and Bluegrass Butte home ranges have not been surveyed in the past 2 to 3 years and the site status is unknown. One additional pair, Black Crater, has been surveyed over the past two years but no birds have been detected.

In 2011, a new pair (Metolius Basin) was detected. This pair has not been found to be reproductive. In 2013, a new pair was detected (Meadow Creek). The reproductive status of this pair has not yet been determined.

Eight barred owl detections have occurred in this subunit since 1999. Two barred owl pairs have been documented with one pair found on the north end of Green Ridge near the Metolius Basin spotted owl pair and the other barred owl pair is associated with the north side of Black Butte (near the Obsidian

spotted owl home range). A single barred owl was detected near Six Creek in 2012. Barred owls have not been detected Deep Canyon watershed associated with the Melvin Butte project area.

Subunit ECN 8 also overlaps four NWFP allocations – LSR, matrix, congressionally reserved, and administratively withdrawn. Late-successional reserves have the objective to protect and enhance conditions of late-successional and old growth ecosystems, which serve as habitat for late-successional and old growth forest related species including the spotted owl. Administratively withdrawn lands include recreation and visual areas, back country and other areas where management emphasis precludes scheduled timber harvest. Matrix is the area where most timber harvest and other silvicultural activities will be conducted. None of the proposed treatment units occur within an LSR allocation.

Table 76 lists the mapped critical habitat acres at different spatial scales. There are 253,196 acres of critical habitat on the Deschutes National Forest and 94,517 acres of Subunit ECN 8. Within the analysis boundary of the Melvin Butte project area, there are approximately 3,731 acres of critical habitat mapped in the ECN 8 subunit. Approximately 2,971 acres of Melvin Butte vegetation management units occur in critical habitat.

Table 76 Mapped critical habitat that overlaps with Melvin Butte Project area.

	Acres of mapped critical habitat on the Deschutes National Forest	Percent (%) of Acres
CHU 7 on the Deschutes National Forest	253,196	100%
Subunit ECN 8 on the Deschutes National Forest	94,517	37% of CHU
Melvin Butte Project Area Boundary	3,731	4% of subunit
Melvin Butte Vegetation Management units	2,971 acres	3% of subunit
		1% of CHU on Forest

NRF Habitat Within Critical Habitat and the Project Area

Elevation and corresponding changes in temperature or moisture regimes constrain the development of vegetation communities selected by spotted owls, and may exceed the bounds of physiological tolerance of spotted owls or their prey. In addition, topography influences the distribution of spotted owl habitat and patterns of habitat selection. The effects of topography are strongest in drier forests, where aspect and insolation (amount of solar radiation received in an area) contribute to moisture stress that can limit forest density and tree growth. In drier forests east of the Cascades, suitable habitat can be concentrated at intermediate topographic positions, on north-facing aspects, and in concave landforms that retain moisture. This leads to a distribution of suitable habitat characterized by ribbon-like bands and discrete patches. Ribbons occur along drainages and valley bottoms, along the north faces of ridges that trend from east to west, and at intermediate topographic positions between drier pine-dominated forests at lower elevations, and subalpine forest types at higher elevations. Discrete patches also occur on top of higher plateaus. The majority of suitable spotted owl NRF habitat as well as historic and current spotted owl home ranges occur within the mid-elevational mixed conifer (white fir PAG) band on the Deschutes National Forest. This band includes the east slope of the Cascades and buttes, especially on the southern half of the forest. Approximately 56% of the NRF habitat on the Deschutes National Forest occurs within designated critical habitat and a large portion of the NRF occurring outside critical habitat is located within wilderness.

Stand composition and structure associated with NRF habitat varies greatly from north to south across ECN 8 and across the Sisters Ranger District. Although elevation, corresponding temperature, and

moisture regimes influence the vegetation communities, these factors coupled with soil types also greatly influence vegetation communities across the Sisters Ranger District. The soil types north of Highway 242 (primarily associated with the Metolius Basin and Green Ridge) are more highly productive than the soil types on the southern end of the district, south of Highway 242. As a result, the northern end of the district and northern portions of ECN 8 have a more diverse stand composition in the mid-elevation mixed conifer PAG's. This mixed conifer PAG s contains an overstory of predominantly Douglas-fir and ponderosa pine both long-lived and fire tolerant. In addition, this PAG also contains incense cedar, western larch, and western white pine, which are also long-lived fire tolerant species. Lastly, white-fir is a short live species that is very susceptible to insects and disease and dominates the understory. Due to these highly productive soils associated diverse vegetation communities, the majority of the historic NRF habitat and historic spotted owl territories occurred north of Highway 242 on the north end of the district.

South of Highway 242 in the southern portion of the Sisters Ranger District, ECN 8, and within the Melvin Butte project area, NRF habitat in mid-elevational mixed conifer is similar to the rest of the Deschutes National Forest. Due to the lower site productivity associated with the southern end of the district, these mid-elevation mixed conifer (white fire) PAG's have very limited species composition. Ponderosa pine is the primary long-lived fire tolerant species in the overstory. White fir dominates the understory and secondarily lodgepole pine, both of which are fire intolerant and highly susceptible to insects and disease. As a result, very little NRF habitat historically and currently occurs in the southern portion of the district as well as southern ECN 8. Due to the lack of stand diversity, NRF habitat is limited in this area, as well as historic nesting territories. In addition, with the last 100 years of fire exclusion and without harvest, these stands continue not to develop into NRF habitat. Typically the white fir and lodgpole pine die from insects and disease before they are able to develop into large overstory trees contributing to high crown closures and large tree structure.

Differences in mixed conifer vegetation composition across the Sisters Ranger District may be explained by changes in landscape geomorphology and soils across from north to south. Land Type Association (LTA) mapping which characterizes different landscapes at large scales can be useful for displaying these differences (US Forest Service). LTA mapping separates out large landforms based on differences in ecological drivers including geomorphology and soils which in turn influence different soil/climatic zones at a landscape scale. LTA's identified for the mixed conifer zone in the western portion of the District, including areas of Metolius Basin and lower to mid flanks of the Cascade Range are identified primarily as ashmantled glacial valleys and ashmantled glaciofluvial fans. Glacial till and glacial outwash in the lower soil profile of these landforms result in low water permeability. The result is a perching of much of the soil water in the upper soil profile and making it available for plant use. Mixed conifer vegetation in the areas of Green Ride in the northeast portion of the District include areas identified as ashmantled low mountains on which ash deposits occur over dense volcanic tuffs and non-fractured rock. Similar to the Metolius Basin soils these materials also help to hold soil moisture for longer periods in the upper soil profile. Landforms in the southern portion of the Ranger District and Melvin Butte project area differ from the north in that they include landforms primarily identified as ashmatled volcanos, ashmatled flows, ashmantled volcanic plains. Soils on these landforms consist of volcanic ash mantles over highly fractured volcanic rock. The result is lower water supplying capacities for vegetation growth due to more water moving through the soil profile into the fractured rock below the plant rooting zone.

Overall, the largest impact to NRF habitat and spotted owl territories across the Sister Ranger District has been wildfire. Since 2002 approximately 144,110 acres has burned or 44% of the district. The majority of these fires have been in the mid-elevation mixed conifer stands.

Table 77 lists the acres of NRF habitat at these different spatial scales. Of the 70,108 acres of NRF habitat on the Deschutes National Forest, approximately 13,964 acres of NRF occur in Subunit ECN 8. The Melvin Butte Project area lies in the southern portion of ECN 8 on the eastern edge of the northern spotted owl's range.

Of the 5,375 acre Melvin Butte project area, approximately 3,731 acres are associated with CHU Subunit ECN 8. NRF habitat identified through a forest wide mapping process underwent field review during the 2011 field season. It was determined during field review that the mapped NRF did not contain adequate stand characteristics to qualify as viable NRF habitat. In addition, to further validate that the lack of suitable stand characteristics in mapped NRF, surveys were completed to protocol from 2009 to 2011 and no responses were detected within the Melvin Butte project area. There is no NRF habitat associated with the project area or with the portion of the project area associated with the CHU.

Table 77 Nesting, roosting, and foraging habitat in critical habitat and the Melvin Butte Project area

Scale	Acres of NRF Habitat
Deschutes National Forest	70,108
Critical Habitat Subunit ECN 8	13,964
Melvin Butte Project Area Boundary	0
Melvin Butte Vegetation Management Units	0
Percentage of NRF Habitat Affected by Melvin Butte Project	0%

Dispersal Habitat and Connectivity

Northern spotted owls regularly disperse through highly fragmented forested landscapes. Corridors of forest through fragmented landscapes serve primarily to support relatively rapid movement through such areas, rather than colonization or residency of nonbreeding owls. During the transience or movement phase, dispersers use mature and old-growth forest slightly more than its availability; during the colonization phase, mature and old-growth forest is used at nearly twice its availability. Closed-sapling sawtimber habitat is used roughly in proportion to availability in both phases and may represent the minimum condition for movement. Spotted owls can also disperse successfully through forests with less complex structure, but risk of starvation and predation likely increase with increasing divergence from the characteristics of suitable habitat. The suitability of habitat to contribute to the successful dispersal of spotted owls is likely related to the degree to which it ameliorates heat stress, provides abundant and accessible prey, limits predation risk, and resembles habitat in natal territories. Dispersal habitat is essential to maintaining stable populations by promoting rapid filling of territorial vacancies when resident spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Generally, dispersal habitat across the Deschutes National Forest is fragmented by roads, timber harvest units, or by areas that have been burned or defoliated by insects or disease but is found from the low ponderosa pine areas to the mountain hemlock zone in varying degrees of quality.

Dispersal habitat was defined by the Interagency Scientific Committee (USDA Forest Service and USDI Fish and Wildlife Service 1990) as stands with an average dbh of 11 inches and a 40% canopy cover. Those conditions are not biologically possible in all eastside plant association groups. In 1996, the Forest conveyed a Science Team of experts on local conditions to determine plausible definitions of dispersal habitat. The team developed a process by which local biological knowledge of sites would be used to describe dispersal habitat (USDA Forest Service 1996). Table 78 lists the following criteria used to define dispersal habitat on the Deschutes National Forest.

Table 78 Dispersal habitat definitions.

Plant Association Group	Stand Criteria Average dbh, Percent Canopy Cover (CC)
Mixed Conifer Wet	11” dbh, 40% CC
Mixed Conifer Dry	11” dbh, 30% CC
Ponderosa Pine	11” dbh, 30% CC
Lodgepole Pine	7” dbh, 30% CC

Mountain Hemlock	7” dbh, 30% CC

Based on the criteria identified in the previous table, an analysis was completed and dispersal habitat was mapped for the entire Deschutes National Forest. Table 79 lists the acres of dispersal habitat at different spatial scales. Of the 289, 552 acres of Dispersal habitat on the Deschutes National Forest, approximately 24,342 acres of NRF occur in Subunit ECN 8. The Melvin Butte Project area lies in the southern portion of ECN 8 on the eastern edge of the northern spotted owl’s range. Approximately, 2,796 acres of dispersal habitat exists across the Melvin Butte project area.

Table 79 Dispersal habitat in critical habitat and the Melvin Butte Project area.

Scale	Acres of Dispersal Habitat
Deschutes National Forest	289,552
Critical Habitat Subunit ECN 8	13,964
Melvin Butte Project Area Boundary	2,796

Connectivity in ECN 8 is highly fragmented due to the amount of fires and past timber harvest that have occurred across the Sisters Ranger District. ECN 8 was delineated in 2011 and Critical habitat was officially designated in in 2013. Although ECN 8 is associated with many fires, during the delineation, areas with the highest fire severity were avoided. Since 2011, the Green Ridge, Pole Creek, and Bridge 99 fires all have continued to impact and fragment ECN 8.

The Pole Creek fire is directly adjacent to the Melvin Butte project and has been the largest fire on the District since 2011. The Pole Creek fire burned approximately 26,795 acres and heavily fragmented the southern portion of ECN 8.

As part of the overall project design for dispersal habitat and to meet the intent of the purpose and need of the project, a retention strategy was developed for spotted owl dispersal habitat. The primary objective of the retention strategy is to provide connectivity for spotted owls in a north to south continuum throughout the project area by retaining dispersal habitat. The retention strategy is based on the inherent soil quality and stand productivity, where the project retains more untreated stands in areas that have high site productivity and contain the most contiguous acres of dispersal habitat. The project was broken into 3 major soil types which are classified as low, moderate, and high site productivity. Due to the high canopy closure and high tree density that must occur in stands to provide dispersal habitat, stand viability is greatly reduced in areas where site productivity is low to moderate. In areas where site productivity is moderate to high, stand viability may be maintained for a longer duration.

The retention strategy identified a range of retention levels for dispersal habitat across the project area. Within stands containing low site productivity, dispersal habitat/untreated stands will be retained at a 10% level, in the areas with moderate site productivity dispersal habitat/untreated stands will be retained at a15% level, and in areas that have the highest site productivity dispersal habitat/untreated stands will be retained at the 20% level. Retention will occur on a stand by stand basis to retain areas that contain the highest densities of contiguous dispersal habitat. Therefore no untreated areas will occur within implementation units. Approximately 1,317 acres of the project area have been identified as low site productivity, therefore 10% or 131 acres will be retained in areas that provide dispersal habitat for the spotted owl. Approximately 1,451 acres of the project area have been identified as moderate site productivity, therefore 15% or 217 acres will be retained in areas that provide dispersal habitat for the spotted owl. Approximately 1,832 acres of the project area have been identified as high site productivity, therefore 20% or 366 acres will be retained in areas that provide dispersal habitat for the spotted owl. See Table 80 for a summary of retention objectives by site potential. These areas will provide residual overstory diversity and structure to allow for dispersal through the project area.

Table 80 Retention Strategy by the Site Productivity for the Melvin Butte Project area

Retention Levels	Acres of Melvin Butte Project Area in Low, Medium, and High Site Productivity	Total Acres Identified to Minimally Retain as Dispersal Habitat
10 percent	1,317 acres	131 acres
15 percent	1,451 acres	217 acres
20 percent	1,832 acres	366 acres
Total	4,600 acres	714 acre

To meet the objective identified in the above Table 80, stands were reviewed and those stands containing the highest densities of contiguous dispersal habitat were identified and retained as No Treatment areas. The following Table 81 displays the actual acres identified for dispersal stands based on site productivity.

Table 81 Retention strategy by Site Productivity for the Melvin Butte project area

Retention Levels	Acres of Melvin Butte Project Area in Low, Medium, and High Site Productivity	Actual Acres Retained for Dispersal Habitat
10 percent	1,317 acres	158 acres
15 percent	1,451 acres	230 acres
20 percent	1,832 acres	364 acres
Total	4,600 acres	752 acres

In addition, the connectivity strategy was built around other stands that will not be treated for other resource issues which also contain dispersal habitat. These areas include the Three Creeks riparian reserve and some areas of steep slopes that are excluded from treatment which total approximately 162 acres.

Of the 2,796 acres of dispersal habitat identified within project area, 914 acres or 32% of the area will be retained to provide connectivity for dispersing birds in a north south continuum throughout the project area.

Alternative 1 - Ecological Trends

Under the No Action Alternative, no treatments will be prescribed within Melvin Butte project area (5,375 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine and mixed conifer stands would be prolonged and the old trees within these stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide dispersal habitat in the short-term. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees. As a result, dispersal habitat for the northern spotted owl will continue to diminish as the overstory canopy's become more open making the species more susceptible to predation. Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time, potentially impacting spotted owl dispersal habitat.

Stand resilience to insects, disease, and wildfire is measured by the Upper Management Zone (UMZ) . The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. There are

approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition, 92% of these stands are above the Upper Management Zone and are at risk or may currently be impacted by insects and disease due to high stand densities and as a result low resiliency.

Alternatives 2 and 3 - Direct and Indirect Impacts

The Revised Recovery Plan emphasizes the conservation of spotted owl sites and high value spotted owl habitat (page I-2). Interim Guidance recommends that site conservation priorities for reproductive status are (page III-44):

- Known sites with reproductive pairs;
- Known sites with pairs;
- Known sites with resident singles; and
- Historic sites with reproductive pairs, pairs, and resident singles, respectively.

Further recommendations include avoiding activities that would reduce nesting, roosting, and foraging habitat within provincial home ranges (1.2 mile radius) of reproductive pairs (III-45). The project meets the interim guidance and recommendations.

No known sites or historic sites occur within the project area, therefore disruptive work activities will not take place within ¼ mile (1.0 miles for blasting, ½ mile for helicopter) of any newly discovered nest sites or home ranges from March 1 to September 30.

The project area does not contain any suitable NRF habitat, therefore no thinning or prescribed burning will occur within suitable NRF habitat. Therefore, there will not be any modification of any NRF habitat in Critical Habitat ECN 8 subunit.

Treatment types for Alternatives 2 and 3 include thinning from below (HTH), mixed conifer thinning from below with group opening (MCGO), mixed conifer thinning from below without group openings (MC without openings), non-commercial thinning (P), Burn Only (B), lodgepole improvement (LPI), and dwarf mistletoe restoration (DM). The following Table 82 summarizes the acres associated with each treatment type.

Table 82 Treatment type and acres for Alternative 2 and 3.

Treatment Type	Alternative 2	Alternative 3
HTH	1,008 acres	1,169
MCGO	892 acres	0
MC without openings	0	820
P	1,179	1,179
B	772	772
LPF	445	445
DM	160	0
Total Acres.	**4,456**	**4,385**

Under both Alternatives 2 and 3, of the approximately 2,796 acres of available dispersal habitat, approximately 1,882 acres will be treated. The majority of the dispersal habitat occurs primarily within units associated with thinning from below (HTH), mixed conifer thinning from below (MCGO and MC without openings), and Prescribed Burning. Some of the second growth ponderosa pine non-commercial thinning units (P), where trees are approximately 40+ years old, minimally meet the requirement for dispersal habitat and therefore dispersal is not typically contiguous in these units.

Very little to no dispersal habitat exists in the lodgepole improvement units or dwarf mistletoe units. The dwarf mistletoe units are associated with past ponderosa pine shelterwood harvest, containing a sparse overstory of individual large trees with a dense understory of regeneration approximately 20 to 40 years old. These stands are very open and over story canopy is discontinuous, therefore does not provide dispersal habitat.

Very little to no dispersal habitat exists within the lodgepole pine improvement units,. A mountain pine beetle outbreak impacted this area approximately 15 years ago and as a result, stands are very fragmented and discontinuous.

The objective each type of thinning is to reduce stand densities by thinning from below to 1) to increase stand resiliency to insects and disease, 2) reduce fuel loading as well as ladder fuels minimizing the risk of stand replacing fire and 3) promote the development of fire tolerant late and old structure stands.

Due to impacts to the majority of NRF and dispersal habitat from stand replacing fire across the district, thinning treatments were designed to maintain and promote overstory ponderosa pine. Ponderosa pine is the building block of large tree structure that provides the basis for NRF and dispersal habitat. These trees take the longest to develop and recruit into the overstory. Due to overstocked stands, fire intensity has been such, that these once fire resilient trees succumb to crown fire and many old growth ponderosa pine stands as well as residual old growth legacy trees have been lost to stand replacing fire. Thinning from below (HTH) has been designed to thin stands in a mosaic fashion retaining heterogeneity in dry mixed conifer and promoting heterogeneity in second growth ponderosa pine stands. Although HTH units will reduce stand densities to a level that canopy cover does not meet minimum requirements for dispersal habitat, treatments will maintain fully stocked stands and contiguous overstory crowns.

Mixed conifer thinning (both MCGO and MC without openings) will also thin stands from below. This treatment focuses on maintaining overstory ponderosa pine removing white-fir and lodgepole pine that contain insects and disease. Treatments also focus on removing ladder fuels in the understory of overstory ponderosa pine. To maintain a contiguous overstory stand, larger overstory white-fir not directly competing with overstory ponderosa pine will be retained. However , to build stand resiliency, within mixed conifer treatments associated with group openings, where stand contain no ponderosa pine, 1-3 acre group openings will be created and reforested with ponderosa pine. This will occur within 30% of this treatment type or on approximately 268 acres, reducing some overstory continuity.

Prescribed burning treatments (B) are designed for maintenance of late and old structure ponderosa pine stands. These stands will only receive prescribed burning and are not expected to reduce canopy cover but to use prescribed fire to reduce understory shrub densities as well as sapling size regeneration.

Treatments were designed to minimize the continued fragmentation of spotted owl dispersal habitat on the landscape in the long-term, and in the short-term to provide connectivity through the project area. The largest blocks of contiguous dispersal habitat were retained throughout the project area. Treatments were designed around these blocks of habitat to maintain movement through the project area.

The project *may affect but is not likely to adversely effect* dispersal habitat from thinning stands from below and reducing canopy cover to levels that no longer meet the dispersal definitions in the programmatic BA.

Physical and Biological Features/ Primary Constituent Elements of Critical Habitat

East Cascades Special Management Considerations/Protection

Special management considerations or protection may be required in the East Cascades to address the effects of past activities associated with Euro-American settlement, such as timber harvest, livestock

grazing, fire suppression, and fire exclusion, that have substantially altered the inland northwest, modifying the patterns of vegetation and fuels and subsequent disturbance regimes to the degree that contemporary landscapes no longer function as they did historically. This has affected not only the existing forest and disturbance regimes, but the quality, amount, and distribution of spotted owl habitat on the landscape. In order to preserve the essential physical or biological features, dynamic, disturbance-prone forests should be managed in a way that promotes spotted owl conservation, responds to climate change, and restores dry forest ecological structure, composition, and processes including wildfire and other disturbances. The following restoration principles were considered during project design:

1. Conserve older stands that contain the conditions to support spotted owl occupancy or high value owl habitat
2. Emphasize vegetation management treatments outside spotted owl territories or highly suitable habitat
3. Design and implement restoration treatments at the landscape level
4. Retain and restore key structural components, including large and old trees, large snags, and downed logs
5. Retain and restore heterogeneity within stands
6. Retain and restore heterogeneity among stands
7. Manage roads to address fire risk
8. Consider vegetation management objectives when managing wildfires where appropriate

Approximately 3,731 acres of CHU Subunit ECN8 occur within the project area. Overall, the project is associated with approximately 4% of the total ECN 8 acres. Approximately, 2,343 acres of dispersal habitat occurs within the CHU area associated with the Melvin Butte project. Approximately 742 acres or 31% of dispersal/connectivity stands within the CHU associated with the Melvin project will be retained in untreated stands. No NRF habitat exists within the CHU. Table 83 provides a summary of effects to dispersal habitat in CHU-ECN8 in the project area. Table 84 provides a summary of effects to dispersal habitat within the total project area.

Table 83 Summary of effects to disperal habitat in CHU ECN 8 overlapping the Melvin Butte Project area.

Acres of CHU occurring Melvin Butte Project Area	% of Melvin Butte Project Area associated with total CHU Subunit ECN8	Acres of Dispersal Habitat within CHU in Melvin Butte Project Area	Acres of Dispersal Habitat retained within CHU in Melvin Butte Project Area Post Treatment	Acres of Dispersal Habitat reduced within CHU in Melvin Butte Project Area	% Dispersal Habitat within CHU in Melvin Butte Project Area Post Treatment
3,731 acres	4%	2,343 acres	742 acres	1,601 acres	31%

Table 84 Summary of effects to disperal habitat within total Melvin Butte Project area.

Overall acres of Dispersal Habitat within Melvin Butte Project Area	Overall acres of Dispersal Habitat retained within total Melvin Butte Project Area Post Treatment	Overall acres of Dispersal Habitat reduced within total Melvin Butte Project Area	% Dispersal Habitat retained with the Melvin Butte Project Area Post Treatment
2,796 acres	914 acres	1,882 acres	33%

Treatments within the Melvin Butte project area and the CHU associated with the project area were designed with the intent of meeting the East Cascade Special Management Considerations. All thinning from below (HTH), mixed conifer with and without group openings (MCGO, MCWOGO), and prescribed burning (B) treatments were designed with the objective of meeting all 8 management considerations. There are no stands within the project area that support owl occupancy and no owl

territories occur within or adjacent to the project area. Thinning prescriptions are a thinning from below retaining late and old structure overstory stands and no snags or down logs are proposed for removal with this project. Mosaic thinning will occur within black bark ponderosa pine to promote heterogeneity and the development of late and old structure stands. Thinning from below in multi-story mixed conifer stands will retain stand heterogeneity by maintaining all the components of the residual age classes and a fully stock stand post thinning. Stands containing the largest contiguous blocks of dispersal habitat were retained between treatment units to retain heterogeneity between stands. Approximately 7.71 miles of roads are proposed to be decommissioned and close approximately 5.85 miles of roads under all action alternatives, reducing road densities in the project area from 5.86 mile/sq. mile to 4.40 miles/sq. mile.

The portion of ECN 8 associated with the Melvin Butte project is a very important element of the subunit. This portion of the subunit provides a very narrow band of connectivity between unsuitable habitat associated with the highly fragmented Pole Creek fire and private timber land directly adjacent and east of the project which is managed for timber production. Directly south of and outside of ECN 8, the plant community changes to lodgepole pine/mountain hemlock dominated stands.

There are limited large blocks of dispersal habitat in this area due to the impacts from past mountain pine beetle outbreaks. No existing NRF habitat or territories occurs directly adjacent to the Melvin Butte project area. Existing dispersal habitat only provides movement through the area in a north to south continuum and does not connect any highly suitable habitat. Connectivity throughout the ECN 8 subunit will not be disrupted by activities associated with the Melvin Butte project. Although treatments will degrade existing dispersal habitat, it will not create barriers to movement, but will reduce security that high canopy closures provide. However, the connectivity strategy provides large untreated blocks between stands thinned from below and will still allow movement while reducing the ongoing fragmentation from stand replacing fire that occurred in the adjacent Pole Creek fire as well as across the district over the past 15 years.

There are approximately 4,456 acres that have the potential to receive vegetation treatments. As a result of both action alternatives, 90% of these stands will be below the Upper Management Zone. Treatment will greatly increase stand resiliency to insects, disease, and wildfire through stand density reductions.

Alternatives 2 and 3 *may affect but are not likely to adversely effect* designated Critical Habitat.

Alternatives 2 and 3 - Cumulative Effects

The cumulative effects area for both action alternatives is both the Whychus and Deep Canyon watersheds as they overlap ECN 8. Both watersheds were utilized to best display the historic spotted owl occupancy on the landscape. The western half of both watersheds occurs within the range of the northern spotted owl under the Northwest Forest Plan boundary. Approximately 122 acres of NRF habitat occurs in the eastern area of the Deep Canyon watershed. No known spotted owl homes ranges or home ranges or detections occur in the Deep Canyon watershed. None of the proposed actions in the watersheds are anticipated to have an effect on spotted owl NRF habitat.

No home ranges occur in the Deep Canyon watershed. Table 85 lists the habitat conditions for each historic home range that occurs in the adjacent Whychus watershed. The Black Crater and Bluegrass Butte home ranges are considered viable but not active.

Table 85 Spotted owl ranges.

Spotted Owl Home Range	Viability and Status	NRF Acres within 1.2 Mile Home Range	Existing Percent (%) NRF acres within 1.2 Mile Home Range	NRF Acres in ECN 8 within 1.2 Mile Home Range	Last year of Activity

Deep Canyon Watershed					
No home ranges occur in this watershed					
Whychus Watershed					
Snow Creek	Non-viable	37	1%	0	2010
Trout Creek	Potentially viable but inactive	553	19%	2,611	1993
Black Crater	Potentially viable but inactive	807	28%	1,197	2007
Bluegrass Butte	Potentially viable but inactive	249	9%	2,510	2007

Fires have had the greatest influence on spotted owl habitat across the Sisters Ranger District due to the reduction of canopy cover, loss of multi-storied stands, and mortality of understory white-fir and to a lesser degree the loss of large Douglas-fir and ponderosa pine prior to the fires. These open stands are considered unsuitable nesting habitat for spotted owls. Insect and disease outbreak in the Whychus and Deep Canyon watersheds along with the Pole Creek Fire have produced ample down wood to meet forest standards and guidelines for down wood in the LSR and Matrix. The watershed has experienced moderate to heavy mortality with the insect outbreak of the early 1990s.

The influx of snags that fall will increase the amount of down wood in the next 20 years. In the mixed severity areas, trees that survived the Pole Creek Fire will be able to provide a more consistent supply of dead wood material. Within stand replacement areas much of the pre-existing downed wood was consumed. However, within the fire perimeter a percentage of the existing down woody material are trees that have fallen since the fire and most are in Decay Classes 1 and 2 (Thomas 1979, Brown 1985). Some downed material was consumed within the mixed mortality and underburned areas as well, especially where fire intensity was greater. This primarily consisted of smaller material (<12 inches dbh) and advanced decayed logs. Larger pre-existing material is still present although logs are now case-hardened in many situations.

The last 100 years of fire suppression has changed stand composition across the Sisters Ranger District. Stand densities have increased as well as outbreaks of insects and disease, although both are endemic to the district. As a result of disturbance large tracks of mortality exist in stands across the district. Since 2002, no major fires have occurred within the Deep Canyon watershed until the 2012 Pole Creek fire where approximately 4,081 acres burned and Two Bulls fire that burned approximately 487 acres totaling approximately 4,568 acres. Table 86 provides a summary of recent fire history in the Deep Creek and Whychus watershed since 2002.

Table 86 Recent fire history in the Deep Canyon and Whychus Watersheds since 2002.

Fire	Year	Acres of National Forest Land
Deep Canyon Watershed		
Pole Creek	2012	4,568
Two Bulls	2014	487
Whychus Watershed		
Cache	2002	40
Black Crater	2006	5,147
Lake George	2006	1,857
GW	2007	186
Black Butte 2	2009	559

Rooster Rock	2010	1,362
Pole Creek	2012	22,512
	Whychus Total	**31663**

The Pole Creek Fire Danger Tree Removal project, Pole Creek Fire Timber Salvage project, and Two Bulls Timber Salvage projects total approximately 1,584 acres. These are ongoing and future projects that will and have removed fire killed trees reducing snag densities within the watersheds reducing snag habitat in the watersheds. These projects do not propose to remove spotted owl NRF or Dispersal habitat. The Pole Creek Fire Danger Tree Removal project and Pole Creek Fire Timber Salvage project both occur within ECN 8.

Activities proposed under the Sisters Area Fuels Reduction (SAFR) project, Glaze Forest Restoration project, Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, Bear Wallow Fire Wood project have occurred or will occur in the two watersheds. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading. The SAFR and Glaze projects only occur within the Whychus watershed and both focus on thinning from below to restore and enhance ponderosa pine conifer stands while reducing the risk of stand replacing fires. These projects do not occur within NWFP lands (outside of the range of the northern spotted owl), therefore do not contribute to cumulative effects. The Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, Bear Wallow Fire Wood projects are all within mixed conifer or lodgepole pine habitat types. These projects all occur within the Deep Canyon watershed. However, these projects do not occur with ECN 8. Only one project occurs within spotted owl Critical Habitat, the Bend Municipal Watershed project, and it occurs in ECN 9. These areas are associated with high levels of bark beetle mortality to lodgepole pine stands. These project areas will directly remove snags to break of fuel continuity within these areas and therefore will reduce snag and log habitat. In addition these projects will also thin stand from below reducing stand densities. No suitable spotted owl NRF habitat will be removed as result of these projects. Overall, the projects that occur within NWFP lands will reduce fuel densities on approximately 7,060 acres. These projects are being implemented to reduce the risk of loss of existing habitat from future large-scale disturbances.

Personal use firewood cutting is occurring within the 3,029 acre Three Creek's Firewood Cutting area. Individual dead trees are being removed by personal use firewood cutters primarily within the road prism of open roads. Cutting is not wide spread and occurs on a site specific basis, where individual trees are removed or small groups of dead trees. Only dead lodgepole pine and white-fir can be taken for firewood.

The proposed thin from below, mow, and burn treatments in the vegetation management projects associated with the Whychus and Deep Canyon Watersheds would accelerate the development of large tree structure in mixed conifer which would provide positive benefits for owl habitat in the long-term (i.e., greater than 30 years post-implementation). This treatment would select and retain the healthiest and largest trees that would be the most resilient to the effects of fire. Within lodgepole pine stands, the focus would be to remove concentration of dead trees, and promote the natural regeneration of lodgepole pine. Lodgepole pine treatments will not remove spotted owl habitat, but will promote the development of fully stocked overstory lodgepole pine stands. The intent of the treatment is to capture the utility of green lodgpole pine stands for spotted owl dispersal during the 100 year rotation, and before the next infestation of the mountain pine beetle. However mixed conifer thinning from below will also occur and will directly reduce dispersal habitat across the approximately7,060 acres associated with these projects.

Conclusion—Alternatives 2 and 3

Alternative 2 and 3 in the Melvin Butte project area does not impact any NRF habitat. Alternatives 2 or 3 will reduce approximately 1,882 acres of dispersal habitat, retaining 914 acres of the largest concentrated blocks of dispersal habitat, therefore ***May Affect but is Not Likely to Adversely Effect*** spotted owl connectivity. The project ***May Affect but is Not Likely to Adversely Effect*** primary constituent elements in 2013 designated critical habitat by reducing approximately1,601 acres of dispersal habitat, retaining approximately 742 acres of the largest concentrated block of dispersal habitat. The project is consistent with the 2011 Revised Recovery Plan. The project is consistent with the Deschutes National Forest Plan standards and guidelines as amended by the Northwest Forest Plan.

Oregon Spotted Frog (Endangered)

Measure: Effects to breeding, reproduction, and rearing habitat

Existing Condition

The Oregon spotted frog inhabits the margins of lakes, marshes, and pools in streams where there is an abundant growth of vegetation (Csuti et al. 2001). Literature cited in the Conservation Assessment (Cushman and Pearl, 2007) describes spotted frog breeding habitat as moderate to large wetlands with extensive emergent marsh coverage that warms substantially during seasons when Oregon spotted frogs are active on the surface (February to May). Sites always include some permanent water juxtaposed to seasonally inundated habitat.

No habitat exists for the Oregon spotted frog and within the Melvin Butte project area. No Oregon spotted frog Critical Habitat Exists within the Melvin Butte project area. No further analysis is required.

Sensitive Species

Table 87 lists 22 Regional Forester sensitive species known to occur or potentially occur on the Deschutes National Forest. Based on a review of records and habitat requirements, the following sensitive species have potential habitat in the project area and may be impacted by the proposed action: Townsend's big-eared bat, fringed myotis, pallid bat, white-headed woodpecker, and Lewis' woodpecker.

Table 87 Regional Forester Sensitive Species occuring or potentially occurring on the Deschutes National Forest.

Regional Forester Sensitive Species				
INVERTEBRATES				
Species	Status	Habitat	Habitat /Presence in Project Area	Effect
Western bumblebee (*Bombus occidentalis*)	Sensitive	Forest edges, gardens, near houses and urban areas	No habitat	No impact
Johnson's hairstreak (*Callophrys johnsoni*)	**Sensitive**	**Mixed forests with dwarf mistletoe**	**Existing habitat**	**May Impact**
Silver-bordered fritillary (*Boloria selene*)	Sensitive	Bogs and wet meadows	No habitat	No impact
Crater Lake tightcoil (*Pristiloma articum crateris*)	Sensitive	Perennial riparian areas	No habitat	No impact
Evening field slug (*Deroceras hesperium*)	Sensitive	Perennial wet meadows	No habitat	No impact

AMPHIBIANS				
Columbia spotted frog (*Rana luteiventris*)	Federal Proposed, Sensitive	Shallow lakes, ponds	No habitat	No impact
MAMMALS				
Townsend's big-eared bat (*Corynorhinus townsendii*)	**Sensitive, MIS**	**Caves, mines, bridges, buildings, rock outcrops, snags in conifer forests, desert**	**Existing habitat**	**May Impact**
Fringed myotis (*Myotis thysanodes*)	**Sensitive**	**Caves, mines, bridges, buildings, rock outcrops, snags in conifer forests, desert**	**Existing habitat**	**May Impact**
Pallid bat (*Antrozous pallidus*)	**Sensitive**	**Caves, mines, bridges, buildings, rock outcrops, snags in conifer forests, desert**	**Existing habitat**	**May Impact**
Spotted bat (*Euderma maculatum*)	Sensitive	Cliffs, caves, rock outcrops in sagebrush/desert habitat	No habitat	No Impact
North American wolverine (*Gulo gulo luscus*)	Sensitive, MIS	Mixed forests, High elevation	No denning habitat; low potential for dispersal habitat	No Effect
BIRDS				
Lewis' woodpecker (*Melanerpes lewis*)	**Sensitive, MIS**	**Open ponderosa pine snags, burned areas**	**Existing habitat**	**No impact**
White-headed woodpecker (*Picoides albolarvatus*)	**Sensitive, MIS**	**Large-diameter ponderosa pine snags**	**Existing habitat**	**No impact**
American Peregrine Falcon (*Falco peregrinus anatum*)	Sensitive, MIS	Riparian, Cliffs	No habitat	No impact
Bald eagle (*Haliaeetus leucocephalus*)	Sensitive, MIS	Lakes, snags	No habitat	No impact
Greater sage grouse (*Centrocercus urophasianus)*	Federal Candidate, Sensitive	Sagebrush flats	No habitat	No Impact
Bufflehead (*Bucephala albeola*)	Sensitive	Lakes, snags	No habitat	No Impact
Northern waterthrush (*Seiurus noveboracensis)*	Sensitive	Riparian streambanks with dense willows	No habitat	No Impact
Harlequin duck (*Histrionicus histrionicus*)	Sensitive	Rapid streams, Large trees	No habitat	No Impact
Horned grebe (*Podiceps auritus*)	Sensitive	Lake	No habitat	No Impact
Tricolored blackbird (*Agelaius tricolor*)	Sensitive	Lakeside, bulrush (cattails)	No habitat	No Impact
Yellow Rail (*Coturnicops noveboracensis*)	Sensitive	Marsh	No habitat	No Impact
Tule greater white-fronted goose (*Anser*	Sensitive	Nests on marshy ponds in the tundra; winters in open	No habitat	No Impact

albifrons)		country		

Rationale for Regional Forester Sensitive Species Not Analyzed in Detail

Silver-bordered fritillary

This butterfly ranges from Central Washington south along the Rocky Mountains to northern New Mexico and east to Illinois, Virginia and Maryland. They inhabit wet meadows, bogs, and marshes as well as forest openings in mountainous areas, and spring-fed meadows in dry prairies (NatureServe 2012). Two primary colonies exist in Oregon: one at Big Summit Prairie on the Ochoco National Forest and one in the Strawberry Mountains in the Malheur National Forest (Miller and Hammond 2007). Threats to this species include livestock overgrazing, wetland loss, and woody vegetation encroachment of willows and hawthorns from fire suppression (Miller and Hammond 2007). Adults lay eggs singly near host plants of the violet family including *Viola glabella* and *V. nephrophylla*. Caterpillars that develop from the eggs feed on these host plants and overwinter by hibernating, emerging as adults in the spring. Favored nectar sources for adults are composite flowers including goldenrod and black-eyed susans. Adults fly May to July with a second generation flying from August into September. There are no proposed treatment activities in riparian habitat. Implementation of Alternatives 2 or 3 would have ***No impact*** on the silver-bordered fritillary.

Crater Lake tightcoil

This snail can be found in suitable wet habitat on the undersides of woody debris, among wet mosses, rushes, and other low vegetation at the edges of wetlands, springs, seeps, and streams in perennially damp forest floor litter, especially where it has accumulated at the bases of shrubs and against logs (Duncan et al. 2003). Suitable wet habitat would be considered as almost exclusively very stable, perennially wet riparian edges around wetlands, springs, seeps, streams, and damp forest floor. Areas that are temporarily wet habitat such as stream borders that may change location (up and down the stream bank) or are seasonally underwater or dry, are not suitable habitat for this species. Only areas with constant water levels that create perennially saturated habitat year-round are suitable and may be occupied. There are no proposed treatment activities in riparian habitat. Implementation of Alternatives 2 or 3 would have N***o impact*** on the Crater Lake tightcoil.

Evening fieldslug

According to Duncan (2005), the evening fieldslug is associated with perennially wet meadows in forested habitats. Microsites include a variety of low vegetation, litter, and debris; rocks may also be used as refugia. This species appears to have high moisture requirements and is almost always found in or near herbaceous vegetation at the interface between soil and water, or under litter and other cover in wet situations where the soil and vegetation remain constantly saturated. Typical landscape features that may provide constant moisture conditions include springs and seeps, as well as wetlands in depressions and around perennial ponds. There are no proposed treatment activities in wet meadows, springs, or seeps. Implementation of Alternatives 2 or 3 would have ***No impact*** on the evening fieldslug.

Columbia spotted frog

Columbia spotted frogs inhabit the margins of lakes, marshes, and pools in streams where there is an abundant growth of vegetation (Csuti et al. 2001). There are no proposed treatment activities in standing water, streams (intermittent or perennial) or riparian areas. This species is not known to occur on the Sisters Ranger District. Implementation of Alternatives 2 or 3 would have ***No impact*** on the Columbia spotted frog.

Spotted bat

The spotted bat is mostly found in desert and canyon habitats. They roost in caves, mines, rock outcrops, and especially crevices in tall vertical cliffs. Roosts are usually near a source of water, but this does not appear to be a main requirement for roosting locations. Winter hibernation sites are poorly known. NatureServe (2012) considers the spotted bat to be widespread in western North America with sparse populations but it may be more common than formerly believed. Abundance, population trends, and threats are largely unknown. This species has not been documented on the Deschutes National Forest but has been detected adjacent to the Deschutes National Forest at Lake Billy Chinook east of the Sisters Ranger District and in Dry River Canyon near Highway 20 north of the Bend-Ft. Rock Ranger District. Potential habitat exists on the eastern fringe of the Deschutes National Forest but not in the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the Pallid bat.

American peregrine falcon

In Oregon, the peregrine falcon nests on cliffs ranging in height from a 75-foot escarpment at a reclaimed quarry to monolithic 1,500-foot high cliffs, as well as structural features of bridges (Joel E. Pagel *in* Marshall et al. 2006). There are no high escarpments, cliffs, or tall bridges in the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the peregrine falcon.

Bald eagle

Suitable habitat for the bald eagle is characterized by the presence of large (mature) trees generally >32 inches dbh. Ponderosa pine and Douglas fir trees with large open limb structures are preferred for nesting on the Deschutes National Forest. Other habitat attributes are the availability of prey, usually within one mile of their nesting territory, and a large water body. Reproductive or foraging habitat for the bald eagle does not occur in the project area. The closest known nest site is six miles from the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the bald eagle.

Greater sage grouse

The greater sage grouse is found in foothills, plains, and mountain slopes where sagebrush is present and the habitat contains a mixture of sagebrush, meadows, and aspen in close proximity. Winter habitat (palatable sagebrush) is probably the most limited seasonal habitat in some areas (NatureServe 2012). Sagebrush habitat in or adjacent to the project area does not exist. Implementation of Alternatives 2 or 3 would have ***No impact*** on greater sage grouse.

Bufflehead

The bufflehead typically nests at high-elevation forested lakes in Central Oregon, using cavities or artificial nest boxes in trees close to water, with most nests within 75 feet of water, but sometimes as far as 650 feet away (Marshall et al. 2003). The birds nest in natural cavities or abandoned northern flicker holes in mixed coniferous-deciduous woodlands near lakes and ponds. There are no lakes or ponds in the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the bufflehead.

Northern waterthrush

The northern waterthrush inhabits riparian habitat, often with willow and alder (NatureServe 2012). There are no proposed treatment activities in stream or riparian habitat. Implementation of Alternatives 2 or 3 would have ***No impact*** on the northern waterthrush.

Harlequin duck

The harlequin duck nests along fast-moving rivers and mountain streams on rocky islands or banks. It requires relatively undisturbed, low gradient, meandering mountain streams with dense shrubby riparian areas (greater than 50% streamside shrub cover), and woody debris for nesting and brood rearing; also needs mid-stream boulders or log jams and overhanging vegetation for cover and loafing; indicator of high water quality (Spahr et al. 1991). There are no proposed treatment activities in stream habitat or riparian in the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the harlequin duck.

Horned grebe

The horned grebe is a rare breeder east of the Cascades and favor semi-permanent ponds (Marshall et al. 2003). They nest among tall vegetation in shallow water on small and large lakes and ponds (approximately ¼ acre or larger), in calm waters of marshes, along rivers and streams. The highest breeding densities occur in pothole marshes of aspen woodlands. Outside the breeding season, horned grebes are found on bays, estuaries and seacoasts, and in migration commonly in inland freshwater habitats, especially lakes and rivers (NatureServe 2012). There are no proposed treatment activities in stream or riparian habitat in the project area. Implementation of Alternatives 2 or 3 would have ***No impact*** on the horned grebe.

Tricolored blackbird

In Oregon, this species is restricted to breeding in southern Oregon and prefers to breed in freshwater marshes with emergent vegetation (cattails) or in thickets of willows or other shrubs (Csuti et al. 2001). In migration and winter they are found in open cultivated lands and pastures (NatureServe 2012). There are no marshes with emergent vegetation in the project area. There are no proposed treatment activities in marshes with cattails and tules. Implementation of Alternatives 2 or 3 would have ***No impact*** to the tri-colored blackbird.

Yellow rail

The nesting habitat of the yellow rail in southcentral Oregon was described as marshes or wet meadows with an abundance of thin-leaved sedges, a layer of senescent (old) vegetation to conceal their nests, and water depths of 0.5 to 5 cm (Popper and Stern 2000). There are no proposed activities in wet meadows or riparian areas. Implementation of Alternatives 2 or 3 would have ***No impact*** to the yellow rail.

Tulewhite-fronted goose

Tule greater white-fronted geese use Oregon as a stop-over location during migration. They prefer marshes and feed more in lower elevation wetland habitat and less in agriculture fields (NatureServe 2012). There are no proposed treatment activities in marshes or tules. Implementation of Alternatives 2 or 3 would have ***No impact*** to the tule greater white-fronted goose.

Fringed myotis, Townsend's big-eared bat, and Pallid bat (Sensitive)

Measure: Roosting and foraging habitat impacted

Existing Condition

The Northwest Forest Plan calls for retaining snags, decadent trees, and green tree recruitment for roosting bats in Matrix and Adaptive Management Areas (Page B-7, Stand Management):

"Adequate numbers of large snags and green trees are especially critical for bats because these trees are used for maternity roosts, temporary night roosts, day roosts, and hibernacula. These should be well distributed throughout the matrix because bats compete with primary excavators and other species that use cavities. Day and night roosts are often located at different sites, and migrating bats may roost under bark in small groups. Thermal stability within a roost site is important for bats, and large snags and green trees provide that stability. Individual bat colonies may use several roosts during a season as temperature and weather conditions change. Large, down logs with loose bark may also be used by some bats for roosting."

Snag densities are poorly known for most species of bats but some research indicates that snag density requirements may be higher than those needed for woodpeckers (Lacki et al. 2008). Bats frequently switch roosts to escape predation and avoid parasites (Lewis 1995, Barclay and Kurta 2007).

Three sensitive bat species have potential habitat in the project area.

Townsend's big-eared bat

The Townsend's big-eared bat is a Regional Forester Sensitive Species and a Forest Plan Management Indicator Species. The following information is summarized from the 2012 forestwide habitat assessment for the Townsend's big-eared bat (USDA Forest Service 2012a). This species is dependent on cave or cave-like structures (buildings) year-round in mixed conifer forests, deserts, and agricultural areas. Foraging associations include edge habitats along streams and in forested habitats, particularly in sagebrush steppe and open ponderosa pine stands. There are no known caves in the project area. They are known to occur in a cave during fall and winter several miles north of the project area. They are assumed to seasonally migrate from the cave north of the project area to caves or cave-like structures in lower elevations during spring and summer. They were documented roosting in forested lava flows on the Deschutes National Forest during spring migration (Dobkins 1995). Lepidoptera, their primary insect prey, appears to be vulnerable to high-severity fire effects; however, low severity fires may enhance their habitat. This species is declining across the western U.S. It is considered stable or slightly decreasing on the Deschutes National Forest (USDA Forest Service 2012a).

The project are does not contain caves or cave like structures/rock outcrops that provide roosting habitat that would promote dispersal.

Fringed Myotis

The following information is summarized from the Western Bat Working Group Species Account for the Fringed myotis (Western Bat Working Group 2005a).

The fringed myotis is a small bat distributed patchily throughout the west. It occurs at 3,900 to 6,900 feet and is most common in drier woodlands (oak, pinyon-juniper, ponderosa pine) but can also be found in desert scrub, mesic coniferous forest, grassland, and sage-grass steppe. It roosts in large decadent trees and snags, crevices in buildings, underground mines and caves, rocks, cliff faces, and bridges. It is likely that structural characteristics (e.g. height, decay stage) rather than tree species play a greater role in selection of a snag or tree as a roost. The two most commonly reported orders in its diet are beetles and moths. This species is adapted for foraging within the forest interior and along forest edges.

Threats include loss or modification of roosting snag habitat, closure or renewed activity at abandoned mines, recreational caving and mine exploration, replacement of buildings and bridges with non- bat friendly structures, loss of clean, open water, and loss of prey species due to pesticides/chemicals.

No winter records in caves on the Deschutes National Forest have been documented. One record during summer surveys with the use of mist-nets was documented at the south end of the Bend-Ft. Rock Ranger

District in 1992. Summer surveys have not occurred on the Sisters Ranger District. This species potentially occurs in snags in the project area.

Pallid Bat

Pallid bats day and night roosts include crevices in rocky outcrops and cliffs, caves, mines, trees (*e.g.*, basal hollows of coast redwoods and giant sequoias, bole cavities of oaks, exfoliating ponderosa pine and valley oak bark, deciduous trees in riparian areas, and fruit trees in orchards), and various human structures such as bridges, barns, porches, bat boxes, and human-occupied, as well as, vacant buildings (Western Bat Working Group 2005b). Roosts generally have unobstructed entrances/exits, and are high above the ground, warm, and inaccessible to terrestrial predators (Western Bat Working Group 2005b). Although year-to-year and night-to-night roost reuse is common, they may switch day roosts on a daily (1 to 13 days) and seasonal basis (Western Bat Working Group 2005b).

Recent research in northern California in the Plumas National Forest showed that pallid bats used cavities in large diameter trees and snags (>21 inches dbh) in mixed coniferous forests at elevations greater than 3,800 feet (Baker et al. 2008). The diet of pallid bats is varied including such insect taxa as beetles, centipedes, crickets, moths, scorpions, and termites. The pallid bat has only been documented once on the Deschutes National Forest on the Sisters Ranger District. The documentation was within low elevation late and old Structure ponderosa pine habitat. The majority of documented species have occurred on adjacent Bureau of Land Management lands in the southeastern corner of the Bend-Ft. Rock Ranger District.

Snag Habitat and Snags Associated with Post Fire Habitats

Bats use of trees and snags includes cavities in hollow trees, cracks or crevices in trees or snags, or behind exfoliating (sloughing) bark. They may be less likely to use heavily charred/sooty fire-killed trees if a sufficient number of roost trees are available in the surrounding area. The 2012 Pole Creek fire that is within and adjacent to the Melvin Butte project likely removed some roost habitat while creating additional roost habitat.

A small portion of the project area (approximately 240 acres) is associated with the Pole Creek Fire along the west side of the 16 road. Burn severity is variable along ranging from light underburn to stand replacing fire. Little is known about the roosting ecology of bats and their prey in burned forests. Limited research has focused on short-term bat foraging activity in burned areas with varying types of severity (Hayes 2009, Buchalski et al. 2013). In general, low intensity wildfires and prescribed fire create relatively few snags (Horton and Mannan 1988) and many are small diameter, which are of less use for most roosting bat species which usually prefer large-diameter (>21 inches dbh) roost trees (Barclay and Kurta 2006). For species that avoid foraging in dense forests, bat activity may increase in post-fire areas due to an increased insect productivity and more open foraging conditions at least for the first year after the fire (Buchalski et al. 2013). During this one year post-fire study, Buchalski et al. (2013) show that bat activity was either neutral or positive regardless of the intensity of the fire.

Lacki et al. (2012) monitored 301 roost snags of long-legged myotis in Oregon, Washington, and Idaho. This is one of the most common bat species occurring on the Deschutes National Forest. Overall, persistence rates declined with increasing roost-years across study areas. Roost snags in Washington showed a lower persistence rate 1 year post-discovery than did roost snags in Oregon and Idaho. Estimates of the percentage of snags still standing 10 years post-discovery were highest for ponderosa pine (6.8%), slightly less for Douglas-fir (5.3%), and lowest for grand fir (0.9%). They found half-lives of roost snags to be <3 roost-years, much shorter than other published values for half-lives of snags of multiple species of conifers (Russell et al. 2006, Angers et al. 2010), and the overall average of roost snag persistence 10 years post-discovery across snag species was 4.3%. Replenishment of snags suitable for

long-legged myotis on an annual basis is likely needed to ensure adequate habitat of this bat species, especially given the frequency of roost switching within years shown by many bats (Lewis 1995, Barclay and Kurta 2007) and the short-term reuse of tree roosts among years.

Thinning from below and the retention of large trees and snags will reduce dense forest patches but improve foraging conditions for bats at least in the short-term, particularly where viable roosting habitats occur within close proximity to water.

As a result of the habitat summary the project area provides suitable naturally occurring and post fire snag habitat within the project areas for Pallid Bat and Fringed Myotis.

Alternative 1 – Ecological Trend

Development of future old growth within second growth ponderosa pine and mixed conifer stands would be prolonged and the existing old trees within stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat in the short-term. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees. As a result, snags would be recruited for roosting, but overstory canopy would diminish changing stand structure that bats depend on for foraging. Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time, potentially impacting bat habitat.

Stand resilience to insects, disease is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. In addition, the UMZ correlation to high tree densities can also provide an indicator to areas that are susceptible to stand replacing wildfire. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition/No Action Alternative 92% of these stands are above the Upper Management Zone and are at risk or could currently be impacted by insects and disease due to high stand densities. Under the No Action Alternative, no treatments will be prescribed within Melvin Butte project area (5,375 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be lack of canopy closure and the loss of the existing historic large-tree component which is likely to occur at a much higher rate than if stand densities were reduced to more healthy levels. Suitable forested habitat for these species consist of late and old structure forests with low densities of large snag. This forest type provides ample shade from canopy closure under which bats can forage on insects, additionally also providing large snags with sloughing bark that provide high quality day roosting habitat. In the short-term higher densities of snags will exist with little canopy closure rather than slowly recruiting larger snags overtime that provide better roosting habitat for both the Pallid and Fringed Myotis bat species. In the long-term the area will lack large tree structure and suitable day roost sites for these species.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer Thinning with Group Openings (MCGO), Mixed Conifer Thinning without Group Openings (MC-without openings), Non-commercial Thinning (P), Prescribed Burning (B) and Scenic Views Enhancement.

Commercial thinning (HTH) and Mixed Conifer Thinning with and without group openings (MCGO and MC - without openings) will consist of primarily thinning from below removing trees >8”dbh. Treatments will focus on maintaining the overstory trees in pure ponderosa pine and mixed conifer stands providing overstory large tree structure. Treatments will retain and promote the development of overstory ponderosa pine reducing site competition. Within mixed conifer treatments these stands are dominated by small trees and will focus on reducing stand densities primarily removing second growth lodgepole pine and white-fir, favoring healthy white-fir and ponderosa pine. This treatment will result in the accelerated growth of residual trees while reducing the fire hazard. Long-term beneficial impacts of small tree thinning will be the reduction of habitat fragmentation by promoting the development of LOS habitat which include large snags at an accelerated rate. Short-term beneficial impacts will be seen in the reduction of risk to existing suitable habitat. This treatment will beneficial to the Pallid and Fringed Myotis bats by creating large snags over the long-term to be utilized as day roost habitat. Lastly, prescribed burning will be a follow up treatment for these treatments. Some large tree mortality is likely to occur from prescribed burning, creating some roosting habitat in the short-term. However, it is likely that there will be an incidental loss of large snags as result of prescribed burning reducing some existing roosting habitat on a site specific basis.

Non-commercial thinning (P) will occur within ponderosa pine plantations that are approximately 20 to 40 years old. Treatments will consist of removing material primarily <8”dbh and occasionally up to 12” dbh material in advanced regeneration plantations. These plantations does not currently provide high quality habitat for the Pallid and Fringed Myotis bats. In the long-term, thinning will reduce stand densities promoting the development of LOS ponderosa pine, recruiting large snag and creating more highly suitable day roost and foraging habitat in these areas.

Scenic Views Enhancement was developed to meet the scenic views Forest Plan standards and guides for the 16 road corridor. Treatments will remove small dense patches of fire killed trees to enhance the visual quality of the foreground. Small diameter fire killed trees are the focus, retaining all live trees and large snags to benefit scenic quality and maintain existing habitat. Treatments will not reduce roosting or foraging.

The objective of prescribed fire is to reduce fuel loading by using prescribed fire to create a continuous mosaic of burned and unburned habitat. Treatments may unintentionally burn existing snags, however new snags could also be recruited through this process. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008).

Table 88 summarizes the amount of habitat associated with treatments under each action alternative for the Melvin Butte project.

Table 88 Total acres of habitat associated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	253	253
HTH	310	336

MC – No Group Opening	-	36
LPI	27	27
MCGO	36	-
P	493	493
Scenic Views Enhancement	41	41
Total Acres.	**1,160**	**1,186**

Overall, approximately 1,160 acres of habitat are associated with treatments identified under Alternative 2, and approximately 1,186 acres under Alternative 3. Alternative 2 is the most proactive, on the landscape this alternative does the best job at breaking up fuel continuity while maintaining large tree habitat.

Overall, implementation of the action alternatives will maintain existing habitat conditions for the Palid and Fringed Myotis bats by maintaining and enhancing the development of large trees structure across the project area. Treatments reduce the risk of losing existing roosting and foraging habitat to stand replacing fire. Under Alternative 2, through thinning, small opening will be created by removing white-fir that are succumbing to insects and disease. Trees removed on average are approximately 14 inches dbh and will not likely provide roosting habitat. However, this treatment will create small openings among fully stocked forest canopies and could enhance foraging opportunities. Treatments will not preclude use of the project area by these species and will increase as contiguous stand of LOS habitat develops across the project area. These changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which have resulted in a decline in large tree open structure stands on the landscape.

The project area and habitat varies greatly from north to south due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this north to south pattern. To capture the importance of habitat variation across the project area, the project area was broken up into 3 areas containing high, medium and low site potential based on inherent soil quality. The retention strategy identified a range of retentions levels across the project area. Within stands containing low site productivity, untreated stands will be retained at a 10% level, in the areas with moderate site productivity dispersal untreated stands will be retained at a15% level, and in areas that have the highest site productivity dispersal untreated stands will be retained at the 20% level. Retention will occur on a stand by stand basis to retain areas that contain the highest densities of contiguous habitat with a stand average of a minimum of 11 inches dbh and exceeding 40% canopy closure. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

Overall the project does not propose to remove any large snag habitat under both alternatives. However, through prescribed burning as a primary treatment to open old growth ponderosa pine stands and as a secondary treatment to thinning from below in multi-storied stands (B, HTH, MC, and MCGO), there is the potential of loss of large snags that provide roosting habitat on approximatley 599 acres under Alternative 2 and approximately 589 acres under Alternative 3.

There are no impacts to Townsend's big-eared bats due to lack of habitat within the Melvin Butte project area.

See snag analysis for complete summary of impacts to snag habitat.

Alternative 2 and Alternative 3 - Cumulative Effects

Activities identified in Table 68 (cumulative effect table for wildlife) were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to the Pallid and Fringed Myotis bat roosting and foraging habitat. The Deep Canyon Watershed is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within or partially within the Deep Canyon watershed –Rooster Rock, Pole Creek, and Two Bulls Fire. Approximately 54 acres of the Pole Creek Salvage are ongoing and approximately 250 acre is being salvage in association with the Two Bulls Fire. Danger tree removal occurred on all the fires mentioned above to varying degrees resulting in a reduction of potential nest sites in stand replacement areas along main roads.

Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood projects have occurred or may occur in suitable habitat. These projects focus primarily on removing dead lodgepole pine among green stands to reduce fuel loading, some of the activity are also associated with mixed conifer habitat. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. There are approximately 21,507 acres associated with these projects, within the Deep Canyon watershed.

Overall, implementation of the action alternatives as well as other projects within the watershed should result in improved habitat conditions for those species dependent on open canopy forest habitats which could lead, over time, to increased populations. Cumulatively there will be a decrease in dense understory habitat; these changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions.

Although treatments will thin stands that are currently suitable roosting and foraging habitat, the Melvin Butte project will have minimal impacts roosting and foraging within the Watershed or on the Deschutes National Forest for the Pallid and Fringed Myotis bats.

These (type) projects are not expected to result in cumulative effects in combination with the Melvin Butte project, because they will have no affect on Townsend's big-eared bathabitat. No short- or long-term Townsend's big-eared bat population decrease would occur; therefore, additive cumulative effects are not anticipated.

Conclusion

Cumulatively, with the ongoing forest management projects within the Deep Canyon watershed, the Melvin Butte project does not propose to remove large snags within the mixed conifer and ponderosa pine habitat types except any posing hazard to operations under OSHA guidelines and those incidentally lost from prescribe fire operations. Implementation of the project will not have measurable impacts to Pallid or Fringed Myotis bat habitat.

There will be no reduction in overall Townsends big-eared bat habitat across the Deschutes National Forest. Therefore implementation of this project will not contribute to a negative trend in viability for this species on the Deschutes National Forest.

North American Wolverine (Sensitive, MIS)

Measure: Effects to denning habitat and dispersal habitat

Existing Condition

The wolverine is a federal Candidate species, a Regional Forester Sensitive Species and a Deschutes LRMP Management Indicator Species. On February 4, 2013, the FWS proposed it for listing as a threatened species under the ESA primarily due to shrinking mountain spring snowpack as a result of climate change (USDI Fish and Wildlife Service 2013). On August 13, 2014 the Fish and Wildlife Service withdrew the proposed rule to list the distinct population segment of the North American wolverine occurring in the U.S. as a Threatened species.

Wolverines are primarily scavengers but also depend on a variety of prey items. In winter, they tend to den in the ground under snow or in rocky ledges or talus slopes (Ingram 1973). However, Copeland (1996) found they tended to prefer montane coniferous forest habitats during the winter. Wolverines make little use of young, thick timber and clear-cuts (Hornocker and Hash 1981).

Hornocker and Hash (1981) concluded that wolverine populations should be treated as regional rather than local whereas Edelman and Copeland (1999) suggested that wolverine populations move along corridors of mountainous habitats and that features such as the Columbia River Gorge and shrub-steppe habitats serve as barriers to dispersal. They also concluded that sightings occurring across the arid mountains of Central Oregon may suggest a movement corridor from the Cascade Mountains to the Wallowa Mountains.

Several historic sightings have been documented on the Sisters Ranger District near Suttle Lake and within the Mt. Jefferson and Mt. Washington wilderness areas. Two aerial flights were conducted in the Three Sisters, Mt. Washington, and Mt. Jefferson wilderness areas and adjacent roadless areas on the Sisters Ranger District 1998 and 1999. There were no detections during the two flights. Baited camera systems placed near the wilderness boundary from 1997 through 1999 did not detect wolverine presence.

During the winter of 2012/2013 and 2013/2014 a research monitoring project using motion-detection cameras at bait stations and a hair snag system to collect samples for genetic analysis occurred on the Deschutes and Willamette National Forests. Target forest carnivores included the wolverine, the American marten, and a montane subspecies of red fox (Vulpes vulpes sp.). No wolverines were detected during this six month study.

A habitat assessment for the wolverine on the Deschutes National Forest was completed in 2012. Denning habitat was modeled from the Forest GIS Plant Association Group (PAG) layer including the alpine dry, alpine meadow, glacier and rock, north aspect of 0-22.5 degrees and 337.5-360 degrees. The results from this were clipped using only the acres above 5500 feet in elevation. Of the 1,656 acres of wolverine denning habitat modeled for the Deschutes National Forest, 64 acres are in the Deep Canyon watershed. All of these acres are within designated wilderness areas, primarily in the Three Sisters wilderness area, with small areas in the Mount Jefferson wilderness area. No denning habitat occurs in the Melvin Butte project area.

Wolverines appear to be extremely wide-ranging and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. Wolverines were documented using burned areas in Idaho (Copeland 1996) from immediately after the fire to up to several years after the event, presumably following ungulate herds. On the Deschutes National Forest, wolverine may travel through and or forage infrequently at lower elevations on the district but utilize higher elevations for most of their needs. Potential dispersal habitat occurs within the project area.

Alternative 1—Ecological Trends

Under Alternative 1 (No Action), current management plans would continue to guide management of the project area. No thinning or mistletoe treatment would occur. No mowing or prescribed burning would occur to reintroduce natural fire back into these ecosystems as well as reducing fuel loads in the project area. No road closures or decommissioning would occur to reduce disturbance to wolverine prey species.

Habitat conditions would remain the same for the short-term. Stand densities would continue to increase due to fire suppression. With increased stand densities comes increased risk of loss from disturbance events (insects, disease, or fire). These events would likely impact the densest stands the greatest due to the stand conditions which would result in reduced availability of suitable habitat for prey species that utilize the project area.

Overall, since the project is not associated with wolverine habitat, the continuing ecological trend will not impact the wolverine or its habitat. However, the no action alternative could reduce available habitat for prey species within the project area.

Alternatives 2 and 3 - Direct and Indirect Impacts

The action alternatives would not remove any suitable habitat for the wolverine. Habitat identified within the watershed is not associated with the project area; therefore there will be no direct or indirect impact to the wolverine or its habitat.

Approximately 14 miles of road are proposed to be closed and decommissioned under all action alternative. This will reduce road densities in the project area from 5.98 mile/sq. mile to 4.66 miles/sq. mile. Road closures are not associated with suitable habitat, however by reducing road densities it will reduce the amount of motorized disturbance to the project area. Road closures could potentially enhance the ability for wolverine to disperse through the project area.

There would be ***No effect*** to the wolverine or its habitat under Alternatives 2 or 3.

Alternatives 2 and 3 - Cumulative Effects

The cumulative effects area for the wolverine is the Deep Canyon watershed. Because there are no direct or indirect effects to the wolverine from the Melvin Butte project, there would be no cumulative effects.

Conclusion

The Melvin Butte project would have no direct and indirect effects to the wolverine or its habitat. There are no ongoing and reasonably foreseeable cumulative effects to the wolverine. Alternatives 2 and 3 would not lead to a trend towards Federal listing for the wolverine. Alternatives 2 and 3 are consistent with the standards and guidelines in the Deschutes National Forest LRMP as amended by the NWFP.

Lewis's woodpecker (Sensitive MIS)

Existing Condition

Formerly widespread, this species is common year-round only in the white oak ponderosa pine belt east of Mt. Hood. Habitat for the Lewis' woodpecker, a migrant in this part of its range, includes old-forest, single-storied ponderosa pine. Burned ponderosa pine forests created by stand-replacing fires provide highly productive habitats as compared to unburned pine (Wisdom et al. 2000). Lewis' woodpeckers feed on flying insects and are not strong cavity excavators. They require large snags in an advanced state of decay that are easy to excavate, or they use old cavities created by other woodpeckers. Nest trees generally average 17 to 44 inches (Saab and Dudley 1998, Wisdom et al. 2000). Known breeding has

been documented in low numbers along Whychus Creek (Marshall et al. 2003) and in recent burned areas across the Deschutes.

In evaluating landscape predictor variables for the Lewis's woodpecker, Saab et al. (2002) found a negative relation to burned ponderosa pine/Douglas-fir stands with high crown closure (>70%) but was positively associated with low snag densities overall. However, although it selects for more open stands, this species selected nest sites with higher densities of large snags (>20"dbh) (Saab and Dudley 1998). Lewis' woodpeckers are different than other woodpeckers. They are aerial insectivores during the breeding season and use lower densities of smaller snags but rely more heavily on large snags (Saab and Dudley 1998). Habitat for Lewis' woodpecker will increase 5-10 years after in fire areas as smaller snags fall.

The Lewis' woodpecker is declining throughout its range. Threats to this species include the loss of suitable habitat, competition for nest trees, and effects of pesticides on insects.

Abele et al. (2004) completed a Technical Conservation Assessment for the Rocky Mountain Region of the Forest Service. During the Assessment perceived threats to the conservation of the Lewis' woodpecker were identified:

1. The loss of breeding and wintering habitats in burned pine forests, park-like pine forests, riparian cottonwood stands, and woodlands.
2. Natural disturbances and management activities associated with them. For example a wildfire followed by salvage logging.
3. Fire Suppression within pine forests that have increased canopy cover (including increase of white fir) and reduced shrub and grass understories, which reduces insect populations that Lewis' woodpecker forage on and reduced aerial foraging areas.
4. Water regulation, which has altered riparian woodlands in the last two centuries.
5. Cattle grazing by altering the historic fire regimes with a reduction of understory vegetation. In addition, altering understory can influence the composition and abundance of prey.
6. Firewood cutting by reducing potential nest sites.
7. Competition with European starling and other cavity nesting species for nest sites.

Through the Forest wide assessment completed for MIS, Lewis' woodpecker reproductive habitat was mapped across the entire Deschutes National Forest. Habitat assessed for the Lewis woodpecker is associated with both green stands and post fire habitats. Approximately 122 acres of habitat occurs within Melvin Butte, 1,405 acres in the Deep Canyon Watershed, and approximately 85,015 acres of habitat occurs across the Deschutes National Forest (see Table 89)

Table 89 Lewis woodpecker habitat within the Melvin Butte Project area, Deep Canyon Watershed and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte project area	Acres of Habitat in the Deep Canyon Watersheds	Acres of Habitat Across the Deschutes National Forest
122 acres	1,405 acres	85,015

For the detailed assessment on the Lewis' woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

There are no known Lewis' woodpecker nest sites within Melvin Butte project area.

Measure: Lewis' woodpecker habitat change in quality due to thinning and removal of fire killed trees in Scenic Views corridor.

Alternative 1 –Ecological Trend

Without treatment the development of future old growth within second growth ponderosa pine and mixed conifer stands would be prolonged and the existing old trees within the would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat in the short-term. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees. Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time.

Stand resilience to insects and disease, is measured by the Upper Management Zone (UMZ) . The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. Since UMZ is a measure of stand density, those stands that are above UMZ are very densely stocked and therefore can also indicate stands that are at risk of stand replacing fire. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition/no action 92% of these stands are above the Upper Management Zone and are at risk or currently be impact by insects and disease due to high stand densities and as a result low resiliency. Under the No Action Alternative, no treatments will be prescribed within Melvin Butte project area (5,375 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/nesting habitat which is likely to occur at a much higher rate than if stand densities were reduced to more healthy levels.

Areas that currently provide suitable Lewis habitat will persist in the short-term, since this species prefers open ponderosa pine stands or post fire environments, and will likely remain open for the next 15 years. Without the treatments prescribed to thin from below within multi-storied ponderosa pine and mixed conifer stands, stand densities and the associated intraspecific competition among trees in the stands will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of large nest trees will be prolonged. In high density stands of second growth ponderosa pine containing mistletoe, in the short-term the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands will likely contain bark beetle outbreaks and high densities of small snags that result in lack of recruitment of large tree structure over time, limiting suitable nesting habitat.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH)

Under the proposed treatment types, both action alternatives prescribe thinning from below in Lewis' woodpecker habitat. The habitat exists as second growth ponderosa pine stands in an advanced stage of development where the majority of trees are reaching maturity. In addition, there are residual old growth stands of ponderosa that will be thinned. These areas provide the most suitable habitat and will be greatly enhanced by thinning from below. On average trees identified for thinning will be approximately 12-14 inches dbh, with secondary non-commercial treatments removing trees 8 inches dbh and less. Thinning

from below will retain the largest healthies trees in the stand. These treatments will reduce stand densities, minimizing the risk of mountain pine beetle outbreaks, and stand replacing fire. This treatment aids in the maintenance of large trees by reducing their susceptibility to fire and insects while reducing competition for space and nutrients. Due to density reduction in the understory, stands will be more open accelerating the development of LOS ponderosa pine and the recruitment of large snags over the next 30+ years.

Prescribed Fire (Burn)

Primary and secondary treatments include mowing and burning. Mowing is designed to reduce shrub densities that contribute to ladder fuels and breakdown residual thinning slash. Similarly, burning is also designed to reduce shrub densities and thinning slash that contributes to ladder fuels, burning may risk losing existing large snags that provide nesting habitat. In addition, through burning operations additional snags could potentially be recruited to provide nesting habitat in the short-term. Prescribed burn only treatments will not receive thinning, while thinning from below will receive secondary treatments of mowing and burning. There is no difference in effect to habitat as a result of either treatment both treatments have the potentially to recruit snags from burning operations providing habitat in the short-term for Lewis' woodpecker. However, prescribed burning also has the potential to remove large soft snags that provide suitable Lewis' woodpecker nesting habitat in the short-term.

Table 90 displays acres of Lewis woodpecker habitat for each treatment type by alternative.

See the DecAid snag and down wood analysis for a summary of the dead wood habitat assessment.

Table 90 Total acres of Lewis' woodpecker habitat associated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
HTH	13	13
B	96	96
Total Acres	**109**	**109**

Affects to Lewis' woodpecker habitat are similar under Alternative 2 and 3. The outcome or long-term benefits to habitat as a result of the effects of each treatment type is also similar across all action alternatives.

Alternatives 2 and 3 similarly address the risk of insect disease, and stand replacing fire, both promote burning and mowing to maintain existing open ponderosa pine stands that need minimal thinning. Both alternatives will promote Lewis' woodpecker habitat by using prescribed fire to create individual fire killed trees which these woodpeckers prefer for nesting, while maintaining habitat continuity across the project area, and promoting the development of future fire resistant stands of LOS ponderosa pine containing future nesting habitat. Although treatments will enhance habitat, not every fire killed trees greater than 17 inches dbh will provide suitable nesting habitat. Habitat is highly dependent on the spatial arrangement of suitable snags for nesting and their proximity to open areas that the Lewis' woodpecker needs for foraging. Treatments prescribed under both alternatives will promote spatial heterogeneity in these stands, retaining the largest trees in the stands providing a mosaic of tree densities. Residual trees will contain a variety of size classes providing residual foraging habitat as well as maintaining late and old structure to provide nesting habitat where it exists.

Overall, approximately 109 acres of Lewis' woodpecker reproductive habitat are associated with treatments identified under Alternatives 2 and 3. Treatments will not target the removal of large trees or snags and therefore will not impact habitat in the short-term. Burning associated with treatments could potentially recruitment some large snags providing nesting habitat in the long-term as snags decay.

Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). Similarly outcomes are expected with the Melvin Butte project. The majority of these stands have not been burned for decades and this will be the first entry with prescribed fire. The goal of the project is to promote and enhance LOS ponderosa pine habitat within stands identified as Lewis' woodpecker habitat. However, only approximately 2% of the project area is associated with Lewis woodpecker habitat treatments.

Alternatives 2 and 3 - Cumulative Effects

Activities identified in Table 68 (Cumulative effect table for wildlife) were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to Lewis' woodpecker reproductive habitat. The Deep Canyon Watershed is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Two large wildfires have occurred within the Deep Canyon Watershed –Rooster Rock (2010) and Pole Creek (2012) Approximately 58 acres of salvage occurred where the fires are associated with the Deep Canyon watersheds leaving the majority of these fires as habitat. Danger tree removal occurred on the fires mentioned above to varying degrees resulting in a reduction of potential nest sites in stand replacement areas along main roads.

Activities proposed under the Pole Creek Fire Timber Salvage, Two Bulls Timber Salvage, Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Forest Road 370 Fuels Reduction project have occurred or may occur in suitable habitat.

The Pole Creek Fire Timber Salvage is ongoing and approximately 54 acres of stand replacing fire areas are being salvage logged with the watershed. Treatments were designed to enhance Lewis woodpecker habitat by retaining 6 snags per acre that will provide the most suitable habitat for the woodpecker. Danger trees associated with the Pole Creek Fire that provide snag habitat will also be removed along 42 miles of road. The total area of danger tree removal is approximately 350 acres. Approximately 250 acres are proposed for salvage within stand replacing areas of the Two Bulls Fire.

The Ursus and Bend Municipal Watershed Hazardous Fuels reduction projects focus primarily on removing dead and live lodgepole pine, as well as white-fir among green stands to reduce fuel loading. There are approximately 6300 acres associated with these projects, neither of these projects proposes to reduce elements associated with Lewis woodpecker habitat.

Private lands are not managed for woodpecker habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

Approximately 1,405 acres of Lewis' woodpecker reproductive habitat exist within the Deep Canyon watershed. The Melvin Butte project under Alternatives 2 and 3 proposes to treat approximately 109 acres of suitable reproductive habitat.

Although treatment will not reduce suitable nest trees, treatments are proposed within 7% of the total Lewis' woodpecker habitat within the Deep Canyon watershed, habitat for this species will remain within the 109 acres associated the Melvin Butte project. Habitat quality will be enhanced as well as habitat utility for this species. With the ongoing forest management projects within the Deep Canyon watershed there will be less than a 1% reduction in the overall habitat for the Lewis" woodpecker across the Deschutes National Forest.

Conclusion

Cumulatively, with the ongoing forest management projects within the Deep Canyon Watershed, this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte Project is consistent with the Forest Plan, and thus continued viability of species A is expected on the Deschutes National Forest.

Alternatives 2 and 3 ***May Impact*** the Lewis' woodpecker as a result of nest disturbance and through the incidental loss of nesting snags during implementation.

Landbird Conservation Strategy Consistency

Biological objectives are all based on "where ecologically appropriate" meaning actions must occur within the proper habitat addressed in order to be consistent or not (Table 91).

Table 91 Lewis' woodpecker conservation strategy consistency.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
Lewis' Woodpecker **In Ponderosa Pine Stands:**	Through natural events or management, maintain >1% of landscape as post-fire old ponderosa pine forest habitat	NA	There are no treatments associated with post fire ponderosa pine habitats
	Through natural events or management, maintain >50% of the post-fire landscape as unsalvaged	NA	There are no post-fire salvage treatments associated with the project.
	Where salvage is occurring in post-fire old ponderosa pine forest, (in burns >100 acres) salvage <50% of the standing and down dead	NA	This is not a salvage logging project.
	Where salvage is occurring in post-fire old ponderosa pine forest, (in all burns) retain all trees/snags >20"dbh and >50% of those 12-20" dbh	NA	This is not a salvage logging project.
Lewis' Woodpecker **In Ponderosa Pine Stands**	In all burns, snags should be clumped and hard and soft decay classes left to lengthen period of suitable habitat	NA	Project does not propose to remove snags in Lewis woodpecker habitat.
	In old forest habitat, provide 24 snags/acre >9"dbh and of these 6 snags/acre should be >20"dbh	Not Applicable	No snags will be removed in old forest ponderosa pine habitat.
	In old forest habitat, provide recruitment snags especially in areas of high risk stand replacement fire	Meets	In old forest ponderosa pine habitat, all residual green old growth will be retained
	In old forest habitat, provide shrub understory of >13% cover	Meets	Wildlife retention will occur with this habitat type that will remain untreated.

White-headed Woodpecker (Sensitive, MIS)

Existing Condition

White-headed woodpeckers are uncommon permanent residents in forests east of the Cascades. They use habitat with large open ponderosa pine, low shrub levels and large snags. Dixon (1995) found white-headed woodpecker densities increased with increasing old-growth ponderosa pine trees and showed a positive association with large ponderosa pine. The white-headed woodpecker is a primary cavity excavator of soft snags. This woodpecker is the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003 p. 364).

White-headed woodpeckers may require dynamic landscapes with both burned and unburned habitat for the long-term persistence of populations (Hollenbeck et al. 2010). Wightman et al. (2010) found existing open-canopied ponderosa pine forests before a fire and a mosaic of burn severities within 1 kilometer of nests was found to characterize nest sites on the Fremont-Winema NF. They found the presence of larger, more decayed snags and fewer live trees near a snag (within 1 hectare) after fire were important factors for nest selection, however this didn't influence nest survival. Open-canopied pine forests with mature, cone-producing trees within proximity of burns were also important in identifying white-headed woodpecker habitat as long as most of the landscape was not subjected to stand replacement burns (Wightman et al. 2010). A mosaic of burn severities across the landscape may improve white-headed woodpecker habitat by opening forest canopies in higher severity burned areas while retaining decayed snags created before wildfire and live cone-producing trees in unburned or low severity burned areas (Wightman et al. 2010).

A long term study on the white-headed woodpecker occurred on the Deschutes and Winema National Forests from 1997-2004 with several Deschutes study sites occurring in the Metolius Basin area. Frenzel (2000) calculated the mean diameter for white-headed woodpecker nest trees to be 26.2"dbh while Dixon (1995) found similar results (mean diameter of 25.6"dbh). Frenzel (2003) found nests at sites with a high density of large diameter trees had a higher survival rate than nests in recently harvested sites. Unharvested sites or sites with greater than 12 trees per acre >21"dbh had a success rate of 63.1% while nests at previously harvested sites or lower densities of large trees had a success rate of 39.8%. Therefore, white-headed woodpeckers were positively associated with higher densities of large trees. On the Winema National Forest, white-headed woodpeckers were found to be using small-diameter trees, logs in a slash pile and upturned roots (6-13"dbh) where large snags were uncommon (Frenzel 2002).

White-headed woodpeckers roost in ponderosa pine habitats with an average canopy closure of 57.4 + 1.9% canopy closure (Dixon 1995). In addition, most (65%) roost sites were located on flat ground and found on the lower one-third of the slope or bottom slope (89%) with slopes ranging from 0-40% and an average of 7 + 1% (Dixon 1995). Roost site elevations ranged from 2900-4311 feet with an average elevation of 3382 + 39 feet (Dixon 1995).

Snags and live trees used for roosts were greater than snags and live trees found within plots (Dixon 1995). Roost trees diameters averaged 24 + 1" dbh and ranged from 7 to 45" dbh while heights ranged from 6 to 164 feet and averaged 66 + 3 feet tall (Dixon 1995). Tree diameter at cavity height ranged from 2 to 30" in diameter and averaged 17 + 2" dbh while cavity heights averaged 8.6 + 1 feet tall and ranged from 5.5 to 20 feet (Dixon 1995).

Dixon (1995) found white-headed woodpeckers did not use the same kind of tree for nesting as they did for roosting. Nest trees were typically dead, had broken tops, were shorter in height, contained more cavities, and had a higher percentage of bark present than roost trees. She also found they used different decay stages for nesting than roosting. See Table 92 for a comparison of decay classes used for nesting and roosting found by Dixon (1995).

Table 92 Nest and roost tree decay class comparison for white-headed woodpecker (Dixon 1995)

Decay Class	Nest Tree Percentage	Roost Tree Percentage
Decay Class 1 (Recently Dead)	25%	11%
Decay Classes 2-3 (Moderately Decayed)	51%	34%
Decay Classes 4-5 (Advanced Decay)	25%	55%

Foraging habitat is usually found in association with nesting habitat. Kozma (2011) surmised because white-headed woodpeckers are primarily bark gleaners and feed on ponderosa pine seeds throughout the winter, large diameter and old-growth ponderosa pine may be more important to white-headed woodpeckers because these trees have a greater bark foraging area, higher insect abundance, and greater and more frequent cone production than smaller trees.

Dixon (1995) found 42% of over 2,000 foraging observations were on branches, 23% on the upper trunk, 22% on the mid-trunk, and 13% on the lower trunk with an average foraging height of 62 feet on large diameter live ponderosa pine trees. Dixon (1995) also showed that white-headed woodpeckers gleaned 35%, fed on cones 31%, pecked 24%, and fed on sap 7% with males foraging slightly higher in trees and feeding on cones more than females.

White-headed woodpeckers feed on tree sap (Dixon 1995, Kozma 2010) as well as insects and seeds. White-headed woodpeckers are weak excavators and this may explain the use of smaller trees for sap feeding. It may be easier for them to drill wells in thinner bark of smaller ponderosa pine compared to thicker, furrowed bark of larger pine (Kozma 2011). See Table 93 for a comparison of sap to non-sued tres for White-headed woodpecker.

Table 93 Comparison of Sap and non-used trees for white-headed woodpecker (Kozma 2010)

Trees	Mean Height (feet)	Height Range (feet)	Mean Diameter (dbh inches)	Diameter Range (dbh inches)
Sap Trees	44	44.6 – 72.5	8.8	2.4 – 14.6
Non-used Trees	54	9.1 – 96.4	12.2	2.0 – 23.3

Threats to this species include increased stand densities in ponderosa pine due to fire suppression, loss of large, old ponderosa pine trees and snags, wildfire, and increased shrub densities. Increased shrub densities may be factors leading to increased mammalian nest predation and increased risk of avian predation on adults (Frenzel 2000).

White-headed woodpecker nest monitoring occurred from 2003 to 2011 in similar treatment types associated with the Metolius Basin project (DNF 2011) as are prescribed in the Melvin Butte project. The monitoring found that resident birds were not displaced by short-term impacts associated with the implementation of treatments resulting in nests that were successful. In addition, due to stand density reductions, nests were more successful due to the increase in suitable habitat.

The NatureServe status for the white-headed woodpecker is apparently secure at the global and national levels (G4 and N4) and imperiled at the state level (S2).

Through the Forest wide assessment completed for MIS, white-headed woodpecker reproductive habitat was mapped across the entire Deschutes National Forest. Habitat assessed for the white-headed woodpecker is associated with both green stands and post fire habitats. Habitat for the white-headed woodpecker occurs sparingly throughout the Deschutes National Forest in the following plant associations –ponderosa pine, Douglas-fir, white fir, and Shasta red fir in open stands where average tree

size is 20”dbh or greater. Approximately 316 acres of habitat currently exists within the Melvin Butte project area. Approximately 1,272 acres of habitat occurs within the Deep Canyon watershed and approximately 198,330 acres of habitat across the Deschutes National Forest. (Table 94).

Table 94 White-headed woodpecker reproductive habitat within the Melvin Butte Project area, Deep Canyon Watershed, and across the Deschutes National Forest

Acres of White-headed Woodpecker Habitat in the Melvin Butte project area	Acres of White-headed Woodpecker Habitat in the Deep Canyon Watershed	Acres of White-headed Woodpecker Habitat Across the Deschutes National Forest
316 acres	1,272 acres	198,330 acres

For the detailed assessment on the white-headed woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

There have been four documented observations of white-headed woodpeckers from 1999 to 2002 in the project area. During the 2010 field season, two nest sites were located in the Melvin Butte project areas as a result of nest survey conducted during the 2010 Hollenbeck et al. white-headed woodpecker research project that occurred on the Sisters Ranger District.

Measure: White-headed woodpecker habitat change in quality due to thinning and prescribed burning operations.

Alternative 1 – Ecological Trend

Stand resilience to insects and disease is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. UMZ can also be used to estimate which stands are more susceptible to stand replacing fire by identifying those stands that are above the Upper Management Zone. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition/no action, 92% of these stands are above the Upper Management Zone and are at risk or could currently be impact by insects and disease due to high stand densities. Under the No Action Alternative, no treatments will be prescribed within Melvin Butte project area (5,375 acres). However, the “ecological trend” in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time, potentially impacting high density stands. In the short-term, an event like this could provide some nesting and foraging habitat but the majority of the areas would not. Since these stands are predominantly 60-80 year old second growth ponderosa pine, snags recruited from the fire would be small with an average diameter of 14 inches. Since the majority of burned trees would be small diameter, most of the fire killed trees would fall in the first 10 years and many areas would be void of nesting habitat in the long-term. If nesting habitat existed it would be limited on the landscape.

Currently, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/nesting habitat which is likely to occur at a much higher rate than if stand densities were reduced to more healthy level.

Areas that currently provide suitable white-headed woodpecker habitat will persist in the short-term, since this species prefers open ponderosa pine stands. Without treatments prescribed to thin from below within

multi-storied ponderosa pine and mixed conifer stands, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of larger nesting trees will be prolonged. In high density stands of second growth ponderosa pine containing mistletoe, in the short-term the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands will likely contain bark beetle outbreaks and high densities of small snags. Therefore there will be a lack of recruitment of large tree structure over time, limiting suitable nesting habitat for the white-headed woodpecker.

Alternative 2 and 3 - Direct and Indirect Effects

Suitable habitat occurs in residual stands of late and old structure ponderosa pine which occur at mid elevation in the northern portion of project area. Most of the ponderosa pine stands within the project area typically unsuitable because they are densely stocked second growth "black bark" that lack soft snags which provide nesting habitat.

Thinning From Below (HTH)

Thinning in suitable reproductive habitat would occur in both second growth ponderosa pine and multi-storied ponderosa pine and mixed conifer stands. Thinning (from 8" dbh and up) from below will favor the largest ponderosa pine in pure pine stands. In mixed conifer stands, thinning will favor ponderosa pine and healthy white-fir. A basal area of 40 – 120 square feet will remain on average in each stand. Treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by reducing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of residual trees while reducing risk of stand replacing fire (removal of ladder fuels). Due to density reduction in the understory, stands will be more open accelerating the development of LOS ponderosa pine and recruiting large snags that the white-headed woodpecker specifically select for nest sites.

Within mixed conifer stands, thinning will favor ponderosa pine focusing removal on smaller diameter white-fir and lodgepole pine. Favoring ponderosa pine will promote more fire resilient stands in the future, as well as reduce the risk of insects and disease that are common to white-fir and lodgepole pine by reducing the abundance of these species in the stands. Although the treatments promote ponderosa pine, residual green white-fir and lodgepole pine will exist in these stands, however they are both short-lived species compared to ponderosa pine and typically recruited as snags at a higher rate due to their susceptibility to insects and disease. It will likely be the lodgepole pine and white-fir that more readily provide nesting habitat over the long-term as large ponderosa pine develop and are recruited as nesting habitat.

Overall residual trees will retain a variety of seral classes providing foraging habitat as well as maintaining late and old structure to provide nesting habitat. Treatments prescribed will promote heterogeneity in these stands, retaining the largest trees and providing mosaic of tree densities. Treatments will be beneficial to the white-headed woodpecker, by opening stands up around available nest sites, it will allow for greater predator avoidance and promote higher nest success.

Prescribed Fire (Burn)

Secondary fuels treatments include mowing and burning to reduce shrub densities and residual thinning slash in the understory. Mowing will potentially reduce rodent populations, promoting the likelihood of nest success. Similarly, burning will also reduce rodent habitat, but will also recruit snags in the short-term providing potential nesting habitat. However, since white-headed woodpecker are weak excavators and dependent on soft snags for nesting, the utility of newly created snags will be limited until they decay to a point that is conducive to excavation. Within black bark ponderosa pine stand that are 60 to 80 year second growth, snags recruited from prescribed burning will range between 14-20 inches dbh. Although

these newly created snags are on the small end for nesting, snag densities are low in these stands and very few snags exist over 21inches. Currently, due to the lack of nest site availability, these newly created small diameter snags may provide the only available nesting habitat in the short-term.

Non-commercial Thinning

In addition, some ponderosa pine plantations that contain individual large diameter ponderosa pine provide some foraging habitat for the white-head woodpecker will be thinned. These plantations will be thinned to accelerate development by reducing competition. White-headed woodpeckers primarily forage by gleaning insects from under the bark of large ponderosa pine but will also excavate sap wells in second growth or young ponderosa pine (Dixon 1995, Kozma 2010). These treatments will reduce some foraging habitat, but a fully stocked stand will remain after treatment. Treatments are intended to reduce stocking density, to promote the development of overstory stands, and reduce the likelihood of losing these trees to bark beetle infestation. Treatment will retain residual foraging opportunities.

Scenic Views Enhancement

Habitat associated with this treatment type occurs in the mixed conifer plant association group. This treatment occurs in stands along the 16 road corridor that were burned in the Pole Creek fire. The majority of this treatment type occurs in the lodgepole pine plant association group. Treatment will be focused on the removal of dense stands of dead lodgepole pine to reduce dead wood densities that will create a fuel hazard in the future. Ponderosa pine is limited in this area and exists primarily as individuals. This area provides both nesting and foraging options due to post fire habitat. Where large dead ponderosa pine exists they will be retained for wildlife habitat. No green trees of any species will be removed within this treatment area. Treatments will remove small dead trees from the vicinity of large dead ponderosa pine. The treatment will primarily focus on the removal of trees that are small in size and do not provide nesting utility of the white-headed woodpecker and therefore will not remove habitat.

See DecAid snag and down wood analysis for a summary of the dead wood habitat assessment.

Table 95 provides a summary of the total treatment acres associated with to suitable white-headed woodpecker habitat by alternative.

Table 95 Total acres of reproductive habitat associated with each treatment type by alternative with each treatment type by alternative for the Melvin Butte Project area.

Treatment Type	Alternative 2	Alternative 3
B	83	83
HTH	29	34
P	151	151
Scenic Views Enhancement	39	39
Total Acres.	**302**	**302**

Affects to white-headed woodpecker habitat are similar under Alternative 2 and 3. The outcome or long-term benefits to habit as a result of the effects of each treatment type is also similar across both action alternatives.

Alternatives 2 and 3 similarly address the risk of insects, disease, and stand replacing fire, as well as promote stand level heterogeneity. Both alternatives promote habitat diversity due to the variety of stand densities stands will be thinned at with the objective of promoting habitat for a variety of species associated with ponderosa pine and mixed conifer dry PAG's. Both alternatives will create a landscape mosaic of thinned and un-thinned habitat, maintaining habitat continuity across the project area, while

promoting the development of future fire resistant stands of LOS ponderosa pine. Residual trees will retain a variety of seral classes providing residual foraging habitat as well as maintaining late and old structure to provide nesting habitat where it exists.

To assist with promoting diversity and variability on the landscape within the ponderosa pine and mixed conifer dry PAG's, approximately 33 % of the project area will be left untreated. Residual untreated areas will be left as entire stands with an occasional small aggregate patch.

Overall, approximately 302 acres of white-headed woodpecker reproductive habitat are associated with treatments identified under Alternatives 2 and 3.

Alternatives 2 and 3 - Cumulative Effects

Activities identified in Table 68 (wildlife cumulative effects table) were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to white-headed woodpecker habitat which is associated with ponderosa pine and mixed conifer stands containing late and old structure ponderosa pine. These activities were reviewed across the Deep Canyon watershed to determine cumulative impact to the white-headed woodpecker.

Two large wildfires have recently occurred within the Deep Canyon Watersheds –Pole Creek and Rooster Rock totaling approximately 5,411 acres. Approximately 54 acres of salvage is occurring within the Pole Creek fire therefore leaving the majority of the majority of the fire associated with the watershed as habitat (<1% of the fires associated with the watershed). Danger tree removal occurred on the fires mentioned above to varying degrees resulting in a reduction of potential nest trees in stand replacement areas along main roads.

Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project and Forest Road 370 Fuels Reduction project, are primarily associated with montane mixed conifer habitat and lodgepole pine these project totaling approximately 7,355 acres. These projects are not likely associated with white-headed woodpecker habitat and therefore will not likely contribute to cumulative effects.

The Three Creeks personal use firewood cutting area also occurs in the watersheds. This area occurs in both Eastside Mixed Conifer (EMC) and lodgepole pine habitat types. Firewood cutting is not wide spread and primarily occurs where dead trees can be accessed from open roads. Although snags are cut and removed, removal occurs on an individual tree basis versus across the entire designated area. The area is approximately 3,029 acres. The majority of firewood removed is associated with beetle killed lodgepole pine; impacts to white-headed woodpecker would be incidental from firewood gathering.

Private lands are not managed for woodpecker habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

The thinning and burning identified with Alternative 2 and 3 are associated with approximately 24% of the total habitat within the Deep Canyon watershed. Habitat quality for white-headed woodpecker will remain throughout the Melvin Butte project area.

White-headed woodpecker habitat is predicted to increase on the Sisters Ranger District as many treatments are focused on ponderosa pine restoration, developing open grown forests with frequent underburned fires creating sustainable white-headed woodpecker habitat.

Conclusion

Cumulatively, the ongoing forest management projects within the Deep Canyon Watershed is associated with less than 1% of the overall white-headed woodpecker reproductive habitat that occurs across the

Deschutes National Forest. The Melvin Butte project will improve conditions for white-headed woodpecker in the project area. Therefore, the Melvin Butte project will not contribute to a negative trend in viability on the Deschutes National Forest for the white-headed woodpecker.

Alternatives 2 and 3 ***May Impact*** the white-headed woodpecker as a result of nest disturbance and through the incidental loss of nesting snags during implementation.

Landbird Conservation Strategy Consistency

Biological objectives are based on "where ecologically appropriate" meaning actions must occur within the proper habitat addressed in order to be consistent or not (Table 96)

Table 96 White-headed woodpecker conservation strategy consistency.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
White-headed Woodpecker **In Ponderosa Pine Stands:**	Provide a mean of 10 trees/acre >21"dbh and at least 2 trees >31"dbh	Meets	Within suitable white-headed woodpecker habitat, residual stand densities will exceed biological objectives
	Provide a mean of 1.4 snags/acre >8"dbh with 50% >25"dbh in a moderate to advanced state of decay	Meets	The project does not propose to remove snag in ponderosa pine stands.
	Provide a mean canopy closure of 10-40%	Meets	Mean residual canopy closure within suitable white-headed woodpecker habitat will be 30%.
	In predominantly old-growth, provide >350 acres of contiguous habitat	Not Applicable	All old growth habitat will be retained.
	In 26-75% old-growth, provide >700 acres of contiguous habitat	Not Applicable	All old growth habitat will be retained.

Johnson's hairstreak (Sensitive)

Existing Condition

This small, three-quarter inch uncommon butterfly ranges from southern British Columbia, south through eastern and western Washington, and western Oregon, to central and south California. Isolated populations exist in northeastern Oregon to central Idaho. In Oregon, it has been found sparsely in the Cascades, Coast Range, Siskiyou Mountains, Blue Mountains and Wallowa Mountains (Pyle 2002). Elevations range from sea level to 6,000 feet. Most of the 52 records for Oregon are above 2,000 feet (Hinchliff 1996). This butterfly species depends on coniferous forests that contain dwarf mistletoes (genus *Arceuthobium*) found in western hemlock, red fir, and Jeffrey pine (NatureServe 2012). Although there are not these tree species with the proposed project area, the area does contain mistletoed white fir and lodgepole pine.

Alternative 1 Ecological Trends

The selection of this alternative would result in no immediate impact to Johnson's hairstreak because no vegetation management actions would occur to reduce mistletoe populations. Potentially suitable habitat would be maintained based on the widespread presence of mistletoe across the project area.

Alternatives 2 and 3 - Direct and Indirect Impacts

The selection of Alternative 2 would result in the specific reduction of mistletoe trees on 160 acres. On average, approximately 97% of the project area is not proposed for any treatment providing mistletoe for

this species. This retention, plus leaving about 906 acres in untreated stands and not removing all mistletoe trees (but only those with the highest damage ratings) would maintain the presence of mistletoe, and Johnson's hairstreak habitat, widely distributed across the entire 5,375 acre project area.

Alternative 3 removes less mistletoe than Alternative 2. Alternative 3 does not propose specific mistletoe treatments, it will thin stands from below containing mistletoe. This will retain more trees with mistletoe and would have a lower potential to remove Johnson's hairstreak habitat.

Alternatives 2 and 3 - Cumulative Impacts

For this species, cumulative effects were bounded by the Deep Canyon watersheds based on the limited scale of the proposed actions in relation to the size of the watersheds and availability of habitat outside of regulated timber harvest and mechanized use (e.g. wilderness and roadless areas). Past actions have been considered in the existing condition of habitat; for cumulative effects ongoing and reasonably foreseeable actions are considered.

The Bend Municipal Watershed Fuelbreak occurs along the 370 road in the Deep Canyon watersheds. The project does not impact Johnson's hairstreak habitat because it focuses on snags within 150 ft on either side of the road and minimally treats the understory of hemlock stands. The proposed actions under Melvin Butte would not have additive effects with the Bend Municipal Watershed Fuel break project.

The Three Creeks personal use firewood cutting area also occurs in the watersheds. This area occurs in both Eastside Mixed Conifer (EMC) and lodgepole pine habitat types. Firewood cutting is not wide spread and primarily occurs where dead trees can be accessed from open roads. The area is approximately 3,029 acres. The majority of firewood removed is associated with beetle killed lodgepole pine; the proposed action under Melvin Butte would not have additive impacts with personal use firewood cutting.

There would be additive effects from this project in association with the Ursus project (5,900 ac of thinning and fuels treatments including mistletoe reduction). However, the Ursus project also treats within white fir and lodgepole stands, not treating stands commonly associated with Johnson's hairstreak habitat. Additive impacts would be minimal based on the minimal treatment of mistletoe trees.

Management Indicator Species

The Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA 1990) identified a group of wildlife species as management indicator species (MIS). These species were selected because they represent other species with similar habitat requirements. Management indicator species can be used to assess the effects of management activities for a wide range of wildlife species with similar habitat needs (FSM 2620.5). Those species selected for the Deschutes National Forest include the bald eagle, northern spotted owl, golden eagle, red-tailed hawk, osprey, northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, woodpeckers (cavity nesters), peregrine falcon, California wolverine, elk, mule deer, American marten, Townsend's big-eared bat, and waterfowl. In addition, habitats and wildlife species identified in the Northwest Forest Plan are addressed.

Some of the MIS species have been discussed in the Threatened, Endangered, or Sensitive (TES) Species report. Effects of the project to TES species can be located in the Melvin Butte Wildlife Biological Evaluation (BE). Species discussed in the BE that are also MIS are the northern bald eagle, northern spotted owl, peregrine falcon, Lewis' woodpecker, white-headed woodpecker and California wolverine. The list of MIS species addressed in this report are located in Table 97 and Appendix D. MIS species that are also Northwest Forest Plan species with specific management recommendations are: black-backed woodpeckers, white-headed woodpeckers, pygmy nuthatches, flammulated owls, and Townsend's big-eared bats.

Table 97 Management indicator species summary.

Species	Habitat	Presence
Birds		
Coopers Hawk (*Accipiter cooperi*)	Mature forests with high canopy closure/tree density	Potential habitat but no known nesting
Sharp-shinned Hawk (*Accipiter striatus*)	High canopy closure and large trees in addition to young, dense, even-aged stands	Potential habitat but no known nesting
Northern Goshawk (*Accipiter gentiles*)	Mature and old-growth forests; especially high canopy closure and large trees	Known presence and known nesting
Great Blue Heron (*Ardea herodias*)	Riparian edge habitats including lakes, streams, marshes and estuaries	No habitat
Great Gray Owl (*Strix nebulosa*)	Mature and old growth forests associated with openings and meadows	No habitat
Golden Eagle (*Aquila chrysaetos*)	Open ponderosa pine or mixed conifer	No habitat
Osprey (*Pandion haliaetus*)	Large snags associated with fish bearing water bodies	No habitat
Red-tailed Hawk (*Buteo jamaicensis*)	Large snags, open country interspersed with forests	Known presence but no known nesting
Waterfowl (See appendix A for species)	Lakes, ponds, streams	No habitat
Woodpeckers (See appendix A for species)	***These species will be discussed in the Snag and Down Wood Section.***	Known presence
Mammals		
American Marten (*Martes americana*)	***This species will be discussed in the Snag and Down Wood Section.***	Potential habitat but no known presence
Elk (*Cervus elephas*)	Mixed habitats	Known presence
Mule Deer (*Odocoileus hemionus*)	Mixed habitats	Known presence
Townsend's big-eared Bat (*Corynorhinus townsendii*)	Mines, Caves, or Buildings	No habitat
Habitats		
Snags, Down Wood and Log Associated Species	Dead Wood Habitat	Associated with cavity nesters and marten
Special or Unique Habitat Associated Species	Springs, Seeps, cliffs, and talus slopes	Known presence

Appendix D identifies species documented on USFS administered lands within the Melvin Butte project area.

Those MIS species containing no habitat will not receive further analysis in this document. The Townsend's big-eared bat is analyzed with TES species.

Other Species Analyzed

In addition to MIS species, impacts need to be assessed for a number of wildlife species deemed as "species of concern" and habitats of concern either through the Northwest Forest Plan or through other directives (example Birds of Conservation Concern and the Landbird Strategic Plan). These habitats and species are listed in Table 98.

Table 98 Other speices analyzed summary.

Species	Habitat	Presence
Birds		
Birds of Conservation Concern-Landbird Strategy See Appendix D	Various Habitats	Known Presence
Mammals		
Roost Sites for Bats	Caves, Mines, Wooden Bridges, Buildings	Known Presence

Northern Goshawk (MIS)

Existing Condition

Source habitats for goshawk are old forest and unmanaged young forests in montane, lower montane, and riparian woodland communities. Important habitat attributes of goshawk prey species include snags, down logs, woody debris, large trees, openings, herbaceous and shrubby understories and an intermixture of various forest structural stages (Wisdom et al. 2000). During winter some goshawks may travel short distances to lower elevations and more open habitats in all upland woodland types (Wisdom et al. 2000) (USFS 2012).

From Wisdom et al. 2000 – "Goshawks nest in various forest structural conditions …nest stands are generally characterized by large trees and the densest canopy cover available within the area (Reynolds et al. 1992) but are occasionally located in small-diameter trees (Hayward and Escano 1989, Squires and Ruggiero 1996)." Foraging occurs in various cover types and structural stages, and the juxtaposition of several habitats may enhance the quality of foraging habitat around nest sites (Hargis et al. 1994) (USFS 2012).

In general, goshawk nest areas are unique in structure, with large trees, dense canopies, and high canopy closure. Goshawk nesting habitat in eastern Washington and Oregon is generally composed of mature and older forests (McGrath et al. 2003). Nest stands are typically composed of a relatively high number of large trees, high canopy closure (>50%), multiple canopy layers, and a relatively high number of snags and downed wood (Finn 1994, McGrath et al. 2003) (USFS 2012).

The data from the BBS (Breeding Bird Survey) for the state of Oregon and the Great Basin Bird Conservation Region (BCR 9), due to the low detectability of this species using BBS methods, the relative abundance is low. The population trend for the BCR is "Possible to moderate population decrease". Partners in Flight (PIF) provides a population estimate database which provides estimates at a continental scale (including global or range-wide population estimates for North American species), population estimates for Bird Conservation Regions (or State portions), estimates for individual states and provinces, and estimates where BCRs overlap with states and provinces (Blancher et al. 2007). The Oregon portion of BCR 9 has only about 0.1% of the total global population and only 14% of the total BCR 9 population of northern goshawks. The detection rate is low (.0.01) for the BBC routes. However, the routes are generally along roads and simply record species observed. As noted earlier, goshawks are difficult to detect and prefer closed canopy forest where they are difficult to observe (USFS 2012).

The following is a potential list of threats due to habitat alteration (USFS 2012):

- Timber harvest is the principal threat to breeding goshawk populations (Squires and Reynolds 1997) due to their reliance on mature and old-growth timber, especially for nesting, although not exclusively (Marshall et al. 2006).

- Fire suppression may lead to increased susceptibility of stand-replacing fire and insect and disease outbreaks, which can result in the deterioration or loss of nesting habitat (Graham et al. 1999 as cited in NatureServe 2011, Wisdom et al. 2000).
- Loss of foraging habitat due to dense conifer understory as a result of fire suppression. Dense understories may obstruct flight corridors used by goshawks to hunt prey (Wisdom et al. 2000).
- Predation on goshawk by other raptors including Red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), and long-eared owl (*Asio otus*) which invade habitat following canopy reduction by logging (Crocker-Bedford 1990).
- Falconry - Goshawks can legally be taken for falconry in various states, including Oregon. Take by falconers is considered low; therefore it is thought to be a negligible threat.

In addition to habitat alteration, threats from disturbance due to logging activities conducted near nests during the incubation and nestling periods can cause nest failure due to abandonment (NatureServe 2011, Squires and Reynolds 1997). Also, high road densities may result in loss of snag and down wood habitat important to goshawk prey (Wisdom et al. 2000) (USFS 2012).

The NatureServe status for the pygmy nuthatch is secure at the global level (G5), apparently secure at the national level for both the breeding and non-breeding ranges (N4B, N4N), and apparently vulnerable at the state level (S3).

Surveys were complete using the Northern Goshawk Inventory and Monitoring Technical Guide (USDA 2006) within the Melvin Butte project area in 2009-2014. One active nest was located as a result of the surveys. Two historic nest sites occur within the project area and were active between 1998 and 2005 (NRIS Wildlife Database). One active goshawk nest site is documented within the project area. A 30+ acre nest core was identified around the nest tree that will be excluded from treatment. A 400 acres of post fledging area was also identified adjacent to the nest core

Through the Forest wide assessment completed for MIS, goshawk reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 3,347 acres habitat occurs within the Melvin Butte project area, 5,346 acres within the Deep Canyon watershed, and 446,557 acres of habitat occurs across the Deschutes National Forest. Table 99 summarizes these acreages:

Table 99 Northern goshawk habitat within the Melvin Butte Project area, Deep Canyon Watershed, and across the Deschutes National Forest.

Acres of Northern Goshawk Habitat in the Melvin Butte Project Area	Acres of Northern Goshawk Habitat in the Deep Canyon Watershed	Acres of Northern Goshawk Habitat Across the Deschutes National Forest
3,347 acres	5,346 acres	446,557 acres

For the detailed assessment on the Northern Goshawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of reproductive habitat affected.

Alternative 1 – Ecological Trend

Areas that currently provide suitable goshawk habitat would most likely have increased mortality due to tree stress. Continued high stand densities will reduce the longevity of residual large trees structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of larger nesting trees will be prolonged. In stands of second growth ponderosa pine, short-term affects from high stand densities reduces the resiliency of these stands against bark beetle attack. The long-term

affects from beetle outbreaks include high densities of small snags within project area, and as a result lack the recruitment of large tree structure over time. Lack of large tree structure within the project area and watershed has been identified as limiting through the historic range of variability analysis (HRV).

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time, potentially impacting high density stands that provide goshawk habitat reproductive habitat.

Stand resilience to insects and disease is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Stands above UMZ that are susceptible or show sign of insect and disease are typically high density, and therefore also typically at risk wildfire. Forest stands managed below the upper management zone are more resilient and less susceptible to wildfire. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition 92% of these stands are above the Upper Management Zone and are at risk or currently be impact by insects and disease due to high stand densities.

High intensity crown fire has been a major cause of habitat reduction to the northern goshawk across the Sisters Ranger over the last 10 years.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing large-tree component/nesting habitat which is likely to be at a much higher rate than if stand densities were reduced to more healthy levels.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer with Group Opening(MCGO), Mixed Conifer without Group Opening

These three treatment types all thin from below, but occur within different seral classes, plant associations and geographical locations within the project area. Treatments associated with HTH are commercial thinning from below and occur in ponderosa pine and mixed conifer stands. These stands contain mature or over-mature overstories with advanced stages of regeneration in the understory. HTH treatments will thin from below removing trees 8 inches dbh and larger.

MCGO and MC no group openings treatments are also commercial thinning from belowing; removing trees 7 inches dbh and larger in the understory of mature ponderosa pine. Thinning will focus on removing white-fir and lodgepole pine understories and reducing the risk of crown fire potential. Within MCGO treatments, where the overstory is dominated by white-fir and lodgepole pine, small group opening will be created less than 3 acres in size and planted to ponderosa pine. This treatment will promote the development of future fire resistant stands. Group openings could be created in up to 30% of a given stand.

Thinning in suitable goshawk habitat would occur in both second growth ponderosa pine and multi-storied ponderosa pine and mixed conifer stands containing residual large trees. Thinning from below in HTH treatments will favor the largest ponderosa pine in pure pine stands. In MCGO and MC no group openings , thinning will favor ponderosa pine and healthy white-fir. A target basal area of 60 square feet is the objective, but will vary across these stands. Different scenarios exist depending on the existing basal area, site productivity, and stand structure objectives as well as differing slightly by alternative. This treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by

removing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands. Negative impacts may result from the MCGO treatments, due to overstory fragmentation associated with creating small group openings from the removal of all lodgepole pine and white-fir. However, due to the edge associated with the openings and the herbaceous material that it will promote, rodent and ground nesting bird habitat will increase in these areas, potentially increasing a more diverse variety of foraging opportunities for the goshawk. In addition, beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat by planting group opening back to ponderosa pine.

Mowing and Burning Only (B)

Underburning will occur in stands with a more fire resistant overstory and fewer small (<9" dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8" dbh) may be needed as a pre-treatment to fire. Mowing of brush may also occur where existing brush density and height would contribute to undesirable fire behavior. This treatment aids in maintaining the overstory by reducing the susceptibility to wildfire and will favor longer-lived, more fire resistant species like ponderosa pine. Beneficial impacts should result in 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 will be minimal due to the lower intensity burn versus that of a wildfire.

Lodgpole Pine Improvement (LPI)

These treatments are primarily focused on the removal of lodgepole pine, however some white-fir exists and could potentially be removed as well. These treatments will remove trees that have fading crowns and the trees are succumbing to beetle attacks or disease or both. The treatment will retain all trees with healthy crowns and the future stand will depend on the understory regeneration. Goshawk reproductive habitat is not wide spread in this area and habitat occurs in small patches. Treatment will remove habitat but will reduce the stand densities and the risk of beetle attack to the understory. Treatment will accelerate the development of even aged lodgepole pine which cycles in this area every 100 years, and although goshawk tend to prefer mixed conifer and ponderosa pine plant association groups for nesting, within the 100 year cycle some areas could potentially provide some small inclusions of nesting habitat in the long-term.

Table 100 summarizes the amount of goshawk reproductive habitat affected by the action alternatives in the Melvin Butte project.

Table 100 Total acres of goshawk reproductive habitat sssociated with each treatment type by alternative for the Melvin Butte Project.

Treatment Type	Alternative 2	Alternative 3
B	492	492
HTH	802	907
MC – No Group Opening	-	442
LPI	135	135
MCGO	453	-
Total Acres.	**1,882**	**1,976**

Affects to goshawk habitat are similar under Alternatives 2 and 3. The outcome of the effects to habitat as a result of each treatment type is similar across both action alternatives; the only thing that changes by alternative is the total acres of habitat treated. In addition, treatments would also need to meet the purpose and need of reducing insects, disease, and the risk of stand replacing wildfire.

Overall, approximately 1,882 acres of goshawk reproductive habitat are associated with treatments identified under Alternative 2 and approximately 1,976 acres under Alternative 3.

Loss of the large tree component would be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below.

Overall within the LOS stands, overstory structural diversity will remain, but understory complexity will be reduced through thinning, mowing, and burning. Although prey habitat will be reduced in the short-term, residual habitat will remain providing foraging opportunities for the goshawk. Long-term benefits of treatments will be a reduction in stress to the overstory promoting longevity, but also to promote the development of future old growth in the stands that will provide long-term nesting habitat.

There are approximately 4,456 acres that have the potential to receive vegetation treatments. As a result of both action alternatives, 90% of these stands will be below the Upper Management Zone. Treatment will greatly increase stand resiliency to insects, disease, and wildfire through stand density reductions.

Alternative 2 and 3 - Cumulative Impacts

Activities identified in Table 68 were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to northern goshawks. The Deep Canyon 5th field watershed is being used as the scale for analysis for the northern goshawk. Based on that review, the potential cumulative impacts are those discussed below.

The majority of nest sites on the Sisters RD are located within the mixed conifer PAGs (14 of 19). These PAGs experienced moderate to heavy mortality from insect and disease occurring in the early 1990's and the subsequent loss of canopy cover. This event probably had the greatest influence on goshawk habitat across the district due to the reduction of canopy cover prior to the fires. These open stands are considered unsuitable nesting habitat for goshawks.

Three large wildfires have occurred within the Deep Canyon Watershed –Rooster Rock (2010), Pole Creek (2012), and Two Bulls (2014). These fires also impacted suitable reproductive habitat. Not every acre of the fires equated to unsuitable habitat for the goshawk but all this habitat is now considered unsuitable for nesting due to the fires intensity.

Approximately 54 acres of ongoing fire salvage is associated with the Pole Creek Fire. Reasonably foreseeable fire salvage is also proposed for the Two Bulls fire totaling approximately 250 acres. These fire salvages do not and will not remove goshawk reproductive habitat.

Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Fire Wood are primarily associated with montane mixed conifer habitat and lodgepole pine totaling approximately 7,060 acres. These projects are not likely associated with goshawk habitat and primarily propose the removal of beetle killed lodgepole pine, therefore will not likely contribute to cumulative effects.

The Three Creeks personal use firewood cutting area also occurs in the watersheds. This area occurs in both mixed conifer and lodgepole pine habitat types. Firewood cutting is not wide spread and primarily occurs where dead trees can be accessed from open roads. Although snags are cut and removed, removal occurs on an individual tree basis versus across the entire designated area. The area is approximately 3,029 acres. The majority of firewood removed is associated with beetle killed lodgepole pine and impacts to the goshawk would be incidental from firewood gathering.

Private lands are not managed for goshawk habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

Although treatments will enhance long-term habitat and will retain habitat connectivity throughout the project area, treatments are proposed within 35% of the total goshawk habitat within the Deep Canyon watershed. With the ongoing forest management projects within the Deep Canyon watershed there will be less than a 1% reduction in the overall habitat for the goshawk across the Deschutes National Forest.

Conclusion

Cumulatively, this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of the goshawk is expected on the Deschutes National Forest.

Consistency with the Deschutes LRMP

Wildlife standards and guidelines WL-6, WL-10, and WL-11 will be assessed. The project is consistent with the Deschutes LRMP (Table 101).

Table 101 Consistency with Forest Plan wildlife standards and guidelines for goshawk.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-6 – Nesting habitat for at least 40 goshawk pairs will be provided in mixed conifer, mtn. hemlock, and ponderosa pine forests outside wilderness.	Meets	Habitat is available across the Forest.
WL-10 – Locating new roads within nest site stands will be avoided.	Not Applicable	No new road construction is proposed for this project.
WL-11 – Nests will be protected within ¼ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restriction around known nest sites and in the event a new nest site is found.

Cooper's and Sharp-shinned Hawks (MIS)

Existing Condition

Cooper's Hawk

The Cooper's and sharp-shinned hawks are considered MIS species in the Deschutes LRMP. They often use dense cover in which to hunt and nest. In Oregon, Reynolds and Wight (1978) studied Cooper's hawk distribution, nest density, and productivity in 3 subregions: 1) the Coast Range and the west slope of the Cascade Range, a moist, densely forested region with a mild maritime climate referred to as western Oregon; 2) southwestern Oregon, which includes the Siskiyou Mountains, characterized by relatively warm, wet winters and hot, dry summers; and 3) eastern Oregon (including the east slope of the Cascade range), a high elevation and more dry region with affinities to the Rocky Mountain forests. The tree species composition in the Bly study area (eastern Oregon) varied from pure stands of ponderosa pine at lower elevations, to mixed stands of ponderosa pine and white fir at mid-elevations, to mixed and pure stands of white fir and lodgepole pine at high elevations. Stands of all age classes in each timber type were represented, however the most common type was mature ponderosa pine overstory with mixed understory of ponderosa pine and white fir. As part of Reynolds and Wight's study from 1978, Reynolds et al. (1982) further studied Cooper's hawk habitat within the same geographic reference: Coast Range and eastern Oregon, including the west and east slopes of the Cascades, and the Wallowa, Blue, Ochoco, Bly, and Steen's mountains in eastern Oregon. Vegetational and physiographic characteristics of nest sites were obtained and the analysis concluded that this species nests in stands that resembled the even-

aged, 2nd-growth stands in larger older trees (30-60 years old in the northwestern region and 50-70 years old in eastern Oregon), and have deep crowns. In northwestern Oregon, all nests except one (ponderosa pine) were in Douglas-fir stands, whereas in eastern Oregon ten nests were in ponderosa pine stands, five were in white fir stands, and three were in Douglas-fir stands. Also, Cooper's hawk nests in both regions were on horizontal limbs against the trunk (a few were out on limbs or in crotches of double trunks) and were either immediately below the nest-tree crown or in the lower portion of the crown. Nests in eastern Oregon were commonly in deformed trees infected by dwarf mistletoe and that had heavy foliage, witches brooms, or double trunks. Nest height and nest-tree height were nearly the same in both regions.

Based on the literature reviews in the state of Oregon, there are many similarities in the vegetation on the DNF and nest-site selections of these characteristics are occurring. Differences are also apparent between study areas (i.e. The study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the DNF; and southern Oregon has large expanses of oak where it is non-existent on the DNF), but similarities in forest composition occur. It is important to take this variability into account when making inferences about habitat use on the DNF from studies at other locations. (USFS 2012).

Only a few studies have investigated the foraging habitat of Cooper's hawks (Fischer 1986, Mannan and Boal 2000, Murphy et al. 1988). We know little of preferences for stands of differing densities, ages, tree sizes, or edge versus deep forests by Cooper's hawks (Reynolds 1989). However, they appear to use available forests opportunistically provided that the available types are not too dense for flight below or within the canopy (Reynolds 1989). (USFS 2012).

Nature Serve identified Cooper's hawk as secure at the global and national scale, and apparently secure in the state of Oregon. It was not identified on the Federal and State Sensitive species list, *Birds of Conservation Concern list*, Oregon Conservation Strategy, or the Partners in Flight lists. (USFS 2012).

The following is a potential list of threats due to habitat alteration for the Cooper' hawk (USFS 2012):

- Timber harvest - Treatments such as commercial and non-commercial thinning, shelterwood and clearcut harvesting, where it reduces crown cover and dense forest. Impacts to habitat will be unique from site to site due to the varying structure of the forest.
- Recreation - Habitat loss from developed and dispersed recreation, as well as new transportation routes associated with new facilities.
- Livestock grazing-Annual removal of prey habitat from grazing.
- Mining - Habitat loss from removal of forest in developing the mine. Disturbance to adjacent habitat from operations.
- Prescribed fire - Prescribed burns simulate natural forms of disturbance that occur periodically across the landscape. These forms of disturbance are likely to be important in providing future nest sites for Cooper's hawks.
- Fire suppression - Results of fire suppression include an increase in tree density and an increased likelihood of crown fires. How increased tree density affects Cooper's hawks should depend on the degree that tree density increases. If tree density is too high, it could interfere with the ability of the Cooper's hawk to fly and hunt. However, increased tree density in some areas might improve the quality of the habitat for nesting. High-intensity crown fires are presumed to be the most deleterious consequence of fire suppression. Crown fires result in vast stand-replacing disturbances with significant habitat loss in ponderosa pine cover types, but especially in lodgepole pine cover types and in mixed conifer.

- Invasive plant establishment - Cheatgrass (Bromus spp.) could be a problem for Cooper's hawk and their prey species. This species invades areas after a disturbance and leads to the rapid accumulation of highly flammable fuel, shortening the fire-free interval. Fires occur more frequently, causing a decline in some perennial grass species, further favoring cheatgrass expansion. The result is a loss in the heterogeneity of the landscape, potentially lowering prey diversity and availability.
- Fuelwood harvest - Fuelwood harvest could adversely affect habitat if snags are removed that are used as perch sites or prey species habitat or cause disturbance during the breeding season.
- Falconry - Cooper's hawks can legally be taken for falconry in various states, including Oregon. Take by falconers is considered low; therefore it is thought to be a negligible threat.

Sharp-shinned Hawks

As part of Reynolds and Wight's study from 1978, Reynolds et al. (1982) further studied sharp-shinned hawk habitat within the same geographic reference: Coast Range and eastern Oregon, including the west and east slopes of the Cascades, and the Wallowa, Blue, Ochoco, Bly, and Steen's mountains in eastern Oregon. All nest sites in eastern Oregon were in even-aged stands of white fir (7), Douglas-fir (1), ponderosa pine (1), or aspen (1). The vegetative structure was essentially the same as in the even-aged nest sites in northwestern Oregon, with the exception that tree density and diameter were less uniform in eastern Oregon. The analysis concluded that this species nested in stands of 3 different vegetative structures: most nests (81%) were in young (25-50 years), even-aged conifer stands with single-layered canopies; 2 nests (13%) were in old-growth (200+years) stands of conifers with multilayered canopies; and 1 nest was in a dense stand of stunted quaking aspen. Sharp-shinned hawk nests in both regions were placed in the denser portion of the lower canopy against the trunk or in a crotch of a double or split trunk. (USFS 2012)

Based on the literature reviews for the state of Oregon there are many similarities in the vegetation on the DNF, including the characteristics of nest-site selections. Differences are also apparent between study areas (i.e. the study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the DNF; and southern Oregon has large expanses of oak where it is non-existent on the DNF), but similarities in forest composition occur. It is important to take this variability into account when making inferences about habitat use on the DNF from studies at other locations. (USFS 2012)

Few telemetry studies have been performed on sharp-shinned hawks, therefore little information is available on foraging habitat. From observations of prey species deliveries to nests, Reynolds and Meslow (1984) estimated that sharp-shinned hawks foraged primarily in the upper canopy zone. However, Clarke (1984) and Joy (1990) observed that sharp-shinned hawks did forage near the ground. Joy et al. (1994) reported that of 11 sharp-shinned hawk nest sites, mature aspen was the most common (8 of 11) vegetation within a 2 km circle around the nest, mixed aspen-conifer was the most common "secondary" habitat (9 of 11), and conifer forest was the most "limited" habitat type. Platt (1973) monitored a male sharp-shinned hawk with radio-telemetry and observed that the male primarily hunted in a clonal-oak grassland community. The author suggested the males' attraction to this community was related to high food availability. (USFS 2012)

Nature Serve identified sharp-shinned hawk as secure at the global and national scale, and apparently secure in the state of Oregon. It was not identified on the Federal and State Sensitive species list, *Birds of Conservation Concern list*, Oregon Conservation Strategy, or the Partners in Flight lists. (USFS 2012).

Threats to the sharp-shinned hawk are similar to those addressed for the Coopers' hawk (USFS 2012).

Comparisons Of Sharp-Shinned Hawk, Cooper's Hawk, and Northern Goshawk Habitat

Several studies have compared nesting habitat use between coexisting Accipiters in North America (Fischer 1986, Kennedy 1988, Moore and Henny 1983, Reynolds et al. 1982, Reynolds 1983, Siders and Kennedy 1996, Trexel et al. 1999, Wiggers and Kritz 1991). Where these species coexist, a relationship occurs in which tree height and DBH of nest trees increases in proportion to Accipiter body size (Kennedy 1988, Reynolds et al. 1982, Siders and Kennedy 1996). For example, sharp-shinned hawk nest sites in Oregon were characterized as dense, 40 to 60-year-old even-aged conifer stands while Cooper's hawk nest sites were 50 to 80year-old conifer stands with somewhat larger, more widely spaced trees, and goshawk nest sites were dense, mature conifer stands with varying densities of mature, overstory trees (Reynolds et al. 1982). However, high interspecific overlap occurs between the species in the use of nest site characteristics such as basal area, canopy cover, and tree density (Kennedy 1988, Moore and Henny 1983, Siders and Kennedy 1996). Siders and Kennedy (1996) observed large overlaps between Cooper's hawk and goshawk nest site characteristics while Moore and Henny (1983) reported large overlaps between Cooper's hawk and sharp-shinned hawk nest site characteristics. (USFS 2012)

Surveys were conducted during goshawk monitoring. No detections or nests were identified within the project area. There are no known historic nest sites one Cooper' hawk general observation that occur within the project area. (NRIS Wildlife Database)

Through the Forest wide assessment completed for MIS, Cooper's and sharp-shinned hawk reproductive habitat was mapped across the entire Deschutes National Forest.

Approximately 1,824 acres of Cooper's hawk habitat exists within the project area. Approximately 11,026 acres of habitat occur within the Deep Canyon watershed, and approximately 275,487 acres of habitat occurs across the Deschutes National Forest.

Approximately 2,215 acres of sharp-shinned hawk habitat exists within the project area. Approximately 514,304 acres of habitat occur within the Deep Canyon watershed, and approximately 426,285 acres of habitat occurs across the Deschutes National Forest.

Table 102 and Table 103 summarize habitat acreages for both Cooper's and sharp-shinned hawks:

Table 102 Cooper's hawk habitat within the Melvin Butte Project area, watershed, and across the Deschutes National Forest.

Acres of Cooper's Hawk Habitat in the Melvin Butte Project Area	Acres of Cooper's Hawk Habitat in the Watershed	Acres of Cooper's Hawk Habitat Across the Deschutes National Forest
1,824 acres	11,026 acres	275,487 acres

Table 103 Sharp-shinned hawk habitat within the Melvin Butte Project area, watershed, and across the Deschutes National Forest.

Acres of Cooper's Hawk Habitat in the Melvin Butte Project Area	Acres of Cooper's Hawk Habitat in the Watershed	Acres of Cooper's Hawk Habitat Across the Deschutes National Forest
2,215 acres	14,304 acres	426,285 acres

For the detailed assessment on the Cooper's and sharp-shinned hawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measures: Acres of reproductive habitat affected.

Alternative 1 – Ecological Trend

Habitat conditions would remain the same for the short-term. Stand densities would continue to increase due to fire suppression. This would increase the amount of potential habitat for both species over time due to increasing canopy closures. However, with increased stand densities comes increased risk of loss from disturbance events (insects, disease, or fire). These events would likely impact the densest stands the greatest due to the stand conditions which would result in reduced availability of suitable habitat in the project area.

Areas that currently provide suitable habitat would most likely have increased mortality levels due to tree stress in the long-term. Without the treatments, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the short-term high density stands of second growth ponderosa pine and plantations with advanced regeneration, due to overstocking and high amounts of mistletoe, the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands and plantations will likely contain bark beetle outbreaks and high densities of small snags will occur within the project area, and habitat would diminish.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the Melvin Butte project area also increases over time, potentially impacting high density stands that provide Cooper's and sharp-shinned reproductive habitat.

Stand resilience to insects, disease, and wildfire is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition, 92% of these stands are above the Upper Management Zone and are at risk or currently be impacted by insects and disease due to high stand densities and as a result low resiliency.

Overall, high stand densities will result in a decrease in tree vigor among all size classes reducing canopy closure and nesting habitat for both the Cooper's and sharp-shinned hawks.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer Thinning From Below with and without Group Opening (MCGO and MC without openings), Non-commercial Thinning (P), Lodgepole Improvement (LPI), and Scenic Views Enhancement

Thinning in suitable habitat would occur in both second growth ponderosa pine and mulit-storied mixed conifer stands. Thinning (8" dbh and up) from below will favor the largest ponderosa pine in pure pine stands. In mixed conifer stands, thinning will favor ponderosa pine and healthy white-fir. An average basal area of 40 to 120 square feet is the object to retain in these stands. Different scenarios exist depending on the existing basal area, site productivity, and stand structure objectives. These treatments aid in maintaining the largest trees where they exist and reduce their susceptibility to fire and insects by removing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands which may directly impact the Coopers' and sharp-shinned hawk habitat by removing reproductive habitat.

Within mixed conifer stands with group openings, although the residual basal area will range between 40 and 120 square feet, in areas dominated by white-fir that are fading from insects and disease, small group openings will be created 1-3 acres in size. This has the potential to reduce nesting habitat, but could

provide added foraging opportunity due to the edge habitat created and opening that will enhance a rodent and ground nesting bird prey bases. Group opening will be planted to ponderosa pine, creating more contiguous block of fire resilient and sustainable mixed conifer stands in the long-term.

Within both Scenic Views Enhancement and LPI treatments, trees targeted for removal are primarily dead and dying trees. The Scenic Views treatment is designed to enhance scenic quality within the 16 road corridor. The treatments will not reduce suitable reproductive habitat but will remove individual fire killed trees cleaning up the woody debris from the Pole Creek Fire. The LPI treatment will not remove reproductive habitat, but will remove disease and insect ridden trees within green stands; the objective is to slow insect and disease spread to residual green stands that remain after the last beetle outbreak in the area. Residual reproductive habitat will remain.

Mowing and Burning Only (B)

Underburning will occur in stands with a more fire resistant overstory and fewer small (<9" dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8" dbh) may be needed as a pre-treatment to fire. Mowing (mastication) of brush may also occur where existing brush density and height would contribute to undesirable fire behavior. These treatments will reduce both fuels associated with thinning and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Mowing and burning will both be utilized as a primary stand treatment as well as a secondary follow up treatment to thinning where it is needed. Fuels treatments will also reduce the understory complexity which may result in a change or reduction in potential prey species for both Cooper's and sharp-shinned hawks. However, adjacent untreated areas may be able to provide the structural complexity for prey species that will maintain and provide potential foraging opportunities for both Cooper's and sharp-shinned hawks.

Table 104 Summarizes the amount of Coopers' hawk reproductive habitat affected by the action alternatives identified for the Melvin Butte project; Table 105 sharp-shinned hawk.

Table 104 Total acres of Coopers' hawk reproductive habitat associated with each treatment type by alternative for the Melvin Butte Project.

Treatment Type	Alternative 2	Alternative 3
B	186	186
HTH	342	390
MC – No Group Opening	-	301
LPI	104	104
MCGO	309	-
P	310	310
Scenic Views Enhancement	162	162
Total Acres	**1,413**	**1,453**

Table 105 Total acres of sharp-shinned hawk reproductive habitat associated with each treatment type by alternative for the Melvin Butte Project.

Treatment Type	Alternative 2	Alternative 3
B	236	236
HTH	381	432
HTH – No Group Opening	-	403
LPI	133	133

MCGO	415	-
P	355	355
Scenic Views Enhancement	175	175
Total Acres	**1,695**	**1,734**

Affects to Cooper's and sharp-shinned hawk habitat are similar under Alternative 2 and 3. The outcome of the affects to habitat as a result of each treatment type is the same across both action alternatives; the only thing that changes by alternative are the total acres of habitat treated. Alternative 3 was developed to address the key issues of mixed conifer thinning with small group openings and removal of large overstory trees containing dwarf mistletoe. As a result, there is a net decrease in the total acres of Cooper and sharp-shinned hawk reproductive habitat that is treated in Alternatives 3. Therefore affects to reproductive habitat by alternative is similar, since the same prescriptions will be implemented under each alternative. Total acres of reproductive habitat treated will change by alternative.

The project area and habitat varies greatly from north to south due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this north to south pattern. To capture the importance of habitat variation across the project area, the project area was broken up into 3 areas containing high, medium and low site potential based on inherent soil quality. A habitat retention strategy for interior forest species was defined using a standard based spotted owl dispersal habitat. This criteria retain a minimum tree size and canopy cover to provide nesting habitat for all accipters. The retention strategy identified a range of retentions levels for dispersal habitat across the project area. Within stands containing low site productivity, untreated stands will be retained at a 10% level, in the areas with moderate site productivity untreated stands will be retained at a15% level, and in areas that have the highest site productivity untreated stands will be retained at the 20% level. Retention will occur on a stand by stand basis to retain areas that contain the highest densities of contiguous habitat with a stand average of a minimum of 11 inches dbh and exceeding 40% canopy closure.

Overall, approximately 1,413 acres of Coopers' hawk reproductive habitat are associated with treatments identified under Alternative 2, and approximately 1,453 acres under Alternative 3.

Overall, approximately 1,695 acres of sharp-shinned reproductive habitat are associated with treatments identified under Alternative 2, and approximately 1,734 acres under Alternative 3.

All treatments described above will aid in the development of a more disturbance resilient landscape.

The Cooper's and sharp-shinned hawks are smaller accipiter' and therefore can utilize younger stands that offer seclusion and structure for nest support than the much larger goshawk which needs larger trees for nest support and overhead canopy to make the larger bird more discreet. Potential nesting habitat for both species would most likely develop within proposed units within 20-40 years. In the short-term, the designated cover clumps and untreated stands would provide dispersal, foraging, and potential nesting habitat.

Foraging habitat would not necessarily decrease in acreage, but would decrease in quality from mechanical shrub treatment or prescribed fire. For Cooper's and sharp-shinned hawks, the reduction of shrubs from mowing activities can impact their prey species like ground dwelling small mammals and shrub/ground nesting passerines. These ground dwelling species depend on the shrubs for nesting, and hiding cover from predators. This activity would reduce the amount of available habitat for some Cooper's and sharp-shinned hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within suitable nesting areas.

In the short-term, Alternative 2 affects the fewest number of acres of habitat for sharp-shinned hawk and Cooper's Hawk and provides a complexity of treatment types to develop more fire resistant mixed conifer and ponderosa pine stands while retaining both nesting and foraging habitat.

There are approximately 4,456 acres that have the potential to receive vegetation treatments. As a result of both action alternatives, 90% of these stands will be below the Upper Management Zone. Treatment will greatly increase stand resiliency to insects, disease, and wildfire through stand density reductions.

Alternative 2 and 3 - Cumulative Impacts

Activities identified in Table 68 (cumulative effect table for wildlife) was reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to Cooper's or sharp-shinned hawks. The Deep Canyon watershed is being used as the scale for analysis for these two species. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within the Deep Canyon Watershed - Rooster Rock (2010), Pole Creek (2012), and Two Bulls (2014). These fires impacted potentially suitable reproductive habitat. Not every acre of the fire equated to suitable habitat for the Coopers' and sharp-shinned hawks but all this habitat is now considered unsuitable for nesting due to the fires intensity (i.e. reduced canopy cover).

The Pole Creek Fire Timber Salvage is currently salvaging 54 acres within the Deep Canyon watershed as well as ongoing salvage of danger trees on associated major routes. In addition, the BFR Ranger District is proposing to salvage approximately 250 acres within the Two Bulls Fire. Salvage is occurring or will occur within stand replacing fire areas. Therefore, no Coopers' or sharp-shinned hawk habitat will be affected by either project.

Activities proposed under Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood project have occurred or may occur in suitable habitat. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. However, stand density reduction will occur over approximately 6,810 acres within these projects and could reduce suitable habitat.

Private lands are not managed for Coopers' or sharp-shinned hawk habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term. Private lands impacted by the fires were harvested but the impacts had already occurred to potential habitat by the fire. Most of the area harvested in the last several years was a result of fire where habitat had already been impacted.

An estimated 11,026 acres of potentially suitable Coopers' hawk reproductive habitat and approximately 14,304 acres of potentially suitable sharp-shinned hawk reproductive habitat exist within the Deep Canyon watershed after the impacts of the fires and ongoing vegetation management projects.

Although treatments will enhance long-term habitat, the Melvin Butte project does propose treatments within currently suitable Coopers' and sharp-shinned hawk reproductive habitat. Under both Alternatives 2 and 3, treatments are proposed within approximately 12% of Cooper's hawk and sharp-shinned hawk habitat in the Deep Canyon watershed. With the ongoing forest management projects within the Deep Canyon watershed, there will be less than a 1% reduction in the overall habitat for the Cooper's and sharp-shinned hawk across the Deschutes National Forest.

Conclusion

Cumulatively, because this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest.

The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of both Cooper's and sharp-shinned hawk is expected on the Deschutes National Forest.

Wildlife standards and guidelines WL-13, WL-18, WL-19, WL-21, WL-27 and WL-28 will be assessed. The project is consistent with the Deschutes LRMP (Table 106).

Table 106 Consistency with Forest Plan wildlife standards for Cooper's hawk and sharp-shinned hawk.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-13/21 – Nesting habitat for at least 60 pairs of Coopers hawks and 60 pairs of sharp-shinned hawks will be provided in mixed conifer and ponderosa pine forests outside wilderness.	Meets	Habitat is available across the Forest.
WL-18/27 – Locating new roads within nest site stands will be avoided.	Not Applicable	No new road construction is proposed for this project.
WL-19/28 – Nests will be protected within ¼ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restrictions in the event a new nest site is found.

Great Gray Owl (MIS, Survey and Manage NWFP)

Existing Condition

This species was identified in the NWFP (USDA 1994a) as a protection buffer species requiring surveys due to an apparent range expansion resulting from opening up dense-canopied stands with shelterwood type harvest activities. A Regional survey protocol was developed in 1995 (USDA 1995) and was updated in January of 2004 (Version 3.0) (USDA/USDI 2004a). An amendment to the NWFP occurred in 2001 which moved the great gray owl from a protection buffer species to a Category C species. This category contained uncommon species for which pre-disturbance surveys are practical. Therefore, surveys were conducted at the project level prior to habitat disturbing activities. All known nest sites will be managed according to Management Recommendations; however these have not been established to date.

No habitat occurs within the Melvin Butte project therefore no further analysis is needed.

Red-tailed Hawk (MIS)

Existing Condition

The red-tailed hawk is an abundant species occupying a variety of open to semi-open habitat types and can tolerate ranging elevations, alpine to sea level. However, they generally avoid tundra and dense, unbroken forests (DeGraaf and Rappole 1995, Timossi and Barrett 1995). Preferred habitats are open to semi-open coniferous, deciduous and mixed forests, forest edges, grasslands, parklands, rangelands, river bottomlands, and agricultural fields with scattered trees (Gilligan et al.1993, Johnsgard 1990, Timossi and Barrett 1995, DeGraaf and Rappole 1995, Marshall et al. 2003, NatureServe 2011). Forest clearings, alpine meadows, estuaries, marshes, agricultural lands, clear cuts, sagebrush plains, and high elevation environments are also used, though less commonly (Gilligan et al.1993, Timossi and Barrett 1995, Marshall et al. 2003, NatureServe 2011). (USFS 2012)

Limiting factors in preferred habitat selection are availability of suitable perches and hunting grounds open enough to locate and catch ground prey (NaturerServe 2011, Fitch et al. 1946, Janes 1984, Janes 1994). Perches can be any object that provides an unobstructed view of a red-tailed hawk territory. These objects are usually high and can be natural (e.g. tree, snag, cliff, rock, or man-made, e.g. utility

pole, tower, fence) (Janes 1984, Janes 1994, Fitch et al 1946, NatureServe 2011). In the Fitch et al. (1946) study, perches were an essential aspect in red-tailed hawk territories. The perches were used for foraging, roosting, resting, mating, and defending territories. The Janes (1984) study found pairs that establish territories with more perches tend to rear more young. (USFS 2012)

Nesting occurs in large mature trees, usually at a forest edge or near an opening in canopy (Fitch et al. 1946, Moorman et al. 1996, Timossi and Barrett 1995, DeGraaf and Rappole 1995). Nests are usually placed higher in trees verses other raptors, and are generally in the largest, tallest tree available or smaller deformed trees where branch structure supports this higher placement (DeGraaf et al. 1991, Timossi and Barrett 1995, DeGraaf and Rappole 1995, La Sorte et al. 2004). Red-tailed hawks seem to prefer nesting trees with open crowns. The placement of a nest is usually next to the trunk of a tree in a crotch or fork from 30 to 90 feet (9-27 m) above the ground (DeGraaf et al. 1991, Verner and Boss 1980, Timossi and Barrett 1995). Nests are often reused from year to year provided the nest is not occupied by earlier nesting raptors and is in suitable condition (Fitch et al. 1946, DeGraaf and Rappole 1995, Tesky 1994). In treeless areas, nests are built on artificial nest structures, the crossbars of utility poles, and towers (Timossi and Barrett 1995 DeGraaf and Rappole 1995, Marshall et al. 2003, NatureServe 2011). Occasionally, red-tailed hawks will use and add material to an existing raven, crow, gray squirrel, or large accipiter nest. La Sorte et al. (2004) found steep slopes are an important factor for a nest site. The steep slope allows for easy entry to the nest from above the canopy layer, allowing for unobstructed views of surrounding area and protection from the slope. Red-tailed hawks will use the same nest for multiple years, particularly if the nest is in suitable location and suitable condition (Fitch et al. 1946, Young 1989 in Tesky 1994). (USFS 2012)

On the Deschutes National Forest, past harvest activities had produced habitat conditions favorable for red-tailed hawks by clear-cutting stands adjacent to mature and late-seral stands. This provided open areas for foraging adjacent to potential roosting and nesting habitat. Due to the age of the clear cuts, many have grown in with trees and shrubs diminishing foraging availability of the red-tailed hawk.

The red-tailed hawk is not on any federal, state, or other conservation lists. Globally, the population is increasing and has no significant threats (NatureServe 2011). Nationally, the population is increasing or stable in most areas (NatuerServe 2011). In Oregon, the red-tailed hawks are secure; the population is not decreasing (NatureServe 2011). (USFS 2012)

Through the Forest wide assessment completed for MIS, red-tailed hawk reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 1,048 acres of habitat exists within the project area. Approximately 2,424 acres habitat occurs within the Deep Canyon watershed, and approximately 192,492 acres of habitat occurs across the Deschutes National Forest. Table 107 summarizes these acreages:

Table 107 Red-tailed hawk habitat within the Melvin Butte Project area, Deep Canyon Watershed, and across the Deschutes National Forest.

Acres of Red-tailed Hawk Habitat in the Melvin Butte Project Area	Acres of Red-tailed Hawk Habitat in the Deep Canyon Watershed	Acres of Red-tailed Hawk Habitat Across the Deschutes National Forest
1,048 acres	2,424 acres	192,492 acres

For the detailed assessment on the red-tailed hawks for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of reproductive habitat affected.

Alternative 1 – Ecological Trend

With the no action alternative, suitable nest trees that occur within dense stands would most likely have increased mortality due to tree stress. Without treatments in the second growth stands, stand densities will prolong future development of larger nesting trees. These high density stands will remain susceptible to bark beetle activity and the susceptibility will increase over time. High stand densities will result in the overall decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing large-tree component/nesting habitat that is likely to be much faster than if the stand densities had been reduced making stands more resilient to insects, disease, and wildfire.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Dwarf Mistletoe (DM), Prescribe Burning (B), Non-Commercial Thinning (P)

These treatments would retain and enhance nesting habitat, and associated large tree structiure (i.e. trees >21" dbh). Both alternatives have the potential to increase foraging areas for red-tailed hawks by thinning from below (under 21" dbh) and potentially increasing access to prey at ground level over the associated acres. Thinning from below will help to decrease the stress on the larger overstory trees, thus retaining potential nest sites for the long-term (>20 years). Treatments to early and mid-seral stands would promote and accelerate the development of LOS.

Under alternative 2, DM treatments will thin trees containing mistletoe to reduce the rate of spread on 63 acres identified as habitat. This treatment will occur in old plantation where 4-14 trees per acre greater than 21 inches dbh occur. Trees infested with dwarf mistletoe will be removed or girdled and left as a snag. Approximately 4 snags per acre will be created from trees containing dwarf mistletoe, potentially retaining habitat within the 63 acres.

Non-commercial thinning will occur in plantations, thinning will reduce small tree densities (<8" inches dbh). Habitat exists in these stands in areas that individual old growth trees were retained as seed trees. No large trees will be removed from these areas. In its current condition foraging is very limited, thinning will open up the plantations enhancing foraging habitat by allowing better access to the forest floor and rodent populations.

The reduction of shrubs from mowing and burning as a follow up to thinning and units identified as prescribed burning only can impact prey species of ground dwelling small mammals (ground squirrels, cottontails, voles, and pocket gophers). These ground species depend on the shrubs for cover for hiding from predators and the forbs for food. This activity would reduce the amount of available habitat for red-tailed hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within nesting areas. Impact from mowing and burning are short in duration (<10 years) and will provide a high diversity of prey habitat (grasses, forb and shrubs) in the long-term.

In addition, during prescribed fire treatments incidental snags could be lost from fire reducing large snags that also provide nesting opportunities, but live trees may be converted to snags due to burning. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags <15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did

not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). Table 108 displays acres of Red-tailed reproductive habitat for each treatment type by alternative.

Table 108 Total acres of red-tailed reproductive habitat associated with each treatment type by alternative.

Treatment	Alternative 2	Alternative 3
B	201	201
DM	63	
HTH	374	438
P	160	160
Total Acres Affected	**798**	**799**

Impacts to habitat will be minimal, but treatments will promote the development of LOS stands promoting large tree production and red-tailed hawk habitat in the long-term. Affects to red-tailed hawk habitat are similar under Alternative 2 and 3. The outcome of the affects to habitat as a result of each treatment type is also consistent across all action alternatives.

Alternative 2 and Alternative 3 – Cumulative Effects

Activities identified in Table 68 (cumulative effects table for wildlife) was reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to red-tailed hawk reproductive habitat. The Deep Canyon watershed is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within the Deep Canyon Watershed – Rooster Rock, Pole Creek and the Two Bulls Fires. These fires impacted potentially suitable reproductive habitat. Not every acre of the fire equated to suitable habitat for the red-tailed hawk. These fires created ideal foraging habitat due to the reduction of small trees and ground cover. Additionally, large snags and large residual green trees provide ample nesting opportunities directly adjacent to foraging habitat.

The Pole Creek Fire Timber Salvage project is ongoing and is salvage logging approximately 54 acres and the Pole Creek Fire Danger Tree Removal project is also salvage logging incidental danger trees along major routes within the Deep Canyon Watershed. The timber salvage project proposes to remove large snags greater than 21 inches dbh but will retain 3 per acre within salvage units. The BFR Ranger District is proposing to salvage log 250 acres of the Two Bulls Fire. No large snags over 21 inches dbh are proposed for removal and no suitable green nest trees over 21 inches dbh are proposed for removal.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood projects have occurred or may occur in suitable habitat. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading and do not propose to remove large trees >20 inches dbh that could provide suitable nest trees. The projects also do not focus on removing large trees >20 inches dbh. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances over approximately 7,060 acres.

Private lands are not managed for red-tailed hawk habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term. Private lands impacted by the fires were harvested but the impacts had already occurred to potential habitat by the fire. Most of the area harvested in the last several years was a result of fire where habitat had already been impacted.

An estimated 2,424 acres of potentially suitable red-tailed hawk reproductive habitat exist within the Deep Canyon watershed after the impacts of the fires and ongoing vegetation management projects.

The Melvin Butte project proposes treatments within approximately 799 acres of suitable reproductive habitat that. All treatments will retain suitable habitat but will reduce tree densities by thinning from below. Within the DM treatments, individual live trees >21 inches ponderosa pine could be removed on across the associated 63 acres, but will enhance long-term habitat by removing diseased trees that are infecting future stands. Populations are expected to increase within the Deep Canyon watershed as a result of treatments that are reducing the risk of insects, disease, and stand replacing fire to existing suitable habitat. In addition, thinning from below will accelerate the development of future LOS enhancing habitat across the watershed in the long-term.

Although treatments will enhance long-term habitat, the Melvin Butte project does propose treatments within currently suitable red-tailed hawk reproductive habitat. Under both Alternative 2 and 3, treatments are proposed within approximately 32% of red-tailed hawk habitat in the Deep Canyon watershed. With the ongoing forest management projects within the Deep Canyon watershed, there will be less than a 1% reduction in the overall habitat for the red-tailed hawk across the Deschutes National Forest.

Conclusion

The Melvin Butte project does not propose any treatments that highly degrade suitable red-tailed hawk reproductive habitat. Cumulatively under Alternative 2 and 3, ponderosa pine >21 inches dbh will be retained while thinning will focus on smaller trees as well as less desirable tree species. Cumulatively, because this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of the red-tailed hawk is expected on the Deschutes National Forest.

Consistency with the Deschutes LRMP

Wildlife standard and guidelines WL-2 and WL-3 will be assessed. The project is consistent with the Deschutes LRMP (Table 109).

Table 109 Consistency with Forest Plan standards and guidelines for the red-tailed hawk

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-2 – Maintain forested character at least 300 feet surrounding active nest sites.	Meets	There are no known nests within the project area. If a nest is located, measures will be incorporated to meet this standard.
WL-2 – While timber management may occur, maintain at least 4 dominant overstory trees per acre suitable for nest and perch trees, favoring ponderosa pine.	Meets	Snag retention guidelines will be in place to provide for large snag structure. Large green trees expected to live will not be removed with this project.
WL-3 – Seasonal restrictions will be in effect for disturbing activities within ¼ mile of active nests.	Meets	Mitigation measures are in place in the event a nest site is found.

Big Game

Existing Condition

Deer

The most important deer habitats in Eastern Oregon are summer habitat, including areas needed for reproductive activities and winter habitat. Preferred summer habitat provides adequate forage to replace body reserves lost during winter and to maintain normal body functions. Summer habitat also includes areas specifically used for reproductive purposes. These areas must have an adequate amount of succulent vegetation, offering highly nutritional forage. In addition, areas used for reproduction should provide isolation from other deer, security from predators and minimal competition from other ungulates. Summer habitat areas are common throughout Eastern Oregon, and can be found in areas varying from lowland agricultural lands to high elevation mountain areas. Winter habitat is found predominately in lower elevation areas of Eastern Oregon. These areas usually have minimal amounts of snow cover and provide a combination of geographic location, topography, and vegetation that provides structural protection and forage. Due to the low nutritive values of available forage during the winter, deer are forced to rely on their body reserves acquired during the summer for winter survival. (ODFW 2002). (USFS 2012).

The entire Melvin Butte project area is within mule deer summer range. Deer summer range was identified within the Deschutes Land and Resource in forested stands at higher elevations which mule deer occupy from late spring to late fall. High quality forage is essential in summer range, providing nutrients for antler growth, milk production for lactating does, providing energy for the breeding season in late fall and maintaining reserves to assist with winter survival. This type of high quality forage is provided by the development of nutrient rich early seral forbs and shrubs. High quality forage is produced by prescribed and wildfires, and tree thinning which open stands enhancing shrub and forb production by reducing shading.

Two primary Standards and Guidelines which are associated with summer range include hiding cover and open road densities. Hiding cover is a habitat attribute which provides escapement from predation as well as avoidance from harassment potential by hunters and other recreation use. Road densities are used mitigate habitat impacts from vegetation management, and where hiding cover S&G's cannot be met, road densities are used to further eliminate disturbance from an area. The guidelines for hiding cover states, "Hiding area must be present over 30% of National Forest Land in each implementation unit, resulting in 70% of each implementation unit existing as a hiding area or within 600 feet of a hiding area. Black bark stands will not be used to measure conformance". A separate set of guidelines are used to address "Black Bark Pine Management" which are second growth pine stands 60-80 years old. These stands provide very poor quality hiding cover due to the lack of horizontal structure and a single age class of trees. (USFS 2012)

The project is within the Upper Deschutes Wildlife Management Unit (WMU) designated by ODFW. The population objective for mule deer within this WMU is 2,200 wintering deer. Although there has been a precipitous drop in population from 1990 to 2011, buck to doe ratios continue to meet Management Objectives (M.O.) and therefore allowable harvest has not changed from 2,200 available tags. However, due to the decline in the population and low fawn recruitment, very minimal antlerless harvest occurs. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the mule deer is secure globally, nationally, and state wide. (USFS 2012).

The following is a potential list of threats to mule deer habitat identified within their range in the intermountain west as well as the Deschutes National Forets (USFS 2012):

- Vegetative species composition has been modified - Invasive plants replacing native shrubs.

- Vegetative structure has been modified - In the absence of fire, the expansion of juniper woodlands reducing diversity of understory grasses, forbs, and shrubs.
- Nutritional quality has decreased – as plants mature and are not regenerated through a disturbance, the nutritional quality also diminishes.
- Usable habitat has been lost and fragmented due to human encroachment and associated activities – due to urbanization, towns are expanded and developments are built within historic winter range areas. Gas and oil expansion also affects migration and habitat loss. On a local level, due to the size of the Central Oregon Community, motor vehicle collisions and traffic volume have created barriers to mule deer migration and removed segments of the population.
- Poaching- removal of individuals from the population due to poaching is the largest loss of deer above all in Central Oregon.

The following Table 110 addresses Standards and Guides outside of Deer Management Area 7 (Mule Deer Summer Range) specific to the management of functional summer range habitat:

Table 110 Deer summer range Forest Plan standards and guidelines

Hiding Cover: 30% Suitable hiding cover must meet one of the following criteria.	**Open Road Densities**	**Black Bark: 10% of treated stand will be in clumps to provide visual screening throughout and meet the following criteria**
Six acre or larger stand capable of hiding 90% of a standing adult deer at 200 feet.	≤ 2.5 mi. per sq. mile	A minimum of ½ acre in size which have not been thinned or harvested for at least 20 years. Small clumps will be suitable in dense stands but larger (4 or 5 acre) clumps may be needed in more open stands.
Six acres or larger stand with an average height of 6 feet and has not been thinned in 15 years		Clumps will be dispersed throughout the unit so that visual screening is provided by the clumps in a combination with topographic features.
Residual clumps of ½ acre or larger stands within units with advanced regeneration and at least 12 greater than 7 dbh per acre remaining after harvest. Clumps should be located away from roads.		

Through the Forest wide assessment completed for MIS, mule deer hiding cover within the summer range was mapped across the entire Deschutes National Forest. Within the analysis area, approximately 3,394 acres of hiding cover occurs throughout the project area. Approximately 16,999 acres of hiding cover occurs within the Deep Canyon Watershed, approximately 716,957 acres of hiding occurs across the Deschutes National Forest. The following Table 111 summarizes these acreages.

Table 111 Deer hiding cover across the Deschutes National Forest.

Acres of mule deer hiding cover in the Melvin Butte Project Area	**Acres of hiding cover in the Deep Canyon Watershed**	**Acres of hiding cover Across the Deschutes National Forest**
3,394 acres	16,999 acres	716,957 acres

The Melvin Butte project is associated with the Deep Canyon 10th field watershed. Within the summer range associated with the watershed, on average open road densities exist at a level of 3.04 miles per square miles.

Within the watershed, approximately 16,999 acres is identified as summer range. Approximately, 50% of the watershed exists as hiding cover.

Current open road densities within the Melvin Butte project area exist at a level of 5.98 miles per square mile.

Current hiding cover exists over 63% of the Melvin Butte project area.

For the detailed assessment on the Mule Deer for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Elk

The Deschutes NF has one primary allocation for the management of elk habitat on forest. Eleven Key Elk Habitat Areas (KEHAs) occur across the forest to provide optimum habitat conditions for both summering and wintering elk herds. No KEHAs occur within the Melvin Butte project area and therefore no specific standards and guides apply to the project. Although elk do occur within the project area they are very limited in number. Management of hiding cover and open road densities for mule deer will also provide cover and security for this small population of elk. No further analysis of elk habitat will be addressed in this document.

Measures: 1) Acres of hiding cover affected and 2) Miles of open road densities reduced.

Alternative 1 – Ecological Trend

Sumer range habitat is the most important habitat in that it provides the basis of building fat reserves for mule deer, keeping animals healthy and alive through the winter months.

Without treatment, it is expected hiding cover would increase in the short-term with increasing stand densities. In the long-term, as stands mature and stand densities increase so does the risk of insects, disease, and wildfire which has been identified as a major factor contributing to the loss of hiding cover across the Forest. Over the last 10 years, more than 100,000 acres of stand replacing fire has occurred on the Deschutes National Forest, severely impacting cover in the short-term. Disturbance species, such as ceanothus, provide an increased forage opportunity. This forage is only beneficial to deer for approximately 10-15 years when nutrient levels diminish and the forage is no longer beneficial. Shrubs begin to dominate burned stands and provide cover, but in many areas with broken terrain, shrubs are not robust enough to provide viable cover. In the long-term, viable forage in these burned areas can be drastically reduced if fire is not utilized to promote a continuous cycle of regenerating shrubs, and cover is reduced until regenerating stands develop enough to once again provide cover.

Alternative 2 and 3 - Direct and Indirect Effects

Ponderosa Pine Dwarf Mistletoe Treatments (DM), Non-commercial Thinning (P), Thinning From Below (HTH), Mixed Conifer Thinning From Below with Group Openings (MCGO), Mixed Conifer Thinning From Below without Group Openings (MC without openings)

Small tree thinning associated with non-commercial thinning in plantations and thinning understories in dwarf mistletoe treatment areas will reduce dense understories and will result in a reduction of hiding cover. The size of hiding cover patches will be decreased and there will be greater distances between

these patches. This may result in deer being more visible to predators and hunters and may result in higher mortality rates. It will also decrease the thermal cover properties of these patches by altering the microsite climate (warmer in the summer). However, treatments will open up the stands allowing more sunlight to hit the forest floor, which may stimulate herbaceous plant growth increasing summer foraging opportunities.

Thinning from below associated with HTH and MC - without group openings would result in similar impacts as non-commercial thinning. However, there will be additional removal of larger trees, which will reduce hiding. Reduction in overhead canopy will also result in increased snow depths making the transition to winter range slightly more difficult with early snows.

Mixed conifer thinning from below with group opening treatments will result in high edge to cover ratios, which is favorable to big game. This will result in forage being in close proximity to cover especially if openings are small (1 to 3 acres in size). Forage quality will be increased in the openings, which will increase summer foraging opportunities.

Prescribed Burning (B)

Underburning, which may include mowing, may impact both forage quality and quantity as well as hiding cover in the short-term. Mowing and burning in high shrub areas will reduce summer forage opportunities. However, mowing/underburning of shrubs will result in shrub cycling reducing the amount of late seral shrubs that have low nutrient levels, stimulating the growth and development of new early seral vegetation rich in nutrients, aiding the mule deer in fat storage for winter months. The project area contains predominantly late seral ceanothus in the higher elevations with inclusions of mid seral manzanita and bitterbrush at the lower elvations. Mowing/underburning will reset large areas to early seral shrubs of bitterbrush and ceanothus stimulating the growth of herbaceous plant material increasing summer foraging opportunities for the next 10 years. This treatment may also reduce down logs across the project area. Down logs provide cover opportunities for bedding at night and security for fawns while does are away foraging.

Lodgepole Pine Improvement (LPI)

In these areas, the mountain pine beetle has been active over the last 15 years. This treatment proposes to remove trees that have fading crowns and are dying from insects and disease reducing spread to adjacent green stands. The objective is to reduce the rate of spread to green stands enhancing the longevity of the green stands. Activities will not remove hiding cover, however removing fading trees could potentially retain residual hiding cover for a longer period of time. Hiding cover will continue to develop in this area as the lodgepole pine regenerates over the next 10 years providing contiguous stands of hiding cover.

The following Table 112 summarizes the amount of deer hiding cover associated with each action alternative identified for the Melvin Butte project area.

Table 112 Total acres of mule deer hiding cover associated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	483	483
DM	65	-
HTH	587	653
MC – No Group Opening	-	662
LPI	184	184
MCGO	722	-

P	439	439
Total Acres.	**2,480**	**2,421**

Affects to deer hiding cover are similar under Alternative 2 and 3. The outcomes of the affects to cover as a result of each treatment type are also consistent across both action alternatives. Due to the changes in each alternative to address key issues, the ranges of treatments prescribed vary by alternative and directly reflect the total amount of deer cover that will be treated. It was identified that the LPI will not remove cover and therefore will not contribute to the cover calculation by alternative.

Approximately 719 acres of hiding cover will be retained without treatment under Alternative 2 and approximately 779 acres under Alternative 3.

Overall, approximately 2,480 acres of hiding cover is associated with Alternative 2 which will maintain 13% hiding cover across the project area, and approximately 2,421 acres under Alternative 3 maintaining 14% hiding cover.

Lastly, approximately 7.71 miles of road are proposed to be decommissioned under both action alternatives. This will reduce road densities in the project area from 5.98 mile/sq. mile to 4.66 miles/sq. mile. Road decommissioning will reduce road densities limiting the amount of motorized disturbance to deer within the project area, maximizing habitat effectiveness in the newly created foraging areas.

Alternative 2 and 3 – Cumulative Effects

Activities identified in Table 68 (cumulative effects table for wildlife) was reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to big game. The Deep Canyon watershed is being used as the scale for analysis for big game, in particular mule deer summer range and the effects to cover. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within the Deep Canyon Watershed – Rooster Rock (2010), Pole Creek (2012), and the Two Bulls Fires (2104). These fires impacted potentially suitable hiding cover. Not every acre of the fire equated to hiding cover but allof this habitat is now considered unsuitable hiding cover due to the fires intensity (ie: reduced canopy cover).

The Pole Creek Fire Timber Salvage project is ongoing and is salvage logging approximately 54 acres and the Pole Creek Fire Danger Tree Removal project is also salvage logging incidental danger trees along major routes. No hiding cover is associated with salvage logging. The BFR Ranger District is proposing to salvage log 250 acres of the Two Bulls Fire. No hiding cover is associated with salvage units since cover was lost during the fire.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood projects have occurred or may occur in areas containing suitable hiding cover. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading and do not propose to thin dense stands of regenerating trees that provide the higher quality hiding cover. Of all the projects listed, the Ursus project has the highest potential of reducing hiding cover due to the thinning from below in the mixed conifer stands associated with the 5900 acres of project.

Of the 3,394 acres of hiding cover identified within the project area Alternative 2 will treat approximately 2,480 acres and Alternative 3 will treat approximately 2,421 acres of hiding cover, reducing hiding cover in the watershed. Approximately, 42% of the watershed will exist as hiding cover under both alternatives post treatment, exceeding Forest Plan Standards and Guidelines of 30%.

Road densities are in excess of Forest Plan S&G's for deer summer range. The project will decommission approximately7.71 miles of road reducing road densities in the watershed. Although the average road density will still exceed Forest Plan S&G's the project will continue to move road densities toward those S&G's.

Conclusion

The Melvin Butte project is within the Upper Deschutes herd management unit identified by the Oregon Department of Fish and Wildlife. Although the overall population of mule deer has dropped far below management objective, the buck to doe ratio annually meets ODFW objective of 15 bucks per 100 does. Limiting factors for mule deer population as identified within MIS Assessment for Mule Deer is providing quality forage and cover. Summer range habitat is critical for mule deer, where large areas of early seral browse in areas of limited disturbance is extremely important to build fat reserves needed to get deer through the rut and the directly following winter months. (USFS 2012)

The No Action Alternative could affect mule deer and their habitat due lack of early seral forage within the project area and in the Watershed. In the event of a wild fire, areas of early seral forage could be created, but due to road densities all security cover would be lost and deer would be more vulnerable to disturbance and predation.

The Action Alternatives have the potential to benefit mule deer summer habitat. Through prescribed fire treatments, thinning with group openings, and thinning from below with prescribed fire as a follow up treatment, treatments will open stands creating earl seral vegetation providing new areas of summer forage. Hiding cover is maintained through project design, maximizing forage production and providing screening cover for animals to disperse through the project area. Lastly, existing road closures and decommissioning user created roads and trails will further reduce disturbance, increasing the habitat effectiveness of newly created foraging areas. In the long-term Alternative 2 is the most proactive alterative in developing big-game habitat. Treatments are designed to provide long-term foraging opportunities, while retaining existing hiding cover and developing future hiding cover throughout summer habitat.

Treatments associated with the Melvin Butte project will retain 42% of the hiding cover within the summer range associated with the Deep Canyon Watershed. This exceeds the Deschutes LRMP Standards and guides. The overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued

Consistency with the Deschutes LRMP

Wildlife standard and guidelines WL-52 through WL-59 will be assessed for deer. The project is consistent with the Deschutes LRMP (Table 113).

Table 113 Consistency with Forest Plan standards and guidelines for mule deer.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-52 – Provide conditions to support at least 2200 deer within the Upper Deschutes Unit.	Meets	Closing roads to reduce human disturbance.
WL-53 – Target open road densities are 2.5 miles per square mile to achieve deer summer range habitat effectiveness targets.	Moving Towards	Resulting open road densities are still above the recommended densities. However, this project will continue to decommission 7.71 miles of roads contributing to road density reductions.

WL-54 – Hiding areas must be present over at least 30% of National Forest land in each implementation unit.	Meets	Hiding cover will exist over approximately 42% of the Deep Canyon Watershed.
WL-55 – Hiding areas will be dispersed throughout the implementation unit.	Meets	Residual untreated stands are retained throughout the project area.
WL-56 - Travel corridors will be provided by linking stands (to assist in meeting hiding cover needs).	Meets	Untreated stands were designated to provide connectivity throughout the project area.
WL-57 – Hiding areas are assumed to provide suitable thermal cover conditions on summer range.	Meets	Untreated stand exceed canopy cover and tree heights to provide thermal cover.
WL-58 – If possible, a narrow strip of trees should be left along roads to reduce view distances.	Meets	Thinning will be implemented in a mosaic fashion to retain small untreated clumps and will be integrated with retention stands. Therefore retaining screening along roads.
WL-59 – Approximately 10% of treated black bark pine stands will be in clumps that will provide visual screening throughout the area.	Meets	Mosaic thinning and untreated stands of black bark pine will be retained exceed the retention standards for black bark ponderosa pine. No wildlife clumps will be left within the 600' defensible space corridor along the private property boundary of Cascade Forest.

Birds of Conservation Concern

In January 2001, President Clinton issued an executive order on migratory birds directing federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitats. Federal agencies were required within two years to develop a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service to conserve migratory birds including taking steps to restore and enhance planning processes whenever possible. To meet this goal in part the U.S. Fish and Wildlife Service developed the Birds of Conservation Concern released in December 2002 (USFWS 2002) and an update to the original list was released in 2008 (USFWS 2008a).

Birds of Conservation Concern are species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. Birds of Conservation Concern encompasses three distinct geographical scales – North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs), USFWS Regions, and the National scale which represents species that have the highest conservation priorities in the United States, including the island "territories" in the Pacific and Caribbean.

Bird species considered for inclusion on lists in this report include non-game birds, game birds without hunting seasons, subsistence-hunted non-game species in Alaska, landbirds, shorebirds, waterbirds, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species. While all of the bird species included in BCC are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing. The goal is to conserve avian diversity in North America and includes preventing or removing the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2008a). The 2008 lists were derived from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Conservation concerns stem from population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors.

Bird Conservation Regions (BCRs) were developed based on similar geographic parameters and are the basic units within which all bird conservation efforts should be planned and evaluated (USFWS 2008a). One BCR encompasses the Melvin Butte project area – BCR 9, Great Basin. See Table 114 for a list of the bird species of concern for the area, the preferred habitat for each species, and whether there is potential habitat for each species within the Melvin Butte project area.

Table 114 BCR 9 (Great Basin) BCC 2008 list.

Bird Species	Preferred Habitat	Habitat within the Melvin Butte Project Area (Y or N)
Greater Sage Grouse (Columbia Basin DPS)	Sagebrush dominated Rangelands	No
Eared Grebe (non-breeding)	Open water intermixed with emergent vegetation	No
Bald Eagle	Lakeside with large trees	No
Ferruginous Hawk	Elevated Nest Sites in Open Country	No
Golden Eagle	Elevated Nest Sites in Open Country	No
Peregrine Falcon	Cliffs	No
Yellow Rail	Dense Marsh Habitat	No
Snowy Plover	Dry Sandy Beaches	No
Long-billed Curlew	Meadow/Marsh	No
Marbled Godwit	Marsh/Wet Meadows	No
Yellow-billed Cuckoo	Dense riparian/cottonwoods	No
Flammulated Owl	Ponderosa pine forests	Yes
Black Swift	Cliffs associated with waterfalls	No
Calliope Hummingbird	Open mountain meadows, open forests, meadow edges, and riparian areas	No
Lewis's Woodpecker	Ponderosa pine forests	Yes
Williamson's Sapsucker	Ponderosa pine forests /Mixed Conifer Large Snags	Yes
White-headed Woodpecker	Ponderosa pine forests	Yes
Loggerhead Shrike	Open country with scattered trees or shrubs	No
Pinyon Jay	Juniper, juniper-ponderosa pine transition, and ponderosa pine edges	No
Sage Thrasher	Sagebrush	No
Virginia's Warbler	Scrubby vegetation within arid montane woodlands	No
Green-tailed Towhee	Open ponderosa pine with dense brush	No
Brewer's Sparrow	Sagebrush clearings in coniferous forests/bitterbrush	No
Black-chinned Sparrow	Ceanothus and oak covered hillsides	No
Sage Sparrow	Unfragmented patches of sagebrush	No
Tricolored Blackbird	Cattails or Tules	No
Black Rosy Finch	Rock outcroppings and snowfields	No

Landbird Strategic Plan

The Forest Service has prepared a Landbird Strategic Plan (USDA 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The primary purpose of the strategic plan is to provide guidance for the Landbird Conservation Program and to focus efforts in a common direction. On a more local level, individuals from multiple agencies and organizations with the Oregon-Washington Chapter of Partners in Flight participated in developing publications for conserving landbirds in this region. A Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington was published in June 2000 (Altman 2000), A Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington was published in March 2000 (Altman and Holmes 2000), and A Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington was published in May 2000 (Altman 2000). These documents outline conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades and the focal species associated with each habitat type. These documents provide recommendations for habitat management. The East-Slope Cascades Strategy covers the Deschutes National Forest and the forest is contained within the Central Oregon subprovince. See Table 115 for specific habitat types highlighted in these documents, the habitat features needing conservation focus and the focal bird species for each.

A Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington

Table 115 Priority habitat features and associated focal speices for the East Slop Cascade Strategy.

Habitat	Habitat Feature	Focal Species for Central Oregon	Habitat within the Project Area (Y or N)
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker	Yes
	Large trees	Pygmy nuthatch	Yes
	Open understory with regenerating pines	Chipping sparrow	Yes
	Patches of burned old forest	Lewis' woodpecker	Yes
Mixed Conifer (Late-Successional)	Large trees	Brown creeper	Yes
	Large snags	Williamson's sapsucker	Yes
	Interspersion grassy openings and dense thickets	Flammulated owl	Yes
	Multi-layered/dense canopy	Hermit thrush	Yes
	Edges and openings created by wildfire	Olive-sided flycatcher	Yes
Lodgepole Pine	Old growth	Black-backed woodpecker	Yes
Whitebark Pine	Old growth	Clark's nutcracker	No
Meadows	Wet/dry	Sandhill Crane	No
Aspen	Large trees with regeneration	Red-naped sapsucker	No
Subalpine fir	Patchy presence	Blue Grouse	No

Cavity Nesters (Woodpeckers) on the Deschutes National Forest

In addition, the Deschutes LRMP identifies all Cavity Nesting Birds that occur on the Forest as a Management Indicator Species. There are 11 species of cavity nesters that occur on the Deschutes National Forest. Table 116 contains the list of bird species.

Table 116 Cavity nesters (woodpeckers).

Habitat	Species	Habitat Occurs in the Melvin ButteProject Area (Y or N)
Lodgepole pine - old growth	Black-backed woodpecker	Yes
Deciduous/mixed deciduous and conifer or riparian - Aspen or riparian cottonwood	Downy woodpecker	No
Ponderosa pine/mixed conifer - open stand open canopies	Hairy woodpecker	Yes
Ponderosa pine - burned forest	Lewis' woodpecker	Yes
Various conifer forest habitats - open stands large tree structure, forest edges	Northern flicker	Yes
Mixed conifer-Late seral Grand fir/white-fir type, multi-layered canopy	Pileated woodpecker	Yes
Ponderosa pine - large trees	Pygmy nuthatch	Yes
Various conifer forest - mature and old growth forest only.	Red-breasted nuthatch	Yes
Aspen with ponderosa pine - Riparian aspen or cottonwood	Red-breasted sapsucker	No
Aspen - large trees with regeneration	Red-naped sapsucker	No
Sub-alpine and alpine forests-old forests of lodgepole pine, grand-fir/white-fir, Engelmann spruce/subalpine fir, whitebark pine, and mountain hemlock. Also post fire habitats	Three-toed woodpecker	Yes
Ponderosa pine - large trees	White-breasted nuthatch	Yes
Ponderosa pine - old growth forest with large snags	White-headed woodpecker	Yes
Mixed Conifer - large trees	Williamson sapsucker	Yes

Following effects analysis address potential impacts to Bird of Conservation Concern, Land Bird Focal Species and MIS woodpecker. The bald eagle, white-headed and Lewis' woodpeckers were addressed in Biological Evaluation for TES species and therefore will not be addressed in this effects analysis.

Ponderosa Pine – Large Trees and Snags – Pygmy Nuthatch, Red-breasted nuthatch, white-breasted nuthatch, and Chipping Sparrow

Existing Condition

The pygmy nuthatch is a resident of ponderosa pine forests east of the Cascades but outside the breeding season, is found just outside the ponderosa pine zone. The red-breasted nuthatch is most abundant in old-growth and mature conifer forests during the breeding season in the Cascade Range but can be found in younger stands at variable densities. The red-breasted nuthatch forages on tree trunks and main branches (Marshall et al. 2003). The white-breasted nuthatch is found in two main habitat types in Oregon – oak and ponderosa pine (Marshall et al. 2003). East of the Cascade crest, they are sympatric with both the red-breasted and pygmy nuthatches (Marshall et al. 2003). They use cavities excavated by woodpeckers or those formed by decay in both live and dead trees for nesting and roosting, but nest primarily in live

trees (Marshall et al. 2003). All species are closely associated with mature or old growth ponderosa pine forests but may be found in mixed conifer forests dominated by ponderosa pine. Pygmy and white-breasted nuthatches excavate their own cavities. Nuthatches forage on the outer branches in the upper canopy on needle clusters, cones, and emerging shoots with some limited foraging on bark. (Marshall et al. 2003). Risks to these species include loss of mature ponderosa pine forests, fire suppression resulting in overstocked stands and reduced snag recruitment, salvage logging, and chemical use (Marshall et al. 2003).

The chipping sparrow is an uncommon to common summer resident preferring open habitats with a shrub or grass component. Chipping sparrows prefer open coniferous forests or stands of trees interspersed with grassy openings or low foliage (Marshall et al. 2003 pp. 538-540). In central Oregon, good numbers of chipping sparrows can be found in juniper, ponderosa pine, and lodgepole pine communities but are not present in sagebrush (Marshall et al. 2003 pp. 540-542). This sparrow breeds in scattered locations in the Cascades and throughout higher elevations of eastern Oregon. The diet of this sparrow is not well known. A study conducted for central Oregon (Eastman 1960 in Marshall et al. 2003) shows a preference for weed seeds. Declines in populations have been noted from Breeding Bird Survey (BBS) results (1966-2000) for the chipping sparrow showing a 3.9% decrease per year. Some reasons for this decline includes habitat changes due to fire suppression resulting in closed canopy habitat, cowbird parasitism, and competition with house sparrows and house finches.

The conservation status based on the Nature Serve ranking indicate the pygmy nuthatch and white-breasted is secure at globally, nationally, and state wide. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the red-breasted nuthatch is secure at globally, nationally, and state wide. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the chipping sparrow is ranked as Least Concern globally, nationally, and state wide.

Habitat for these species occurs throughout the Deschutes National Forest. Approximately 316 acres of habitat exists within the project area. Approximately 1,272 acres of habitat occurs within the watershed and approximately 243,364 acres of habitat occurs across the Deschutes National Forest. Table 117 summarizes these acreages:

Table 117 Habitat for these species within the Melvin Butte Project area, the watershed and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
316 acres	1,272 acres	243,364 acres

Measure: Acres of suitable reproductive habitat affected for the Nuthatches, and chipping sparrow.

Alternative 1 – Ecological Trend

The ecological trend is that snag habitat would continue to be provided in the short and long-term. Previously treated stands would continue to grow providing future late-structural habitat. Untreated dense stands would continue to see increased snag recruitment through tree mortality from natural disturbances such wildfire, wind events, insect and disease pathogens, and lightning. High tree density in some of the ponderosa pine and mixed conifer stands would not only retard the development of large diameter (>21”) ponderosa pine and white-fir trees and future snags but also may hasten the development of smaller diameter snags and coarse woody material as a result of mortality from bark beetles, disease, or fire. Large snags and downed logs would continue to be limited for the nuthatches. The increased fire risk

would also put these limited habitat features at risk. If a high intensity wildfire burns through the planning area, habitat for many of these species would be lost.

Habitat for species that are more dependent on closed canopies and dense understories (i.e. red-breasted nuthatch) will continue to increase over time. At higher elevations white-fir will continue to out compete ponderosa pine resulting in increased stand densities and loss of late successional conditions over time. This will eventually result in fewer large snags and down woody material on the landscape and fewer nesting sites. Loss of ponderosa pine results in fewer foraging opportunities for species like the pygmy nuthatch that 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. Increased stand densities is a major factor in the decline of chipping sparrow habitat, which can be directly tied to fire suppression over the last 100 years. Stand densification as a result of no action would continue to be a factor in habitat loss.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Prescribed Burning (B) Non-commercial Thinning (P) and Scenic Views Enhancement

Thinning from below (HTH) will occur within both second growth “black bark” ponderosa pine stands as well as multi-storied ponderosa pine stands containing old growth. Within black bark pine stands thinning will promote heterogeneity by mosaic thinning. Thinning will occur on trees >8 inches dbh retaining the largest and healthiest trees in the stands. The objective of mosaic thinning is to try to replicate how the stand would be spatially arranged under natural fire scenarios, creating skips, gap, and small clumps of unthinned trees. Within multi-storied stands, thinning from below will occur, reducing ladder fuels to the overstory, reducing the competition for resources promoting the longevity of the old growth in the stand. Small diameter trees with old growth form will be retained. Treatment objectives will retain LOS characteristics in the stand, but also continuing to recruit large trees into the overstory perpetuating old growth ponderosa pine habitat. Non-commercial thinning treatments will primarily remove material <8”dbh and in some cases up to 12” dbh material in advanced regeneration plantations.

Within the Scenic View treatment, the primary objective is to reduce the fuel loading associated with stand replacing mortality from the Pole Creek Fire. These stands will remove fuel concentration to meet the Scenic Views objective in the Deschutes Forest Plan. Treatments will retain individual snags throughout the corridor primarily removing pockets of burned lodgepole pine. No green trees will be removed from this project.

The objective of prescribed fire is to reduce fuel loading to create a continuous mosaic of burned and unburned habitat. Treatments may unintentionally burn existing snags, however new snags could also be recruited through this process. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008).

Table 118 summarizes the amount of habitat associated with treatments under each action alternative for the Melvin Butte project.

Table 118 Total acres of habitat assoicated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	83	83
HTH	29	34
P	151	151
Scenic Views Enhancement	39	39
Total Acres.	**302**	**307**

Overall, approximately 302 acres of habitat are associated with treatments identified under Alternative 2 and approximately 307 acres under Alternative 3.

Within ponderosa pine and mixed conifer stands dominated by ponderosa pine overstory structural diversity will remain, but understory complexity will be reduced through follow up treatments to deal with slash generated for activities such as mowing, and burning. Fuels treatments associated with harvest treatments could potentially be beneficial as treatments reduce understory complexity, promoting a more herbaceous understory increasing an insect prey base. Although foraging habitat will be reduced in the short-term, for species such as the chipping sparrow through the removal of regenerating pines in the understory, some residual habitat will remain providing foraging opportunities. Since treatments are primarily thinning from below, habitat for the nuthatches will be retained. Although overall stand densities will be reduced, fully stocked over-story stands will remain post-treatment, continuing to provide foraging opportunities. Long-term benefits of treatments will be a reduction of stress to the overstory promoting the longevity of large tree structure and the limited residual old growth, but also promoting the development of future old growth in the stand that will provide long-term reproductive habitat.

Similarly, in PCT units within ponderosa pine containing advanced regeneration, treatment will reduce some foraging habitat but will not remove any residual large trees. These stands are very homogenous and overstocked, and treatments will promote stand heterogeneity through variable density thinning. Treatment will accelerate the development of large tree structure promoting the development of future nesting and foraging habitat for all these species, but could remove some foraging habitat for the chipping sparrow and white-breasted nuthatch the use younger stands for foraging habitat in the short-term.

In the long-term, treatments associated with Alternative 2 and 3 are the most proactive in promoting the development of more fire resistant stands.

See DecAid Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Alternative 2 and 3 – Cumulative Effects

Activities identified in Table 68 were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to pygmy nuthatch, white-breasted nuthatch, and chipping sparrow. The Deep Canyon watersheds will be used to discuss cumulative impacts to these species.

Three large wildfires have occurred within the Deep Canyon Watersheds – Rooster Rock (2010), Pole Creek (2012), and Two Bulls (2014). Approximately 54 acres of ongoing salvage is occurring within the Pole Creek Fire as well as the site specific salvage of fire killed danger trees along major routes. The BFR is proposing 250 acres of fire salvage associated with the Two Bulls Fire. These two fire salvage project are removing fire killed trees from stand replacing fire area. These areas did not provide habitat for the pygmy nuthatch, white-breasted nuthatch, or chipping sparrow.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood project have occurred or may occur in suitable

habitat. The Bear Wallow and Bend Municipal Watershed Hazardous Fuels reduction projects focus primarily on removing dead lodgepole pine among green stands to reduce fuel loading. The majority of the activity would occur in lodgepole pine habitat but some occurs in mixed conifer. The Ursus project primarily occurs in mixed conifer habitat and focuses on retaining and promoting ponderosa pine in mixed conifer stands. The project focuses on thinning stands from below to restore and enhance ponderosa pine and mixed conifer stands while reducing the risk of stand replacing fires. Treatments proposed will reduce the risk of loss of existing nesting and foraging habitat from future large-scale disturbances. Overall, these projects primarily occur in approximately 7,060 acres of mixed conifer and lodgepole pine habitat types within the Deep Canyon watershed. These plant association groups do not provide highly suitable habitat for these species and therefore will minimally degrade habitat.

Private lands are not managed for habitat. Therefore, it is assumed that any habitat provided by private timberland in the watershed is incidental and may not be long term.

Of the 316 acres of reproductive habitat identified within the project area, Alternative 2 treatments are associated with approximately 302 acres of reproductive habitat and approximately 307 acres under Alternative 3.

Of the 1,272 acres of reproductive habitat within the Watershed, cumulatively Alternatives 2 and 3 are associated with approximately 23% of the total habitat.

The two alternatives will thin, mow and burn approximately <1% of the total habitat across the Deschutes National Forest.

Conclusions

Treatments associated with the ponderosa pine PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that these species need for nesting and foraging. However, through project design c, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide foraging opportunities.

Overall, implementation of the action alternatives as well as other projects across the district should result in improved habitat conditions for those species dependent on large ponderosa pine habitat which could lead, to increased populations. Cumulatively there will be a decrease in dense understory habitat; these changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat species and a decline in open pine habitat species. Some snag habitat will be lost, however measures are in place to minimize effects.

Although treatments will thin stands that are currently suitable reproductive habitat, the Melvin Butte project will not contribute to a change in viability for the species within the Watershed or on the Deschutes National Forest for these species.

Cumulatively, with the ongoing forest management projects within the Deep Canyon Watershed none of the projects propose to remove large snags or LOS habitat types. There will be less than a 1% of the overall habitat associated with treatments across the Deschutes National Forest. Implementation of this project will not contribute to a change in viability for these species on the Deschutes National Forest.

Landbird Conservation Strategy Consistency

Biological objectives are all based on “where ecologically appropriate” meaning actions must occur within the proper habitat addressed in order to be consistent or not (Table 119).

Table 119 Consistency with Forest Plan guidelines and standards for cavity nesters.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
In Ponderosa Pine Stands and Mixed Conifer Dominated by Ponderosa Pine: **Pygmy Nuthatch** **Chipping Sparrow** **Other species to benefit from objectives: White-breasted Nuthatch, Red-breasted nuthatch**	PYGMY NUTHATCH		
	Provide a mean of 10 trees/acre >21”dbh and at least 2 trees >31”dbh	Yes	Treatment will not target large ponderosa pine except where diseased trees are hindering the development of future Late and Old Structure stands. In such a case sufficient large trees will be left to me this objective.
	Provide a mean of 1.4 snags/acre >8”dbh with 50% >25”dbh in a moderate to advanced state of decay	Yes	Due to the amount of mortality within the watershed sufficient snags will exist to meet this requirement as well as those retained in the project area.
	CHIPPING SPARROW		
	Interspersion of herbaceous ground cover w/shrub and regen pine patches	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-20% of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat
	20-60% cover in shrubs (including small trees) and >20% of shrub layer in regen saplings conifers, mean canopy cover 10-30%	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-20% of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat
	Ensure a mix of understory conditions such that 10 to 30% of the landscape meets site level conditions as describe above	Yes	10 to 20% of the project area will be retained in untreated stands and will meet site level conditions as described

Mixed Conifer, Edges and Openings Created by Wildfire – Olive-sided Flycatcher and Hairy Woodpecker

Existing Condition

The olive-sided flycatcher is a summer resident that breeds in low densities throughout coniferous forests of Oregon. The hairy woodpecker is a resident in forests throughout Oregon except for juniper. The olive-sided flycatcher, an aerial insectivore, prefers forest openings or edge habitats where forest meets meadows, harvest units, rivers, bogs, marshes etc. (Marshall et al. 2003). Similar to the flycatcher, the hairy woodpecker is found primarily in mixed conifer and ponderosa pine forests adjacent to deciduous stands but is most common in burns or areas infested with mountain pine beetles (Marshall et al. 2003).

There is some preference for older stands for the hairy woodpecker and where old trees are absent, they prefer thinned stands. Nesting success for the flycatcher was highest within forest burns where snags and scattered tall, live trees remain (Marshall et al. 2003 and Wisdom et al. 2000 p. 215). Common features of nesting habitat include tall prominent trees and snags used as foraging and singing perches. The flycatcher forages from high prominent perches at the tops of snags or from the uppermost branches of live trees and needs unobstructed air space to forage. It preys on flying insects and in particular, bees and wasps. (Marshall et al. 2003 pp. 374-375). The hairy woodpecker nests in dead trees with light to moderate decay and their diet consists of beetles, ants, spiders, and other insects (Marshall et al. 2003).

Population trends based on BBS data show highly significant declines with an Oregon statewide decline of 5.1% per year from 1966-1996 for the olive-sided flycatcher. Factors potentially contributing to population declines on breeding grounds include habitat loss through logging, alteration of habitat through management activities (e.g., clearcutting, fire suppression), and lack of food resources. (Marshall et al. 2003 p. 376). Wisdom et al. (2000 p. 218) also noted that where altered fire regimes result in fewer but larger fires, the juxtaposition of early and late seral habitats becomes less favorable. However, the Columbia Basin (Southern Cascades) shows increases of >60% for the olive-sided flycatcher compared to other areas. BBS data (1966-2000) for Oregon show no significant decline for the hairy woodpecker (0.5% decline per year).

The conservation status based on the Nature Serve ranking indicates the hairy woodpecker is secure globally, nationally, and state wide. (USFS 2012)

The conservation status based on the Nature Serve ranking indicates the olive-sided flycatcher is near threatened, through the International Union for Conservation of Nature (IUCN) Red List of threatened species.

Habitat for the olive-sided flycatcher and hairy woodpecker occurs throughout the Deschutes National Forest. Through the Forest wide assessment completed for MIS, hairy woodpecker reproductive habitat was mapped across the entire Deschutes National Forest and will be used as a surrogate for the olive-sided flycatcher. Approximately 1,398 acres of habitat exists within the project area. Approximately 4,517 acres habitat occurs within the Watershed and approximately 507,920 acres of habitat occurs across the Deschutes National Forest. Table 120 summarizes these acreages:

Table 120 Habitat or the olive-sided flycatcher and hair woodpecker within the Melvin Butte Project area, watershed and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
1,398 acres	4,517 acres	507,920 acres

For the detailed assessment on the hairy woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of suitable habitat affected for olive-side flycatcher and hairy woodpecker.

Alternative 1 – Ecological Trend

Overtime, stocking density in suitable habitat would continue to increase, thus decreasing natural openings and associated habitat components needed by the olive-sided flycatcher and hairy woodpecker. Existing dense stands would continue to fall apart due to tree mortality, creating openings which may provide future habitat. This alternative would leave the stands in a dense condition, making them susceptible to fire, which could benefit the hair woodpecker by providing early post-fire habitat it needs. However, the olive-sided flycatcher needs a mosaic of burned and unburned habitat and there is a risk that

green trees would not be left due to the intensity of the fire. Approximately, 40% of the Sisters Ranger District has been impacted by wildfire over that past 15 years, which the majority of the wildfires have occurred in the mixed conifer plant association group. In the short-term the hairy woodpecker has benefited from the pulses of high quality foraging habitat that the burned forest provides. However, within five years post fire the majority of the insect activity subsides and foraging greatly diminishes. Although the dead trees provide nesting habitat, hair woodpecker densities greatly diminish in these post fire habitats due to the lack of foraging opportunities.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer Thinning with Group Openings (MCGO), Mixed Conifer Thinning without Group Openings (MC-without openings), Non-commercial Thinning (P), Prescribed Burning (B) and Scenic Views Enhancement.

Commercial thinning (HTH) and Mixed Conifer Thinning with and without group openings (MCGO and MC - without openings) will consist of primarily thinning from below removing trees >8”dbh. Treatments will focus on maintaining the overstory trees in pure ponderosa pine and mixed conifer stands providing overstory large tree structure for both olive-sided fly catcher and hairy woodpecker. Treatments will retain and promote the development of overstory ponderosa pine reducing site competition. Within mixed conifer treatments these stands are dominated by small trees and will focus on reducing stand densities primarily removing second growth lodgepole pine and white-fir, favoring healthy white-fir and ponderosa pine. This treatment will result in the accelerated growth of residual trees while reducing the fire hazard. Long-term beneficial impacts of small tree thinning will be the reduction of habitat fragmentation by promoting the development of LOS habitat which includes large snags at an accelerated rate which will promote nesting habitat for both olive-side flycatcher and hairy woodpecker. Short-term beneficial impacts will be seen in the reduction of risk to existing suitable habitat to olive-sided flycatcher and hair woodpecker. This treatment will beneficial to the both species by creating large snags over the long-term to be utilized as nesting and beneficial to hairy woodpecker for foraging habitat. In addition, with Mixed Conifer Thinning with group opening, small group opening of approximately 1-3 acres in size will be created. This will beneficial to olive-sided flycatcher by creating small opening and associated edge for foraging on the wing. In addition, isolated large snags adjacent to the opening will provide highly suitable nesting habitat for the olive-sided flycatcher.

Non-commercial thinning (P) will occur within ponderosa pine plantations that are approximately 20 to 40 years old. Treatments will consist of removing material primarily <8”dbh and occasionally up to 12” dbh material in advanced regeneration plantations. These plantations do not provide high quality habitat for the hairy woodpecker or olive sided flycatcher. However, due to overstocking isolated pockets of insect out breaks occur in these stands providing some foraging habitat. In addition, small pockets of small snags (approximately 1/2 acre to 1 acre in size) also occur providing some nesting opportunities. In the long-term, thinning will reduce stand densities promoting the development of LOS ponderosa pine, recruiting large snags and creating more highly suitable reproductive habitat in these area.

Scenic Views Enhancement was developed to meet the scenic views Forest Plan standards and guides for the 16 road corridor. Treatments will remove small dense patches of fire killed trees to enhance the visual quality of the foreground. Small diameter fire killed trees are the focus, retaining all live trees and large snags to benefit scenic quality and maintain existing habitat. Treatment will not reduce reproductive habitat, however will minimally reduce some foraging habitat for both species by removing dense pockets of small fire killed trees.

The objective of prescribed fire is to reduce fuel loading by using prescribed fire to create a continuous mosaic of burned and unburned habitat. Treatments may unintentionally burn existing snags, however new snags could also be recruited through this process. Mortality of snags in ponderosa pine habitat

during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). This treatment would be beneficial to both olive-sided flycatcher and hairy woodpecker. Treatments will create a mosaic of green and dead trees providing both foraging and nesting opportunities for both species.

Table 121 summarizes the amount of habitat associated with treatments under each action alternative for the Melvin Butte project.

Table 121 Total acres of olive-sided flycatcher and hairy woodpecker habitat assoicated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	253	253
HTH	310	336
MC – No Group Opening	-	36
LPI	27	27
MCGO	36	-
P	493	493
Scenic Views Enhancement	41	41
Total Acres	**1,160**	**1,186**

Overall, approximately 1,160 acres of habitat are associated with treatments identified under Alternative 2, and approximately 1,186 acres under Alternative 3. Alternative 2 is the most proactive on the landscape; this alternative does the best job at breaking up fuel continuity and maintaining large tree habitat adjacent to forest edges.

Overall, implementation of the action alternatives will maintain existing habitat conditions for olive-sided flycatcher and hairy woodpecker by maintaining and enhancing the development of large tree structure across the project area. Treatments reduce the risk of losing existing habitat to stand replacing fire. Under Alternative 2, through thinning, small openings will create and provide some edge habitat while retaining a fully stocked overstory for perch trees. Treatments will not preclude use of the project area by the olive-sided flycatcher and hairy woodpecker. These changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat species and a decline in open pine habitat species.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Alternative 2 and 3 – Cumulative Effects

Activities identified in Table 68 (cumulative effect table for wildlife) was reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to the hairy woodpecker, or olive-sided fly catcher reproductive habitat. The Deep Canyon Watershed is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within or partially within the Deep Canyon watershed –Rooster Rock (2010), Pole Creek (2012), and Two Bulls Fire (2014). Approximately 54 acres of the Pole Creek Salvage are ongoing and approximately 250 acre is being proposed to salvage associated with the Two Bulls Fire. Danger tree removal occurred on all the fires mentioned above to varying degrees resulting in a reduction of potential nest sites in stand replacement areas along main roads. Fire salvage directly impacts hairy woodpecker nesting and foraging habitat by removing fire killed that provide high quality foraging habitat in the first 5 years post fire while bark beetles are highly active as well as removing suitable nest snags. Fire salvage can also remove suitable nesting habitat for olive-sided flycatcher, when snags are removed along edge habitat directly adjacent to green unburned forests.

Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood projects have occurred or may occur in suitable habitat. These projects focus primarily on removing dead lodgepole pine among green stands to reduce fuel loading, some of the activity are also associated with mixed conifer habitat. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. There are approximately 7,060 acres associated with these projects, within the Deep Canyon watershed. Treatment within these area focus primarily on reducing stand densities by thinning from below and removing concentration of dead lodgepole pine from bark beetle outbreaks. Treatments in these project areas could reduce hairy woodpecker habitat by removing dead and dying lodgepole pine that provide both foraging and nesting opportunities. Where these project thin around large green ponderosa pine and large ponderosa pine snags, treatments will be beneficial to nesting and foraging habitat for the olive-sided flycatcher.

Overall, implementation of the action alternatives as well as other projects within the watershed should result in improved habitat conditions for those species dependent on open canopy forest habitats which could lead, over time, to increased populations. Cumulatively there will be a decrease in dense understory habitat; these changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions.

Conclusion

Cumulatively, with the ongoing forest management projects within the Deep Canyon watershed, none of the projects propose to remove large snags within the mixed conifer and ponderosa pine habitat types except any posing hazard to operations under OSHA guidelines. Because this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of hairy woodpecker is expected on the Deschutes National Forest.

Landbird Conservation Strategy Consistency

Biological objectives are all based on “where ecologically appropriate” meaning actions must occur within the proper habitat addressed in order to be consistent or not (Table 1220.

Table 122 Consistency with Forest Plan standards and guidelines for cavity nesters.

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Olive-sided Flycatcher **Other species to benefit**	Where ecologically appropriate in mixed conifer through natural events or management maintain: >2% of landscape as post-fire habitat	Not applicable	This is not a post fire salvage project.

from objectives: **Hairy Woodpecker**	Where ecologically appropriate in mixed conifer through natural events or management maintain: >40% of the post fire landscape as unsalvaged.	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: in burns >100 acres, salvage <50% of standing dead and down	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20”dbh and >50% of those 12-20”dbh	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20”dbh and >50% of those 12-20”dbh	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: patches with a mix of live and dead trees/snags to provide potential nesting trees in context of potential foraging and perch trees	Not applicable	The project is not a fire salvage project.

Mixed Conifer, Large Trees and Snags –Pileated Woodpecker, Brown Creeper, Hermit Thrush, Flammulated Owl, and Williamson’s Sapsucker

Existing Condition

The brown creeper is the only North American bird that relies on both the trunk and bark of trees for nesting and foraging. The pileated woodpecker is limited attitudinally by habitat availability as the higher and lower elevations lack enough large trees for nesting, roosting and foraging. The brown creeper is found predominantly in coniferous forests but can be located in hardwood stands as well. Pileated woodpeckers occur primarily in dense mixed conifer forests in late seral stages and are rarely found in pure ponderosa pine stands. Brown creepers nest under loose, sloughing bark of large diameter snags with little to moderate decay. The mean diameter of nest trees range from 16” dbh to 42” dbh. In northeastern Oregon, creeper abundance was positively associated with the height of the canopy and density of trees. (Marshall et al. 2003 pp.453-456). Adams and Morrison (1993) found similar results with creepers being highly correlated with mature-aged stands with moderate overall stand density.

Pileated woodpeckers need large diameter snags or live trees with decay for nesting and roosting sites, large diameter logs for foraging on ants and other arthropods, and dense canopy to provide cover. Creepers seem to be fairly common but forest management practices, especially the loss of large diameter snags and live trees, may cause a threat to this species. BBS data (1966-1991) for the pileated woodpecker shows no significant change. Risks include activities that eliminate or reduce the number of snags, logs, and cover. In addition, conversion of fir stands to pure ponderosa pine reduces suitable habitat. (Marshall et al. 2003).

The hermit thrush is an uncommon to common summer resident preferring mid to high elevation mature and old growth forests at mid to high elevations. The hermit thrush breeds in mature forests of all types especially those with a shaded understory of brush and small trees ranging from aspen groves to juniper

woodlands to moderately open coniferous forests. Higher densities of hermit thrushes have been reported in old-growth riparian stands relative to other mature and young riparian stands. The hermit thrush nests on the ground or use small trees in the understory. They are ground foragers of insects; however fruits and berries may also be consumed especially during migration and in winter. Populations seem to be stable at this time. Microsites selected for foraging tend to have little to no vegetation or litter. Threats to the hermit thrush include the loss of mature forests and controlled burning of forest understories, especially spring burning. Hermit thrush responses have been known to decrease after fires (Sallabanks 1995). (Marshall et al. 2003 pp. 483-485 and 487-489).

Williamson's sapsuckers are highly adaptable and are able to withstand considerable disturbance. Populations seem to be fairly stable however, snag removal remains the primary threat for this species (Marshall et al. 2003). Williamson's sapsuckers are weak excavators and select for the soft and decayed wood for nest sites regardless of tree species (Marshall et al. 2003). Williamson's sapsuckers are summer residents east of the crest and are most often found in ponderosa pine during the breeding season (Marshall et al. 2003). However, east of the cascade the majority of mixed conifer forests are ponderosa pine dominated, and the Williamson's sapsucker is dependent on large ponderosa pine snags for nesting.

Flammulated owl habitat also includes dense patches of saplings or shrubs used for roosting. The flammulated owl forages exclusively at night primarily for nocturnal arthropods (USDA 1994b). Little is known on the population status of the flammulated owl to indicate significant population declines (Marshall et al. 2003).The flammulated owl is unique in the Pacific Northwest. It preys almost exclusively on insects and is a neotropical migrant. The flammulated owl and Williamson's sapsucker breed on the eastern slope of the Cascades and are found in mature to old growth forests with limited understories at mid to high elevations (Marshall et al. 2003).

The project area contains mixed conifer habitat containing the large tree structure needed by these species. However, due to the small size of the project and proposed treatments there is limited effects to habitat as a result of proposed treatments.

The conservation status based on the Nature Serve ranking indicate the pileated woodpecker is secure globally, nationally, and state wide. (USFS 2012)

The conservation status based on Nature Serve ranking indicates the brown creeper, flammulated owl, and hermit thrush are "least concern" for these species.

The conservation status based on the Nature Serve ranking indicate the Williamson's sapsucker is secure at globally, nationally, and state wide. (USFS 2012)

Through the Forest wide assessment completed for MIS, pileated woodpecker reproductive habitat was mapped across the entire Deschutes National Forest and will be used as a surrogate for the brown creeper, hermit thrush, Williamson's sapsucker, and flammulated owl. Approximately 1,216 acres of habitat exists within the project area. Cumulatively, approximately 4,890 acres habitat occurs within the Watershed and approximately 243,364 acres of habitat occurs across the Deschutes National Forest. **Error! Reference source not found.**summarizes these acreages:

Table 123 Habitat within the Melvin Butte Project area, watershed, and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
1,216 acres	4,890 acres	243,364 acres

For the detailed assessment on the pileated woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of suitable habitat affected for pileated woodpecker, brown creeper, hermit thrush, flammulated owl, and Williamson's sapsucker.

Alternative 1 – Ecological Trend

Under the No Action stand densities would increase and perpetuate the loss of large structure over time, which these species require for suitable nesting and foraging habitat. In dense stands, increased competition for nutrients will prolong the development of large trees. Nest site availability for the pileated woodpecker, brown creeper, hermit thrush, and flammulated owl will be limited, increasing competition for existing sites leading to greater predation risks. Increased stand densities may increase the risk of loss from fire.

The Williamson's sapsucker would see a decrease over-time as stands begin to deteriorate; this species is a weak excavator and feeds on sap wells of smaller diameter trees but utilizes large snags for nesting. Dense stands of large and small diameter green trees would deteriorate in the short-term. Due to stand densities very few large trees would develop over the long-term and large snags for nesting would be limited in the project area.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer Thinning From Below with and without Group Openings (MCGO and MC-without openings), Lodgepole Improvement (LPI), Scenic Views Enhancement

There are no known direct impacts to any of the above listed species as a result of any action alternatives. However, indirect impacts exist from the removal of green trees 21 inches and greater associated with thinning from below in mixed conifer/ponderosa pine (HTH, MCGO, and MC-without openings). Large trees identified for removal in these treatment types will primarily be white-fir that are competing with large diameter ponderosa pine for nutrients or are creating ladder fuels to overstory ponderosa pine. Treatments will also reduce habitat by removing overstory white-fir to break up fuel continuity in mixed conifer stands, the average diameter for removal is 14 inches dbh in these stands. Do to the fiberous nature of white-fir and how quickly it decays it tends to be a species that is commonly observed being excavated by pileated woodpecker on the district and provides nesting, roosting, and foraging habitat for the other previously mentioned species. Although treatments will favor ponderosa pine, residual white-fir will remain as clumps and individual trees in areas they are not competing with overstory ponderosa pine. In addition large snags are not targeted for removal, but there is a possibility for incidental loss of snags during treatments. Generally, snags would be avoided during treatments, but incidental removal would occur, as OSHA regulations require removal of snags that pose hazard to operations.

The LPI treatments will also treat some deteriorating white-fir. Treatments are focused on removing unhealthy lodgpole pine from stands to reduce beetle mortality to green stands and promote residual tree vigor. Although treatments will remove commercial size trees they will primarily be smaller diameter trees, therefore some minor impacts to reproductive habitat is expected. Minimal effects are anticipated due to the limited amount of habitat associated with this treatment type.

Prescribed burning would also occur. In the short-term these treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established trees, increasing the stands resiliency to wildfire. The objective is to create a mosaic of burned and unburned areas, creating a discontinuous distribution of fuel throughout the project areas. Due to the removal of shrubs from prescribed burning this treatment has the potential to reduce reproductive habitat for the hermit thrush. However, fuels treatments could also enhance flammulated owl foraging habitat by promoting grass/forb/shrub complexities which will increase insect production over the long-term.

The Scenic Views Enhancement treatment was developed to meet Scenic Views objectives associated with the 16 road corridor. As a result of the Pole Creek Fire this area received stand replacing fire, to meet forest plan standards and guides, areas containing high densities of small dead trees will be removed to enhance scenic quality. All green trees and large snags that contribute to visual quality will be retained. This treatment will not likely reduce reproductive habitat or future habitat since all green trees and large snags will exist post treatment.

In the remaining 45% of untreated habitat, there will continue to be an increased risk from disturbance, although breaking up the fuel continuity across the landscape will reduce the risk of a large scale disturbance event. In addition some of the areas identified for no treatment occur within higher site potential areas (i.e. Riparian Reserves); these sites are capable of producing large trees with greater canopy closure and are directly adjacent to the areas that are currently suitable habitat. These areas have the potential to provide habitat.

Table 124 summarizes the amount of habitat associated with treatments under each action alternative for the Melvin Butte project.

Table 124 Total acres of reproductive habitat associated with each treatment type by alternative for the Melvin Butte Project.

Treatment Type	Alternative 2	Alternative 3
B	278	278
HTH	357	417
MC – No Group Opening	-	52
LPI	18	18
MCGO	53	-
Scenic Views Enhancement	60	60
Total Acres	**766**	**825**

Overall, approximately 766 acres of habitat are associated with treatments identified under Alternative 2 and approximately 825 acres associated with Alternative 3. These areas are primarily multi-storied stands dominated by large trees.

In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity, reducing the risk of larger scale disturbance events. Approximately 65% of the identified habitat is associated with vegetation treatments. However, treatments do not propose to remove large trees and snag that are important habitat components to these species. Treatment will not preclude use of habitat by these species. Overall, the treatments described above will aid in the development of a more resilient landscape as well as habitat to disturbance.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Alternative 2 and 3 – Cumulative Effects

Activities identified in Table 68 were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to the cavity nesters that utilize mixed conifer habitat with large trees and snags. The Deep Canyon watershed will be used to discuss cumulative impacts to these species.

Three large wildfires have occurred within the Deep Canyon Watershed –Rooster Rock (2010), Pole Creek (2012), and Two Bulls Fires (2014). Approximately 54 acres of salvage logging are ongoing within the Pole Creek Fire and approximately 250 acres of salvage logging is being proposed within the Two Bull Fire. Danger tree removal has occurred or will occur on all the fires mentioned above to varying degrees resulting in a reduction of potential nest sites in stand replacement areas along main roads. Creating areas with limited nesting opportunities.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood project have occurred or may occur in suitable habitat. The Ursus project, Bend Municipal Watershed Hazardous Fuels reduction project, and Bear Wallow Firewood project all focus primarily on reducing fuel loads by removing dead lodgepole pine and white-fir among green stands, some of the activity could occur in mixed conifer habitat but will primarily occur in lodgepole pine habitat. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. There are approximately 7,060 acres associated with these projects, none of these projects propose to remove large snags within mixed conifer.

Treatments associated with the mixed conifer PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that these species need for nesting and foraging. In mixed conifer habitat dominated by ponderosa pine, the project will also manage stands by thinning from below, but will favor the ponderosa pine to develop a more fire resistant stand containing large ponderosa pine as the dominant species. Treatment will maintain large white-fir in the overstory, except where it is the dominant species and then ponderosa pine will be promoted. Through project design criteria, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide foraging opportunities for species like these species of birds associated with mixed conifer habitat.

Overall, implementation of the action alternatives as well as other projects across the district should result in improved habitat conditions for these species dependent on large tree mixed conifer habitat. Cumulatively, these project primarily focus on the removal of dense understory stands; they do not propose to removed large snags and trees therefore minimal impacts will occur to habitat associated with pileated woodpecker, brown creeper, hermit thrush, and flammulated owl and Williamson's sapsucker. However, dead and dying trees in the medium size classes (averaging approximately 12 - 14 inches dbh) will be removed to reduce fuel concentrations, potentially removing some foraging opportunities. Although they are not large snags these medium sized snags do provide some limited nesting opportunities. All projects and associated treatments will maintain healthy ponderosa pine and white-fir, promoting a more fire resilient mixed conifer stand and minimizing the risk of losing more landscape to wildfire, creating unsuitable habitat to the pileated woodpecker, brown creeper, and hermit thrush and Williamson's sapsucker. Large untreated blocks of habitat have been retained throughout the project area to provide habitat connectivity as well as retention of habitat within each treatment unit. The project will promote long-term habitat for these species by reducing the risk of stand replacing fire, and promoting the development of large tree structure in mixed conifer stands.

Although treatments will thin stands that are currently suitable reproductive habitat, the Melvin Butte project does not propose to remove large trees and large snags that is associated with reproductive habitat within the Watershed or on the Deschutes National Forest for the pileated woodpecker, brown creeper, hermit thrush, Williamson's sapsucker, and flammulated owl.

Conclusion

Cumulatively, with the ongoing forest management projects within the Deep Canyon watershed none of the projects propose to remove large trees and snags within the mixed conifer and ponderosa pine habitat

types. Although the Melvin Butte project will treat approximately 65% of the suitable reproductive habitat for the pileated woodpecker within the project area, treatment will not target habitat component such as large trees and snags within the project area. The project does not propose to removes stand elements that contribute to reproductive habitat for the pileated woodpecker, the project is associated with 3% of the total suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The changes to habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of the pileated woodpecker is expected on the Deschutes National Forest.

Landbird Conservation Strategy Consistency

Biological objectives are all based on "where ecologically appropriate" meaning actions must occur within the proper habitat addressed in order to be consistent or not (Table 125).

Table 125 Consistency with Forest Plan standards and guidelines for pileated woodpecker, brown creeper, hermit thrush, flammulated owl and Williamson's sapsucker.

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
	BROWN CREEPER		
Brown Creeper **Hermit Thrush** **Flammulated Owl** **Williamson's Sapsucker** **Other species to benefit from objectives:** **Pileated Woodpecker**	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: blocks of late-successional habitat >75 acres	Meets	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: >4 trees/acre >18"dbh with at least 2 trees >24"dbh	Meets	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
	HERMIT THRUSH		
	Where ecologically appropriate initiate actions in mixed conifer to maintain or provide: patches of forest with multi-layered structure and a dense understory shrub layer	Meets	Patches of mixed conifer will remain untreated. In areas that are proposed for treatment the goal is to move stands towards historical condition.
	FLAMMULATED OWL		
	>10 snags/100 acres, >12in. dbh and >6ft. tall	Yes	No ponderosa pine snags will be targeted for removal in ponderosa pine thinning and Mixed conifer dry thinning

	>20 trees/8 acres, >21 in. dbh to function as recruitment snags	Yes	This project proposes to thin stand from below favoring ponderosa pine >20 in. dbh for retention where it occurs. The exception is ~200 acres of mixed conifer where overstory treatments focus on trees with an average diameter of 14 inches dbh. No large trees exist in these stands.
	WILLIAMSON'S SAPSUCKER		
	1 snag /acre, >18 in. dbh in ponderosa pine	Yes	Within ponderosa pine treatment, the focus will be thinning of green trees, no ponderosa pine snags are targeted for removal
	Mean canopy cover 25-75%	Yes	The project will thin stand from below, residual canopy closures will exist on the low end of the range, except within mixed conifer thinning with group openings. Group opening will occur at a level of 1-3 acres in size and will not exceed 30% of treatment units.

Coniferous Forests – Edges – Northern Flicker

Existing Condition

The northern flicker is a common resident throughout Oregon and is encountered in almost any terrestrial habitat. It is generally most abundant in open forests and forest edges adjacent to open country while they tend to avoid dense forest (Marshall et al. 2003). There is some evidence the flicker prefers older mature forests. Reinkensmeyer (2000 in Marshall et al. 2003) noted the preference for old growth versus mid-successional western juniper in central Oregon. Most nests in forested areas are found in older, open forests, along older forest edges, and in large diameter remnant snags (Marshall et al. 2003). They also tend to nest in trees with moderate to heavy decay. The flicker diet consists of ants, beetles, crickets, other insects, fruits, and seeds and they prefer to forage on the ground (Marshall et al. 2003). BBS data (1966-2000) for Oregon show a non-significant decrease of 0.6% per year decline. The flicker requires open space and may gain foraging habitat from human caused changes but the presence of decayed wood is still required. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the orthern flicker is secure globally, nationally, and state wide level. (USFS 2012)

Approximately 365 acres of reproductive habitat exists within the project area. Approximately 3,036 acres of habitat occurs within the Deep Canyon watershed and approximately 219,576 acres of habitat occurs across the Deschutes National Forest. Table 126 summarizes these acreages:

Table 126 Northern flicker habitat within the Melvin Butte Project area, watershed and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
365	3,036 acres	219,576 acres

For the detailed assessment on the northern flicker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of suitable habitat affected for Northern flicker

Alternative 1 – Ecological Trend

Increased stand densities perpetuates the problem of losing large structure over time from competition and disturbance events, which this species requires for suitable nesting and foraging habitat. It also limits available nest sites, resulting in more competition for existing sites between species. Increased stand densities may increase the risk of loss from fire. This species requires snags for nesting and generally utilizes larger snags associated with older mature forests. In the event of fire existing snags are lost and replaced with hard snags. Currently there are a limited number of large trees available for potential use. Replacement large trees are a concern. Many of the future habitat trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size. In the short-term as over-stocked stands die and openings are created, flicker use could increase, but due to the lack of large trees, the longevity and utility of the small snags that will occur in these stands are limited. Individual large trees which provide potential habitat are surrounded by dense patches of smaller trees with some shrubs in the understory. Competition for nutrients and water makes these trees more susceptible to insects and disease. In addition, large trees within densely stocked stands are more susceptible to wildfire, due to increased fuel loadings and ladder fuels from 100 years of fire suppression. Large trees will continue to be at an increased risk to insect, disease, and wildfire.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH) Mixed Conifer Thinning From Below with and without Group Openings (MCGO and MC-without openings), Non-commercial thinning (PCT) Scenic Views Enhancement.

The northern flicker is a generalist in that it utilizes a variety of habitat types effectively and resides at varying elevations. It nests in mature late structure stands, and forages in open areas that provide insects, seeds, and fruiting plants. Flickers primarily forage on the ground, but will also excavate. Although they are an excavator they typically excavate for nesting. Past regeneration harvest that created large openings provided areas more likely to be utilized by the flicker; however these regeneration harvests are about 40 years old and understory stand densities have grown up and do not provide these open habitat types any longer. The thinning and fuels treatments planned under the action alternatives within both mixed conifer and ponderosa pine are designed to reduce the risk of high intensity wildfires in the short-term. In addition treatments will retain residual late and old structure stand characteristics that exist throughout the project area and promote the development of late and old structured (LOS) habitat throughout the project area in the long-term. Treatments will thin the plantations, opening these areas up for use by the flicker in the short-term, and promote the development of large tree structure in these plantations in the long-term which will recruit large snags to be used as nesting habitat. The action alternative will remove dead and dying trees in mid-seral mixed conifer stands to break of fuel continuity across the project area. Treatment will maintain the largest and healthiest trees in the overstory, continuing to provide large structure to be recruited as nesting habitat and enhance habitat by reducing stand densities to provide better foraging opportunities and access to the forest floor.

With the exception of the occasional felling of snags that may pose a hazard to human safety during thinning operations associated with mature ponderosa pine stands, thinning operations would have no direct effects to snags or coarse woody material habitats. Commercial harvest would directly affect green tree replacements by reducing the number of trees in treatment units. However the units would retain more than sufficient green tree replacements to exceed levels for snag recruitment in the long-term. Thinning would open up areas, and the indirect effects of treatments include healthier stands, but could reduce some foraging opportunities in the short-term. In addition through prescribed burning, there is the potential to recruit overstory snags and down wood in the short-term that could enhance nesting and foraging habitat in mature ponderosa pine stand.

The objective of prescribed fire is to reduce fuel loading by using prescribed fire to create a continuous mosaic of burned and unburned habitat. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). Similarly outcomes are expected with the Melvin Butte project. The majority of these stands have not been burned for decades and this will be the first entry with prescribed fire. This treatment will be beneficial to the flicker from both a foraging and nesting stand point. Prescribed burning will remove herbaceous vegetation, providing ample opportunities for ground forage for the flicker and snag recruitment in the overstory which will also provide both nesting and foraging opportunities.

Table 127 summarizes the amount of habitat associated with treatments under each action alternative for the Melvin Butte project.

Table 127 Total acres of flicker habitat associated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	84	84
HTH	31	35
MC – No Group Opening	-	12
MCGO	12	-
P	162	162
Scenic Views Enhancement	41	41
Total Acres.	**330**	**334**

Overall, approximately 330 acres of habitat are associated with treatments identified under Alternative 2, and approximately 334 acres under Alternative 3. Both alternatives are similar however, Alternative 2 is more proactive in creating more fire resilient stands within mixed conifer by removing fading white-fir by creating small group opening and planting them to ponderosa pine. Overall treatments are fairly small on the landscape (<1% at the Forest scale and 1% at the watershed level) and very little habitat is associated with treatments.

Proposed treatments would reduce the risk of high intensity wildfire by thinning the understory, and reducing the ladder fuels that make the area susceptible to a stand replacing fire. Treatments would accelerate stand development providing long-term habitat for the flicker which prefers a variety of habitat

types but focus on mature stands. Although the recruitment of dead wood habitats would be slow, silvicultural treatments would provide beneficial indirect effects by promoting faster growth of green tree replacements, ultimately providing larger diameter snags and down wood over the next 30+ years. As the stands age, additional snags and logs would develop, providing a higher diversity of habitat and structure. As a result, stands would contain more abundant nesting habitat. In the short-term, commercial thinning from below and thinning of plantations with advance regeneration will reduce the dense understory in the ponderosa pine and mixed conifer stands, which could promote ground foraging for the flicker.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Alternative 2 and 3 – Cumulative Effects

Activities identified in Table 68 (cumulative effect table for wildlife)was reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to northern flicker reproductive habitat. The Deep Canyon watershed is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Three large wildfires have occurred within the Deep Canyon Watershed – Rooster Rock Fire (2010), Pole Creek Fire (2012), and Two Bull Fire (2014). Approximately 54 acres of ongoing fire salvage is occurring in the Pole Creek Fire and approximately 250 acres of fire salvage is proposed within the Two Bulls Fire where the fires are associated with the Deep Canyon watershed. Danger tree removal has occurred or will occur on all the fires mentioned above to varying degrees resulting in a reduction of potential nest sites in stand replacement areas along main roads. The Two Bulls Fire proposes to salvage 250 acres of stand replacing fire within ponderosa pine habitat within Deep Canyon watershed. The fire salvage will only remove snags less than 20 inches dbh. Pole Creek and Two Bulls fire salvage both remove snag habitat that will reduce potential reproductive habitat for the northern flicker.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood project have occurred or may occur in suitable habitat. The Ursus, Bend Municipal Watershed Hazardous Fuels reduction, and Bear Wallow Firewood project focus primarily on removing dead lodgepole pine among green stands to reduce fuel loading, some of the activity could occur in mixed conifer habitat but will primarily occur in lodgepole pine habitat. The Overall, treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. There are approximately 7,114 acres associated with these projects, none of these projects propose to remove large snags, however they will be removing medium size snags averaging approximately 14 inches dbh. The treatments will remove concentrations of dead lodgepole pine and white fir to break up the fuel continuity in the project areas. Treatments will remove habitat, but large snags will be retained on an individual basis to maintain snags habitat throughout the project areas.

Conclusion

Cumulatively, because this project impacts less than 1% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of the northern flicker is expected on the Deschutes National Forest.

American Marten

Existing Condition

Martens are closely associated with forested habitats that have complex physical structure near the ground (Buskirk and Powell 1994, Bull et al. 2005, Slauson et al. 2004 and 2007). Open areas, such as

regeneration logging units, recent severely burned areas, and natural openings are avoided, especially during the winter. Martens cross and re-cross their own tracks to investigate micro habitat features, such as stumps, logs, and brush piles that might contain food. They often use fallen logs as runways (Clark et al. 1987). Forested riparian habitats are used disproportionately higher than they are available, which indicates their importance as travel corridors (Bull and Heater 2005, Buskirk et al. 1989). (USFS 2012)

Much of their time during winter is spent resting or hunting beneath the snow in subnivean spaces created by physical structure close to the ground. This complex structure is more characteristic of older forest structural stages than younger forests. These conditions are also more characteristic of moist and cold forest types where fire return intervals are greater, allowing time for dead wood to be recruited and accumulate. Large logs may be particularly important as winter resting structures (Bennett 1984). (USFS 2012)

Martens are extremely susceptible to predation and are reluctant to venture into openings (Buskirk and Powell 1994). Martens seem to be sensitive to patch size, and usually avoid open habitats dominated by grasses, forbs, and saplings, especially in winter. These areas do not provide the structure necessary for a network of travel ways under the snow, nor do they offer access to this subnivean zone. A lack of overstory cover offers little protection from predators. These open habitats also have more severe microclimatic conditions than areas with forest canopy cover (Buskirk and Powell 1994). (USFS 2012)

Older aged forests often provide overstory cover from avian predators and the means to escape avian and mammalian predators (Bull and Heater 2001). Because marten avoid openings and prefer larger forest patches (Chapin et al.1998 and Hargis et al.1999), habitat fragmentation may lead to isolation of local populations too small for long term viability (Gibilisco 1994). (USFS 2012)

Marten use a variety of structures for resting and denning sites. Resting and denning sites offer protection from predation and thermal stress; thus, availability of quality denning sites likely increases the rates of survival and fecundity in marten (Raphael and Jones 1997). A variety of structures are used for dens, with trees, logs, and rocks accounting for 70 percent of the reported den structures. In virtually all cases of dens in trees, snags, or logs, dens were found in large structures characteristic of late-successional forests. In the Blue Mountains, marten selected for specific habitat as determined by comparing used sites with available and unoccupied sites ($p<0.01$) (Bull et al. 2005). Stands used by martens had higher densities of large snags greater than 20 inches dbh and trees greater than 10 inches dbh. They selected unharvested, closed canopy (50-75%), old-structure stands in subalpine fir and spruce forests. Northern aspects in upper slopes and drainages were selected for. In the Cascades, marten selected sites with higher canopy closure during snow periods than during snow-free periods (Raphael and Jones 1997). In Oregon, canopy closure at rest sites in lodgepole pine dominated stands averaged 36% in snow periods and 27% in snow-free periods. (USFS 2012)

Raphael and Jones (1997) found that down wood and slash piles were important resting and denning structures in the eastern Cascades of central Oregon. Forests in their study area were dominated by lodgepole pine. (USFS 2012)

The current conservation status of the American marten as listed by NatureServe, as secure nationally and globally, but the Oregon Department of Fish and Wildlife Sensitive Species List status is Vulnerable which signifies that the species is facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled in a specific geographic area or the state, but could become so with continued or increased threats to populations and/or habitats.

Historically the primary threat to marten range-wide was loss of source habitat through conversion to early seral stages by logging or wildfire. The Land and Resource Management Plan (LRMP) for the Deschutes National Forest went into effect in 1990 and the LRMP recognized the current mountain pine

beetle epidemic was killing thousands of acres of lodgepole pine forest and removing habitat for marten. In the early 2000s uncharacteristic wildfires contributed to additional loss of habitat on the forest. Thousands of acres of dead and dying trees created conditions suitable for stand replacement wildfires that increased in acreage to 46,660 acres during the 1990s decade and mushroomed to 190,000 acres during the 2000-2010 decade. While not all of this acreage was suitable marten denning habitat, much of the fire acreage in both decades was in mixed conifer and mountain hemlock plant associations that provided marten resting, foraging, and denning habitat. The majority of the acreage occurred on the north end of the Deschutes National Forest, Sisters Ranger District. Most of the fire acreage was defined as stand replacement that removed the overstory as well consuming much of the coarse woody debris on the ground and standing snags. This combination removed marten foraging, resting, and denning suitability on tens of thousands of acres and has likely had the greatest impact on marten on the Deschutes National Forest over the last 20 years the DLRMP has been in place. (USFS 2012)

The Melvin Butte project contains very little marten habitat due to the fact that there is only minor amounts of mixed conifer wet and lodgepole pine PAGs in the project area. Marten habitat occurs in the project area at higher elevation mixed conifer, mountain hemlock, and residual green lodgepole pine stands. This habitat is contained in the western end of the project area and occurs above 5400 feet. Marten probably avoid the ponderosa pine and mixed conifer dry PAGs due to the more open nature of the stands and their tendency to avoid openings (Ruggerio et al. 1994). These stands also lack complex horizontal structure typically found in more mesic forest conditions and along riparian reserves. However, they may use the area for dispersal in a north to south continuum along the slopes of the Cascades. Some individual blocks of habitat occur in mixed conifer dry stands and although it is marginal habitat, the habitat was identified based upon the overstory canopy cover the stands provide.

Through the Forest wide assessment completed for MIS, American marten reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 968 acres of habitat exists within the project area. Approximately 6,168 acres of habitat occurs within the Deep Canyon watershed, and approximately 435,607 acres of habitat occurs across the Deschutes National Forest. The following Table 128 summarizes these acreages:

Table 128 American martin habitat within the Melvin Butte Project area, Deep Canyon Watershed, and across the Deschutes National Forest.

Acres of Habitat in the Melvin Butte Project Area	Acres of Habitat in the Deep Canyon Watershed	Acres of Habitat Across the Deschutes National Forest
968 acres	6,168 acres	435,607 acres

Denning habitat was modeled in Wildhab using all plant association groups (PAGs) except juniper and ponderosa pine without the presence of lodgepole pine. Only dense stands were considered denning habitat except in the lodgepole pine and dry cold white fir PAGs where open and dense were deemed suitable for denning. Those PAGs where lodgepole pine is an early seral species were also considered suitable denning habitat. Minimum dbh was defined as equal to or greater than 5 inches (Class 3) for lodgepole pine and equal to or greater than 15 inches (class 5) for the other PAGs.

For the detailed assessment on the marten for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Measure: Acres of reproductive habitat affected for marten

Alternative 1 – Ecological Trend

Within the Deep Canyon watershed within the lodgepole pine community, a mountain pine beetle out break occurred killing 90% of the lodgepole pine stands from 2001 to 2008, with beetle mortality

continuing to date. Very little canopy cover occurs in these stands making marten susceptible to predation, rendering these stands unsuitable habitat. Overtime, as dead trees are recruited as down logs, these concentrations of down logs accumulate and subnivean foraging and resting opportunities will be provided for the marten. Within mixed conifer stands, areas that currently provide suitable marten habitat would most likely have increased mortality due to tree stress from competition. Without the treatments prescribed to thin from below within multi-storied mixed conifer stands, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the short-term, available denning habitat will be limited and in the long-term the future development late and old structure characteristics would be prolonged as well as stands containing sufficient canopy cover to provide protection from predation.

Stand resilience to insects, disease, and wildfire is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition/no action 92% of these stands are above the Upper Management Zone and are at risk or currently be impact by insects and disease due to high stand densities and as a result low resiliency. Approximately 29% (1,571 acres) of the project area is within the wet mixed conifer PAG, approximately 10% (531 acres) in lodgepole pine PAG, and <1% (8 acres) in the mountain hemlock PAG.

Across the Deschutes National Forest, landscape scale fires have created a decline of marten habitat over the last 10 years. These fires have consumed large areas of mixed conifer stands due to fuel concentration and stand densities associated with the mixed conifer PAG's. A stand replacing fire event would remove marten habitat, and would take several decades to re-establish suitable marten habitat.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/denning habitat which is likely to be at a much higher rate than if stand densities were reduced to more healthy levels.

Alternative 2 and 3 - Direct and Indirect Effects

Thinning From Below (HTH), Mixed Conifer Thinning From Below With and Without Group Openings (MCGO and MCW/OGO)

Thinning in suitable marten habitat would occur in mixed conifer stands containing residual old growth trees. Thinning from below (from 8" dbh and up) will favor ponderosa pine and healthy white-fir. The target basal area is between 40 to 60 square feet post treatment but will vary from 40 to 140 square feet for dominant overstory tree species in each stand. Where stands are dominated by white-fir, basal areas will be higher, as residual overstory white-fir will be left in aggregate patches and as individual trees. Different scenarios exist depending on alternative and the existing basal area, site productivity, and stand structure objectives. This treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by removing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands. Negative impacts may result from more open stands, reducing the canopy cover and potentially making the marten more susceptible to predation. Beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. This treatment will not remove any snags or down wood unless the snag poses a hazard during operations. Snag cavities utilized by marten are often white-fir snags excavated by

pileated woodpeckers. Treatments will maintain the largest and healthiest white-fir to provide future snags and down wood.

Due to the removal of ponderosa pine from past management activities within the areas identified for MCGO treatment, stands are comprised primarily of white-fir and lodgepole pine. These tree species are not fire resistant and due to mountain pine beetle outbreaks in the project area, much of the lodgepole pine is dead. As a result of the mortality in these stands, canopy closure is low reducing the amount of suitable reproductive marten habitat and increasing fueling loading in these areas. White-fir is also a short-lived species, and highly susceptible to insects and disease, and many of the white-fir in these stands are declining from mistletoe. The project proposes to remove the overstory and promote ponderosa pine within these stands where it previously existed, creating a more fire resilient mixed conifer stand in the long-term. To maintain habitat for the marten as well as other species dependent on interior forest habitat, through mosaic thinning, healthy white-fir will be retained as individuals and in clumps. High densities of small dead trees (<7" dbh) that contribute to fuel loadings may be removed, but the large snags meeting habitat requirement >10inches dbh will be retained to provide short-term habitat for rest site opportunities. Negative impacts may result from more open stands by removing dense patches, creating areas where marten are more susceptible to predation. Long-term beneficial impacts should result from treatments by reducing risk to existing suitable habitat and facilitating the development of more fire resistant future habitat by promoting the development of ponderosa pine in these stands. Where interlocking crowns remain in the overstory, marten use will continue due to the security and overstory structure that the stands will continue to provide.

Lodgepole Pine Improvement (LPI)

LPI treatments will also treat some mixed conifer habitat. Treatments are focused on removing unhealthy lodgepole pine from stands to reduce beetle mortality to green stands and promote gree tree vigor. Although treatments will remove commercial size trees they will primarily be smaller diameter trees that will be removed, therefore this will be a minor impact to reproductive habitat associated with these species. Minimal effects are anticipated due to the limited amount of habitat associated with this treatment type.

Prescribed Burning (B)

Prescribed burning is also proposed. These treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established trees, increasing the stands resiliency to wildfire. The objective is to create a mosaic of burned and unburned areas, creating a discontinuous distribution of fuel throughout the project areas. Although burning could reduce down log concentrations, snags will likely be created and will be recruited as down wood in the short-term. Treatments will reduce the risk of stand replacing fire which has greatly impacted marten habitat across the district due to the loss of interior forest habitats.

Scenic Views Enhancement

The Scenic Views Enhancement treatment was developed to meet Scenic Views objectives associated with the 16 road corridor. As a result of the Pole Creek Fire this area received stand replacing fire, to meet forest plan standards and guides, areas containing high densities of small dead trees will be removed to enhance scenic quality. All green trees and large snags that contribute to visual quality will be retained. This treatment will not likely reduce reproductive habitat or future habitat since all green trees and large snags will exist post treatment.

Table 129 summarizes the amount of marten reproductive habitat associated with each action alternative identified for the Melvin Butte project.

Table 129 Total acres of marten reproductive habitat assoicated with each treatment type by alternative.

Treatment Type	Alternative 2	Alternative 3
B	207	207
HTH	325	383
MC – No Group Opening	-	50
LPI	17	17
MCGO	50	-
Scenic Views Enhancement	50	50
Total Acres.	**649**	**707**

Affects to marten habitat are similar under Alternatives 2 and 3. The outcomes of the affects to habitat as a result of each treatment type are also consistent across both action alternatives. The project area and habitat varies greatly from north to south due to the change in elevation and inherent soil quality within this north to south pattern. To capture the importance of habitat variation across the project area, the project area was broken up into three productivity zones north to south. A habitat retention strategy was defined where in the low elevation ponderosa pine approximately 10% of area would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine/ mixed conifer dry habitat with moderate site productivity approximately 15% of this landscape would be left in untreated stands and aggregate patches, and within the high elevation mixed conifer wet stands with high site productivity, approximately 20% of this landscape would left in untreated stands and aggregate patches. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments and maintain marten habitat over time.

Overstory structural diversity will be reduced in MCGO and MC-no openings units but will remain in HTH units and understory complexities will be reduced through follow up fuels treatments to deal with slash generated from thinning activities. Fuels treatments associated with harvest treatments may have impacts to martens and their prey species. Although prey habitat will be reduced in the short-term, some residual habitat will remain providing foraging opportunities for the marten. Long-term benefits of treatments will be a reduction of stress to the overstory promoting the longevity of the residual large tree structure, but also promoting the development of future old growth in stands that will be thinned from below, providing long-term habitat. Similarly, in a meta-analysis by Fontaine and Kennedy 2012, the analysis showed that surrogate fuels treatments (thinning and prescribed fire) in fire prone forests, increased vertebrate biodiversity.

Affected habitat varies little between each alternative and these differences are insignificant.

There are approximately 4,456 acres that have the potential to receive vegetation treatments. As a result of both action alternatives, 90% of these stands will be below the Upper Management Zone. Treatment will greatly increase stand resiliency to insects, disease, and wildfire through stand density reductions.

Overall, approximately 649 acres of marten reproductive habitat are associated with treatments identified under Alternative 2 and approximately 707 acres under Alternative 3 totaling 70% of the existing reproductive habitat in the project area. The majority of these treatments will occur in the wet mixed conifer PAG. Thinning and burning will reduce snag and down wood structural complexities that contribute to marten reproductive habitat. Thinning will reduce the overall canopy closure associated with these areas with the goal of crown fire reduction. Although burning will recruit snags and down wood, slash treatment associated with these stand will decrease overall down wood level in the stands minimally meeting Forest Plan objectives. Marten reproductive habitat will be reduced within the project area, however a full stocked overstory will remain post treatment. Although these stands may not meet the need for marten denning habitat, these areas will still provide avenues for dispersal.

See snag and down wood analyses to review the projects effect to dead wood habitat as it relates to the marten.

Alternative 2 and Alternative 3 – Cumulative Effects

Activities identified in Table 68 were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to the marten. The Deep Canyon watershed will be used to discuss cumulative impacts to this species.

Three large wildfires have occurred within the Deep Canyon Watershed –Rooster Rock (2010), Pole Creek (2012), and Two Bulls Fires (2014). Approximately 54 acres of salvage logging are ongoing within the Pole Creek Fire and approximately 250 acres of salvage logging is being proposed within the Two Bull Fire. Danger tree removal along main roads has occurred or will occur on all the fires mentioned above to varying degrees. Salvage activities and danger tree abatement will occur within areas of stand replacing fire in Pole Creek Fire Salvage and does not provide marten habitat. Also the Two Bulls Fire Salvage occurs in low elevation ponderosa pine, therefore does not occur within marten habitat.

Activities proposed under the Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Firewood project have occurred or may occur in suitable habitat. The Ursus project, Bend Municipal Watershed Hazardous Fuels reduction project, and Bear Wallow Firewood project all focus primarily on removing dead lodgepole pine among green stands to reduce fuel loading, some of the activity could occur in mixed conifer habitat but will primarily occur in lodgepole pine habitat. Treatments proposed will reduce the risk of loss of existing habitat from future large-scale disturbances. There are approximately 7,115 acres associated with these projects, none of these projects propose to remove large snags within mixed conifer, however treatments associated with these projects will contribute to an overall reduction in canopy closure. The objectives of these treatments are to reduce the risk of crown fires on the landscape, post treatment habitat suitability will diminish for marten. In areas containing concentration of snags and down logs, these concentrations will be removed and therefore will lack dead wood complexities that provide marten habitat. Minimally treatment will meet Forest Plan standards and guides for snags and down logs. Where green stands exist, fully stocked stands will be retained post thinning, minimally providing dispersal opportunities for marten. However, treated stands will likely not provide denning opportunities.

Treatments associated with the mixed conifer PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that this species needs for denning. In mixed conifer habitat dominated by ponderosa pine, the project will also manage stands by thinning from below, but will favor the ponderosa pine to develop a more fire resistant stand containing large ponderosa pine as the dominant species. Treatment will maintain large white-fir in the overstory, except where it is the dominant species and then ponderosa pine will be promoted. Through project design criteria, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide habitat for marten.

Overall, implementation of the action alternatives as well as other ongoing projects in the Deep Canyon Watershed should result in improved habitat conditions for this in the long-term. Cumulatively, in the short-term there will be a decrease in dense understory habitat; reducing denning and foraging opportunities. Treatments will maintain healthy white-fir in the overstory promoting a more fire resilient mixed conifer stand and minimizing the risk of losing more landscape to wildfire, creating unsuitable habitat for marten. Large untreated blocks of habitat have been retained throughout the project area to provide habitat connectivity as well as retention of habitat within each treatment unit. The project will promote long-term habitat for this species by reducing the risk of stand replacing fire, and promoting the development of large tree structure in mixed conifer stands.

Melvin Butte project will reduce marten reproductive habitat on approximately 10% of the Deep Canyon Watershed.

Conclusion

Cumulatively, because this project impacts less than 1% of suitable American marten habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat (increase in disturbance) will be insignificant at the scale of the Forest. The Melvin Butte project is consistent with the Forest Plan, and thus continued viability of American marten is expected on the Deschutes National Forest.

Consistency with the Deschutes LRMP

Wildlife standard and guideline WL-63 will be assessed. The project is consistent with the Deschutes LRMP (Table 130).

Table 130 Consistency with Forest Plan standards and guidelines for American marten.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-63 – In preferred forest types, concentrations of down woody material will be left at an average of approx. one per acre after any timber harvest. Concentrations incorporating high tree stumps, logs, or snags are especially desirable.	Meets	This project does not target large snags for removal.

Snags and Down Wood

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity and numerous species' habitat. This dead wood habitat is crucial in the continuation of species that depend on snags and logs for all or parts of their life cycle (Laudenslayer 2002). Bird and mammal species rely on dead wood for dens, nests, resting, roosting, and/or feeding on the animals and organisms that use dead wood for all or parts of their life cycle. Snags come in all sizes and go through breakdown and decay processes that change them from standing hard to soft, then on the ground to continue decaying into soil nutrients.

Not every stage of the snag's decay stage is utilized by the same species, but rather a whole array at various stages or conditions. In forested environments, 93 wildlife species are associated with snags. This includes 4 amphibians, 63 birds, and 26 mammal species (Rose et al. 2001). Uses of snags include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating.

Snag and down wood levels are best analyzed at scales of subwatersheds or greater (Mellen et al. 2006). Due to the recent fires that span both the Whychus and Deep Canyon watersheds snags and down wood will be addressed as they relate to size, density, and distribution by habitat type for the Melvin Butte project area and within both the Whychus and Deep Canyon watersheds (262,308). The Whychus and Deep Canyon watersheds will be the zone of influence for measuring cumulative effects for snags and down wood.

Approximately, 642 acres of the Pole Creek Fire of 2012 overlap and is directly adjacent to the Melvin Butte project area. Fires are a unique phenomenon, creating a boom and bust cycle of dead wood habitat, when looking across a large landscape. Habitats created by fire represent only a small percentage of

broad landscapes. Therefore, analyses of fire created dead wood habitats need to be conducted on a larger area to help determine how individual fire areas are contributing to habitat at the larger scale.

There are four general habitat types found within the Melvin Butte project area; ponderosa pine/Douglas-fir (PPDF), eastside mixed conifer (EMC), lodgepole pine (LPP), and montane mixed conifer (MMC). The ponderosa pine/Douglas-fir habitat type is dominated by ponderosa pine trees; no Douglas-fir exists within the Melvin Butte project area. The eastside mixed conifer habitat type consists of several different tree species (e.g. ponderosa pine, white fir, lodgepole pine). The lodgepole habitat type is dominated by lodgepole pine, but white-fir and ponderosa pine can be found in these stands. The montane mixed conifer habitat type includes a mix of several high elevation tree species. Tree species found in this habitat type include those mentioned previously as well as subalpine fir, whitebark pine, and western white pine. The same compliment of habitat types is also found within the Deep Canyon and Whychus Watersheds. See Appendix C for more information.

DecAID will not be used to analyze snags, but DecAID will be used to evaluate habitat to individual species that utilize snags. **"Forest inventory data are not available for recent post-disturbance habitats"** (emphasis added). High snag densities resulting from these disturbances are temporary because snag densities decline rapidly as snags fall in the first decade or so after the disturbance. As a result, stands which have recently sustained a stand-replacing disturbance are not well represented in the inventory data in DecAID, even those from unharvested plots; they are an extremely small proportion of the landscape at any one point in time. Plots occurring in areas experiencing recent fire or other stand replacing disturbance likely are included in the inventory data from one of the other three structural condition classes and are likely plots with high levels of down wood (i.e., the right side of the distribution histograms). It was not possible to separate out plots occurring in these disturbed areas. As a result, inventory data are not available for recent post-fire habitats. (Mellen-McLean 2006). Due to the large amount of recent post fire habitat associated with the Whychus and Deep Canyon watersheds, forest inventory data will not be utilized for the cumulative effects analysis that is conducted at the watershed scale.

The Melvin Butte Project is within Northwest Forest Plan (NWFP) Lands which amends the Deschutes NF LRMP, the NWFP provides the management direction for the Melvin Butte project. The following summary of land management direction is displayed to compare standards and guides associated with the Deschutes National Forest. This comparison is given to understand which the most restrictive direction is and how dead wood habitat will be managed based on the best available science and guidance.

Northwest Forest Plan (NWFP)

The NWFP provides S&Gs for snags and logs by land allocation (USDI and USDA 1994). There is no management within congressionally reserved lands; therefore, there are no S&Gs for snags and down wood. Harvest is limited in riparian reserves and late-successional reserves (LSRs) and treatments must meet the attainment of the Aquatic Conservation Strategy Objectives and follow guidance in LSR Assessments. Standards and guidelines for the matrix allocation also apply to the Administratively Withdrawn allocation.

Matrix S&Gs include the retention of green tree replacements and snags both in patches and singly. For treatments such as clear-cuts with reserves and shelterwood harvests, 15% of the area associated with each cutting unit is to be retained. However, this S&G does not apply to intermediate harvests (i.e. thinning). At a minimum, snags are to be retained in the harvest units at levels sufficient to support species of cavity nesting birds at 40% potential population levels.

Provide specified amounts of coarse woody debris in matrix management. In eastern Oregon, a minimum of 120 lineal feet of logs per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained.

Deschutes LRMP Standards and Guidelines

Standards and guidelines in the Deschutes NF LRMP which apply to species associated with snags and down wood include WL-37 and WL-38:

WL-37: In coniferous forest, sufficient snags will be maintained to provide 40 percent of potential population levels of cavity nesting species within even-aged harvest units of the General Forest, visual areas (retention, partial retention, and middle ground), and Deer Management Area allocations. In uneven-aged harvest units, within the management areas noted above, live replacement trees will be left during any harvest to assure 60 percent of cavity nesting potential through the rotation, except where natural deficits occur in diameter classes. In both even and uneven-aged management, groupings of green replacements will be the preferred implementation technique. Compliance will be based on the harvest unit area rather than an individual acre evaluation. In all other management areas, at least 60 percent of cavity nesting species potential population needs will be provided.

WL-38: Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.

WL-72: Logs and downed woody debris will be retained after timber management activities with an average of at least 3 cull logs per acre, plus 3 additional logs per acre in more advanced stages of decomposition.

Wildlife Tree and Log Implementation Strategy

The Deschutes National Forest Wildlife Tree and Log Implementation Strategy (WLTL) provides guidance and options for meeting the snag, green tree replacement (GTR), and down log objectives across the forest, regardless of management direction (USFS 1994b). This strategy focuses on the treatment unit as the area of accountability for meeting WLTL objectives. It states that "Snags, GTRs, and down logs will not be provided on every acre in the forested ecosystem. A mosaic distribution of WLTL resources across the landscape maintaining viable populations and ecological functions is the desired condition." Current literature and research at the time, as well as incorporating the NWFP and Eastside Screen requirements were used to develop the number of hard snags (recently dead standing snag) needed by each species to support various percentages of their population. These were developed for each vegetative series and for areas west and east of the Northwest Forest Plan line.

Table 131 summarizes the estimated number of snags per acre to meet 100% maximum population potential (MPP) for cavity nesters, and estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs).

Table 131 Snag and GTRs for wildlife tree and log implementation strategy.

	Habitat Type		
	Ponderosa Pine	**Mixed Conifer**	**Lodgepole Pine**
100% MPP based on best available science	4 snags/acre	4 snags/acre	6 snags/acre
GTRs @ 13-19" residual stand*	8 tpa	8 tpa	6 tpa

*This concurs with the 10-19" average dbh for the small/medium structure stage defined in DecAID.

Biological Potential

Habitat requirements, including snag and down woody material levels, were described in the LRMP and amended Eastside Screens for a variety of wildlife species using information known at the time in

Thomas (1979) and Brown (1985). However, more recent empirical studies indicate that snag numbers and sizes selected by some wildlife species are far higher than those calculated by the maximum potential population technique (Bull et al. 1997, Rose et al. 2001).

This suggests that the LRMP direction of managing for 100 percent population levels (WL-37 S&G) of primary excavators may not represent the most current knowledge of managing for cavity nesters and that these snag levels, under certain conditions, may not be adequate for some species, particularly for secondary cavity nesters. In addition, the current direction provides recommendations for green stands only when studies show that cavity-nesting birds require higher snag densities in post-fire conditions versus green stands for nesting and productivity (Bull et al. 1997, Rose et al. 2001). This is likely because cavity-nesting birds require more snags for foraging, cover, and protection from predators in post-fire environments.

DecAID Advisory Tool

The DecAID Advisor (Mellen-McLean et al. 2009) is used as the best available science for the Melvin Butte snag analysis. DecAID is a web-based advisory tool that helps managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. DecAID is used to estimate sizes and densities of dead wood that provide habitat for many species and ecological processes. It presents information on the range of “natural conditions” (as represented by unharvested plots within the plots sampled), “current conditions” (all plots sampled, including both unharvested and harvested plots), and wildlife use.

Historical Range of Variability

The terms Historical Range of Variability (HRV), Natural Conditions, and Historical Conditions in DecAID are sometimes used interchangeably to indicate conditions which occurred on the landscape prior to the influence of humans (particularly Europeans). Because it is difficult to determine the actual snag and down wood levels prior to the influence of humans, the term Reference Condition is used in DecAID when referring to the use of vegetation inventory data from DecAID based on data from unharvested plots. When using the “natural condition” of snag and down wood distribution represented by the summary of forest inventory data from unharvested inventory data in DecAID, caution should be used due to years of fire exclusion. The vegetation data can help determine the "natural range of variability" for dead wood, which can be used as a proxy for HRV. It is assumed that adequate habitat will be provided because species which survived those levels of habitat in the past are present today. The more that current conditions deviate from HRV, the less likely it is that adequate habitat occurs on the landscape to sustain those species. Although existing snag and down wood levels and composition in DecAID may not accurately reflect pre-European “natural” or historical conditions, they are still within reason when comparing them to other recent research.

Comparison of DecAID with other research

Harrod et al. (1998) estimated snag densities in ponderosa pine dominated dry forests for snag densities (> 6” dbh) at 6 to 14 snags per acre (4.5-7.0 tons per acre) in pre-European settlement landscapes. These estimates were derived by calculating the basal area of snags from pre-1930 growth rates, holding forest stand structure relatively constant (i.e., as a new live tree is recruited another one becomes a mortality) and applying published snag fall rates (Bull et al. 1980, Keen 1929, Raphael and Morrison 1987, and Schmid et al. 1985). It was assumed that historical frequent, low intensity fires did not accelerate snag fall rates.

Agee (2002) estimated lower snag densities (2 snags per acre) than Harrod et al. (1998) for the ponderosa pine/Douglas-fir forest series by estimating the number of trees in 0.25 acre clumps of 16 age classes and assuming that the oldest patch was killed by insects every 25 years. He assumed fire helped to decompose snag patches and after 5 fires at 10 year intervals, snags would be completely consumed. Agee (2002) compared his estimates to Harrod et al. (1998) but assumed an average snag diameter of 30" dbh when calculating biomass, whereas Harrod et al. (1998) estimated densities for size classes as small as 6" dbh. Results from regional studies in Eastern Washington and Oregon (across all land ownerships) by Ohmann and Waddell (2002) suggest there are currently 2.025 total snags per acre greater than 10"dbh, of which 0.405 snags are greater than 20"dbh.

Snag densities reported by Harrod et al. (1998), Agee (2002), and Ohmann and Waddell (2002) are within the range (50% tolerance level) of those reported in DecAID (Mellen-McLean et al. 2009) for Ponderosa pine/Douglas-fir and Eastside Mixed Conifer habitat types for small and medium trees.

How DecAID was Reviewed for the Melvin Butte Project

Analysis areas should be sufficiently large to encompass the range of variation in wildlife habitat types and structural conditions that occur in the area (Mellen-McLean et al. 2009). In general, at least 20 square miles (12,800 acres) in each habitat type is suggested as a minimum size for an analysis. The Whychus and Deep Canyon watersheds (HUC 10) were used for an appropriate comparison to the vegetation inventory data in DecAID for the Melvin Butte project area.

The PAGs in the Melvin Butte project area were compared to habitat types in DecAID. The DecAID habitat types are: (1) ponderosa pine/Douglas-fir (PP/DF) which best represents the ponderosa pine dry (PPD) and ponderosa pine wet (PPW) PAGs; (2) eastside mixed conifer (EMC) which best represents the mixed conifer wet (MCW) and MCD mixed conifer dry (MCD) PAGs; and (3) lodgepole pine (LP) (Table 132).

Table 132 Plant association groups, corresponding habitat types in DecAID, and acres in the Melvin Butte project area.

Plant Association Group in Melvin Butte project area	DecAID Habitat Type	Number of Acres in the Melvin Butte project area
Ponderosa pine (wet and dry)	Ponderosa Pine/Douglas Fir	1,123
Mixed conifer (wet and dry)	Eastside Mixed Conifer	3,694
Lodgepole Pine (wet and dry)	Lodgepole Pine	530
Mountain Hemlock (dry)	Montane Mixed Conifer	8

An HRV analysis of existing snag density and down wood across the Deschutes National Forest and at the 5th field watershed (HUC 10) level used information from DecAID and the Ochoco and Deschutes Viable Ecosystems Management Guide (*Viable*, USDA FS 1994c). The Viable model was developed to classify vegetation on a landscape basis and compares existing vegetation with site potential. Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. The 2004 Deschutes National Forest satellite imagery layer was used to develop the Viable map. Data is mapped on a 25 meter pixel grid and assigned a value relating to size, structure, tree species, and tree density for the animal species. The resulting layer was then updated by removing stand replacement and mixed mortality fires and forest management activities within the last five years.

The percentage of the landscape in each snag category was then weighted to match the HRV ranges from the Viable analysis. The snags per acre categories were summarized to get a historical range of snag densities that would be expected to occur in the Melvin Butte analysis area.

Wildlife Data Tolerance Level

In DecAID, a tolerance level as it relates to wildlife data is defined as follows: "Tolerance Levels are estimates of the percent of all individuals in the population that are within some specified range of values" (Mellen-McLean et al. 2009). DecAID is not a viability model and tolerance levels should not be interpreted as population viability "thresholds." DecAID tolerance levels may be interpreted as three levels of "assurance": low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level)" (Mellen-McLean et al. 2009). The higher the tolerance level, the higher the "assurance" that snag habitat is being provided. For example, using data from the wildlife species curves for white-headed woodpeckers in small and medium sized trees in the ponderosa pine/ Douglas-fir habitat type, the snag density (≥10"dbh) for white-headed woodpeckers is as follows (Table 133):

Table 133 Wildlife data tolerance level.

Tolerance Level	Snags per acre	Explanation
30% tolerance level	0.3 snags/acre	Areas with < 0.3 snags/acre would be expected to be used for nesting by only 30% of the individuals within the population of white headed woodpeckers, and conversely 70% of the population would be expected to nest in areas with > 0.3 snags/acre.
50% tolerance level	1.7 snags/acre	Half the individuals within the population would be expected to nest in areas with <1.7 snags/acre and the other half would be expected to nest in areas with >1.7 snags/acre.
80% tolerance level	3.7 snags/acre	80% of the individuals within the population of white headed woodpeckers would be expected to nest in areas with <3.7 snags/acre and conversely 20% of the population would be expected to nest in areas with >3.7 snags/acre.

Snags - Existing Condition

To define the existing condition, snags densities were derived from stand exam plot data collected within the project area. Stand exam data was utilized to define the existing condition for snags across the project area due to the fact that the project area is very small (5,375 acres), this data more accurately displays snag densities compared to the GNN data which is better suited for larger landscapes as identified in the DecAid Advisor. Plot data was collected within each habitat and stand structure type within the Melvin Butte project area. Snag data (Table 134) was extrapolated from stand exam plots and displayed in the size classes identified within the DecAid Advisor: Snags <10 - 19 inches dbh and <20+ inches dbh.

Table 134 Average dead trees per acre by dbh class within the Melvin Butte Project area.

Size Class	Existing Condition
10-19 inches dbh	9.28 snags/acre
20+ inches dbh	.71 snags/acre

To determine snags densities for wildfires within the Whychus and Deep Canyon watersheds, pre-fire GNN stand structure and composition data was used and associated with the vegetation mortality mapping for those fires. Once vegetation mortality was applied, GNN stand structure and composition data could estimate post fire snag numbers and sizes on all 26,120 of the acres of stand replacement, mixed severity, and underburned stands throughout the fire area. Please see Appendix C for a detailed report of how the analysis was conducted.

Snag habitat will only be provided in the short term. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). Once the snags are on the ground there will be a period of time that stand replacement areas have minimal amounts

of snags. In the mixed severity areas, trees that survived the Pole Creek Fire will be able to provide snags in the future, so these areas will have a more constant supply of snags in the future

Measure: Snag levels have increased across the landscape due to insect disease and stand replacing fire.

- Consistency with the Deschutes LRMP (USDA 1990), Deschutes Wildlife Tree and Log Implementation Strategy (USDA 1994b), and the Northwest Forest Plan (USDA 1994b) snag and green tree retention guidelines.
- The amount of snags that occur within the Whychus and Deep Canyon Watersheds.

Down Wood - Existing Condition

Logs are an important component on the landscape. They provide organic and inorganic nutrients in soil development, 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 may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. It is still unknown what levels of down woody material are needed to provide quality habitat for associated species. (Bull et al. 1997). Tallmon and Mills (1994) have shown that red-backed voles, a primary prey species for the spotted owl, are highly associated with large down material in more advanced decay stages. Truffles, a dietary staple of the northern flying squirrel, have also been loosely associated with down material.

Too much down material may impede travel by big game and present a fire hazard. However, increased levels also provide cover for small invertebrates and may protect seedlings from browse and scorching. Orientation has also been shown to be important. Logs that lie along a contour are used more than those lying across contours. Larger sized logs are also used more and by more species than smaller logs. (Bull et al. 1997).

A variety of species are associated with down wood. Use by species differs in relation to size, decay class, and purpose of use, as well as many other factors. Therefore, by providing for varying densities, sizes, species, and decay classes on the landscape, it will provide for an array of wildlife species. Most available information of wildlife use of downed wood is representative of green stands.

Down wood abundance on the Deschutes National Forest is highly variable due to many factors. The Deschutes National Forest lies on the eastside of the Cascades where there is a limited availability of water and nutrients as compared to the westside of the Cascades. This, combined with overcrowded stand conditions due to fire suppression, has led to tree mortality above historic levels especially within smaller size classes. Plant associations groups that tend to be drier (i.e. ponderosa pine and mixed conifer dry) may recruit higher levels of down wood today than historically.

Measure: Down wood levels have decreased across the landscape due to stand replacing fire, but are expected to increase dramatically in the next 20 years.

- Consistency with the Deschutes LRMP (USDA 1990), Deschutes Wildlife Tree and Log Implementation Strategy (USDA 1994b), and the Northwest Forest Plan (USDA 1994b) down wood guidelines.

Alternative 1 – Ecological Trend

There are no known direct impacts to snags, down wood, or green tree replacements (GTRs) under Alternative 1 (No Action). Current fuel continuity due to increased fuel loadings from the past 100 years of fire suppression has put the project area at risk of large fires within the Whychus and Deep Canyon

watersheds, there have been 7 large fires since 2002. The Melvin Butte project area is one of the few remaining mid-elevation areas on the Sisters Ranger District that has not burned. Due to the history of the district and small lighting caused fires in or near the project area from 2014 fire season, the likelihood is high for stand replacing fire in this area. These large stand replacement events create snags; however, this pulse of snags is short lived (less than 25 years) and there is a long lag until snags are available on the landscape. In addition, there are limited large trees to provide future large snag habitat. Competition will continue to increase in these overstocked stands and smaller snags are expected to increase across the landscape over time.

Snags are expected to increase over time as insects and disease in overly dense stands continue to cause additional tree mortality at natural levels consistent with increasing levels of inter-tree competition. Down wood levels would be expected to increase as snags continue to fall in the future in the absence of fire. Although a steady recruitment of new snags and logs are expected, they would generally be less than 20" (see Table 134 snag existing condition) dbh size classes, the preferred size class by many species of wildlife. Green tree replacements would also remain at existing levels across the landscape and all trees would continue to be available for use as green tree replacements.

Wildfires may create additional snags and logs beneficial to some woodpecker species. However, there is also risk of a high-intensity stand replacement fire which may reduce current habitat conditions for a larger number of species. In addition, these pulses of post-fire habitat are usually short-lived. Stand resilience to insects, disease, and wildfire is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition 92% of these stands are above the Upper Management Zone and are at risk or could be impacted by insects, disease and stand replacing fire due to high stand densities.

Extreme fire hazard equates to high flame lengths and varying degrees of crown fire. Given assumptions made from best available science, extreme and even moderate and high fire hazard would be damaging to valued stand characteristics.

Small diameter down wood will continue to be created as competition for nutrients and water makes trees more susceptible to insects and disease. There are limited large trees ≥ 21" dbh available for future large down wood recruitment. Increased stand densities perpetuates the problem of losing large structure over time, which many species require large trees for suitable nesting and foraging habitat. In dense stands increased competition for nutrients will require a longer period of time for the smaller trees to become large trees and utilized by these species. It also allows for fewer available nest sites, which could result in more competition for existing sites between species and lead to greater predation risks. Increased stand densities may increase the risk of loss from fire. Species which require snags for nesting primarily utilize softer snags (moderate decay), these softer snags would likely be consumed more rapidly with increased fire intensities, leading to large areas of the landscape being unsuitable if such an event were to occur.

The Forest Vegetation Simulator was utilized to model the trend in snag densities by size class over time. Snag densities derived from plot data collect through stand exams were displayed in the existing condition and utilized to model snag densities over time. Snag data was displayed in 10 year increments over a 100 year time period without the presence of fire. It is important to realize that the likelihood of fire occurring in Melvin Butte project area is high. Approximately 42% of the Sisters Ranger District within the elevation zone of the Melvin Butte project has burned since 2002. Table 135 show the change of snag densities overtime without treatment.

Table 135 FVS modeled snag densities for the existing condition.

Year	Snags 10-19 inches dbh	Snags 20+ inches dbh
2014	9.28	0.71
2024	10.44	0.84
2034	10.40	0.86
2044	10.18	1.05
2054	9.65	1.23
2064	9.42	1.44
2074	9.34	1.61
2084	8.70	1.75
2094	7.97	1.83
2104	7.38	1.93

Small diameter snags continue to increase for the first 30 years then precipitously decrease for the next 70 years. However, due to the amount of small diameter trees succumbing to insects and disease, it slightly decreases competition and the number of large snags increase, but by a very slight amount.

The following is a summary of snags **greater than 10 inches** dbh per acre by structure stage and habitat type for snag dependent species. The following Table 136 through Table 144 summarize snag densities for the Existing Condition within the EMC, PP, and LP habitat by the large, open and small structures classes for the Whychus and Deep Canyon watersheds.

Table 136 Existing condition EMC habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	82	523	368	436	423	273	2,105
Whychus Creek	960	2,263	1,542	2,309	715	1,145	8,933
Grand Total	1,042	2,786	1,910	2,745	1,138	1,418	11,038

Table 137 Existing condition EMC habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	143	379	192	162	119	350	1,344
Whychus Creek	352	701	994	1,611	1,172	3,671	8,501
Grand Total	494	1,080	1,186	1,773	1,291	4,021	9,845

Table 138 Existing condition EMC habitat type small structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	365	1,220	1,132	554	563	223	4,057
Whychus Creek	2,328	5,157	1,903	2,216	831	609	13,046
Grand Total	2,694	6,377	3,036	2,770	1,394	833	17,103

Table 139 Existing condition PP habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	175	977	43	17	37	6	1,255

Whychus Creek	2,503	2,928	49	48	59	93	5,679
Grand Total	2,677	3,904	92	66	97	99	6,934

Table 140 Existing condition PP habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	155	119	48	35	222	359	938
Whychus Creek	813	293	95	106	164	195	1,665
Grand Total	969	412	143	140	385	554	2,603

Table 141 Existing condition PP habitat type small structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	4,404	520	75	17	148	24	5,188
Whychus Creek	16,156	8,643	572	93	67	49	25,581
Grand Total	20,560	9,164	647	109	215	73	30,768

Table 142 Existing condition LP habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	4	69	417	332	215	159	1,196
Whychus Creek	246	532	482	602	183	66	2,111
Grand Total	250	601	900	934	398	225	3,307

Table 143 Existing condition LP habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	49	54	73	52	7	547	781
Whychus Creek	177	222	364	294	269	1,453	2,779
Grand Total	225	275	437	346	276	2,000	3,560

Table 144 Existing condition LP habitat small structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	169	629	1,851	1,122	1,238	183	5,192
Whychus Creek	2,134	2,622	914	1,421	369	248	7,708
Grand Total	2,303	3,251	2,765	2,542	1,608	431	12,900

The following Table 145 through Table 153 summarize snag densities **greater than 10 inches dbh** for the Existing Condition by percent (%) of the Whychus and Deep Canyon watersheds within the EMC, PP, and LP habitat by the large, open and small structures classes for the Whychus and Deep Canyon watersheds.

Table 145 Existing condition percent of watershed in EMC habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	4	25	17	21	20	13
Whychus Creek	11	25	17	26	8	13

Total	9	25	17	25	10	13

Table 146 Existing condition percent of watershed in EMC habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	11	28	14	12	9	26
Whychus Creek	4	8	12	19	14	43
Total	5	11	12	18	13	41

Table 147 Existing condition percent of watershed in EMC habitat type open structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	9	30	28	14	14	6
Whychus Creek	18	40	15	17	6	5
Total	16	37	18	16	8	5

Table 148 Existing condition percent of watershed in PP habitat type small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	14	78	3	1	3	0
Whychus Creek	44	52	1	1	1	2
Total	39	56	1	1	1	1

Table 149 Existing condition percent of watershed in PP habitat type open structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	17	13	5	4	24	38
Whychus Creek	49	18	6	6	10	12
Total	37	16	5	5	15	21

Table 150 Existing condition percent of watershed in PP habitat types small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	85	10	1	0	3	0
Whychus Creek	63	34	2	0	0	0
Total	67	30	2	0	1	0

Table 151 Existing condition percent of watershed in LP habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	0	6	35	28	18	13
Whychus Creek	12	25	23	29	9	3
Total	8	18	27	28	12	7

Table 152 Existing condition percent of watershed in LP habitat type open structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	6	7	9	7	1	70

Whychus Creek	6	8	13	11	10	52
Total	6	8	12	10	8	56

Table 153 Existing condition percent of watershed in LP habitat type small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	3	12	36	22	24	4
Whychus Creek	28	34	12	18	5	3
Total	18	25	21	20	12	3

Alternative 2 and 3 - Direct and Indirect Effects

Snags

Under Alternatives 2 and 3, the Melvin Butte project proposes thinning from below (HTH), mixed conifer thinning from below with group openings (MCGO), mixed conifer thinning form below without group opening (MC-No Group Openings), ponderosa pine with dwarf mistletoe, non-commercial thinning (P), prescribed burning only (B), lodgepole pine improvement harvest (LPI), and Scenic Views Enhancement. Table 154 displays total acres of treatment type by alternative.

Table 154 Total acres of treatments associated for each alternative by treatment types.

Treatment Type	Alternative 2	Alternative 3
B	933	933
HTH	1,008	1,169
MC – No Group Opening		820
MCGO	840	
LPI	249	445
Dwarf Mistletoe	160	
P	1,179	1,179
Scenic Views Enhancement	241	241
Total Acres.	**4,610**	**4,787**

Large snags are not proposed for removal as part of the treatments under any of the action alternatives. Minor incidental loss of snags may occur during treatments due to OSHA requirements for removal of danger trees during operations; however these are incidental and would occur randomly throughout the project area, not affecting snag patches. Snags ≥ 10 inches dbh that are determined to be safety hazards will be felled and left as down wood. The majority of hazard tree abatement will likely occur within the Scenic Views Enhancement treatment area, since it overlaps the Pole Creek Fire. Hazard tree abatement will be occur on a site specific basis and will impact far less than 1% of existing snags.

Lodgepole pine and white-fir snag numbers would be slightly reduced from current levels due to harvesting of standing dead lodgepole pine and white-fir within approximately 249 acres associated with Lodgepole Improvement Harvest (LPI) and approximately 241 acres of Scenic Views Enhancement treatment. Within the LPI units, stands have been heavily impacted by mountain pine beetle outbreaks and due to stress from site competition multiple diseases affecting the white-fir such as mistletoe, root rot, and fir engraver. Treatments will remove dead and dying trees to reduce fuel concentrations around green trees. Stand densities will be reduced, minimizing the likelihood of continued bark beetle outbreaks enhancing the longevity of the residual green trees by removing diseased trees. The Scenic Views Enhancement treatments occur along the 16 road corridor and are associated with primarily lodgpole pine

and some mixed conifer. During the Pole Creek Fire, this portion of the 16 road received stand replacing and mixed mortality fire. The road corridor is within the Scenic Views land allocation identified under the Deschutes Land and Resource Management Plan. The objective of this treatment are to enhance the scenic quality of the road corridor by removing concentration of small diameter fire killed trees retaining all live trees as well as all large snags. Treatment will enhance the visual quality along the road corridor while retaining snag habitat providing opportunities for cavity nesting habitat and watchable wildlife (LRMP M9-79,80, 81).

Alternatives 2 and 3 proposed understory treatments including non-commercial thinning, whip falling, and/or ladder fuel reduction and prescribed burning across all habitat types (ponderosa pine, mixed conifer, and lodgepole pine) and associated with all treatment types. Although thinning will not target snag removal, prescribed burning could inadvertently recruit existing snags as down logs and recruit snags from residual green trees. These activities could have minor short-term impacts to snags, logs, and GTRs, but may have some beneficial impacts to these habitat components in the long-term by creating stand conditions that would accelerate and develop larger tree structure and future snags and logs, than if these small trees were not thinned.

In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity across the project area, reducing the continuation of these disturbance events. Under Alternative 2, within MCGO treatment, small group opening will be created from 1 to 3 acres in size where the unhealthy white-fir dominates the stand. These group openings will be planted to ponderosa pine to increase the stands resilience to insects, disease and fire. In the short-term, due to the removal of unhealthy white-fir, there will be lower recruitment of white-fir snags in these areas but treatments will retain all healthy white-fir and ponderosa pine promoting vigor and accelerating the development of large tree structure throughout these stand. As a result, larger snags will be recruited in the long-term, which have the potential to be utilized by a much larger variety of species dependent on dead wood habitat.

Thinning is expected to reduce down wood recruitment in the short-term; however in the long-term it is anticipated that there will be more large trees that can be recruited into down wood.

In addition, removal of understory in overstocked stands will decrease the competition for nutrients and water, which is anticipated to lower the susceptibility of the trees to insects and disease (Cochran and Barret 1999). Currently there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees and snags are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Sufficient recruitment of future large down wood from currently smaller green trees is of concern. Many are in overstocked stands which will increase the time it takes the trees to reach larger size and height. Cochran and Barret (1999) showed that 30 years after thinning on the Deschutes National Forest there were large differences in average tree sizes among different group stocking levels. They also showed that the growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees.

Fuels treatments in the project area will break up the fuel continuity and reduce the risk of a large fire event, which should reduce the risk to individual large snags and trees. Effects to snags from prescribed underburning are similar for both alternatives with similar acres proposed under Alternative 2 and 3 (933 acres). Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh and showed evidence of woodpecker foraging use in southeastern Arizona. Several studies

showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). It is anticipated in the Prescribed Burn Only (B) treatments that snags will be lost from operation. This should also be partially mitigated by the recruitment of larges snags since there is a large component of old growth associated with this treatment type.

Fuels treatments will reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could minimize predation pressures on white-headed woodpeckers, thereby benefitting this species.

Within the areas that have prescribed fire identified, there is also potential of changing large snags into down wood. Burning prescriptions and pre-ignition fuels reduction should reduce the chance of losing large snags. However, it is assumed that some large snags would be consumed during prescribed fire operations.

Down wood that is on the ground is at risk of being consumed by the proposed prescribed fire treatments. Randall-Parker and Miller (2002) found that 50% of the down logs were consumed in the Arizona prescribed fires. Horton and Manann (1988) found that the number and volume of ponderosa pine logs decreased by 42% and 56% respectively after prescribed fire (both fall and spring burns). Preferred avian foraging sites before burning (logs with sapwood) were proportionately less numerous after the prescribed fire (Hortona and Manann 1988).

In areas that do not have prescribed fire as part of the treatments, all current down wood will remain.

By reducing both activity fuels and overall fuel loadings, prescribed burning, and mastication treatments for both alternatives is anticipated to increase stand resiliency to wildfire and reduce competition with established trees in the long-term.

Within the mixed conifer habitat type, high down log densities were identified in EA unit 57 due to high levels of bark beetle mortality associated with the lodgpole pine. Some of the logs occur as natural recruitment, but many are human created from personal use firewood cutting. The down wood densities are such that it creates a barrier for equipment to access the unit and implement thinning prescriptions, and also creates areas of high fuel concentration. To effectively treat these stands, down wood will be removed from these areas to allow equipment access. However, down wood will be retained to meet NWFP standards for Matrix lands at 120 lineal feet per acre.

Approximately 775 acres of the project area will remain as untreated stands, retaining high stocking densities providing habitat for interior forest species. These denser (untreated) forest patches will act as part of the greater landscape mosaic. These areas will have a higher stocking rate and will provide some diversity of canopy cover across the landscape. Due to high tree densities these areas will recruit high level of snags and down woody material.

In untreated habitat there will continue to be an increased risk from disturbance, although breaking up the fuel continuity across the landscape will reduce the risk of a larger scale disturbance events. In addition, some of the areas identified for no treatment occur within higher site potential areas, which allow them to produce large trees with greater canopy closure. These areas have the potential to provide large snags and down woody material in the short-term.

FVS was used to modeled and compare snag recruitment overtime between the No Acton Alternative/Existing Condition and the Action Alternatives. Stand exam plot data was utilized to

determine snag numbers within treatment types. Snag data was modeled on 10 year increments over a 100 years. The following Table 155 and Table 156 displays the average snag density over time by treatment type and size class.

Table 155 Snags per acre for Alternative 2 modeled on 10 year increments by treatment types.

	DM Alt 2 (snags/acre)		**MCGO Alt 2 (snags/acre)**		**HTH Alt 2 (snags/acre)**		**P Alt 2 (snags/acre)**		**Burn Alt 2 (2008-2088) (snags/acre)**		**LPI Alt 2 (snags/acre)**	
Year	10-19" dbh	20"+ dbh	10-19" dbh	20"+ dbh	10-19" dbh	20"+ dbh	10-19" dbh	20"+ dbh	10-19" dbh	20+	10-19" dbh	20"+ dbh
2014	8.048	0.814	10.434	1.712	72.660	12.504	4.636	0.822	6.662	0.790	9.456	0.258
2024	1.177	0.245	8.047	1.705	34.272	9.672	0.439	0.134	27.255	1.416	1.172	0.058
2034	0.931	0.244	7.277	1.748	31.055	11.347	0.470	0.224	4.968	0.776	1.584	0.083
2044	0.804	0.255	7.157	1.828	26.891	13.013	0.506	0.337	4.864	0.938	1.553	0.099
2054	1.121	0.304	6.988	1.940	22.457	14.718	0.867	0.455	4.402	1.155	1.680	0.133
2064	2.120	0.352	6.734	2.129	18.205	16.066	2.213	0.542	3.873	1.398	1.920	0.178
2074	2.987	0.374	6.651	2.415	14.218	16.923	3.147	0.590	3.243	1.633	2.247	0.246
2084	2.796	0.384	6.201	2.778	11.322	17.237	3.595	0.634	2.639	1.883	2.803	0.319
2094	2.565	0.376	5.740	3.131	9.310	17.087	3.534	0.667	2.146	2.151	3.375	0.375
2104	2.222	0.382	5.503	3.482	7.395	16.502	3.263	0.696	6.754	0.807	3.268	0.427

Table 156 Snags per acre for Alternative 3 modeled on 10 year increments by treatment types.

	MC - No Openings Alt 3 (snags/acre)		**PCT Alt 3 (snags/acre)**		**Burn Alt 3 (2008-2088) (snags/acre)**		**LPI Alt 3 (snags/acre)**		**HTH Alt 3 (snags/acre)**	
Year	**10-19" dbh**	**20"+ dbh**	**10-19" dbh**	**20"+ dbh**	**10-19" dbh**	**20"+ dbh**	**10-19" dbh**	**20"+ dbh**	**10-19" dbh**	**20"+ dbh**
2014	10.43	1.71	4.636	0.822	6.662	0.790	9.456	0.258	57.970	10.018
2024	8.05	1.71	0.439	0.134	27.255	1.416	1.172	0.058	28.153	8.091
2034	7.28	1.75	0.470	0.224	4.968	0.776	1.584	0.083	25.675	9.148
2044	7.16	1.83	0.506	0.337	4.864	0.938	1.553	0.099	22.477	10.506
2054	6.99	1.94	0.867	0.455	4.402	1.155	1.680	0.133	18.919	11.915
2064	6.73	2.13	2.213	0.542	3.873	1.398	1.920	0.178	15.474	13.043
2074	6.65	2.41	3.147	0.590	3.243	1.633	2.247	0.246	12.241	13.791
2084	6.20	2.78	3.595	0.634	2.639	1.883	2.803	0.319	9.937	14.074
2094	5.74	3.13	3.534	0.667	2.146	2.151	3.375	0.375	8.291	13.989
2104	5.50	3.48	3.263	0.696	6.754	0.807	3.268	0.427	6.636	13.533

Within approximately 160 acres associated with Dwarf mistletoe, heavily infected trees will be selected in both the overstory and understory for removal. Some trees greater than 21 inches in these stands will be identified for removal, some will be girdled to contribute toward snag habitat. Trees over 21 inches that have low levels of mistletoe will be retained and the mistletoe pruned away. Although snags are not targeted for removal, those that currently exist will have been recruited as down wood within the first 10 years. The DM units are young stands of ponderosa pine; due to the age of the stands and lack of large trees, the majority of snags recruited within the next 90 years will be small to medium sized. Snags in the

large size class (greater than 20 inches dbh) are slow to recruit, but also increase over the next 90 years post treatment.

The majority of snags in the project area exist within approximately 840 acres associated with the MCGO treatment and approximately 1,008 acres associated with the HTH treatments. Both treatments thin from below in a mosaic fashion within mixed conifer and ponderosa pine stands. These treatments do not target snags for removal and the objective for both treatment types are to promote fire resistant Late and Old structure stands while retaining late and old structure components. These treatment objectives will; reduce stand densities which will promote tree vigor by reducing site competition for resources, reduce the risk of stand replacing fire, and promote the development of Late and Old Structure (LOS) stands which includes large snags. Trees selected for removal within the MCGO treatment will primarily be white-fir and lodgepole pine. Small group openings (<3 acres in size) will be created in areas void of ponderosa pine and dominated by white-fir that are fading from insects and disease. Stands within HTH treatment are ponderosa pine dominated and white-fir will be selected for removal unless it is not directly competing with ponderosa pine; treatments will promote the largest and healthiest ponderosa pine in these stands. From the modeled snag data within the first 10 years, snag densities decline. Over the next 90 years, there are fewer smaller snags and more large snags over 20 + inches dbh per acre as a result of the development of late and old structure habitat.

Within approximately 1,179 acres of PCT units, these areas consist of 20 to 40 year old ponderosa pine plantations where very few snags exist. Treatment will thin stands in a mosaic fashion trying to force some heterogeneity into these planted areas. No snags are targeted for removal, due to the size and age of these plantations, the modeled data show that the majority of snags are small to medium sized. Within the first many of these small to medium snags are recruited as down wood, but as predicted, due to thinning and the reduction of site competition, snag recruitment increase at about year 40.

The approximately 933 acres of Burn only treatment occur within stands dominated by LOS ponderosa pine or are classified as LOS due to stand characteristics. Within the first 10 years following treatment there is a large increase in small and medium snags and a slight increase in large snags. Within the following 20 years post treatment, the majority of the small and medium snags have been recruited as down wood, and over the remaining 100 years snag levels are recruited to similar levels consistent to those levels associated with the existing condition.

LPI treatment will occur on approximately 249 acres. This area has been impacted by a mountain pine beetle outbreak over the past 15 years. Treatments are focused to remove dead and dying lodepole pine and white-fir within residual green stands to reduce fuel loadings and disease. In review of the modeled data, the small and medium snags will be greatly reduced in this area within the first 10 years from treatments as well as recruitment into down wood. Within the next 100 years, snag densities recover due to the 100 year cycle of the development of lodgepole pine. Due to the size of lodgepole pine, very few mature trees reach 20 inches dbh and therefore snag densities in this size class stay consistently low over the 100 year period.

Alternative 3 was developed based on key issues identified during public scoping. Key issues consisted of not creating group opening treatments in the mixed conifer thinning units and not removing large ponderosa pine in dwarf mistletoe treatments. Dwarf mistletoe treatments were combined with HTH (thinning from below) and mixed conifer thinning from below will not have any group openings. The outcome of each treatment and snag recruitment modeled over 100 years is the same as Alternative 2. The major differences in the two alternatives are under Alterative 3, snag densities for year 2014 for the HTH treatment are much lower and snag recruitment for MC-no group openings is much higher over time. Under Alternative 3, the dwarf mistletoe treatment will not be accomplished, and as a result will just be thinned from below and were lumped in with the HTH units. Snag densities are low in the DM units and when lumped with HTH treatments in Alternative 3 it brought the overall snags per acre down.

However, the HTH treatment and projected snag recruitment is consistent with Alternative 2. Within the MC-no group openings, since there will be no group openings created that remove insect and disease ridden white-fir pockets, those trees will be recruited as snags over time. Therefore, creating a high recruitment of white-fir snags throughout the 100 year period.

Overall, under each alternative the project does not propose target the removal of snags. The only down wood that is proposed for removal occurs in EA unit 57 and will occur under both action Alternatives. Retention of down wood will occur to meet the NWFP standards and guides. Alternative 3 is the more conservative of the two action alternatives, it will recruit more snags consistently through time on a unit by unit basis. Alternative 2 is a more proactive approach to address insects and disease as well as developing more fire resistant stands in the future. However, on a snag level basis there is a small margin of difference between alternatives and snags per acre recruited overtime. Due to the small size of the project area as well as treatment units and the fact that dead wood is not specifically targeted for removal, the project will have very minor effect to snags and coarse woody debris as a result of Melvin Butte project.

Alternative 2 and Alternative 3 - Cumulative Effects

The cumulative effect analysis for snags and down wood is completed at both the Whychus and Deep Canyon 10th field watershed. Due to the fact that the Pole Creek Fire over laps the Melvin Butte project area and both Whychus and Deep canyon watersheds, both watersheds will be used to measure the incremental impacts from the Melvin Butte project with ongoing and future foreseeable projects, to determine cumulative effects to snags and down wood.

The last 100 years of fire suppression has changed stand composition across the Sisters Ranger District. Stand densities have increased as well as outbreaks of insects and disease, although both are endemic to the district. As a result of disturbance large tracks of mortality exist in stands across the district. Since 2002 a series of uncharacteristically large wildfires created large areas of stand replacement across the district. From 2002 to the present, approximately 44% of the district land base has been affected by wildfire.

Activities identified in Table 68 were reviewed to assess whether, in combination with the likely impacts of the Melvin Butte project, there would be any cumulative impacts to snags and down wood. Eastside mixed conifer stands within the Whychus and Deep Canyon 10th field watersheds is being used the zone of influence to measure cumulative effects for this analysis. Based on that review, the potential cumulative impacts are those discussed below.

Table 157 displays large wildfires which have occurred within the Whychus Watershed - Black Crater, Lake George, Black Butte 2, and Rooster Rock. Deep Canyon Watershed – Two Bulls Fire.

Table 157 Recent fire history in the Whychus and Deep Canyon Watersheds.

Fire	Date	Acres of National Forest Land
Cache	2002	40
Black Crater	2006	5,147
Lake George	2006	1,857
GW	2007	186
Black Butte 2	2009	559
Rooster Rock	2010	1,362
Pole Creek	2012	26,120
Two Bulls	2014	487

Total	35,758

Approximately 1,642 acres have been salvaged within these fires equaling approximately 4%.

The Pole Creek Fire Danger Tree Removal project, Pole Creek Fire Timber Salvage project, and Two Bulls Timber Salvage projects total approximately 1,584 acres. These are ongoing and future projects that will and have removed fire killed trees reducing snag densities within the watersheds reducing snag habitat in the watersheds.

Activities proposed under the Sisters Area Fuels Reduction (SAFR) project, Glaze Forest Restoration project, Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, Bear Wallow Fire Wood project have occurred or will occur in the two watersheds. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading. The SAFR and Glaze projects all focus on thinning from below to restore and enhance ponderosa pine conifer stands while reducing the risk of stand replacing fires. These treatments do not propose the removal of snags or down woody material. The Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, Bear Wallow Fire Wood projects are all within mixed conifer or lodgepole pine habitat types. These areas are associated with high levels of bark beetle mortality to lodgepole pine stands. These project areas will directly remove snags to break of fuel continuity within these areas and therefore will reduce snag and log habitat. Overall these project will reduce fuel densities on approximately 21,507 acres. These projects are being implemented to reduce the risk of loss of existing habitat from future large-scale disturbances.

Personal use firewood cutting is occurring within the 3,029 acre Three Creek's Firewood Cutting area. Individual dead trees are being removed by personal use firewood cutters primarily within the road prism of open roads. Cutting is not wide spread and occurs on a site specific basis, where individual trees are removed or small groups of dead trees. Only dead lodgepole pine and white-fir can be taken for firewood.

Private lands are not managed for snag habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental.

The following tables display the change in snag densities by habitat type for snags greater than 10 inches dbh across the Whychus and Deep Canyon watersheds as a result the Melvin Butte project.

The following is a summary of snags per acre **greater than 10 inches dbh** by structure stage and habitat type for snag dependent species. The following Table 158 through

Table 166 summarize the **changes to snag densities** as a result of Alternative 2 and 3 within the EMC, PP, and LP habitat by the large, open and small structures classes for the Whychus and Deep Canyon watersheds.

Table 158 Alternative 2 and 3 EMC habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	82	534	368	433	423	266	2,106
Whychus Creek	960	2,275	1,542	2,307	714	1,134	8,932
Grand Total	1,042	2,809	1,910	2,740	1,137	1,400	11,038

Table 159 Alternative 2 and 3 EMC habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	143	420	192	160	115	315	1,345
Whychus Creek	350	1,574	958	1,551	1,047	3,020	8,500
Grand Total	493	1,994	1,150	1,711	1,162	3,335	9,845

Table 160 Alternative 2 and 3 EMC habitat type small structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	365	1,221	1,132	554	563	222	4,057
Whychus Creek	2,328	5,180	1,902	2,211	828	596	13,045
Grand Total	2,693	6,401	3,034	2,765	1,391	818	17,102

Table 161 Alternative 2 and 3 PP habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	175	977	43	17	37	6	1,255
Whychus Creek	2,503	2,928	49	48	59	93	5,680
Grand Total	2,678	3,905	92	65	96	99	6,935

Table 162 Alternative 2 and 3 PP habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	155	119	48	35	222	359	938
Whychus Creek	813	300	95	105	164	188	1,665
Grand Total	968	419	143	140	386	547	2,603

Table 163 Alternative 2 and 3 PP habitat type small structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	4,404	520	75	17	148	24	5,188
Whychus Creek	16,157	8,644	572	93	67	48	25,581
Grand Total	20,561	9,164	647	110	215	72	30,769

Table 164 Alternative 2 and 3 LP habitat type large structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	4	69	417	332	215	159	1,196
Whychus Creek	246	532	482	602	183	66	2,111
Grand Total	250	601	899	934	398	225	3,307

Table 165 Alternative 2 and 3 LP habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	49	54	73	52	7	547	782
Whychus Creek	177	251	364	293	262	1,432	2,779
Grand Total	226	305	437	345	269	1,979	3,561

Table 166 Alternative 2 and 3 LP habitat type open structure.

Snags Per Acre	0	0-15	15-30	30-60	60-90	>=90	Total
Deep Canyon	169	629	1,851	1,122	1,238	183	5,192
Whychus Creek	2,134	2,627	913	1,420	368	246	7,708
Grand Total	2,303	3,256	2,764	2,542	1,606	429	12,900

The following Table 167 through Table 175 summarize the **changes to snag densities** for snags **greater than 10 inches dbh** from alternative 2 and 3 by percent (%) of the Whychus and Deep Canyon watersheds within the EMC, PP, and LP habitat by the large, open and small structures classes for the Whychus and Deep Canyon watersheds.

Table 167 Alternative 2 and 3 percent of watershed in EMC habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	4%	25%	17%	21%	20%	13%
Whychus Creek	11%	25%	17%	26%	8%	13%
Total	9%	25%	17%	25%	10%	13%

Table 168 Alternative 2 and 3 percent of watershed in EMC habitat type open structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	11%	28%	14%	12%	9%	26%
Whychus Creek	4%	8%	12%	19%	14%	43%
Total	5%	11%	12%	18%	13%	41%

Table 169 Alternative 2 and 3 percent of watershed in EMC habitat type small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	9%	30%	28%	14%	14%	6%
Whychus Creek	18%	40%	15%	17%	6%	5%
Total	16%	37%	18%	16%	8%	5%

Table 170 Alternative 2 and 3 percent of watershed in PP habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	14 %	78 %	3 %	1 %	3 %	0 %
Whychus Creek	44 %	52 %	1 %	1 %	1 %	2 %
Total	39 %	56 %	1 %	1 %	1 %	1 %

Table 171 Alternative 2 and 3 percent of watershed in PP habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	17 %	13 %	5 %	4 %	24 %	38 %
Whychus Creek	49 %	18 %	6 %	6 %	10 %	11 %
Total	37 %	16 %	5 %	5 %	15 %	21 %

Table 172 Alternative 2 and 3 percent of watershed PP habitat small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	85 %	10 %	1 %	0 %	3 %	0 %
Whychus Creek	63 %	34 %	2 %	0 %	0 %	0 %
Total	67 %	30 %	2 %	0 %	1 %	0 %

Table 173 Alternative 2 and 3 percent of watershed LP habitat type large structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	0 %	6 %	35 %	28 %	18 %	13 %
Whychus Creek	12 %	25 %	23 %	29 %	9 %	3 %
Total	8 %	18 %	27 %	28 %	12 %	7 %

Table 174 Alternative 2 and 3 percent of watershed LP habitat type open structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	6 %	7 %	9 %	7 %	1 %	70 %
Whychus Creek	6 %	9 %	13 %	11 %	9 %	52 %
Total	6 %	9 %	12 %	10 %	8 %	56 %

Table 175 Alternative 2 and 3 percent of watershed LP habitats type small structure.

Snags Per Acre	0	0-10	10-20	20-30	30-60	>=60
Deep Canyon	3 %	12 %	36 %	22 %	24 %	4 %
Whychus Creek	28 %	34 %	12 %	18 %	5 %	3 %
Total	18 %	25 %	21 %	20 %	12 %	3 %

Overall, Alternatives 2 and 3 do not target snags for removal. Within LPI treatments on approximately 249 acres under Alternative 2 and 445 acres under alterative 3, there is the potential for individual lodgepole pine and white-fir snags to be removed. This treatment will reduce fuel loadings in areas adjacent to healthy stands and will focus on the removal of unhealthy trees that are fading from residual mountain pine beetle attack and disease. Total area treated is very small on the landscape and total snags removed are minor at a watershed scale. Cumulatively, as a result of Alternative 2 and Alternative 3 there is no change to snag densities as it relates to the overall snags per acre for the watersheds as well as the percent of the watershed for each habitat type as displayed in the existing condition and this cumulative effect section (See Table 134, Table 154, Table 158 through

Table 166 and Table 167 through Table 175 above). Since snags are not targeted for removal and snag removal is incidental, the percent of snags reduction on the watershed scale is not measureable and is a minor impact.

The following

Table 176 display estimated acres by quality of habitat for snag dependent species after the proposed treatments are completed for Melvin Butte within the Whychus Creek and Deep Canyon Watersheds. Quality of habitat is based on DecAid tolerance level and associated snag densities. Please see Appendix C for a detailed report of how the analysis was conducted and the existing condition for habitat quality.

Table 176 Comparison of habitat for species post Melvin Butte treatments.

Species	0-30% Poor Quality	>30-50% Low Quality	>50-80% Moderate Quality	>80% High Quality	Grand Total
American Marten	266,230	28,008	25,988	123,088	443,314
Black Backed Wood Pecker	429,942	149,257	50,378	28,526	658,103
Cavity Nesting Birds	316,492	46,795	7,988	5,662	376,938
Hairy Woodpecker	232,395	142,230	1,410	903	376,938
Pileated Woodpecker	583,976	45,890	14,162	14,075	658,103
Pygmy Nuthatch	375,737	99,878	75,101	107,388	658,103
White-headed Woodpecker	269,801	147,231	60,970	180,100	658,103
Williamson's Sapsucker	582,173	46,110	15,745	14,075	658,103

Conclusion

Cumulatively under Alternatives 2 and 3 no snags are targeted for removal. Incidental removal will occur where fuels loading and overall stem density reduction is occurring around healthy stands of trees. Targeted tree removal in these areas will be trees that are fading from residual bark beetle out breaks and disease issue. This treatment will occur on approximately 249 acres under Alternative 2 and approximately 445 under Alternative 3 within Lodgepole Improvement treatment. Within the Scenic views treatments to meet Deschutes Forest Plan Standards and Guides, small fire killed trees will be removed on approximately 240 acres to enhance foreground visual objective along the 16 road.

The Whychus and Deep Canyon Watershed has been highly impacted by wildfire, high snag densities currently exist within these watersheds. Over time within these post fire areas, snag habitat will decrease creating a gap in time when little snag habitat exists (primarily in stand replacement areas) because there are few green trees of sufficient size to provide recruitment. Dahms (1949) found 10 years post-fire, 50% of fire killed ponderosa pine snags remained standing but this declined to 22% standing after 22 years. It is estimated that about 75% of all snags may fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). Treatments proposed for Melvin Butte will promote the development Late and Old structure habitat and reduce the risk of wildfire to these watersheds. The Melvin Butte project will retain full stock stands to recruitsnags individually over time. With the ongoing forest management projects within the Whychus and Deep Canyon Watersheds by comparing the snags per acre by habitat type across both watersheds there will be less than a 1% reduction in overall snag habitat. Implementation of this project will not incrementally contribute to a change in viability of dead wood habitat on the Deschutes National Forest.

Consistency with the Deschutes LRMP, Deschutes Wildlife Tree and Log Strategy, and

the Northwest Forest Plan

Wildlife standards and guidelines WL-37 and WL-38 will be assessed. The project is consistent with the Deschutes LRMP, the Deschutes Wildlife Tree and Log Strategy, and the Northwest Forest Plan (Table 177).

Table 177 Consistency of Forest Plan standards and guidelines for snags and down wood habitat.

Source Document	Standard & Guideline or Management Recommendation	Doesn't Meet, Meets, Exceeds, or Does Not Apply	Rationale
Northwest Forest Plan	Retain snags at levels to meet 100% of potential population levels for white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl.	Meets	Snags are not targeted for removal with this project. However incidental removal could occur within the Lodpole Improvement units as well as Scenic View Enhancement units. All large snags will be retain >20 inches dbh, target snag levels are expected to exceed 100% potential population levels.
	Provide Green Tree Replacements to meet the 100% of potential population levels for white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl.	Meets	The project will implement primarily thinning from below retaining fully stocked stand. Residual stand densities will exceed target stand densities to meet 100% potential population levels.
	Within Matrix lands a minimum of 120 linear feet of logs per acre greater or equal to 16 inches diameter and 16 feet long should be retained.	Meets or Exceeds	Down wood is not targeted for removal except where it will interfere with mechanical thinning. In these situations down logs will be maintained to meet NWFP S&G's
Deschutes NF LRMP – Wildlife Tree and Log Strategy	Retain snags of various sizes to meet at least 40% of potential population levels in matrix and 100% of potential population levels in LSR by PAG	Meets	Snags are not targeted for removal.
	Provide Green Tree Replacement to meet at least 40% of potential population levels in matrix and 100% of potential population levels in LSR by PAG	Meets	The project will implement primarily thinning from below retaining fully stocked stand. Residual stand densities will exceed target stand densities to meet 100% potential population levels.

Northwest Forest Plan Species of Concern: Bats

Measure: Roosting and foraging habitat impacted

The Northwest Forest Plan calls for retaining snags, decadent trees, and green tree recruitment for roosting bats in Matrix and Adaptive Management Areas (Page B-7, Stand Management):

"Adequate numbers of large snags and green trees are especially critical for bats because these trees are used for maternity roosts, temporary night roosts, day roosts, and hibernacula. These should be well distributed throughout the matrix because bats compete with primary excavators and other species that use cavities. Day and night roosts are often located at different sites, and migrating bats may roost under bark in small groups. Thermal stability within a roost site is important for bats, and large snags and green trees provide that stability. Individual bat colonies may use several roosts during a season as temperature and weather conditions change. Large, down logs with loose bark may also be used by some bats for roosting."(NWFP 1994)

Snag densities are poorly known for most species of bats but some research indicates that snag density requirements may be higher than those needed for woodpeckers (Lacki et al. 2008). Bats frequently switch roosts to escape predation and avoid parasites (Lewis 1995, Barclay and Kurta 2007).

Table 178 lists 11 species of bats with habitat on the Deschutes National Forest and potentially occurring in the project area.

Table 178 Bat species potentially occurring in the Melvin Butte Project area.

Bat Species Potentially Occurring in the Project Area			
Species	**PAG**	**Roost Substrate**	**Potential Presence (Yes/No)**
Long-eared myotis	Mixed conifer and ponderosa pine	Large hollow trees, snags, loose bark, crevices, rock outcrops, bridges, buildings, caves	Yes
Fringed myotis	Ponderosa pine	Trees, snags, buildings, caves, rocks, cliffs and bridges	Yes
Long-legged myotis	Mixed conifer, ponderosa pine	Trees, snags, buildings, caves, rocks, cliffs and bridges	Yes
Little brown myotis	Mixed conifer, ponderosa pine, desert	Trees, snags, buildings, caves, rocks, cliffs and bridges	Yes
California myotis	Mixed conifer, ponderosa pine, desert	Arid habitat, rocky outcrops, caves, bridges	Yes
Yuma myotis	Mixed conifer, ponderosa pine, desert	Trees, snags, buildings, caves, rocks, cliffs and bridges; highly associated with water	Yes
Small-footed myotis	Mixed conifer, Ponderosa pine, desert	Loose bark on trees and snags, crevices, cliffs, caves, mines, building	Yes
Big brown bat	Mixed conifer, ponderosa pine, desert	Trees, snags, buildings, caves, rocks, cliffs and bridges	Yes
Canyon bat	Ponderosa pine, desert	Arid habitat, rocky outcrops, caves, bridges	Low potential
Silver-haired bat	Ponderosa pine	Under bark in large snags, bridges, buildings	Yes
Hoary Bat	Mixed conifer	Green foliage and branches	Yes
Townsend's big-eared bat	Ponderosa pine, desert.	Highly associated with caves but sometimes uses hollow trees in ponderosa pine forests, lava, bridges, and buildings	Yes

Pallid bat	Ponderosa pine, desert	Arid habitat, coniferous forests, rocky outcrops, caves, bridges	Yes
Spotted bat	Ponderosa pine fringe, desert	Highly associated with vertical cliff habitat	No

Snag Habitat and Impacts From Fire

Little is known about the roosting ecology of bats and their prey in burned forests. Limited research has focused on short-term bat foraging activity in burned areas with varying types of severity (Hayes 2009, Buchalski et al. 2013). In general, low intensity wildfires and prescribed fire create relatively few snags (Horton and Mannan 1988) and many are small diameter, which are of less use for most roosting bat species which usually prefer large-diameter (>21 inches dbh) roost trees (Barclay and Kurta 2006). For species that avoid foraging in dense forests, bat activity may increase post-fire due to an increased insect productivity and more open foraging conditions at least for the first year after the fire (Buchalski et al. 2013). During this one year post-fire study, Buchalski et al. (2013) show that bat activity was either neutral or positive regardless of the intensity of the fire.

Bats use of trees and snags includes cavities in hollow trees, cracks or crevices in trees or snags, or behind exfoliating (sloughing) bark. They may be less likely to use heavily charred/sooty fire-killed trees if a sufficient number of roost trees are available in the surrounding area. The 2012 Pole Creek Fire and 2014 Two Bulls fire likely removed some roost habitat while creating additional roost habitat within the Deep Canyon watershed. Removal of dense forest patches may have improved foraging conditions for bats at least short-term, particularly where viable roosting habitats occur within close proximity to water.

Lacki et al. (2012) monitored 301 roost snags of long-legged myotis in Oregon, Washington, and Idaho. This is one of the most common bat species occurring on the Deschutes National Forest. Overall, persistence rates declined with increasing roost-years across study areas. Roost snags in Washington showed a lower persistence rate 1 year post-discovery than did roost snags in Oregon and Idaho. Estimates of percentage of snags still standing 10 years post-discovery were highest for ponderosa pine (6.8%), slightly less for Douglas-fir (5.3%), and lowest for grand fir (0.9%). They found half-lives of roost snags to be <3 roost-years, much shorter than other published values for half-lives of snags of multiple species of conifers (Russell et al. 2006, Angers et al. 2010), and the overall average of roost snag persistence 10 years post-discovery across snag species was 4.3%. Replenishment of snags suitable for long-legged myotis on an annual basis is likely needed to ensure adequate habitat of this bat species, especially given the frequency of roost switching within years shown by many bats (Lewis 1995, Barclay and Kurta 2007) and the short-term reuse of tree roosts among years by bats.

Alternative 1 -Ecological Trends

There are no known direct impacts to snags, down wood, or green tree replacements (GTRs) under Alternative 1 (No Action). Current fuel continuity due to increased fuel loadings from the past 100 years of fire suppression has put the project area at risk of large fire. Within the Whychus and Deep Canyon watersheds, there have been 7 large fires since 2002. The Melvin Butte project area is one of the few remaining mid-elevation areas on the Sisters Ranger District that has not burned. Due to the history of the district and small lighting caused fires in or near the project area from 2014 fire season, the likelihood is high for stand replacing fire in this area. These large stand replacement events create snags; however, this pulse of snags is short lived (less than 25 years) and there is a long lag until snags are available on the landscape. In addition, there are limited large trees to provide future large snag habitat. Competition will continue to increase in these overstocked stands and smaller snags are expected to increase across the landscape over time.

Snags are expected to increase over time as insects and disease in overly dense stands continue to cause additional tree mortality at natural levels consistent with increasing levels of inter-tree competition. Down

wood levels would be expected to increase as snags continue to fall in the future in the absence of fire. Although a steady recruitment of new snags and logs are expected, they would generally be less than 20" dbh size classes, the preferred size class by many species of wildlife. Green tree replacements would also remain at existing levels across the landscape and all trees would continue to be available for use as green tree replacements.

However, there is also risk of a high-intensity stand replacement fire which may reduce current habitat conditions for a larger number of species. In addition, these pulses of post-fire habitat are usually short-lived. Stand resilience to insects, disease, and wildfire is measured by the Upper Management Zone (UMZ). The UMZ relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. 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 other insects and diseases. Forest stands managed below the upper management zone are more resilient. There are approximately 4,456 acres that have the potential to receive vegetation treatment. Under the existing condition/no action 92% of these stands are above the Upper Management Zone and are at risk or currently be impact by insects, disease and stand replacing fire due to high stand densities and as a result low resiliency.

Extreme fire hazard equates to high flame lengths and varying degrees of crown fire. Given assumptions made from best available science, extreme and even moderate and high fire hazard would be damaging to valued stand characteristics.

As insects and disease increase in these stands large areas of dense snags will increase. As snags fall, roosts will be lost and there will likely be a long period of time before large roosts are available. Loss of stands containing green trees will limit use by some species (e.g., long-legged bat and silver-haired bat) until stands recover. Recovery of forested stands will depend on the presence of conifer seed sources. In many areas, the absence of a seed source will delay recovery by several decades. Where there was a seed source, the majority (80-90%) is comprised of white fir. This is not a tree species usually favored by bats as white fir does not get as large as Douglas-fir or ponderosa pine or develop deep fissured bark used for roosting. However, white-fir does result in hollow snags more often than the other species, which also provides roost habitat. In the event of future impacts to the project area by fire Mixed mortality and underburned stands across the landscape will likely serve as habitat. However, in stands dominated by white fir, these stands will likely see additional impacts over the next 5-10 years as white fir damaged by fire are likely to die due to the thin bark and root system near the surface. This will provide more snag habitat but will also reduce the canopy. Many species use riparian areas which will likely recover more quickly than conifer stands unless fire intensity was at a level to kill the root systems. Bat species that roost in rock crevices, bridges, cliff faces, and buildings are not likely to see any decrease in these types of roost site structure; however, impacts to the vegetation surrounding these sites from the fire may impact suitability.

Alternative 2 and 3 - Direct and Indirect Impacts

Large snags are not proposed for removal as part of the treatments under any of the action alternatives. Minor incidental loss of snags may occur during treatments due to OSHA requirements for removal of danger trees during operations; however these are incidental and would occur randomly throughout the project area, not affecting snag patches. Snags ≥ 10 inches dbh that are determined to be safety hazards will be felled and left as down wood.

Lodgepole pine and white-fir snag numbers would be slightly reduced from current levels due to harvesting of standing dead lodgepole pine and white-fir within approximately 249 acres associated with Lodgepole Improvement Harvest (LPI) and approximately 241 acres of Scenic Views Enhancement treatment. Within LPI units, both lodgepole pine and white-fir are either dead or dying due to insects and

disease outbreaks. These outbreaks were brought on as a result of stress to individual trees from high stand densities and intraspecific competition for site resources. Treatments will remove dead and dying trees to reduce fuel concentrations around green trees. Stand densities will be reduced, minimizing the likelihood of continued bark beetle outbreaks enhancing the longevity of the residual green trees by removing diseased trees. The Scenic Views Enhancement treatments occur along the 16 road corridor and are associated within lodgepole pine and some mixed conifer. During the Pole Creek Fire, this portion of the 16 road received stand replacing and mixed mortality fire. The road corridor is within the Scenic Views land allocation identified under the Deschutes Land and Resource Management Plan. The objective of this treatments are to enhance the scenic quality of the road corridor by removing concentrations of small diameter fire killed trees retaining all live trees as well as all large snags. Treatments will result in enhanced visual quality along the road corridor while retaining snag habitat providing utility for bats as roosting habitat (LRMP M9-79,80, 81).

Alternatives 2 and 3 propose understory treatments including non-commercial thinning, whip falling, and/or ladder fuel reduction and prescribed burning across all habitat types (ponderosa pine, mixed conifer, and lodgepole pine) and associated with all treatment types. These activities would not directly remove snags in the short-term, but may have some beneficial impacts to these habitat components in the long-term by creating stand conditions that would accelerate and develop larger tree structure and future snags, than if these small trees were not thinned.

In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity across the project area, reducing the continuation of these disturbance events. Under Alternative 2, within MCGO treatments, small group openings will be created from 1 to 3 acres in size where the unhealthy white-fir dominates these stands. These group openings will be planted to ponderosa pine to increase the stands resilience to insects, disease and fire. In the short-term, due to the removal of unhealthy white-fir, there will be lower recruitment of white-fir snags in these areas but treatments will retain all healthy white-fir and ponderosa pine promoting vigor and accelerating the development of large tree structure throughout these stands. As a result, larger snags will be recruited in the long-term, which have the potential to be utilized by bats.

In addition, removal of understory in overstocked stands will decrease the competition for nutrients and water, which is anticipated to lower the susceptibility of the trees to insects and disease (Cochran and Barret 1999). Currently there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees and snags are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999) showed that 30 years after thinning on the Deschutes National Forest there were large differences in average tree sizes among different group stocking levels. They also showed that the growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees.

Fuels treatments in the project area will break up the fuel continuity and reduce the risk of a large fire event, which should reduce the risk to individual large snags and trees. Effects to snags from prescribed underburning are similar for both alternatives with similar acres proposed under Alternative 2 and 3 (933 acres). Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh and showed evidence of woodpecker foraging use in southeastern Arizona. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn

during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). Therefore it is anticipated that although some existing bat habitat may be lost for prescribed fire activity, new snags will be produced from fuels treatments in the short-term. However, newly created snags will remain unsuitable until they decay to the point of providing viable roosting habitat.

Approximately 775 acres of the project area will remain as untreated stands, retaining high stocking densities providing habitat for interior forest species. These denser (untreated) forest patches will act as part of the greater landscape mosaic. These areas will have a higher stocking rate and will provide some diversity of canopy cover across the landscape and in the short-term will recruit existing large trees as snags providing bat roosting habitat in the short-term

In untreated habitat there will continue to be an increased risk from disturbance, although breaking up the fuel continuity across the landscape will reduce the risk larger scale disturbance events. In addition, some of the areas identified for no treatment occur within higher site potential areas, which allow them to produce large trees with greater canopy closure. These areas will continue to provide large green tree structure with areas of higher snag densities intermixed.

See snag and log analysis for a complete summary on affects to snag habitat.

Alternatives 2 and 3 - Cumulative Impacts

The cumulative effects area for bats includes both the Whychus and the Deep Canyon watersheds due to stand replacing fires that are associated with both watersheds and overlap the Melvin Butte project area. Previous effects to potential bat habitat include loss of large-diameter trees and snags due to timber harvest, reduction in large-tree structure due to overstocked stands, and fires. The Black Crater, Pole Creek, and Two Bulls Fires created roost habitat particularly in the mixed mortality areas and in some of the stand-replacing burned areas. Foraging habitat in previously dense contiguous large patches may have been enhanced in these fires due to openings in the mid-canopies.

Approximately 54 acres of salvage logging are ongoing within the Pole Creek Fire and approximately 250 acres of salvage logging is being proposed within the Two Bulls Fire. Danger tree removal has occurred or will occur on these fires to varying degrees resulting in a reduction of potential roost sites in stand replacement areas along main roads.

Activities proposed under the Sisters Area Fuels Reduction (SAFR) project, Glaze Forest Restoration project, Ursus Hazardous Fuels Reduction project, Bend Municipal Watershed Fuels Reduction project, and Bear Wallow Fire Wood project have occurred or will occur in the two watersheds. Fuels reduction treatments focus on removing dead lodgepole pine among green stands to reduce fuel loading. The SAFR and Glaze projects all focus on thinning from below to restore and enhance ponderosa pine conifer stands while reducing the risk of stand replacing fires. Overall, treatments proposed could reduce snag and log habitat, but primarily focus on thinning from below to reduce fuel densities on approximately 21,507 acres. These projects are being implemented to reduce the risk of loss of existing habitat from future large-scale disturbances.

Potential roost sites are not limited in the watershed outside the project area due to the mosaic of varying degrees of fire severities. In portions of the watersheds, treatments and natural fires enhanced foraging habitat by opening up mid-canopies while in other areas, a reduction in shrub habitat may reduce habitat for insect prey. Fires across the watersheds have resulted in a reduction of large snags.

The proposed thin, mow, and burn treatments in Ursus vegetation management projects would accelerate the development of large tree structure which would provide positive benefits for bat roost habitat long-term (i.e., greater than 30 years post-implementation).

Personal use firewood cutting is occuring within the 3,029 acre Three Creek's Firewood Cutting area. Individual dead trees are being removed by personal use firewood cutters primarily within the road prism of open roads. Cutting is not wide spread and occurs on a site specific basis, where individual trees are removed or small groups of dead trees. Only dead lodgepole pine and white-fir can be taken for firewood.

Alternatives 2 and 3 would not incrementally add to ongoing and reasonably foreseeable impacts to bats, the Melvin Butte project does not propose to remove large snags that provide habitat.

Conclusion

Cumulatively under Alternative 2 and 3 no snags are targeted for removal. Incidental removal will occur where fuels loading and overall stem density reduction is occurring around healthy stands of trees. Targeted tree removal in these areas will be trees that are fading from residual bark beetle out breaks and disease issue. This treatment will occur on approximately 249 acres under Alternative 2 and approximately 445 under Alternative 3. The Whychus and Deep Canyon Watershed has been highly impacted by wildfire, high snag densities currently exist within these watersheds. Over time within these post fire areas, snag habitat will decrease creating a gap in time when little snag habitat exists (primarily in stand replacement areas) because there are few green trees of sufficient size to provide recruitment limiting roosting habitat for bat habitat. Dahms (1949) found 10 years post-fire, 50% of fire killed ponderosa pine snags remained standing but this declined to 22% standing after 22 years. It is estimated that about 75% of all snags may fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). Treatments proposed for Melvin Butte will promote the development Late and Old structure and reduce the risk of continued wildfire to these watersheds, promoting roosting habitat for bat over-time. The Melvin Butte project will retain fully stocked stands to recruit snags individually over time. With the ongoing forest management projects within the Whychus and Deep Canyon Watersheds there will be less than a 1% reduction in overall snag habitat. Implementation of this project will not incrementally contribute to a change in viability of bat habitat on the Deschutes National Forest.

FIRE, FUELS AND AIR QUALITY

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Fire, Fuels, and Air Quality specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This section addresses the following component of the Melvin Butte vegetation project purpose and need:

Reduce fuel loadings and forest vegetation density to lessen the hazard associated with uncharacteristic wildfires to nearby communities and key ecosystem components, such as watersheds, large old trees and wildlife connectivity habitat.

To meet the purpose and need of this project, the Melvin Butte action alternatives are designed to reduce the likelihood of an uncontrolled stand replacement wildfire impacting values at risk. This specialist report is focused on the effects that vegetation management activities described in the action alternatives will have on fire hazard within the project area. Other components of the purpose and need are addressed in other specialist reports and within the main NEPA document.

Management Direction

General direction for the Forest Service as it relates to Fuels Management is directed by Forest Service Manual (FSM) 5150. FSM 5150 directs Forests to initiate fuels treatments in accordance with local land and resource management plans. On the Deschutes National Forest, the Land and Resource Management Plan (Deschutes LRMP), was completed in 1990. In areas within the range of the Northern Spotted Owl, the Deschutes LRMP was amended with the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl and its corresponding Record of Decision and Standards and Guidelines (Northwest Forest Plan). The Northwest Forest Plan requires that Watershed Analyses be completed in Key Watersheds. The Whychus Watershed Analysis (1998), Update (2009), and Updated (2013) respond to these requirements. Fire and fuels management are directed and/or guided by the goals, objectives, standards, and guidelines in all of these plans. Refer to Table 179 and the following discussion for an overview of these documents.

Table 179 Overview of the goals, standards, guidelines, and recommendations within the Deschutes National Forest LRMP and the Northwest Forest Plan.

Deschutes LRMP
Forest Management Goal*: Provide a fire protection and prescribed burning program which is responsive to land and resource management goals and objectives.

Forest-wide goal: To provide a well-managed fire protection and prescribed fire program that is cost efficient, responsive to land stewardship needs, and resource management goals and objectives	FF-1: Prevention of human caused wildfire will focus on areas of high use and high risk. Identified areas of high use and high risk are: • Recreation use along major travelways and bodies of water during the summer periods • Personal use firewood cutting during late spring and early summer • Large numbers of deer hunters during the fall • Large areas of Beetle Killed pine adjacent to subdivisions and private developments • Industrial operations on National Forest Land during summer FF-5: All wildfires will receive a timely and energetic suppression response that minimizes suppression costs plus resource losses, and best meets multiple use standard and guidelines for each management area. Those fires that threaten life, private property, public and firefighter safety, improvements or investments shall be given high priority and suppressed to minimize losses. FF-6: All wildfires will require an appropriate suppression response. FF-9: Burn plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire. Prescribed burning will conform to air quality guidelines. Burn plans will define an escaped fire. A fire that escapes will be declared a wildfire and the Wildland Decision Support System (WFDSS) will be used to document further action. FF-10: Unplanned ignitions may be managed to meet multiple objectives if (1) consistent with the land management allocation and upon approval of a decision within the WFDSS and (2) the fire is burning within prescription. Normally, prescribed burning will be by planned ignition. FF-11: Levels and methods of fuels treatment will be guided by the resource objectives within the management area. * In May of 2015, the Deschutes National Forest made an administrative change to the glossary of the Land and Resource Management Plan to reflect updated wildland fire management policy and terminology. Management direction with the Land and Resource Management Plan has been reinterpreted to reflect this update.
Management Area Goal: Old Growth	M15-19: Prescribed fire is not appropriate in lodgepole pine stands. In Ponderosa pine and mixed conifer stands, prescribed fire may be used to achieve desired old growth characteristics. It may also be used there to reduce unacceptable fuel loadings that potentially could result in high intensity wildfire. M15-20: Prescribed fire is the preferred method of fuel treatment. However, if prescribed fire cannot reduce unacceptable fuel loadings, other methods will be considered. M15-21: Natural fuel loading will normally be the standard.

Management Area Goal: Scenic Views	M9-27: In Retention Foregrounds slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor for one year after the work has been completed. In partial retention foregrounds, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity. M9-90: Low intensity prescribed fires will be used to meet and promote the desired visual condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a large high intensity fire. In foreground areas, prescribed fires will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered. M9-91: If at any time during the course of the prescribed burn it appears that the objectives for the burn are not being met, all burning will cease.
Management Area Goal: Front Country	M18-34: Prescribed fire may be used to protect, maintain, and enhance timber and forage production. The broadest application of prescribed fire will occur in the Ponderosa pine type. Criteria for using fire are as follows: • To reduce risk of conflagration fire • To increase soil productivity by cycling bound nutrients • To prevent encroachment of less desirable, competing tree species • To increase palatability and cover of desirable forage species • To prepare sites for reforestation M18-35: The lowest cost option [for fuel treatment] which meets the silvicultural, soil, water, and fire objectives should be selected. M18-36. Slash will be treated to minimize chances of large wildfires, but will not be cleared to the point that the forest floor is devoid of all slash and logs. Some slash and larger dead material will be left for ground cover for soil protection, microclimates for establishment of trees, and small mammal habitat. Optimum fuel loadings should be guided by … "Photo Series for Quantifying Forest Residues"… These fuel loadings will be revised when new data, methods, or research indicate that a new profile would improve resource management programs.
Northwest Forest Plan	
Administratively Withdrawn	[Administratively Withdrawn Areas] are identified in current forest and district plans or draft plan preferred alternatives and include recreational and visual areas, back country, and other areas not scheduled for timber harvest
Matrix	Most of the timber harvest will occur on matrix lands. Standards and guidelines assure appropriate conservation of ecosystems as well as provide habitat for rare and lesser -known species

Whychus Watershed Assessment (1998), Update (2009) and Update (2013)

The Whychus Watershed Assessment (1998), Update (2009) and Updated (2013) prioritizes areas for treatment and guides future management within 12 sub-watersheds on the Sisters Ranger District, including: Upper Indian Ford, Lower Indian Ford, Fourmile Butte, Upper Trout Creek, Lower Trout Creek, Headwaters Whychus Creek, Upper Whychus Creek, Middle Whychus Creek, Lower Whychus Creek, Three Creek, Triangle Hill and Deep Canyon. The Melvin Butte project area falls within the Deep Canyon sub-watershed (see Hydrology section) and also the Cascade Forest Landscape Strategy Area. From the original assessment to the update, this strategy area has risen in priority from 4th to 2nd. This is because there have been sixteen large wildfires in the Sisters Ranger District since 2002 that have reduced mixed conifer habitat, reduced connectivity, and increased the importance of remaining habitat. As it

relates to fire and fuels, the Melvin Butte project responds to several of the goals identified for the Cascade Forest Landscape Strategy Area (CFLR):

- Restore forest habitats.
- Aim for a balance of vegetation within each Plant Association Group resulting in a healthy and resilient forest using the historic range of natural variability as a guideline.
- Reduce potential for habitat loss due to stand replacement wildfires in areas where this type of fire behavior is outside the historic natural range of variability and when risks to public safety and large scale loss of property are unacceptable.
- Protect this habitat from loss due to large-scale fires, insects and disease epidemics, and major human impacts so that late-successional ecosystems and biodiversity are maintained.

Additional input from national policies also guides the planning of activities on Deschutes National Forest lands.

National Fire Plan (2000)

In response to catastrophic fire events prior to 2000, the National Fire Plan of 2000 was co-authored by the Forest Service, Department of Interior, and Western Governors Associations to outline operating principles for firefighting readiness, prevention through education, rehabilitation, hazardous fuels reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology transfer. The National Fire Plan is a series of documents with an accompanying budget request that guides fire and fuels management as to how best to respond to recent fire events, reduce the impacts of wildland fires on rural communities, and ensure sufficient firefighting resources in the future. The National Fire Plan is also where direction on reducing immediate hazards to the Wildland Urban Interface (WUI) began. The Melvin Butte Project responds to the following hazardous fuels reduction and restoration elements of the National Fire Plan:

- Hazardous Fuels Reduction- Assign highest priority for fuels reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires.

- Restoration- Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fire on a priority watershed basis. Methods will include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

Wildland Urban Interface and Community Wildfire Protection Plan

In 2004, the City of Sisters, local fire protection districts, Deschutes and Jefferson Counties, Oregon Department of Forestry, U.S. Forest Service, and the Bureau of Land Management formed a committee to develop a community wildfire protection plan (CWPP) under the direction established by the 2003 Healthy Forest Restoration Act (Project Wildfire 2009). The purpose of the updated 2014 Greater Sisters Country CWPP is to:

- Protect lives and property from wildland fires;
- Instill a sense of personal responsibility and provide steps for taking preventive actions regarding wildland fire;
- Increase public understanding of living in a fire-adapted ecosystem;
- Increase the community's ability to prepare for, respond to and recover from wildland fires;
- Restore fire-adapted ecosystems; and

- Improve the fire resilience of the landscape while protecting other social, economic and ecological values.

The plan outlines a strategy, identifies priorities for action, and suggests immediate steps that can be taken to protect the communities from wildland fire while simultaneously protecting other important social and ecological values. The plan was first revised in May 2006 to include considerations of community growth, seasonal recreation areas, and ingress and egress corridors that were not identified in the initial plan or in the Federal Register (Vol. 66 No 3.). In December 2009, a second revision was drafted to outline updated priorities and action plans for fuels reduction treatments, structural vulnerabilities, and defensible space in the Greater Sisters Country wildland urban interface (WUI). As a result of these revisions, the committee outlined the following goals:

- Reduce hazardous fuels on public lands;
- Reduce hazardous fuels on private lands (both vacant and occupied);
- Reduce structural vulnerability;
- Increase education and awareness of wildfire threat; and
- Identify, improve and protect critical transportation routes
- and prioritized the following treatments on public lands:
- All areas where Crown Fire Potential is rated Extreme by the federal agencies within the designated WUI boundary (*with priority given first to the areas within ¼ mile of communities at risk);*
- Within 300 feet of any evacuation route from each Community at Risk;
- For mixed conifer and lodgepole stands which have missed typical fire cycles and still pose threats of potential crown fires to communities, specific fuels treatments shall be accomplished on federal and state lands to reduce and maintain fuel loads to that which can produce flame lengths of less than four feet to provide for effective initial attack and minimize the resistance to control; and
- Although the treatments should focus on areas rated Extreme for Crown Fire Potential, maintenance of previously treated lands is also a top priority where treatment is critical to maintain this status within the CWPP area. Treatment and maintenance of previously treated lands before treatment begins again in other places is an important component of keeping communities safe.

Additionally, the committee determined that the overall WUI boundary would include communities as well as key transportation corridors and seasonal recreation areas with infrastructure, such as Forest Road 16 and the popular Three Creek Lake recreation area. This site specific definition of WUI will be used throughout this document and differs from that defined in the literature related to the structure protection and the home ignition zone (Cohen no date, Cohen 2000). Research related to the WUI as it relates to the home ignition zone was considered but is unrelated to issue of compromised ingress and egress from the Three Creek Lake recreation area.

Interagency Prescribed Fire Planning and Implementation Procedures Guide

Federal prescribed fire programs are guided by the principles of the 1995 *Federal Wildland Fire Management: Policy and Program Review* (USDA, USDI, 1995) and the 2001 update (USDA, USDI, et al, 2001). Federal wildland fire policy is guided by the 2009 *Guidance for Implementation of Federal Wildland Fire Management Policy* (USDA, USDI, et al, 2014). Collectively these principles establish that

wildland fire programs be implemented equally, consistently and concurrently, as a means to protect, maintain, and enhance resources. Firefighter and public safety are emphasized as priorities in the planning and implementation of all fire management activities.

The purpose of the PMS 484 is to provide consistent interagency guidance, promote common terms and definitions, and provide standardized procedures, for the planning and implementation of prescribed fire.

The PMS 484 describes what is **minimally** acceptable for prescribed fire planning and implementation. Agencies may choose to provide more restrictive standards and policy direction, but must adhere to these **minimums**.

Interagency prescribed fire program goals are to:

- Provide for firefighter and public safety as the first priority.
- Ensure that risk management is incorporated into all prescribed fire planning and implementation.
- Use prescribed fire in a safe, carefully planned, and cost-efficient manner.
- Reduce wildfire risk to communities, municipal watersheds and other values and to benefit, protect, maintain, sustain, and enhance natural and cultural resources.
- Use prescribed fire to restore natural ecological processes and functions, and to achieve land-management objectives.

National Cohesive Wildland Fire Management Strategy (2014)

As a cohesive strategy, effort was designed as a three-phased process to allow for inclusiveness and understanding of the complexities of managing wildfire risks across the country. Environments are created to foster and sustain stakeholder engagement and increase collaboration between federal, state and local governments and partner organizations. The best available science was used to develop a National Cohesive Strategy that will help guide the future of wildland fire management.

The strategy vision is to safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire.

The strategy goals are to:

1.) Restore and Maintain Landscapes
2.) Fire-Adapted Communities
3.) Response to Wildfire

Working in conjunction with scientific data analysis, The National Strategy establishes broad, strategic national-level direction as a foundation for implementing programs and activities across the nation. Based on a landscape-level collaborative approach, describing how the Nation can focus future efforts in making strategic investments to reduce the severe effects of wildfire on areas of high risk.

The mission of the Cohesive Fuels Treatment strategy is to lessen risks from wildfires by reducing fuels build-up in federally-managed forests in the most efficient and cost effective manner possible. Four principles guide the strategy: 1) prioritization, 2) coordination, 3) collaboration, and 4) accountability. While all of these principles are important to fuels management, the first principle *prioritization*, provides direction for treatments proposed in the Melvin Butte project area.

Prioritization - The President and the Congress have given clear direction that priority in the fuels treatment program should focus on two key areas. First, priority should be given inside the WUI, places where people have settled in forests, woodlands, shrublands, and grasslands. Here, people, their

structures, and their work face the greatest threats. Second, outside the WUI, priority treatments must concentrate on sites where vegetation is most likely to support catastrophic fires that threaten vital resources or locations of particular value to local communities. In addition, non-WUI treatments must be applied to areas where fuel loads could quickly increase to dangerous levels without active management.

In the Melvin Butte project area, the proposed action and action alternatives recommend treatments adjacent to private land that are outside of the designated WUI. Vegetation in these areas could support a wildfire that could threaten vital forest resources, such as the city of Bend's municipal water supply. The Rooster Rock fire, which started in early August of 2010, is an example of how a fire initiating on Forest Service land in this area could easily travel to private land and threaten this resource (Rooster Rock Fire WFDSS Decision; Noonan-Wright et al 2011). Fire behavior during active burning periods was documented as primarily fuels and spot fire driven with flame lengths too high for direct attack (Loomis 2010).

Clean Air Act

Air quality is an important aspect of the central Oregon area. For the most part, air quality conditions are good except during certain times in the winter when temperature inversions create woodstove pollution problems, and certain times in the spring and summer when prescribed burning activities are occurring (1990 LRMP, pg. EIS 2-131).

The 1990 federal Clean Air Act (CAA) is a legal mandate designed to protect human health and welfare from air pollution. Individual states develop programs for implementing the CAA through State Implementation Plans. For this area we utilize the Oregon Department of Forestry (ODF) Smoke Management Plan.

The Oregon Implementation Plan considers local geography and industry to further define how the provisions of the CAA would be implemented through the Oregon Smoke Management Plan. The pollutants thought to affect human health include particulate matter emitted in smoke that is less than 10 microns in diameter (PM 10). The plan includes regional monitoring and regulation of pollutants less than 10 and 2.5 micrometers (PM 10 and PM 2.5) in size. The Forest Service is required by law to follow the directions of the State Forester in conducting prescribed burning in order to achieve strict compliance with all aspects of the CAA by working in conjunction with the Oregon Department of Forestry (ODF) to adhere to the Oregon Smoke Management Plan. The prevention of **Significant Deterioration** provisions of the CAA requires measures, to preserve, protect, and enhance the air quality for areas designated as "Class 1" airsheds (42 U.S.C. 475(d)(2)(B). The closest Class 1 airshed is the Three Sisters Wilderness located 1 mile west of the project area.

A **Smoke Sensitive Receptor Area (SSRA)** is an area designated by the board, in consultation with the Department of Environmental Quality that is provided the highest level of protection under the smoke management plan because of its past history of smoke incidents, density of population or other special legal status related to visibility (OAR-629-048-0140).

The following are potential project area SSRA's: Redmond located 20 air miles and Bend approximately 12 air miles.

In 2005, the ODF Smoke Management Program developed a concept known as the "Best Burn Day Strategy". This strategy helps to reduce the amount of burning necessary on marginal days when a higher likelihood of smoke intrusions exists. Specifically, the "Best Burn Day Strategy" seeks to:

"provide maximum opportunities for land management objectives to be met while maintaining air quality, health standards and visibility objectives. Burning can be managed more effectively with improved

coordination, communication, technology, public education, increased utilization of forest fuels and maximizing burning during optimum burning conditions whenever possible" (ODF-SMP, pg. 1).

Fire Behavior Modeling Assumptions, Limitations, and Inputs

Fire Behavior modeling inputs (LANDFIRE 2010: LF 2010 – LF 1.2.0) were downloaded from www.landfire.gov. LANDFIRE delivers seamless landscape-level, geospatial canopy and fuels data products for incorporation into fire behavior modeling software. Methods are based on peer-reviewed science from multiple fields. LANDFIRE products are consistent, comprehensive, and standardized. Efforts were made to field verify and update the data to reflect some of the recent vegetation changes across the modeling area, including the effects from recent fires (i.e., Pole Creek). However, the amount and extent of error is uncertain. Although this approach has limitations, model outputs yield useful information for comparisons of landscape fuel treatments (e.g. pre- and post-treatment effectiveness; Stratton 2004).

FlamMap, a fire behavior mapping and analysis program that computes conditional fire behavior characteristics (flame length, crown fire potential, burn probability, etc.) over an entire landscape, was used with LANDFIRE to determine fire hazard across the Melvin Butte project area. Fire behavior outputs are considered "potential" because they are conditional on a fire actually occurring (Finney 2006). FlamMap is a state of the art tool used by many researchers and in many studies including, Finney (2006), Stratton (2004), Gerke and Stewart (2006), Stratton (2009), and Ager et al. (2010), to name a few. FlamMap uses eight distinct raster (i.e. "grid") data files (aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class) and specific weather and fuel moisture conditions as inputs.

Modeled fire hazard potential provides a "snap shot" of the existing condition for fuels and describes the likelihood of effective fire suppression actions under simulated weather and topography conditions. This metric assumes that there is no connection between adjacent pixels of data and is based on the combination of flame length and crown fire potential. In FlamMap, flame length calculations are based primarily on the surface fire spread models while crown fire activity links surface fire activity with canopy characteristics (Rothermel 1972, VanWagner 1977, Rothermel 1991, Finney et al. 2006). Therefore, combining crown fire activity with flame lengths into one metric provides a comprehensive depiction of the current "hazard" within an area.

In order to determine the effect to air quality resulting from wildfire compared to prescribed fire, an analysis was done with the computer model First Order Fire Effects Modeling (FOFEM). Currently, FOFEM provides quantitative fire effects information for tree mortality, fuel consumption, mineral soil exposure, smoke emissions and soil heating. The assumptions made within FOFEM and in this analysis are as follows:

- Smoke potentially impacts human health through inhalation of Particulate Matter (PM).
- The National Fuel Loading Models (FLM) data set was used for both prescribed burning and wildfires. This data set was masked to areas within the Melvin Butte project area where prescribed fire may occur under each Alternative. The FLM surface fuel classification system (Lutes et al. 2009) was developed by the Missoula Fire Sciences Laboratory to characterize wildland surface fuels. The FLM provide a simple and consistent way for managers to describe onsite fuels for input into the FOFEM model.
- Prescribed burning is conducted under typical spring fuel moisture conditions (1 hour fuels 6%, 10 hour fuels 8%, and 100 hour fuels 10%); wildfires occur under 90th percentile fire season fuel moisture conditions (See Assumptions section for more detail)

- PM outputs under all alternatives are modeled using the existing fuel vegetation profile. Treatment effects (thinning, mastication, harvest, and biomass removal) will ultimately reduce fuel loading and/or arrangement and thus emissions prior to prescribed burning. Using the existing fuel profile, rather than the treated fuel profile, allows for the most conservative comparisons of emissions or a "worst case scenario" approach accounting for temporal variability associated with treatments across the project area.

Indicator and Measurement

The primary purpose of the Melvin Butte project is to decrease fire hazard. There is a need to reduce forest fuel loadings in order to lessen the hazard associated with uncharacteristic and large wildfires threatening nearby communities and key ecosystem components. To indicate how the alternatives affect fire hazard within the Melvin Butte planning area the following measurements are used:

1) Change in fire hazard across the project area. The measure is the amount of area in acres of low, moderate, and high fire hazard when compared to all alternatives.
2) The effect to air quality resulting from high intensity wildfire. The measure is the production of PM 2.5 and PM 10 under wildfire vs. prescribed fire conditions for proposed treatment areas.

What is Fire Hazard?

In regards to wildland fire, there exists a considerable range of definitions for hazard (Hardy C. C., 2005). For the purpose of this analysis, the following definition is used:

Fire Hazard is a fuel complex, defined by volume, type, condition, arrangement, and location that determines the degree of ease of ignition and the resistance to control (NWCG 2014).

This analysis assumes that a fuel complex rated low for fire hazard will not support widespread crown fire and surface fire behavior will be of relatively low intensity under summer like weather conditions. To rate wildfire hazard, the matrix in Table 180 was used (Valliant, Ager, Anderson, & Miller, 2012).

Table 180 Fire hazard matrix for the Melvin project area (Vaillant et.al. 2012)

Potential Flame Length (ft.)	Crown Fire Potential		
	Surface*	Torching	Active
Less than 4	Low	Low	Moderate
4 – 8	Moderate	Moderate	Moderate
8 – 11	Moderate	High	High
More than 11	High	High	High

*no crown fire potential

Using this matrix, fire hazard is represented as a combination of potential flame length and crown fire activity in which the fuel complex will support during 90th percentile weather conditions.

Weather and Fuel Moisture Inputs

The Round Mountain Remote Access Weather station (RAWS) was selected as the weather station that best represents fuel conditions for the planning area, since it is located at a similar elevation (5,900 feet) to the project area and temperature, relative humidity, and consequently fuel moistures are closely tied to elevation. The Colgate RAWS is closer to the Melvin Butte planning area than the Round Mountain RAWS, but the Colgate RAWS sits at a lower elevation (approximately 3,280 feet) and consequently may underestimate fuel moistures (which would overestimate fire behavior). The modeling inputs used in fire

behavior modeling are those representing the 90th percentile "fire season" (July 1 to September 30) conditions from the Round Mountain RAWS from 1996 to 2013. The Round Mountain RAWS has data available from 1988 to 2013, but the most complete data set is available from 1996 to 2013. Sensitivity analysis of the dead fuel moisture conditions at the Round Mountain RAWS showed very little difference between the 97th and 80th percentile conditions for fuel moisture, indicating a generally receptive fuel bed during a substantial proportion of fire season. Dead fuel moistures were conditioned using 90th percentile weather including, humidity and temperature prior to modeling to incorporate the local spatial variability in dead moisture that occurs with topographical influences. As live and herbaceous fuel moistures predicted from RAWS stations are modeled rather than field sampled, the values extracted from the RAWS were increased by 20% to be more in line with live fuel moisture sampled across the forest (National Fuel Moisture Database 2014). Historic gust data, also derived from the Round Mountain RAWS, was used to identify wind speeds in the modeling environment, since average wind speeds derived from RAWS stations represent a 10-minute average taken only once at 1300hrs daily. Research has shown wind speeds that persist for only one minute can produce large fluctuations in flame height, trigger crowning, and throw showers of sparks across a fireline (Stratton, 2004). A northwest wind (315°) was used in the Melvin Butte analysis since most historic large fires in this particular area on the Sisters Ranger District have burned generally in a south easterly direction (see Figure 19).

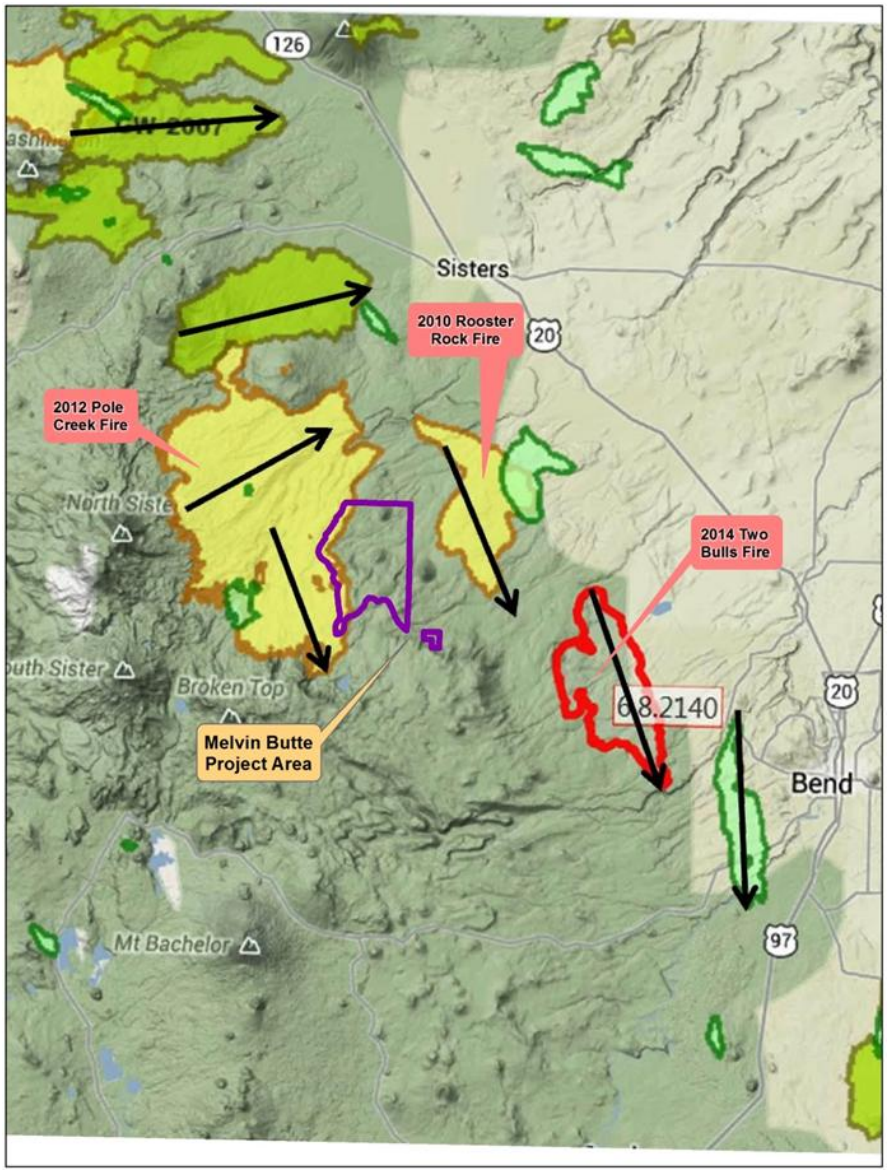


Figure 19 Historical fire spread direction N-S & W-E. One day spread distance of 4 to 6 miles (Stratton 2014).

Table 181 Percentile fuel moisture and winds used to model fire behavior within the Melvin Butte planning area and vicinity

Variable	80th Percentile	90th Percentile	97th Percentile
1 hour fuel moisture (%)	3	3	2
10 hour fuel moisture (%)	4	4	3
100 hour fuel moisture (%)	8	7	6
Live herbaceous moisture (%)	40	35	35
Live woody moisture (%)	84	83	83
Wind Gust (mph)	22	25	30
Wind direction	Northwest		

Project Area Description

Fire Regime

Fire regimes are used to describe the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects, in a given area or ecosystem (NWCG, 2014). A fire regime is a landscape level reference condition generalization based on fire histories at individual sites. There is no record of a significant fire within the Melvin Butte project boundary in the past 100 years. The national, coarse-scale classification of fire regimes includes five groups:

Fire Regime I: 0-35 years, Low severity

Typical climax plant communities include ponderosa pine, eastside/dry Douglas-fir; where surface fires are most common. Large stand-replacing fire can occur under certain weather conditions, but are rare events (i.e. every 200+ years).

Fire Regime II: 0-35 years, Stand-replacing, non-forest

Includes true grasslands and savannahs with typical return intervals of less than 10 years, with typical return intervals of 10-25 years.

Fire Regime III: 35-100 years, Mixed severity

This regime usually results in heterogeneous landscapes. Large, stand replacing fires may occur but are usually rare events. Such stand-replacing fire may "reset" large areas (10,000-100,000 acres) but subsequent mixed intensity fires are important for creating landscapes' heterogeneity. Within these landscapes a mix of stand ages and size classes are important characteristics; generally the landscape is not dominated by one or two age classes.

Fire Regime IV: 35-100+ years Stand-replacing

Seral communities that arise from or are maintained by stand-replacement fire, such as lodgepole pine, aspen, western larch, and western white pine, often are important components in this fire regime. Dry sagebrush communities also fall within this fire regime. Natural ignitions within this regime that results in large fires may be relatively rare, particularly in the Cascades north of 45 degrees latitude.

Fire Regime V: >200 years, Stand-replacing

This fire regime occurs at the environmental extremes where natural ignitions are very rare or virtually nonexistent or environmental conditions rarely result in large fires.

The Melvin Butte project area is composed of vegetation characterized by Fire Regime II, III, IV, & V as shown in Table 182 and Figure 20.

Table 182 Fire regimes by acres in project area.

Fire Regime	Description	PAG	ACRES	% Forested
I	0- 35 year, frequent low severity	P. Pine	1,109	21%
III	35-100+ years, mixed severity	M. Conifer	3,690	69%
IV	35-100+ years, stand replace severity	LP. Pine	523	10%
V	200+ years, stand replace severity	Hemlock	8	0%
OTHER	Not burnable or Unclassified	Rock /Cinder	44	0%
TOTAL			5,374	100%

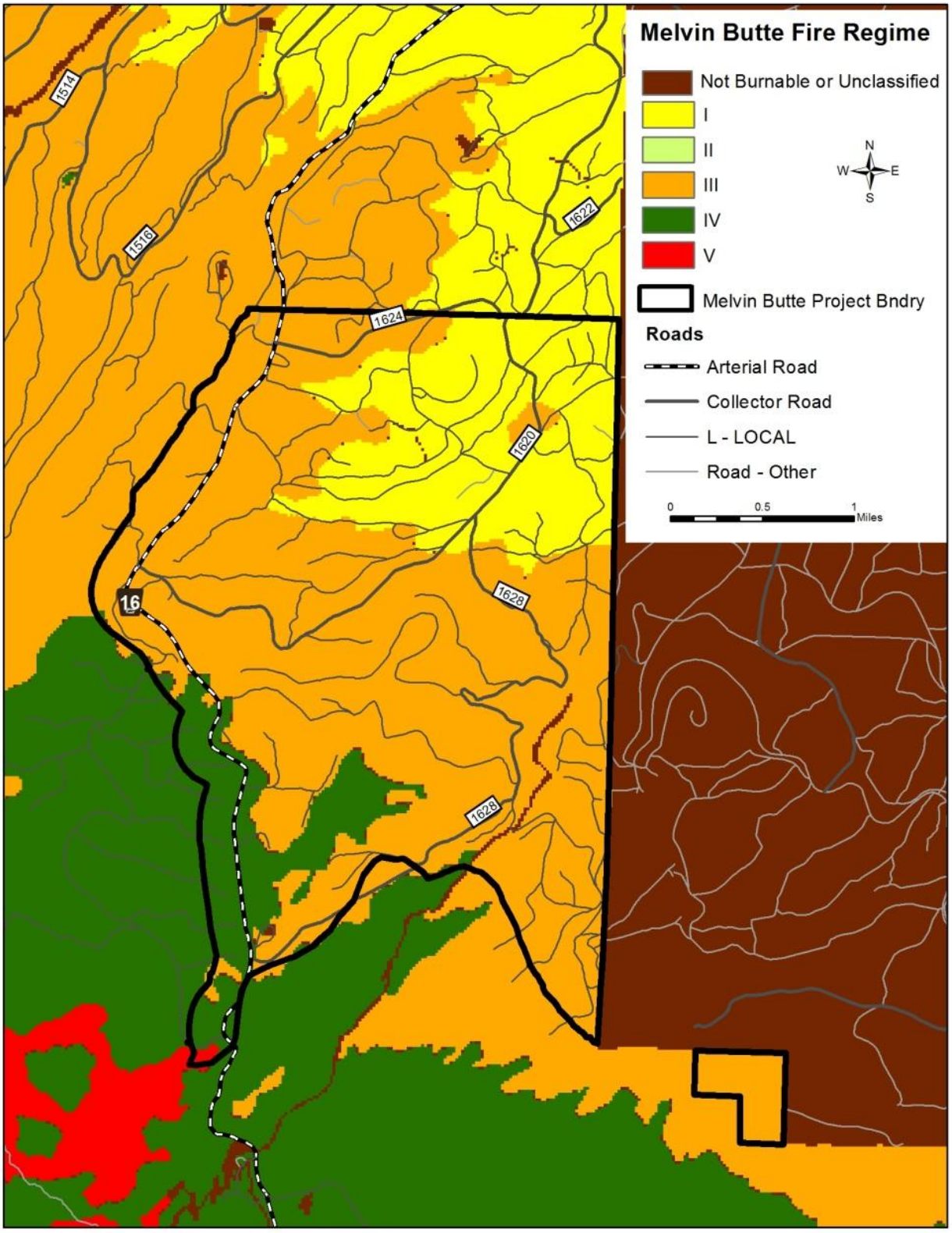


Figure 20 Melvin Butte planning area historic fire regimes.

There is no record of a significant fire within the Melvin Butte project boundary in the past 100 years. Prior to the enactment of federal resource management agencies around 1910, approximately 40 to 50 thousand acres of the 1.6 million acre Deschutes National Forest burned annually, primarily in frequent fire adapted ponderosa pine forest type but also in mixed conifer forest type in the upper elevations of the project area. Fires were a mix of low and mixed severity that maintained the structural and compositional stages within the historic range of variability (HRV). Past forest management practices such as regeneration harvest (clear-cutting and over-story removal) and fire exclusion through fire suppression policy have shifted the structural stages outside of the HRV in the Melvin Butte project area. Along with Fire Regime analysis the project uses HRV as a reference framework for historical estimates of forest size-classes (structure) and seral stages, tree species (or lack of) proportional dominance, that may have been present at any given point in time in the past 300 years (see the silviculture section of this environmental assessment for more details pertaining to HRV).

A significant amount of departure from reference conditions affecting resilience occurs in the ponderosa pine, where large diameter open ponderosa pine and mixed conifer plant association groups (Whychus Watershed Analysis). Historically, about 90% of the project area was dominated by large ponderosa pine. Currently, more than 75% of the project area is dominated by trees less than 20 inches in diameter at breast height. Much of this acreage occurs as small blocks of plantations (about 22% of the project area); second growth stands; lodgepole pine stands; or other areas dominated by small trees.

Fire History

Fredrick Colville's 1898 report, "Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon", generally describes vegetation on the eastern slope of the cascades over century ago. Colville described ponderosa pine-dominated forests 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 describes the upper range of ponderosa pine forests as "denser, and often contain a considerable amount of Douglas spruce [fir]….California white fir… with an undergrowth of snowbrush…manzanita…" and the areas dominated by lodgepole pine as "small, thin barked trees easily killed by fire…..set so close together that it is often difficult to ride through them on horseback".

More than a century of human intervention has inadvertently created conditions that have put mixed-conifer forests in the Pacific Northwest at considerable risk. Fire exclusion and past logging and grazing practices have contributed to this problem, as have uncharacteristically large insect outbreaks and severe wildfires (Merschel, Spies, Heyerdahl 2014).

Evolving fire science and recent publications covering fire ecology topics such as fire history, and effects of thinning and burning on fire behavior and fuels is notable and applicable to the Melvin Butte planning area. Hyerdahl et. al. (2012) conducted a fire ring study within the Whychus Watershed concluding that between 1675 – 1850 fires occurred every 8 years on average (range 4 to 16 years). Everett et al.(2000) report on mean fire free intervals of 6.6 to 7 years in dry forest types during the pre-settlement period (1700/1750-1860**)** and lengthened intervals of 3 to 38 years during the fire suppression period (1910-1996). They found a clear shift to a less frequent, but greater severity fire regime, associated with longer recovery intervals (Everett et al. 2000)

Wright and Agee (2004) report mean fire free intervals of 7 to 43 years (1562 to 1995) in dry mesic forests of eastern Washington State. Sampling with Dry forests suggested that historical fires were of low intensity, leaving over story structure intact. The composition and structure of the historical forest was characterized by a preponderance of very large (>100 centimeters or 39.4 inches dbh) ponderosa pine. Mesic forests exhibit a wider range of fire severities, with moderate and occasional high severity fires or crown fires. Fire frequency and size decline dramatically about 1900, coincidentally with increased timber harvesting and fire suppression (Wright and Agee 2004).

Recent large fire occurrence in and around the project area (Figure 21 and Table 183) provides some insight into potential fire behavior and impacts to the Whychus watershed and the Melvin Butte project area.

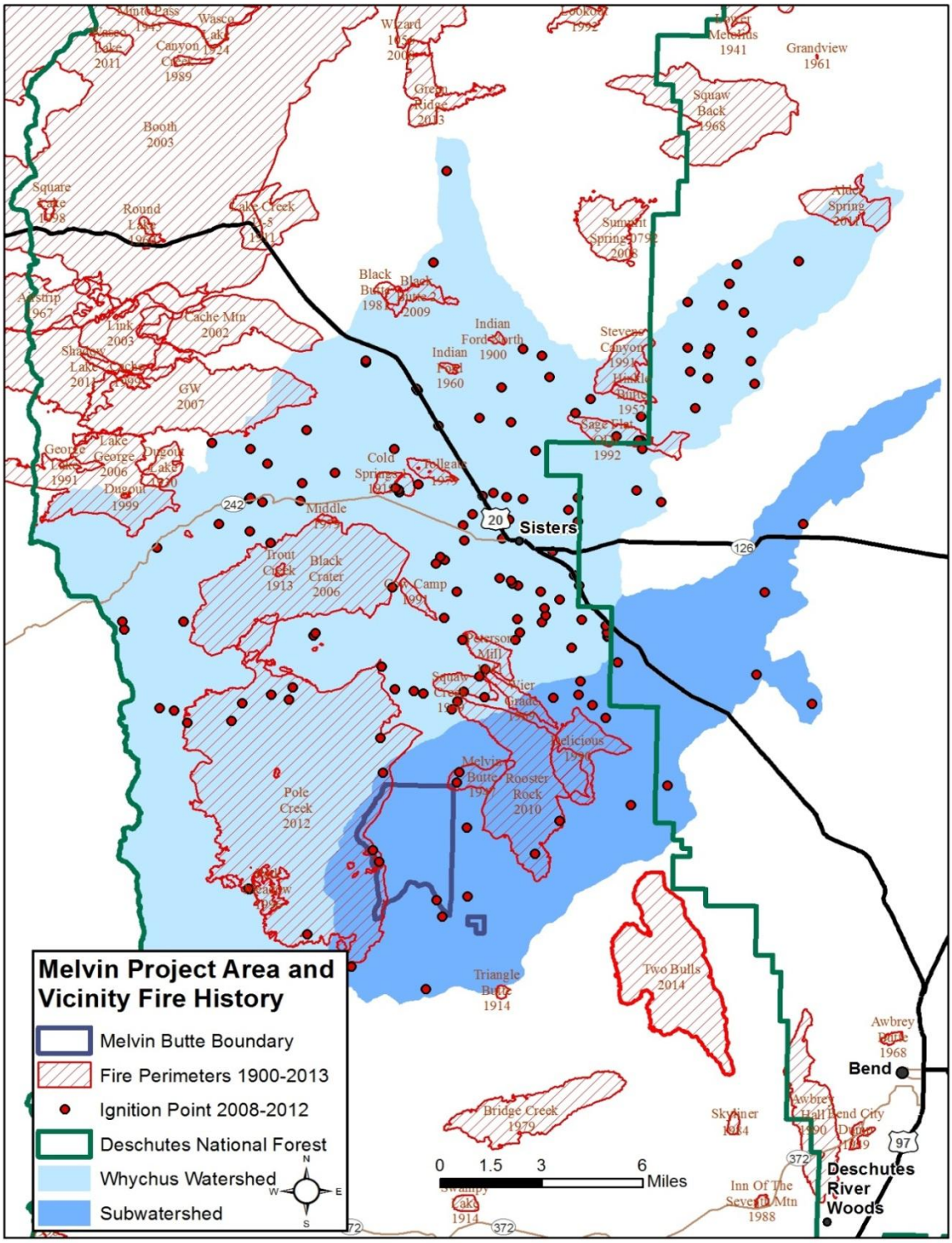


Figure 21 Fire occurrence within the Whychus Watershed.

Table 183 Nine significant fires surrounding the Melvin Butte Project area since 2000. The analysis area acres are within the Whychus Watershed.

Fire Name	Year	Cause	Fire Acres	Analysis Area Acres
Cache Mountain	2002	Lightning	4,358	43
Black Crater	2006	Lightning	9,411	9,396
Lake George	2006	Lightning	5,537	1,857
GW	2007	Lightning	7,349	954
Stevens Canyon	2008	Lightning	173	76
Black Butte II	2009	Lightning	578	559
Rooster Rock	2010	Human	6,119	6,119
Alder Springs	2011	Human	1,449	1,052
Pole Creek	2012	Lightning	26,119	26,119
TOTAL			**61,093**	**46,175**

The most recent fire of significance is the human caused Two Bulls Fire, June 7th 2014. Beginning as two fires (Figure 22) that merged into one, the Two Bulls fire travelled six miles in an afternoon and evening. The northerly wind driven fire prompted immediate evacuations in areas west of Bend. No homes or structures were damaged or lost as a result of this fire. However, equally strong winds out of the west would have likely led to several more subdivisions being impacted by the fire. The fire burned approximately 6,908 acres of mostly private land and cost nearly $5.6 million to suppress. Two Bulls, which was primarily influenced by a strong north wind, occurred three miles east of the Melvin Butte planning area. The fire regime and fuel type are similar to what is found in the Melvin Butte planning area. The Two Bulls fire provides an example of expected spread rates and fire growth.

Figure 22 2014 Two Bulls Fire. Photo by Steve Orange, Sisters Ranger District Timber Sale Administrator.

The second most recent fire of significance is the lightning caused Pole Creek Fire, September 9th 2012, which occurred directly west and adjacent to the Melvin Butte planning area. The Pole Creek fire travelled three to four miles during its first burn period and grew to about 26,119 acres. No homes or structures were lost, however, notification and evacuation strategies were implemented immediately and key ecosystem habitat was severely impacted. Additionally, the Three Creek Lake recreation area along with the city of Bend's municipal watershed was threatened. This fire (Figure 23) burned actively for three weeks in fire regimes I, III, IV & V, produced significant smoke impacts, and cost upwards of $18 million to suppress. Fuels treatments played a significant role in stopping the fires spread to the east, which provided anchor points for fire suppression personnel during containment efforts. The burned area contains similar fire regime and pre fire fuel type to the Melvin Butte project area, thus the Pole Creek fire provides an example of expected spread rates and fire growth.

Figure 23 2012 Pole Creek Fire. Photo taken from Broken Top by Katie Ryan.

The third most recent fire of significance is the human caused Rooster Rock, August 2, 2010, which occurred directly north and east of the Melvin Butte planning area. The Rooster Rock fire travelled three to four miles during the first burn period and grew to about 6,119 acres. This fire burned one structure, threatened numerous other structures and resources of concern, including the city of Bend's municipal watershed (Rooster Rock Fire WFDSS Decision; Noonan-Wright et al 2011). Fire behavior was documented as primarily fuels and spot fire driven with flame lengths too high for direct attack (Loomis 2010; Figure 24). Weather at the time of Two Bulls, Pole Creek, and Rooster Rock fires, as well as forest fuel conditions are representative of events and conditions, respectively, which occur within the Melvin Butte planning area.

Figure 24 Head of Rooster Rock fire with two spot fires along the flank. Displays typical fire behavior in Melvin Butte project area vegetation type. Photo courtesy of Mel Gard, archived on Inciweb.

Existing Condition

The Melvin Butte area is characterized by large areas of mistletoe infested ponderosa pine stands with an area of beetle killed lodgepole pine intermixed with dense stands of mixed conifer. Mountain pine beetle epidemics in lodgepole pine forests can leave vast acreages of forest with dead lodgepole pine (Raffa et al. 2008) and the past 30 years on the Deschutes and Fremont-Winema National Forests can serve as an example of the scale of these disturbances. There have been two distinct peaks in activity in the region, one occurring in the 1980s and the other more recently ramping up after 2000, persisting to this day at a distinctly lower level (Shaw. Et al. 2012). Decades of fire exclusion, insect and disease activity, and previous forest management activities, have all contributed to relatively high vertical and horizontal forest fuel loadings. The current landscape condition combined with lightning or a human caused ignition source during typical summer time weather creates an atmosphere where a wildfire could present a high risk to human safety and loss of vital forest habitat.

Forest Fuel Condition and Fire Hazard

The combination of dwarf mistletoe activity (see silviculture section), previous forest management practices, and fire suppression activity over the last 100 years has shaped current vegetative conditions and consequently fuels within the Melvin Butte project area (Figure 25).

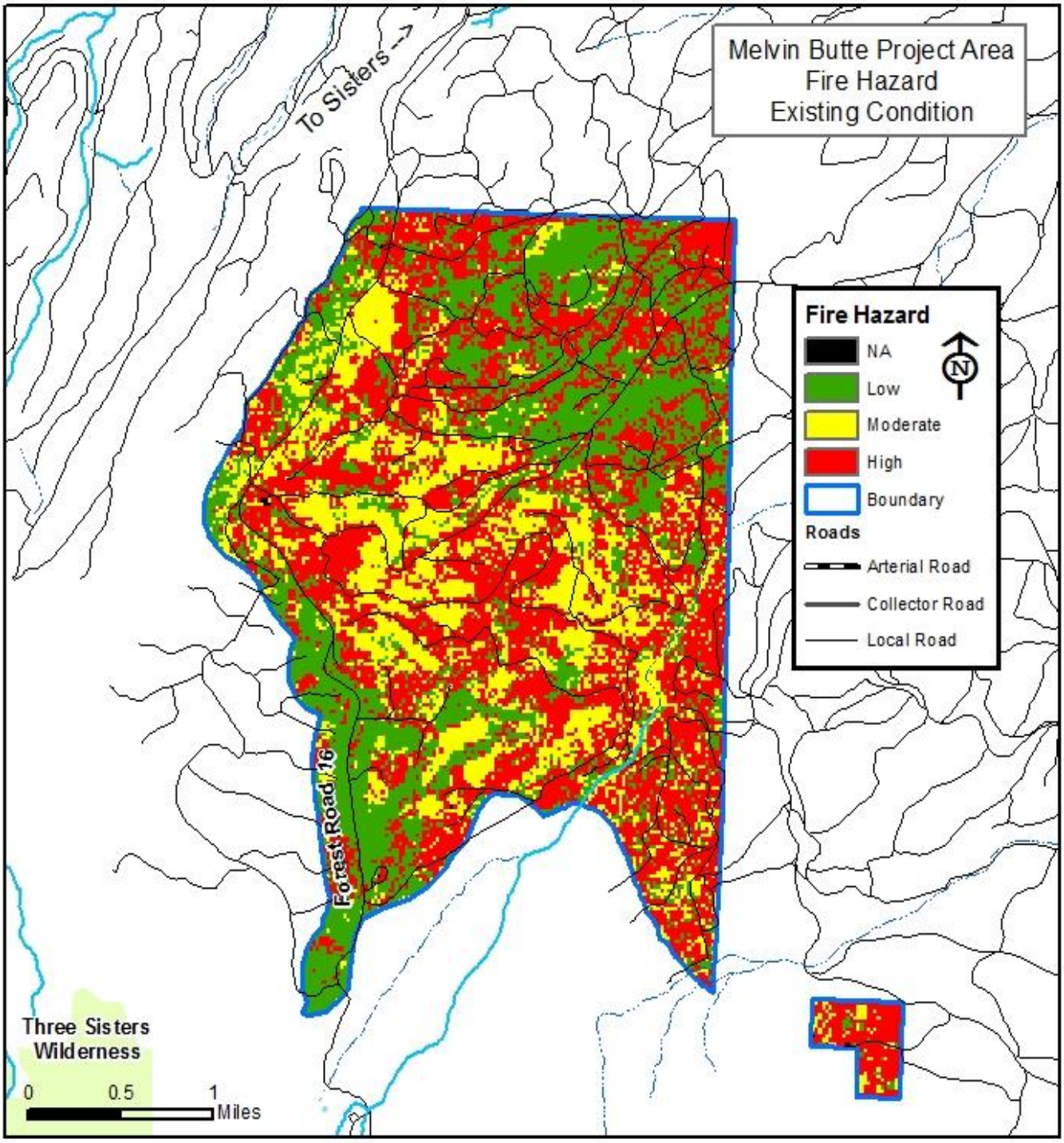


Figure 25 FlamMap and GIS modeling display of the existing fire behavior hazard within the Melvin Butte Project boundary.

Values at Risk

Wildfire in this area could quickly threaten nearby recreational developments, adjacent private timberland, and the Bend Municipal Watershed. Deschutes National Forest fire managers have identified

the roadless areas to the south and unburned wilderness areas to the southwest of Melvin Butte as High Risk Exposure Areas. *Firefighter and Public Safety* - High fuel loadings, continuous fuels, poor access and high snag densities classify these areas as safety hazards that increase the risk of exposure for initial attack and/or extended attack firefighting resources. The project area coupled with adjacent vegetation management project areas is bordered by private land, wilderness and roadless areas. From a landscape view, this is one of the few areas where treatments can be implemented on a large enough scale to make a significant change in fire hazard. Public health and air quality degradation would be a concern if wildfire occurred in the Melvin Butte area. The communities of Sisters, Redmond, and Bend experienced six consecutive days of severely degraded air quality during the Pole Creek Fire when the 24-hour average for levels of PM 2.5 (fine particulate matter) remained in the "Very Unhealthy to Hazardous" range (Oregon Health Authority and Oregon Department of Forestry, 2014). Smoke impacts from the Pole Creek Fire were felt across Jefferson and Deschutes Counties, as well as the Willamette Valley.

Forest Road 16 WUI Travel Corridor - Accessible from the town of Sisters, is the primary travel route within the project area to the Three Creek Lake recreation area and is considered WUI due to its critical role as a travel corridor and evacuation route. The Greater Sisters CWPP steering committee expressed great concern over critical transportation routes, such as Forest Road 16, as part of the CWPP planning process and recommended that routes such as these be protected (Project Wildfire 2014). A problem fire, lightning or human-caused could jeopardize ingress to and egress from the Three Creek Lake Recreation area and consequently jeopardize public and fire fighter safety. Because of this, there is an immediate need to reduce and maintain arterial travel corridors. Fire hazard can be explicitly defined in many ways but is fundamentally the state of the fuels as determined by the volume, condition, arrangement, and location (Hardy 2005). For this reason, treating fire hazard must modify fuels in a way that lessens the likelihood of fire ignition, potential damage, or resistance to control (Evans et al 2011).

The 2012 Pole Creek post fire perimeter includes a section of FS road 16. The two lane paved road was used as a containment strategy called backfiring. Backfire is a tactic associated with indirect attack where fire managers intentionally set fire to fuels inside the control line to slow, knock down, or contain a rapidly spreading fire. Backfiring provides a wide defense perimeter and may be further employed to change the force of a convection column (NWCG, 2014). Although the western side of FS road 16 has received recent fire activity, vertical and horizontal fuel loads are at levels in support of high intensity fire and do not provide an adequate margin of safe egress and ingress to firefighters and the public.

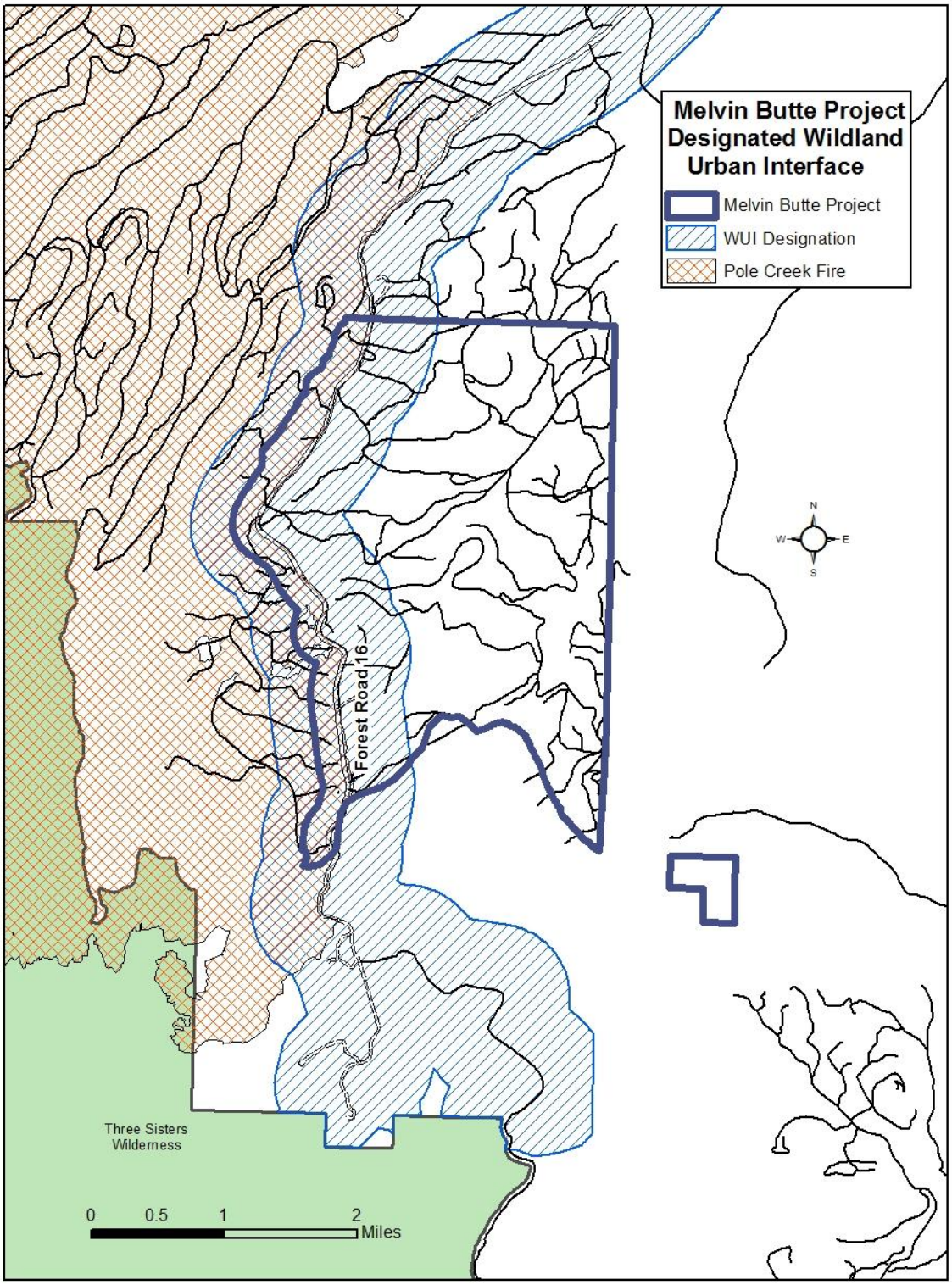


Figure 26 Forest Road 16 travel corridor designated as Wildland Urban Interface by the Greater Sisters Country CWPP.

Across much of the Melvin Butte project area, treating the WUI (Figure 26) in combination with the surrounding landscape functions will reduce fire hazard, reintroduce fire into fire adapted systems, and improve ecosystem health.

Private Timberlands – The east side of the Melvin Butte planning area is bordered by the "Skyline Forest". The Skyline Forest, currently owned by Whitefish Cascade, is a 33,000 acre (50 sq. mile) tree farm historically known as the Bull Springs Tree Farm. The 2014 Two Bulls Fire burned more than 6,000 acres of the Skyline Forest. Fidelity's Skyline Forest contains an informal system of trails, wildlife habitat and a migration corridor for mule deer and elk moving between summer and winter range (Deschutes Land Trust, 2014).

Recreation Values – Upper and Lower Three Creek Sno-Parks, Triangle Hill Loop and portions of the Windigo Cross District Trail are located within the Melvin Butte project area. All but the Windigo Trail are primary attractions to winter recreationists. Within a mile of the southern portion of the project area boundary there are five trailheads and three campgrounds as described in Chapter 3 of the Melvin Butte EA. This area can attract upwards of 400 recreationists at one time during summer months. Safe and timely evacuations on a one way ingress to and egress from route will be the primary concern if a wildfire were to impact the area.

Bend Municipal Watershed – The Bridge Creek Watershed approximately 3.5 miles south from the project area. Approximately half of Bend's water comes from this area. As seen in Figure**(Historical fire spread direction, N-S & W-E. One day spread distance of 4 to 6 miles (Stratton, 2014)) an established wildland fire occurring in the Melvin Butte project area has high potential to move south and threaten this watershed.

See "Hazard Reduction Strategy and Principles to Protect Values at Risk" within the Project Design section to view values at risk vicinity map.

Project Design

Description of Hazardous Fuels Reduction Activities

Table 184 Total project area treatments acres by analysis Alternatives 2 and 3

Alt. 2 Treatments	Acres	Alt. 3 Treatments	Acres
Prescribed Fire	809	Prescribed Fire	809
Thinning	998	Thinning	1,923
Mixed con. group openings	835	Lodgepole pine imp.	249
Dwarf mistletoe areas	160	Plantation	1,174
Lodgepole pine imp.	249	Scenic View Enhance	240
Plantation	1,174	*Retention Strategy	775
Scenic View Enhancement	240	*No Treatment	229
*Retention Strategy Area	775		
*No Treatment	159		
Alt. 2 Total Acres	4,465	Alt. 3 Total Acres	4,395

*Retention Strategy Area and No Treatment acres were analyzed for treatment. Specialists determined no primary or secondary treatments will occur on these acres thus not included in the Alternative acres for each Alternative.

Small and medium size tree harvest is accomplished by using ground based harvest equipment. Some small tree thinning may be accomplished by hand while utilizing chainsaws. Small tree thinning units, identified as pre-commercial thinning (PCT), are typically plantation treatments thinned at a level desired to meet wildlife and silvicultural objectives (Table 184).

Activity slash fuel generated from PCT units may be 1) lopped and scattered or 2) piled by machine or by hand and burned or removed as biomass. Ladder fuel reduction (LFR), typically occur in the Thinning, Scenic View Enhancement, Lodgepole pine improvement treatments thinning of small trees up to 8" in diameter in based on silvicultural prescription. Excess slash material remaining with LFR treatment units would be piled by machine or by hand and burned or removed for biomass.

Mowing is proposed as a secondary treatment in both action alternatives to decrease the height of live or dead brush through the mastication (mowing) of brush in stands as needed throughout treatment units within the project area.

Burn only (with small tree thinning permitted to prepare containment lines for holding purposes in EA unit 8) treatment is proposed on 30 acres to re-introduce fire on the landscape and to meet wildlife objectives in both Alternatives 2 & 3.

Prescribed Fire is proposed as a secondary treatment on all acres for each alternative following thinning and mowing activities. All prescribed fire activities would occur when fuels and weather conditions are conducive to achieving planned fuels and resource objectives. Typical underburn conditions occur during spring and fall seasons, however depending on the season, objectives may still be achieved any time of year.

Underburning results in some amount of first order, or short-term, fire effects that include bole scorch, needle scorch, shrub mortality and at times may also result in some tree mortality. These effects depend on many variables such as climatology, stand condition, fuel loadings, fuel moistures, ignition patterns and weather conditions during burn operations.

All proposed treatment units will receive some form of thinning, mowing, and underburning to reduce surface fuel loadings. Fire behavior analysis and professional experience conclude that all successional treatment types achieve desired conditions. Longevity of treatments and other ecological values such as brush response, recruitment of beneficial species, and nutrient cycling indicate that prescribed underburning is the desired treatment over mowing in stands that have been both proposed for mowing and/or underburning. Best available science shows that all intermediate treatments should be accompanied by surface fuel modification, and the most success related to effective fuel reduction is achieved when using prescribed fire for such treatments (McIver et al. 2012; Graham et al. 1999).

Hazard Reduction Strategy and Principles to Protect Values at Risk

As seen in the existing condition hazard rating Figure 27high fire hazard exists within the project area. Fire knows no boundaries, once a fire gets established under the current conditions intensities will build quickly with minimal opportunity to contain and protect values at risk. When designing treatments, consideration was put into how fire would travel across the landscape (see Figure 19 historical fire spread direction in Weather and Fuel Moisture Inputs section). The intent is to maximize treatment effectiveness through strategic placement emphasis towards values at risk. The figure to the right shows the location of strategic roads, campgrounds and trailheads, the Bridge Creek Watershed, and other ownership lands within and adjacent to the Melvin Butte project area.

Road Systems and WUI Corridor

Road systems allow ground suppression forces to access wildfires. Use of major roads in a defensible space is recommended, especially in the WUI where public safety and evacuation is of high concern. Forest Road 16 within the WUI corridor would be cleared of contiguous surface fuel loading up to 250 feet from both sides of the road. Forest Roads 1620, 1624, and 1628 would be cleared of contiguous surface fuel loadings up to 150 feet from both sides of each road where permissible. Snags should not be retained near the roads (within a tree length) that remain open to the public. This strategy allows for safe ingress/egress to and from a fire for fire fighters and ties in with the Greater Sisters Country CWPP Action Plan and Implementation priorities. Consequently, when fuel conditions allow surface fires to gain high intensities and get into the canopies of trees contributing to extreme fire behavior (torching, crowning, and long range spotting), direct attack by ground forces becomes ineffective. Wildland fires under these conditions will cross any road system with such intensity that suppression forces have little chance of containing the fire from the road. Aerial delivery of fire retardant alone will only slow a wildfire for a short period of time. Suppression forces need to quickly utilize the effect of the retardant to contain a wildfire. Roads provide a good area for retardant to be utilized by suppression forces.

Private Timberlands

On the eastern edge of the project adjacent to the Skyline Forest, emphasis would be placed on hazardous fuels reduction by not allowing for wildlife clumps within 600 feet of the private ownership boundary. Downed wood or slash piles should not be retained within 200 feet of the private ownership boundary in order to limit ember production and spotting onto private inholdings in the event of a fire initiating on federal lands.

Key Ecosystem Components

Late Successional Old Growth areas are designated for survey and manage protocols as assigned by the 1994 Northwest Forest Plan. Surveys were not completed within the Melvin Butte project area however, there is an applicable court ruling exemption referred to as Pechman allowing plantations and prescribed fire fuels reduction treatments without pre-disturbance surveys. Pechman (d) states that only trees less than 8 " dbh can be cut and removed as biomass; it also allows prescribed burning. These large old trees are currently at risk from ladder fuel and surface fuel accumulations. The Pechman Exemption would be utilized to treat specific units as displayed in Table 185 below to protect 541.3 acres of old growth stands. For more information regarding survey and manage see the botany section of this environmental analysis.

Table 185 Pechman Exemption treatment units and acres.

Pechman Exemption treatment units proposed for thinning up to 8" dbh and prescribed fire.	
EA Unit Number	**Unit Acres**
1	3.0
2	6.9
3	34.9
4	46.7
5	4.1
6	112.9
7	11.9
8	29.8
9	54.6

10	126.5
12	.3
13	79.6
14	4.0
15	5.7
17	19.5
84	.9
Total	**541.3**

The absence of fire over the last 100 years combined with the development of shrubs and dense thickets of regeneration in the understory has placed the ponderosa pine stands at high risk of stand replacing wildfire. Reintroduction of fire in these ponderosa pine type stands would be used as needed to achieve the desired conditions. Prescriptions would be developed for low intensity prescribed fire to start a return to historic fire regime conditions. Subsequent prescribed fire entries would be conducted, through time, to create a more fire resilient stand condition which would help in defending private lands and help preserve the ponderosa pine stand type. Interior project area treatments will focus on reducing ladder fuel loadings while utilizing small tree thinning, mowing and prescribed burning treatments designed to reduce surface fire spread rates in and around plantation investments. Emphasis on fuel reduction treatments will also occur directly adjacent to wildlife retention and no treat areas within the project in order to protect the forests wildlife connectivity strategy.

Developed Recreation Sites and Neighboring Bridge Creek Watershed

The recreation assets inside the project area include Upper and Lower Three Creek Sno-Parks, Triangle Hill Loop and portions of the Windigo Cross District Trail. Within a mile and south of the project area recreation sites include Trapper Meadow, Three Creek Lake, Driftwood Campgrounds and Park Meadow; Trapper Meadow, Tam McArthur Rim, Little Three Creek Trailheads. Further south approximately 3 miles away is the Bridge Creek Watershed an important municipal water source supplying the city of Bend. All sites listed are at risk from a crown fire initiating within the project area. Crowning fires are the most intense wildfires and usually produce long range spotting that hampers control efforts. Dense stands of timber support independent crown fires allowing fire to burn through the canopy of the trees independent of the surface fire. Torching and crowning with support of the surface fire is also a common problem during wildfires in denser stands of timber. Breaking up the continuity of the vegetation canopy in timber and in surface fuel loadings through thinning mowing and burning greatly decreases the chance of an active or passive crown fire. By maintaining stands at crown bulk densities of less than 0.10 kg/m^3, active or independent crown fire activity can be limited (Agee, 1996). Thinning from below, leaving dominant and co-dominant trees with thick bark and high crowns significantly changes the potential for fire to move from surface up into the tree crowns (Fitzgerald, 2002) (See Figure 27, values at risk).

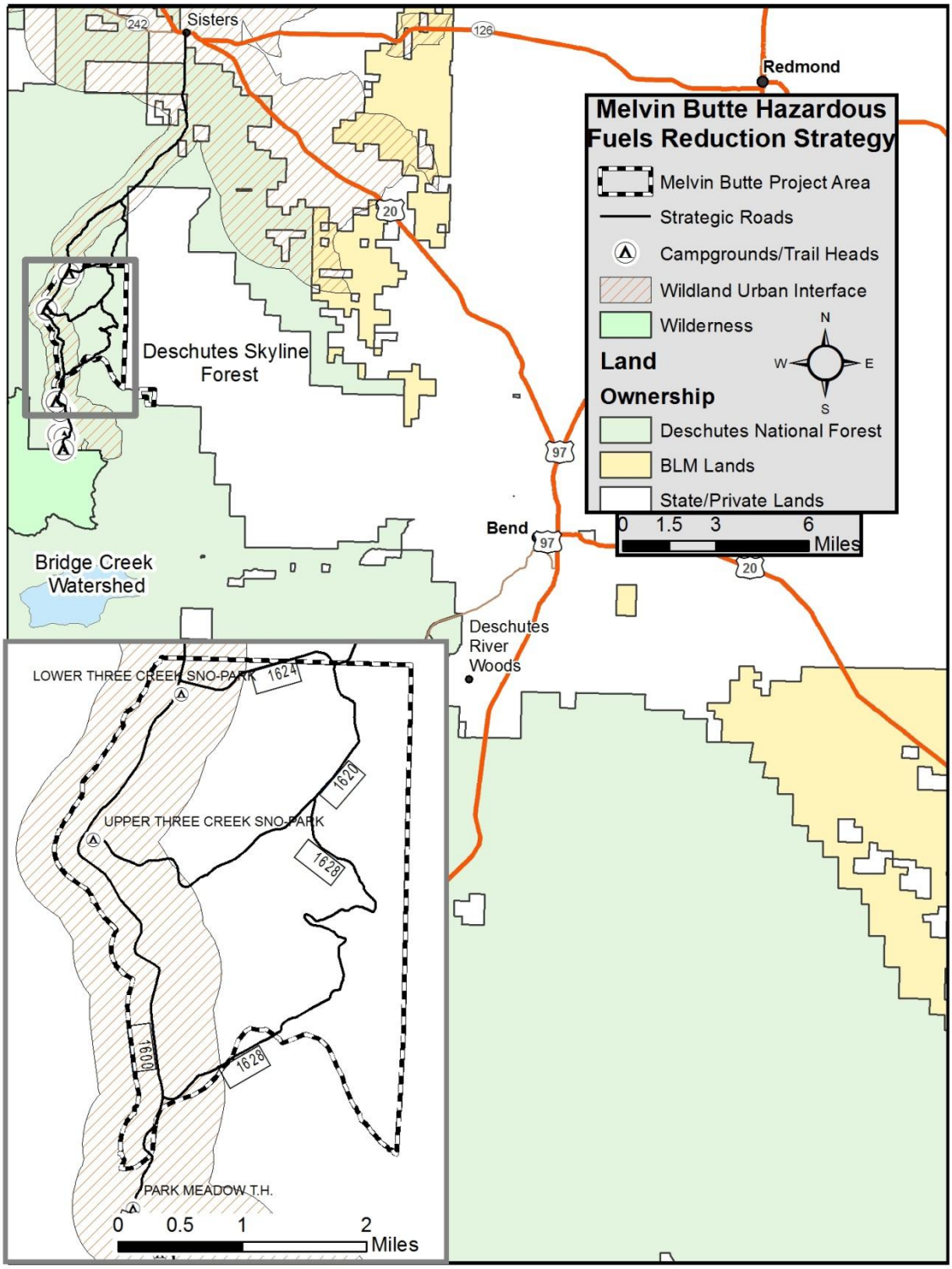


Figure 27 Vicinity map of values at risk associated with the Melvin Butte Hazardous Fuels Reduction Strategy.

Table 186 describes principles of fire resistance. Although this table was originally developed for ponderosa pine forests, the principles can be applied to the ponderosa pine dominated mixed conifer stands within Melvin Butte area. Mixed conifer treatments are aimed at reducing canopy base heights and crown bulk density. It is unlikely that these treatments alone would stop rapid moving wildfire displaying extreme fire behavior. However, the treatments will provide a place for firefighting resources to attempt to stop a wildfire through control actions such as backfire or burnout operation.

There are two components to crown fire hazard: crown fire initiation and crown fire propagation. Crown fire initiation is influenced by canopy base heights and surface fuels. Ladder fuel thinning and the reduction of surface fuel height through mechanical mowing will reduce a stands susceptibility to crown fire initiation. Ladder fuel thinning is the removal of sub-merchantable understory trees and shrubs in the lower canopy of the mixed conifer stands. Surface fuel loadings are reduced through piling and burning and ideally biomass utilization and underburning. Mastication is another method to reduce potential surface fire intensities. Mastication reduces the intensities by rearranging the forest fuels.

A stands susceptibility to active crowning (crown fire propagation) is most strongly affected by crown bulk density and, to a lesser extent, foliar moisture content (Scott J. H., 2001). Foliar moisture content is dependent on tree species composition and season, and cannot be modified by forest management except by altering species composition. Crown bulk density can be lowered through over-story thinning and, if the understory is well developed, through ladder fuel thinning.

Table 186 Principles of fire resistance for dry forests adapted from Agee 2002 and Hessburg & Agree 2003, and Agee & Skinner 2005.

Principles	Effect	Advantage	Concerns
Reduce surface fuels	Reduce potential flame length	Control easier, less torching[1]	Surface disturbance, less with fire than other techniques
Increase height to live crown	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase[2]
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase and surface fuels may be drier[2]
Keep big trees of resistant species	Less mortality for same fire intensity	Generally restores historic structure	Less economical; may keep trees at risk of insect attack

[1] Torching is the initiation of crown fire.
[2] Where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon, 1996).

The effects of thinning and burning on fire behavior and fuels have been well studied in the past decade. Evaluating fuel treatments from across the west, the reduction in fire behavior parameters and fuel loading is maximized by the combination of mechanical thinning plus burning (Schwilk et al. 2009). Thinning alone by traditional commercial harvest methods leads to increases in small diameter (<1 inch dbh) surface fuels immediately after treatments (Agee and Lolley 2006), but these fuels decrease to pre-treatment levels within 5 years (Youngblood et al. 2008). Amounts of larger fuels (>1 inch dbh) post-thinning can significantly increase and may not decrease for a long period without the use of prescribed burning. Pre-commercial thinning using mastication equipment can increase total fuel loading and fuel bed depths by as much as two inches, but the magnitude varies by fuels size class (Dodson et al. 2008a). Thinning followed by burning significantly decreases surface fuel loading (Stephens and Moghaddas 2005a, Agee and Lolley 2006, Youngblood et al. 2008, Harrod et al. 2008a) regardless of thinning method.

Canopy closure, canopy bulk density, canopy base height, and surface fuel loading influence torching and crowning fire behavior. Thinning generally reduces canopy closure and canopy bulk density, and

increases canopy base height (Stephens and Moghaddas 2005a, Agee and Lolley 2006, Harrod et al. 2007a, Harrod et al. 2007b, Harrod et al. 2008a, Harrod et al. 2009). Burning alone is less effective at altering these characteristics in mature stands (Stephens and Moghaddas 2005a, Agee and Lolley 2006, Harrod et al. 2007b, Harrod et al. 2009, Schwilk et al. 2009), but can reduce surface fuels loading (Youngblood et al. 2008), thereby decreasing surface fire behavior and the potential for fire to move into the canopy. However, burning alone can be effective in young coniferous forests for thinning stands from below, reducing surface fuels, and raising canopy base height (Peterson et al. 2007). Crown fire severity is generally mitigated by fuel treatment (prescribed fire only, thinning only, or combination), as compared to stands with no treatment (Pollet and Omi 2002, Finney et al. 2005).

Treatments may allow for increased solar radiation to reach the forest floor and may result in lower fuel moistures, higher wind speeds, and increased growth of flammable grasses, forbs, and shrubs. These conditions may actually increase the rate of spread and potentially flame lengths and crown damage, if a fire were to occur (Thompson and Spies 2009, Agee and Skinner 2005, Weatherspoon and Skinner 1995, Raymond 2004). However, where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon 1996, Bigelow and North 2012). Additionally, these changes in canopy characteristics and surface fuels were incorporated into the modeling scenario and are reflected in the resulting hazard outputs. As forest conditions are not static, maintenance treatments will be required in order to maintain the previously described effects so that the growth of flammable material is maintained over time.

Fires in low hazard areas could be effectively suppressed using hand crews and direct fireline construction. Moderate and high hazard areas would require heavy equipment such as dozers, and/or aerial methods to effectively suppress a wildfire (NWCG 2006). Moderate and high hazard areas also have an increased likelihood of negative resource and social effects from wildfire such as fire fighter safety, public safety concerns, resource damage, and smoke production. Refer to other sections of this environmental assessment for information related to the effect of wildfire on specific resources.

Desired Condition

Wildfire hazard levels are moderate to high across the project area. Of particular concern is public and firefighter safety during a wildfire event along with the potential negative impacts to ecosystem resources. However, given the project areas adjacency to private lands and the amount of large wildfires within close proximity high intensity wildfire is not desirable within the planning area. Current fuel loadings, conducive to fire regime intervals and expected fire behavior, within the Melvin Butte project provide few opportunities to effectively manage wildfire. In order to provide opportunities for firefighters to contain a wildfire that originates in the project area or in the adjacent private lands there is a need for discontinuous fuels, which lessen the intensity and resistance to control of wildfire.

From a fuels perspective, the desired future condition would be a mosaic of landscape-scale treatments managed to reduce fire hazard to facilitate suppression of large high intensity wildfires, protect valuable resources, and allow the re-introduction of fire as a disturbance process at lower intensity levels. These conditions tier to the Forest-wide goal for Fire and Fuels management (see Table 179 in Management Direction section) by being responsive to resource management goals while improving the efficiency of future fire suppression efforts (Deschutes LRMP p 4-73). Specifically, the goals for Fire and Fuels Management include prevention of human caused wildfire in areas identified as high use and high risk including, major travel ways and firewood cutting areas, two major components of the Melvin Butte project area (Deschutes LRMP p 4-73, 4-74). Additionally, these conditions tier to several of the management area goals which encourage the use of prescribed fire to meet resource goals (e.g., timber and forage) and to reduce hazardous fuels (see Table 179 in Management Direction section; Deschutes

LRMP p 4-119, p 4-131, p 4-139, p 4-144, p 4-162). At the stand level, in areas dominated by ponderosa pine and in the WUI, this translates to canopy characteristics and a fuel profile which do not support high intensity fire behavior (i.e., crown fire, high resistance to control, high flame lengths) under severe fire weather conditions. To achieve this state of resiliency, stands should be maintained at a height to live crown that is well above the shrub and seedling components. Shrubs should be maintained at a height and continuity that would reduce the potential for rapid rates of spread and crown fire initiation. Dead and down material should not be overly extensive. Large trees more resistant to fire-induced mortality should be maintained (Agee 2002, Hessburg & Agee 2003). These conditions are supported by the Greater Sisters Country CWPP and Whychus Watershed Assessment and Updates, and can be achieved with a variety of methods including prescribed burning, mowing/mastication, pruning and thinning treatments.

Outside of the WUI, leaving some untreated areas at the landscape scale and providing for within-stand spatial heterogeneity of residual trees and shrubs are important components of treatment which help meet the goals of habitat loss due to stand replacement fire while restoring forest habitats as outlined in the Whychus Watershed Assessment and Updates (see Table 179 in Management Direction section). These desired conditions highlight the importance of maintaining large trees as well as variable spatial arrangements of residual trees to account for small and large scale variability in the historic range of natural variability (Larson and Churchill 2012, Baker et. al. 2007, Hessburg et. al. 2006).

The desired condition is a fire resilient forest. To meet this goal the fire regime of the entire project area would be in a condition of one where there is a natural or historical range of variability of fire frequency matched with expected severity. To facilitate effective direct attack with hand crews and equipment it is desired that fuel loadings spaced across the project area be reduced to a level that will not support potential flame lengths over four feet during mid-summer wildfire conditions.

Twenty one percent of the Melvin Butte planning area is within Fire Regime I. Within this fire regime surface fires are common and large stand-replacing fires can occur under certain weather conditions, but are rare events. Fire history studies in nearby pine stands show that the area experienced low-intensity surface fires every 5-20 years and open stands of large, long-lived fire resistant ponderosa pine were typical (Arno, 1996) (Bork, 1984) prior to the 1900's. A recent study performed by Heyerdahl et al. determined that fires occurred every 8 years on average ranging 4 to 16 years. To achieve this goal the desired surface vegetation would be characterized by potential fire behavior represented by Scott and Burgan, 2005 fuel models GS1 and TU1.

Desired post treatment ponderosa pine fuel loadings can be represented by the following photo series:

(Maxwell, W.G., Ward, F.R. 1980. Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest).

PNW-105: 1-PP-2, 1-PP-4, 4-PP-4, or 7-PP-4.

Sixty nine percent of the Melvin Butte planning area is within Fire Regime III. The forest fuel hazard concern in the mixed conifer is crown fire. In mixed conifer treatment units it is desired that crown bulk density be reduced to a level that will not support crown fire under 90th percentile weather conditions. The generally accepted crown bulk density threshold for crown fire is 0.10 kg/m3 (Agee J. K., The Influence of Forest Structure on Fire Behavior, 1996). Variability is both a historical norm and a future restoration goal in many forests with mixed severity fire regimes. Management objectives that aim to capture that variability within and among fuel beds can guide future restoration efforts. Scale of variability for all fuels strata is an important consideration in the planning and layout of restoration activities (Hudec and Peterson, 2012).

Desired post treatment mixed conifer fuel loadings can be represented by the following photo series:

PNW-105: 1-MC-3

Ten percent of the Melvin Butte planning area is within Fire Regime IV. The primary hazard concerns in the lodgepole pine stands is the potential of high surface fire intensities resulting from the large component of dead and down. To achieve this goal the desired surface vegetation would be characterized by potential fire behavior represented by Scott and Burgan fuel model TL1.

Desired post treatment in lodgepole pine fuels loadings can be represented by the following photo series:

PNW-105: 1-LP-2 or 1-LP-3

The desired condition is a wildfire hazard rating of low for the entire project area. It is recognized that it is not feasible to achieve low hazard rating for the entire project area and still satisfy other resource needs. The intent of the action alternatives is to reduce fire hazard over the greatest area possible while balancing other resource concerns and budget constraints. The landscape within the project area should display a mosaic of strategically placed areas with emphasis in travel corridors, and adjacent to private property, wildlife retention areas as well as other no treatment areas to reduce fire hazard.

Effects of Alternatives

Environmental effects are based on the following assumptions:

- Ignitions will continue within the Melvin Butte project area, wildland fire will not be eradicated, and it is not possible to determine the probability of future fire occurrence. The analysis presented assumes that the probability of future fire occurrence within the project area is 100%. In reality, the extent, likelihood, and/or severity of future wildfire is unknown. Assuming that the area *will* burn into the future provides a useful baseline from which to compare the effects of the alternatives. Given the recent fire history of the Sisters Ranger District, this assumption is not implausible.
- This analysis is landscape in scale. As with any landscape analysis, some level of error is to be expected, especially since treatments affect fine scale fuel loading and fire hazard in variable and complex ways (Waltz et al. 2003). Furthermore, there is no way to determine the finite scale at which the utility of this data dissolves. Given that the data was derived from 2012 Landfire satellite imagery, some of the more recent changes resulting from the mountain pine beetle outbreak may not be reflected. Efforts were made to field verify and update the data to reflect some of these recent vegetation changes across the modeling area, including the effects from recent fires (i.e., Rooster Rock) and vegetation management projects (i.e., Sisters Area Fuels Reduction). However, the amount and extent of error is unknown. Although this approach has limitations, model outputs yield useful information for comparisons of landscape fuel treatments (e.g. pre- and post-treatment effectiveness; Stratton 2004). See more detail in the modeling assumptions, inputs and limitations section.
- There are no treatments that will result in completely safe conditions for people, property, or important ecosystem components. Certain unknown combinations of an ignition(s) with vegetation under dry live and dead fuel moistures, high winds, and/or low relative humidity will continue to threaten social and natural resources.
- Public and firefighter safety is the top priority in fire management. Treatments will focus on creating a safe work environment for fire suppression forces.
- Tree mortality and other related resource damage from potential wildfire is not predicted by any of the models used in this analysis and thus is not measured in any quantifiable way. However, qualitative inferences about tree mortality and related resource damage can be inferred from this analysis as vegetation that burns while in a hazardous state (as defined in this analysis) influences a tree's probability of surviving fire (Regelbrugge and Conard 1993, Fowler et al. 2010).

- The full scope of treatment (thinning, piling, pile burning, mastication, prescribed fire, and maintenance of post treatment conditions) is implemented instantaneously through the modeling process. In reality, it may take 2 or more years once thinning is initiated before the first entry of prescribed fire and the timing of secondary maintenance treatments will vary by stand conditions. This will result in variability in fire hazard. The extent and effect of this variability on fire hazard is unknown and not incorporated into this analysis.
- Within the group opening treatments planned within the mixed conifer plant association groups, some assumptions were made to address effects to canopy and fuel characteristics.
    - "Group opening" treatments within the mixed conifer plant association group were assumed to be variable in size, ranging from 1-3 acres (approximate planned size), and were randomly placed where applicable.

  Until marking crews assess each acre of ground, there is no way to spatially determine where the group openings or modified stand conditions will be located. Actual placement of these treatments and modified stand conditions would likely change fire spread and consequently burn probability, but to what extent is unknown.

- "Wildfire" weather and fuel moistures used in FlamMap and the FOFEM simulations utilized 90th percentile "fire season" conditions. "Fire season" is typically defined as the 92 day period between July 1st and September 30th, during which most fires and acres burn. The 90th percentile is defined as the combination of live and dead fuel moisture, temperature, relative humidity, and wind speed on a summer day that is warmer, drier, and windier than 90% of all other recorded days within "fire season". This threshold establishes reasonable conditions for estimating "problem fire" behavior in the modeling environment. The effects of treatments other than the previously mentioned are assumed to cover 100% of the treatment area. Leaving certain areas untreated within units would likely reduce the effectiveness of fire hazard reduction indicated in the analysis, but to what extent is unknown.

Alternative 1– Ecological Trends

The purpose of the Melvin Butte project is to restore resiliency in a historic fire adapted ecosystem and reduce the risk of high intensity wildfire. Without treatments, a fire in the area will place the public, firefighters and ecosystem habitats at increased risk. Treatments are aimed at both providing rapid fire containment options and to prevent high intensity wildfires from threatening values at risk.

Fire Hazard

Direct effects of a no action alternative include the ongoing fire suppression efforts and natural ecosystem degradation that will contribute to an increase in flame lengths and risk of crown fire above historical range of variability resulting in an increase in active crown fire within the analysis area. Even though fuel reduction projects have been conducted within the watershed and with recent wildfire scars the area already is within its range in some respects. If no action was implemented, the continued accumulation of fuels leading to increased surface flame lengths and increased risk of crown fire would negate investments already implemented. The natural decay rate would reduce fuels at a much slower rate than they would accumulate through ordinary pruning and mortality. The higher flame lengths are likely to result in higher scorch heights, greater tree mortality, and greater fire severity than expected for this landscape when utilizing fire regimes as a reference condition. Wildfire would reduce fuels as well as return fire as an ecological process within the project area, however the severity and extent to which the wildfire would occur would fail to meet Forest Plan direction to; Limit acres of habitat damaged by wildfire, retain and enhance key wildlife habitat, reduce risk of large scale wildfire, while maintaining site productivity, place fire tolerant stands on maintenance schedule to meet management objectives, and maintain prescribed fire burning schedule to meet management objectives.

The indirect effects of a no action alternative would result in a shift in species composition, structure, and patterns that would support fire spread from the surface to the crowns over greater portions of the landscape than in the past and projected for the future. No action would result in continued connectivity of understory and overstory vegetation and would include secondary fire effects associated with higher flame lengths, and fire intensities, including soil damage, potential for insect and disease due to fire weakened canopy, cambium kill, loss of the coarse woody debris component, and a loss of fire resilient species. Under a no action alternative, these fire behavior conditions associated with a departed landscape would continue and are likely to increase over time.

The potential for crown fire is the main concern in mixed conifer stands. There is very little that can be done once a crown fire starts (information from "Crown fire behavior and prediction in conifer forests: a state-of-knowledge synthesis", Alexander, Cruz, Vaillant, & Peterson, 2013):

Crown Fires Move Fast – At a minimum, a doubling or tripling in a fire's rate of advance follows the onset of crowning. Wind-driven crown fires have been documented to spread at up to 100 m/min (3.7mph) for several hours and in excess of 200 m/min (7.5mph) for up to an hour. A crown fire initiated in the Melvin Butte project area could threaten life, private property, ecosystem habitat and easily reach the Bend municipal watershed outside the planning area south 3.5 miles away within one burning period.

Crown Fires are Intense – A fire can easily quadruple its intensity in a matter of seconds when crowning takes place (e.g., from 3,000 kW/m to 12,000 kW/m). The resulting wall of flame, standing nearly erect, is on average up to two to three times the tree height and emits fierce levels of radiation. Flame fronts commonly exceed 30-45 m in depth. Once a crown fire initiates, suppression resources, including air tankers are ineffective.

Crown Fires get big quickly – The area burned by a crown fire is at least four to nine times greater than a surface fire for the same period of time. Assuming unlimited horizontal fuel continuity, crown fires are capable of burning an area of upwards to 173,000 acres with a perimeter length of 100 miles in a single burning period and have done so in the past in similar fuel profiles as present in the Melvin Butte planning area.

Crown Fires can spot long distances – Crown fires commonly display high-density, short range spotting (< 50 m). Spotting distances of up to about 1.25 miles, although less common, are frequently seen on crown fires, resulting in normal barriers to fire spread being breached. Many spot fires are simply overrun by the main advancing flame front of a crown fire before they effectively contribute to an increase in the fire's overall rate of advance. Cases of long-distance spotting have been reported of up to 2 miles on the Deschutes National Forest. It would not take much for a crown fire initiated in the Melvin Butte project area to send embers into the adjacent private lands or into the Bend watershed to the south.

A No Action approach to management would prevent the opportunity to reduce hazardous forest fuel loadings thereby increase the potential for crown fire and high intensity wildfire threatening fire fighter and public safety and important values at risk.

Air Quality

Under a no action alternative, smoke emissions associated with a wildfire under the current fuel loadings and stand structure departures within the Melvin Butte analysis area that have not been treated would result in higher particulate emissions than projected for future conditions.

The maximum number of treated acres proposed in the Melvin Butte project area is 4,465 acres. Therefore, under the No Action Alternative, this same number of acres would potentially not receive a prescribed fire treatment. Table 187 shows the potential PM production if a wildfire was to burn on these acres under the conditions previously described.

Table 187 Estimated total potential particulate matter emissions from total acres under wildfire condition without treatments.

Fire condition	Tons $PM_{2.5}$	Tons PM_{10}
Wildfire – 4,465 total acres	6,204	7,320

Smoke and PM emitted from wildfires within the Melvin Butte project area could impact the communities and outlying areas of Sisters, Redmond, and Bend. This is because under wildfire conditions, there is no ability to limit emissions by burning during favorable atmospheric conditions. It is possible that during a wildfire the air quality and visibility within the Three Sisters Wilderness, a Class 1 Airshed due west of the project area, would also be adversely affected. Recreational sites near and around the Melvin Butte planning area, such as the Three Creek Lake recreation area, Park Meadow Trail, and the Pole Creek Trail could also be adversely impacted by smoke when tourism and recreation are at their highest. The continued deferral of treatment within the project would only exacerbate the negative effects on air quality, when a wildfire does occur.

Air quality issues as a result of a wildfire in this area will result in the high particulate (hazardous to human health) levels for extended durations of 5 days or weeks. As compared to prescribed fire with low particulate levels for 3 to 24 hours. Figure 28 shows an example of worst case scenario prescribed fire particulate levels and duration compared with the 2012 Pole Creek Fire particulate levels and duration.

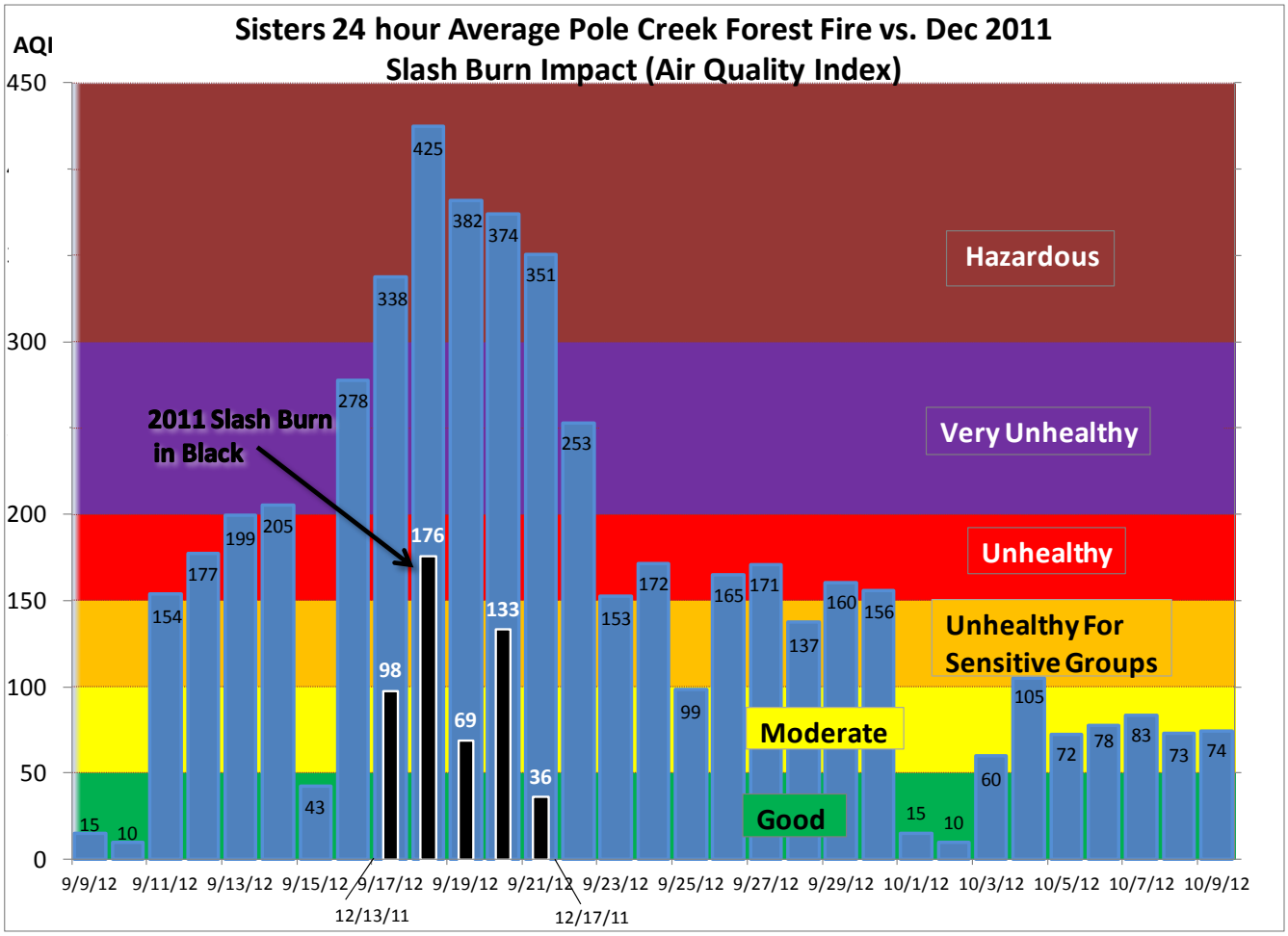


Figure 28 Data from Sisters Forest Service nephelometer. Image created by the Oregon

Alternative 2 and 3 - Direct and Indirect Effects

Fire Hazard

The differences in hazard supported by each alternative are largely determined by the fuel model changes associated with each proposed treatment. In Alternatives 2 and 3, treatment type and associated effects remain static however total number of acres and spatial arrangement is variable, resulting in differences in underlying effects on fire hazard. Table 187 and Figure 29 below, display the resulting treatment effect of each alternative on fire hazard within the project area and across the treatable acreage. Treatments proposed have the ability to reduce high fire hazard, as compared to the existing condition. The ability to use direct attack allows for a greater probability that unwanted fires can be contained at smaller fire sizes limiting resource damage and potential loss of values at risk.

Alternatives also vary in the treatment of stands infected with dwarf mistletoe, the effect of this on fire hazard is minimal as the variability is related to the treatment of overstory trees only and the goal of fuels treatment in these areas would not be to modify the overstory. Under Alternative 2, treatments in mixed conifer where fir encroachment is thick surrounding large pine, group openings ranging from 1-3 acres in size would be created and planted to ponderosa pine. In these units, fire hazard outside of these openings would remain high. Under Alternative 3, the fire hazard would drop to low across these units since these Alternatives propose general thinning; i.e. stands would not contain group openings.

The action alternatives provide for two non-significant Forest Plan amendments to meet the purpose and need for action. These amendments are primarily focused on treatments located in the Wildland Urban Interface. Treatments in Foreground areas located along Forest Road 16 would reduce the risk of high intensity stand replacement fire and help maintain old ponderosa pine trees over time. These amendments would help meet the goals stated in the Community Wildfire Protection Plan. Amendments would allow for areas larger than five acres for prescribed burning, increase the number of years for foreground slash cleanup to a five-year period, and increase scorch height of trees. These changes would allow for more effective fuels management and also help meet the scenic values described for these areas over the long-term.

For the purposes of this analysis, fire hazard is specifically defined as the combination of potential flame length and crown fire as defined in Table 188, Figure 29 and Figure 30.

Table 188 Fire hazard rating comparison by acres for no action and action alternatives in the Melvin Butte Project area.

	No Action 5,375 acres		**Alternative 2 4,465 acres treated**			**Alternative 3 4,395 acres treated**		
Hazard Rating	**Acres**	**%Area**	**Acres**	**%Area**	**Change Acres**	**Acres**	**%Area**	**Change Acres**
UNFORESTED	44	<1%	44	<1%	0	44	<1%	0
LOW	1,706	32%	3,503	79%	1,797	4,211	79%	2,505
MODERATE	1,226	23%	621	14%	-605	692	13%	-534
HIGH	2,399	45%	310	7%	-2,089	426	8%	-1,973

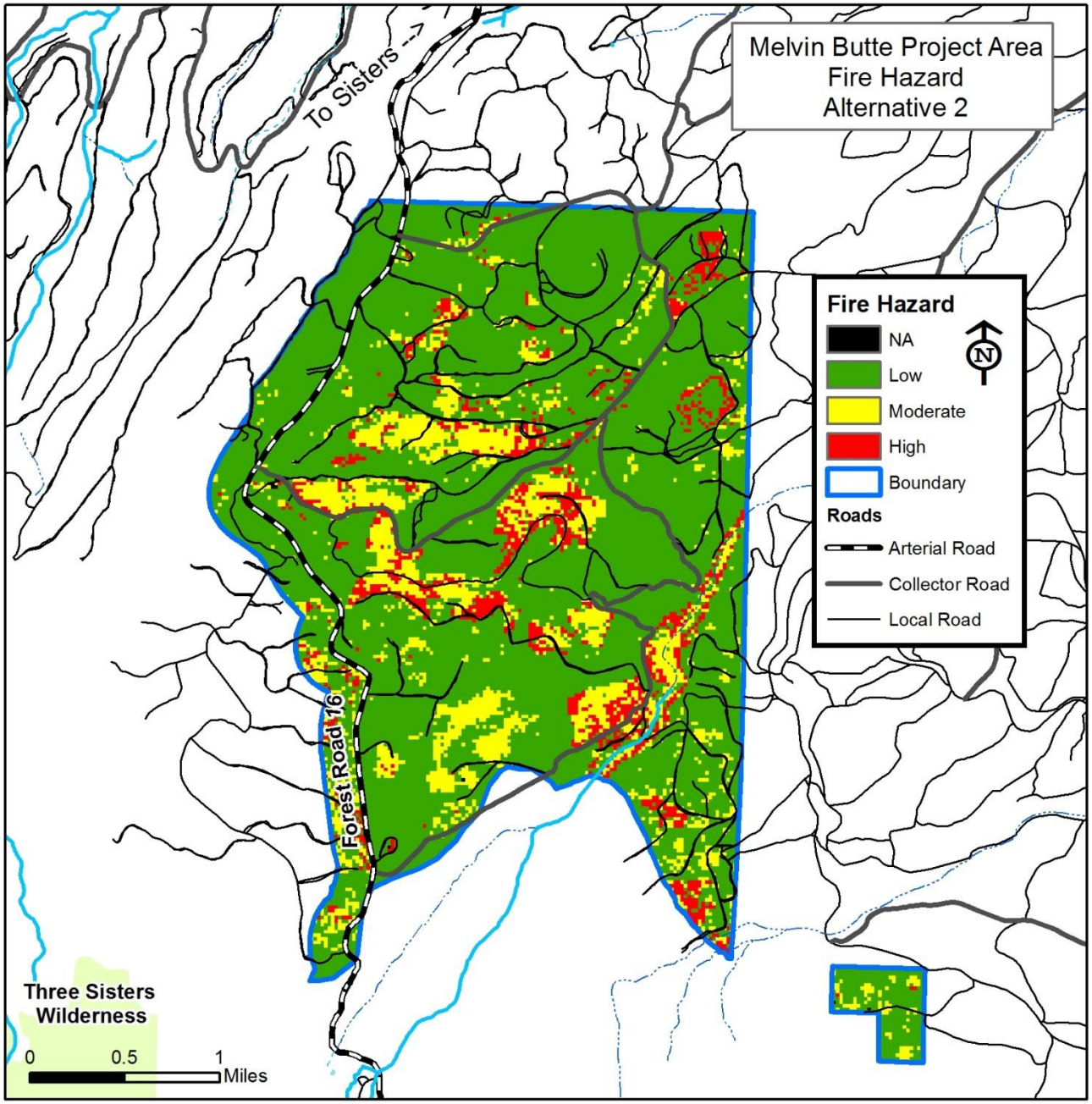


Figure 29 Fire hazard across project area under the 90th percentile fuel and weather conditions under Alternative 2.

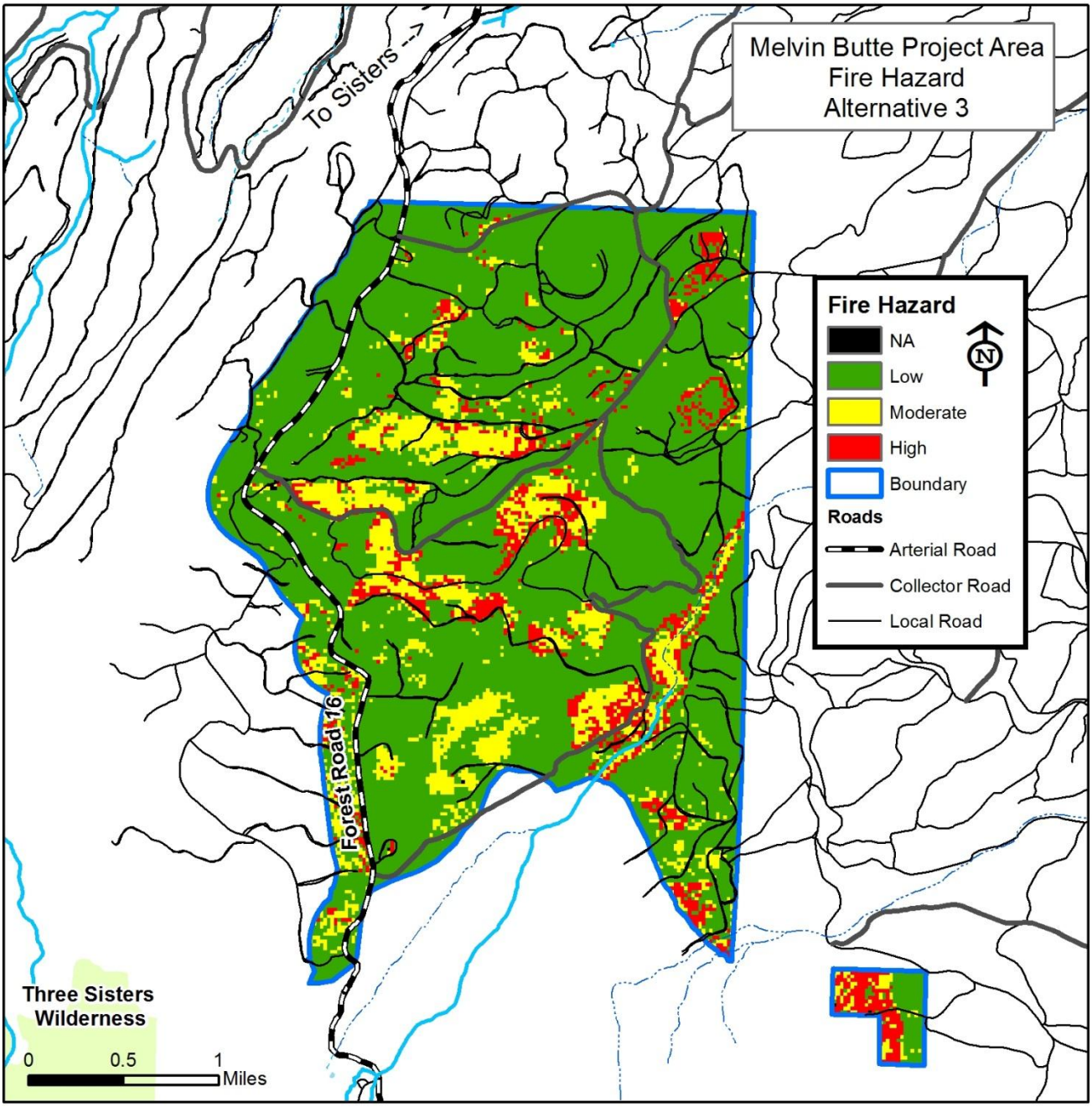


Figure 30 Fire hazard across project area under 90th percential fuel and weather conditions under Alternative 3.

At the landscape scale, the spatial differnces between the Alternatives is subtle, with the exception being the units adjacent to the private property boundary on the southeastern side of the project area. Under Alternative 3, these areas remain threatened. This is primarily due to the conditions that remain hazardous and the direction of fire spread, from north to south (see Figure 19 Historical fire spread direction in the Weather and Fuel Moisture Inputs section of this report) threatening the project area in the event of a fire start on private property values at risk outside the project area to the south.

Figure 29 and Figure 30 compares the fire hazard areas under each Alternative and indicates that treatments would reduce threatened acreage by 47% across the project area. While acres classified as low are not "fire proof", there is reduced likelihood of resource damage and increased likelihood of suppression success if an ignition were to occur.

Air Quality

PM emissions connected with Alternatives 2 and 3 are of concern due to the project area's proximity to several Central Oregon communities (e.g., Sisters, Redmond, Bend municipal watershed and residents in outlying areas) and the Three Sisters Wilderness, a Class 1 air shed.

Under Alternatives 2 and 3, air quality would be affected primarily by PM produced during prescribed burning and pile burning activities. The total area proposed for treatment with prescribed burning under Action Alternatives is 4,465. Comparing this amount of area burned under prescribed fire and wildfire conditions shows the potential reduction in total PM emissions between Action Alternatives and the No Action Alternative (Table 189). Results indicate that PM emissions created during wildfire conditions are approximately double that which would be potentially emitted under prescribed fire conditions.

Table 189 Estimated total potential PM emissions from Alternative 2 & 3 prescribed fire treatments compared to the same amount of acres consumed under wildfire conditions without treatment.

Fire Condition	Tons $PM_{2.5}$	Tons PM_{10}
Action Alternatives 4,465 acres prescribed fire	2,868	3,385
Wildfire under No Action 4,465 total acres	6,204	7,320

Cumulative Effects

The cumulative effects boundary for this analysis is defined as the Whychus Watershed boundary shown in Figure 31. A fireshed boundary is typically defined by the watershed boundary thus a reasonable boundary for cumulative effects analysis. Adding together management treatment acres plus wildfire acres occurring between 2009 thru 2014 there are approximately 60,000 or 25% of the Whychus Watershed acres recently touched by some form of treatment within the past 5 years.

Past and ongoing treatments in the cumulative effects area are anticipated to have a net positive landscape level effect on fire hazard reduction, using well supported documentation that treatments that reduce surface fuels and ladder fuels lower the susceptibility of forested ecosystems to problem wildfire (Agee and Skinner 2005). Within the last 20 years in this area, numerous fuels related activities have occurred associated with the SAFR, Hwy 20, McCache, Canal, and Underline projects. A total of 21,966 acres within this cumulative effects boundary have received some combination of fuels modifying treatment.

This total includes any area where there may have been or will be treatments where fuels reduction was the primary purpose such as pre-commercial thinning, mowing, and prescribed fire.

There are no other known reasonably foreseeable actions or projects within this cumulative effects area outside of those previously discussed. However, experience with fire suppression in Central Oregon shows that unless acres treated are in the immediate vicinity (less than approximately 1/4 mile) of the area in question, they would have no effect on fire behavior within the project area. Any fire behavior effect from treated acres within a ¼ mile of the Melvin Butte planning area are accounted for in the simulation modeling of predicted fire behavior for each alternative, and are therefore accounted for in the data analysis and reporting of direct and indirect fire behavior effects for each of the Alternatives. Firewood cutting is the primary on-going fuels modifying activity within the project area. This proposed action

would mitigate the fire hazard associated with slash left behind by fire wood cutters along with all other special forest product activities.

Proposed treatments cumulatively allow for more opportunities to use prescribed fire in the future across the landscape. Prescribed fire after vegetation treatment reduces the amount of smoke emissions generated by reducing the amount of fuel available for combustion.

All burning activity would be conducted in compliance with the Oregon Smoke Management Plan regulations and restrictions that function to track smoke produced and monitor emissions to ensure that there would be no cumulative effects on air quality (Oregon Revised Statute 477.013). Daily smoke management direction issued by the state can include restrictions on the spacing of prescribed burns and the number of acres permitted to be ignited on a given day in order to manage the potential smoke impacts over a larger area.

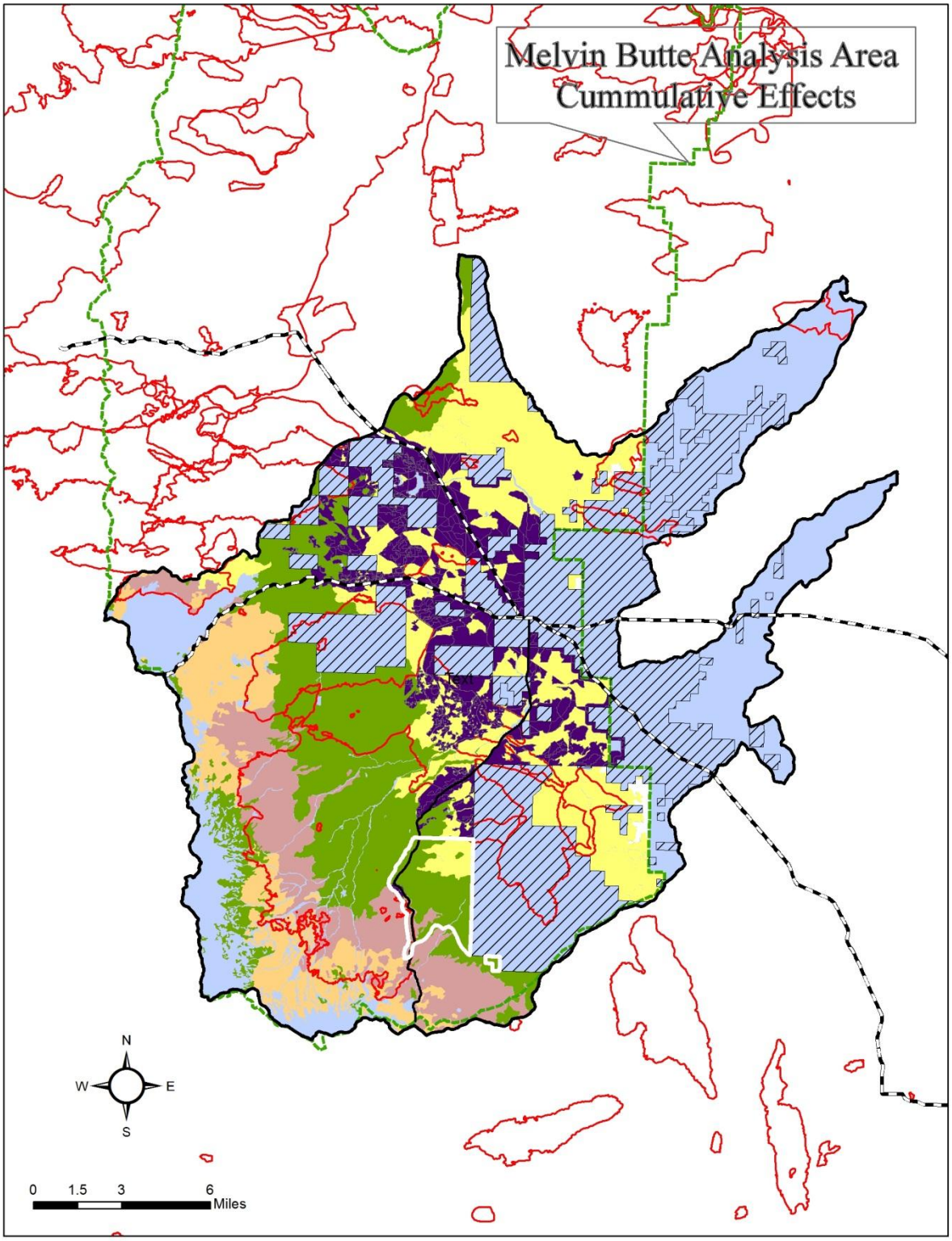


Figure 31 Watershed map with fire regime, hazardous fuels treatment, large wildfires, and the Melvin Butte Project area.

Conclusion

The No Action Alternative would not meet the analysis purpose and need by addressing the issues in the Melvin Butte analysis area associated with fire and fuels on the landscape. The potential for increased fire behavior, increased ladder fuel connectivity, and associated flame lengths and risk of crown fire would result in fire effects not moved toward the purpose and need of forest health and resiliency by reducing fire hazard. The risk to life, property, fire suppression crews, and natural resources would increase due to the widespread potential of crown fire risk and the continued increase of stand density, crown bulk density, ladder fuel connectivity, and fuel loading associated with unmanaged stands in a fire dominated ecosystem.

The action alternatives 2 or 3 would equally meet the objectives of moving this landscape toward structure, composition, and patterns on the landscape within the constraints of reducing the risk of high intensity wildfire to life, property, and fire suppression crews, as well as providing for wildlife habitat, maintaining natural processes, and helping to create and retain a fire resilient ecosystem now and into the future. Utilizing prescribed fire wherever possible would likely result in greater overall success. The ecosystems ability to tolerate fire within historical range of variability and move it toward a resilient future range of variability as a natural process depends on the degree to which the objectives for the Melvin Butte analysis area as well as all other projects achieved on the district. Treating surface fuels, reducing ladder fuels, and opening overstory forest canopies, have been seen to generally produce a more fire-safe forest condition (Brown, Agee, & Franklin, 2004). One effective substitute for natural fires and its infinite number of effects on ecosystems is prescribed fire (Kauffman, 2004). The treatments of forest overstory with selective tree removal is an important initial step in the restoration of forest stands, as these treatments assist in the ability of fire and fuels managers to properly modify fire severities by inputting prescribed burns into the system, affected by decades of fire exclusion and land use. This process is not the final step in the management of wildlands it is only one in a series that continues the trajectory of the affected landscape into the future. Due to the fact that it takes time to accomplish forest restoration, the goal of the planned treatments is to set particular stands on trajectories toward stand structural classes that may be next successionally and contribute to an overall landscape resiliency.

The action alternatives would manage fire behavior with overstory, understory, and ground forest fuel treatments including hand and machine piling, mechanical mowing, in conjunction with prescribed burning to treat fuels in order to facilitate a fire resilient landscape consistent with the historical range of variability as well as setting it up for future range of variability and providing for effective wildfire suppression adjacent to values at risk such as wildlife habitat, recreation assets, private timberlands, while reducing risk of crown fire threatening recreation values and Bend s municipal watershed. Lastly, both proposed actions result in treatments improving safety along Forest Road 16a designated WUI travel corridor, which would enable fire suppression resources to provide additional fire protection and reduce risk to life, property, and natural resources during wildfire events.

The project is consistent with the standards and guidelines as outlined in the Deschutes Forest Plan, as amended, and meets the desired future conditions outlines for the project area. The action alternatives are also consistent with the Clean Air Act and all relevant national and regional guidance.

BOTANY

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Botany specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This report documents consideration of Protected, Threatened, Endangered and Sensitive (TES), Survey and Manage, and Invasive plants related to the Melvin Butte Forest Management project. The intent of this analysis is to comply with existing regulations and management direction to protect and sustain Sensitive and Survey and Manage Plant species and prevent and manage invasive plant species on public lands.

Sensitive Plant Species

Regulatory Framework/Management Direction

This analysis is prepared in compliance with the Forest Service Manual (FSM) 2672.4, and the Endangered Species Act of 1973 (Subpart B; 402.12, section 7 consultation). Effects of the proposal are evaluated for those TES plant species on the current Regional Forester's Sensitive Species List (RFSS 2670/1950, December 9, 2011) (See Appendix A) for those species documented or suspected to occur on the Deschutes National Forest. The Deschutes National Forest Land and Resource Management Plan has a number of standards for sensitive plant species which apply (USFS, 1990).

Analysis Methods

Analysis of the project included a pre field review of existing information on sensitive plants and their habitats. Portions of the area have been surveyed over the past 20 years and new and existing information was used for spatial analysis using Geographic Information Systems (GIS). Potential habitat for several sensitive species was identified in the project area and it was surveyed in 2007.

The direct and indirect effects of the action alternatives are evaluated and the cumulative effects of the project, considered with other activities in the past or near future are also discussed.

Measures to be used in the effects analysis include probability of detrimental impacts to rare plant species in number of plants affected and acres of habitat lost or gained. Expected impacts from the project are based on professional knowledge and experience of similar projects in the past.

Pre-field Review

Information about the area was consulted. Site conditions indicated potential habitat in forested areas for four R6 sensitive vascular plant species: 1) Peck's penstemon, *Penstemon peckii, 2)* Tall, Agoseris *Agoseris elata,3)* the Green Tinged Paintbrush, *Castilleja chlorotica* and 4) whitebark pine, *Pinus albicaulis*. There was also potential habitat for the sensitive fungi, *Hygrophorus caeruleus.* See Appendix A.

Survey Results

The area was surveyed in the summer of 2007 and portions were reexamined in the fall 2011 and 2012 during fungi surveys. No sensitive species or high probability potential habitat were found in the project area. However, six sites for whitebark pine were found to be adjacent to the project area.

Existing Condition

The Melvin Project area is located on forested slopes northeast of the Three Sisters and Broken Top Cascade Mountains. The project area contains a gradation of plant habitats and associations tied to the elevation and precipitation gradient found between higher elevation moist mixed conifer forests to lower elevation dry mixed conifer and ponderosa pine forests. The area has only one stream, Three Creeks

which is transitions from perennial to intermittent in the project area. No sensitive plant species or high probability potential habitat, or other special habitats were found in the project area.

One sensitive plant species, whitebark pine is located adjacent to the project area and could be indirectly affected by the project.

Whitebark pine- (*Pinus albicaulis)* is a five needle pine on the Regional Forester's Sensitive species list. Surveys for the species have been done across the forest and both permanent monitoring plots and select trees are identified and mapped. There are six sites for whitebark pine adjacent to the project area ranging at distances from 333 to 666 feet south of the boundary.

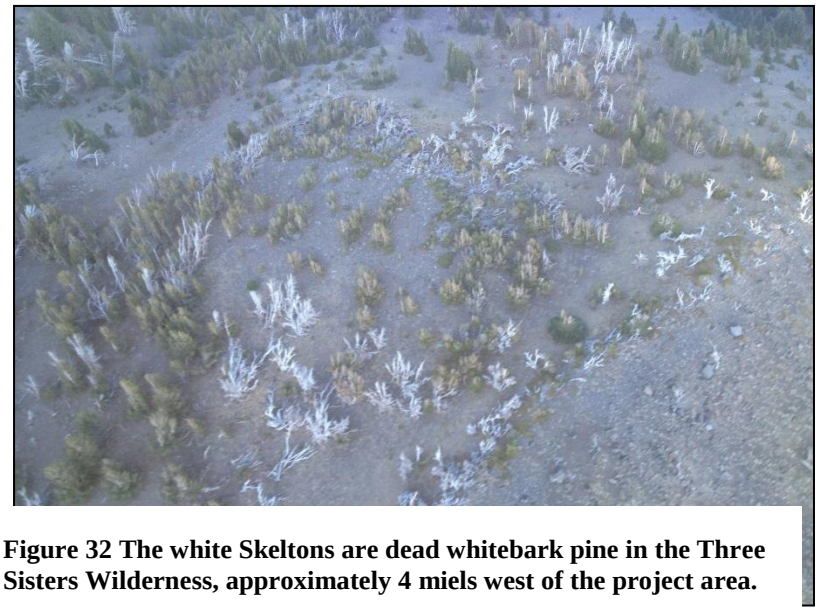


Figure 32 The white Skeltons are dead whitebark pine in the Three Sisters Wilderness, approximately 4 miels west of the project area.

Whitebark pine are found in subalpine and timberline areas. They are in decline across most of their range in North America because of the combined effects of mountain pine beetle outbreaks, wildfires and fire exclusion, environmental effects from climate change and the exotic pathogen, *Cronartium ribicola*, which infects five-needle white pines and causes the disease white pine blister rust.

In 2011, whitebark pine was added to the list of Federal candidate species eligible for Endangered Species Act protection due to the high magnitude of threats. There is currently no known way to stop white pine blister rust or the mountain pine beetle from infecting trees (Figure 32). Progress has been made in development of more disease resistant trees. Over 100 Select trees have been designated on the Deschutes National Forest. These trees have had cones collected from them and are under blister rust screening at Dorena Genetic Resource Center.

In addition to the Select trees, 75 permanent monitoring plots have been installed in whitebark pine stands in the central Cascades. These monitoring plots are used to assess the overall health of the population.

Whitebark pine has a co-evolved dependence on the native bird, Clark's nutcracker and wildfire. The tree is dependent on the bird to disperse its large wingless seeds, and the nutcrackers utilize fresh whitebark pine seeds and cache thousands of seeds for later use (Keane et al 2012). Forgotten caches grow to create new whitebark pine trees. The exclusion of wildfire has led to the successional replacement of whitebark pine with late seral species on some more productive sites (Keane et al 2012). Whitebark pine are more fire resistant than some high elevation conifers and can withstand low intensity fire (Bower, 2014). Fires create a complex pattern on the ground and good caching habitat for Clark's nutcrackers. Post-fire areas provide better growing conditions for whitebark regeneration by removing competitors (Keane et al 2012). Fire regimes in whitebark pine forests are complex and variable and include a mixture of severities.

Recommendations to help sustain whitebark pine include: 1) Reducing the impacts of disturbances with proactive measures to reduce the risk of blister rust, mountain pine beetle, and wildfire on whitebark pine forests. This may include pruning branches with cankers, spraying fungicide or insecticide, thinning, and treating fuels around rust-resistant trees to reduce wildfire-caused mortality; 2) Protecting rust-resistant

seed sources from future mortality caused by disturbance, climate change, and competition; and 3) Implementing treatments to create conditions that encourage whitebark pine regeneration, conserve seed sources, and promote rust resistance. This includes creating nutcracker caching habitat, reducing competing vegetation, and decreasing surface and canopy fuels using direct or indirect treatments, manipulating forest composition, and diversifying age-class structure (Keane et al 2012).

Project design features and mitigation measures to protect botanical resources are found in the *Resource Protection Measures Common to All Action Alternatives* section of this environmental assessment.

Analysis Issues and Measures

The alternatives have the potential to impact Botanical resources.

- *Probability of detrimental impacts to plants as estimated by amount and degree of ground disturbance (acres).*
- *Potential for detrimental or beneficial effects to plants from wildfire or prescribed fire as measured by amount and risk (acres).*
- *Risk of invasive plant spread as estimated by amount and degree of ground disturbance (acres).*

Alternative 1- Ecological trends

There is no probability of direct effects to Sensitive plant species because no known populations or habitat were found in the project area. Indirect effects include an increased probability of potential damage to whitebark pine adjacent to the project area if a wildfire damages the seed trees. There is also a slightly higher probability of continued damage to whitebark pine from mountain pine beetles transferring hosts from lodgepole to whitebark pine. Fire risk and probability is discussed in the Fuels section. This probability is higher in Alternative 1 than in Alternative 2 or 3.

Alternative 2 - Direct and Indirect Effects

Alternative 2 has a low probability of direct effects to Sensitive plant species because no known populations or habitat were found in the project area. Beneficial indirect effects include the decreased probability of disturbance and potential fire damage to whitebark pine seed trees adjacent to the project area if a wildfire burns in the area. Reducing ladder fuels and adding gaps of young regeneration could help lower fire intensity. Fire risk and probability is discussed in the Fuels section. Fire risk is lowest in Alternative 2 because the most fuels reduction and thinning occurs.

Actions which benefit lodgepole pine and reduce its susceptibility to mountain pine beetle can also indirectly benefit whitebark pine. Mountain pine beetle can attack and kill whitebark pine in the transition zone between mid- to higher elevation forest types (Bower 2014). Much of the lodgepole forest in the area is dying or dead and at the end of its lifespan. Actions in the Lodgepole Pine Improvement Area (249 acres) to remove weakened trees and create patches to be planted with young trees as part of a fuel break will remove weakened and diseased older lodgepole which are most susceptible to mountain pine beetle and help stabilize beetle population levels. Mountain pine beetle generally attack larger/older lodgepole pine trees (Eglitis 2014).

Alternative 2 - Cumulative Effects-

This analysis considers the cumulative effects to whitebark pine within Whychus watershed (specifically the Headwaters, Upper, and Middle Whychus, Deep Canyon, Snow Creek Ditch, and Three Creek subwatersheds) over the past 100 years to 10 years into the future. This analysis area was chosen because it is where most of the whitebark population occurs on Sisters Ranger District.

The effects being considered are: potential for detrimental or beneficial effects from thinning, prescribed fire or wildfire as measured by amount and risk. Past management which has affected whitebark pine in the cumulative effects analysis area over the past 100 years includes: timber harvest, fuels reduction, grazing, fire exclusion, fire suppression actions, prescribed fires, and road construction.

Fire exclusion and suppression since the early 1900's have negatively affected whitebark pine because of the decline of open early seral habitats for seed caching by the Clarks nutcracker and tree regeneration from forgotten caches. Wildfires, under the influence of fire exclusion and suppression have burned 25% (45,319 acres) of the Whychus watershed since 1998 (USFS 2013). Wildfires such as the 2012 Pole creek fire burned whitebark pine habitat and had both positive and negative effects to whitebark pine as described above. Approximately 5,000 acres of whitebark habitat burned at varying intensities in the Pole creek fire with both positive and negative effects to the tree species. Approximately 40 acres of the Pole Creek fire area were planted with disease resistant whitebark pine seedlings to help compensate for impacts to seed trees from the fire.

Cattle and sheep grazing from the 1880s to about 1980 may have reduced vegetative and reproductive vigor within this species in the analysis area and caused short term compaction which reduced soil moisture infiltration. Cattle and sheep grazing occurred in high elevation forests and wilderness areas until approximately 30 years ago.

Past timber harvest, firewood cutting and road construction may have directly or indirectly damaged whitebark pine in the higher elevations of the watershed by destroying or injuring trees or compacting soils. Soil disturbance from machinery may have also created open areas for seed caching. Recent Forest Service activities within the lower elevations of cumulative effects analysis area are trending to reduce the risk of fire spread into higher elevation forests by thinning trees, reintroducing prescribed fire, and reducing the potential intensity of wildfires that may destroy seed trees.

There are no planned foreseeable future actions in the next 10 years that may affect whitebark in the subwatershed.

Alternative 3 - Direct and Indirect Effects

Alternative 3 has no direct effects to Sensitive plant species because no known populations or habitat were found in the project area. Beneficial indirect are similar but slightly less than Alternative 2 because less fuels reduction and thinning occurs. Fire risk is discussed in the Fuels section.

Alternative 3 - Cumulative Effects

The cumulative effects of Alternative 3 are similar to Alterative 2.

Conclusion:

There are no direct effects to sensitive plants under any alternative. There is a potential for indirect effects to whitebark pine from wildfire or mountain pine beetles. This potential is greatest with Alterative 1, and least in Alternative 2, followed by Alterative 3. The cumulative effects to whitebark pine are mixed. The project has beneficial effects and does not add to a negative trend.

Survey and Manage Plant Species

Regulatory Framework/Management Direction

This analysis is prepared in compliance with the Northwest Forest Plan.

Northwest Forest Plan (1994)

The Northwest Forest Plan is a series of federal policies and guidelines governing land use on federal lands in the Pacific Northwest region of the United States. The Plan was developed with the intent of protecting habitat for the northern spotted owl, but came to include much broader habitat protection goals. It creates a network of Riparian Reserves and Late Successional Reserves to conserve and protect habitat and amends the Deschutes National Forest Land and Resource Management Plan (USDA 1990).

Requirements for surveys and management of vascular plants, bryophytes, lichens and fungi apply. Direction is to implement the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 ROD). This is discussed in more detail below.

Project Consistency

The project is consistent with the January 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*. This project utilizes the December 2003 species list. This list incorporates plant species changes and removals made as a result of the 2001, 2002, and 2003 Annual Species Reviews.

In addition, there are three species receiving special consideration as directed in the May 13, 2014 Regional Forester letter. These species are *Cladonia norvegica*, *Chaenotheca furfuracea*, and *Clavariadelphus truncatus*. We reviewed these species and conducted pre-disturbance surveys for the lichen *Cladonia norvegica* and *Clavariadelphus truncatus*. The species *Chaenotheca furfuracea* does not require surveys but does require management of known sites if they exist. No known sites for this species are found in the project area.

Details of the project surveys, site management and compliance with Survey and Manage Guidelines is discussed below and detailed in Appendix B and in Table Appendix B 1.

Pechman Exemptions

The Melvin Butte Vegetation Management Project applies two exemptions from a stipulation entered by the court in litigation regarding Survey and Manage species and the 2004 Record of Decision related to Survey and Manage Mitigation Measure in *Northwest Ecosystem Alliance v. Rey*, No. 04-844-MJP (W.D. Wash., Oct. 10, 2006). Previously, in 2006, the District Court (Judge Pechman) invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations.

Following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain categories of activities from the Survey and Manage standards and guidelines, including both pre-disturbance surveys and known site management. Also known as the "Pechman Exemptions", the Court's Order from October 11, 2006 directs:

"Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

> *a. Thinning projects in stands younger than 80 years old:*
>
> *b. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;*
>
> *c. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the*

stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and

d. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

Exemptions Utilized

Two of the Pechman Exemptions (a & d.) were applied to specific stand types in the project area: plantations and late successional old growth (LSOG). The exemptions allow these areas to be treated without pre-disturbance surveys (Table 190).

For more information about why plantations were proposed for treatment see the Forest vegetation section. For more information about why late successional old growth (LSOG) were proposed for treatment see the Fire and Fuels section. The project meets the Pechman Exemptions as described below:

Table 190 Consistency with the Pechman Exemptions in the Melvin Butte Project area.

Pechman Exemptions as applied in the Melvin Vegetation Management Project		
Exemption	**Where applied/Number of acres**	**How applied**
a. Thinning projects in stands younger than 80 years old	Plantations – Thinning prescription 1,174 acres	Plantation between ages of 34-22 years old will be thinned. Plantations were surveyed for invasive species only.
d. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."	Prescribed Fire /Fuels treatments Prescription 497 acres	Late successional forest areas are slated for fire/fuels treatments including pre-commercial thinning and prescribed fire. These areas were not surveyed to protocol.

Analysis Methods

Analysis of the project included a pre field review of existing information on Survey and Manage plants and their habitats and surveys where required. The direct and indirect effects of the action alternatives are evaluated and the cumulative effects of the project, considered with other activities in the past or near future are also discussed.

Measures to be used in the effects analysis include probability of detrimental impacts to Survey and Manage plant species in number of plants affected and acres of habitat lost or gained. Expected impacts from the project are based on professional knowledge and experience of similar projects in the past.

Prefield Review: The lichen, *Cladonia norvegica* has a known site along Snow Creek, 1 mile west of the project area. Several bryophytes and vascular plants had potential habitat. In addition 64 fungi species were identified which could have potential habitat in old growth areas. See Appendix B.

Survey Results: Surveys for Category A and non-fungi Category B Survey and Manage species were completed in 2007. Two years of surveys for Fungi on the Survey and Manage List as a Category B species were completed in 2011 and 2012 according to protocol. These species require surveys if old growth habitat will be disturbed. No Survey and Manage species were found in the project area. The species, *Clavariadelphus truncatus* was surveyed for in fungi surveys and was not found.

Surveys for *Cladonia norvegica* were completed in 2011and 2012 on 1,241 acres of old growth habitats, as part of the larger Popper Vegetation Management Project which burned in the 2012 Pole Creek Fire. The unburned portion of the Popper project was modified to create the Melvin Vegetation Management Project. A few suspect lichens were found outside the Melvin project area near the wilderness boundary, however, these sites burned that year in the Pole Creek fire and the plants habitat, old decomposing down logs, were lost before they could be confirmed. No *Cladonia norvegica* was found in the Melvin Butte Project area.

Effects Analysis

Alternative 1- Ecological trends

No known populations or habitat for Survey and Manage species were found or known to exist in the project area.

Alternative 2 and Alternative 3 - Direct and Indirect Effects

There are no known direct or indirect effects to Survey and Manage plant species (see Appendix X) because no known sites exist in the project area and no populations or habitat were found in areas that were surveyed to protocol in the project area.

Hazardous fuel treatments, using prescribed fire for noncommercial treatments, would be conducted on about 497 acres of late successional old growth. This treatment is exempt from survey and management requirements per Pechman exemption (d) (see discussion above). The exemption allows for ladder fuels less than 8 inches diameter at breast height to be cut, if necessary, and the area prescribed burned. Pre-disturbance surveys are not required. No survey and manage species or probable habitat is known from the area.

Additionally, about 1,174 acres of plantations planted from 1981-1993 (ranging from 22 – 34 years old) would be thinned using a variable density prescription. Stands less than 80 years old are exempt from pre-disturbance surveys under the Pechman exemption (a). No survey and manage species or probable habitat is known from the area.

Alternative 2 and Alternative 3 - Cumulative Effects

There are no cumulative effects to Survey and Manage plant species because there are no effects to Survey and Manage species.

Conclusion

There are no direct, indirect or cumulative effects to Survey and Manage plant species under any alternative because no known populations or habitat were found in areas surveyed to protocol in the project area.

INVASIVE PLANT SPECIES

Regulatory Framework/Management Direction

Forest Service Manual (FSM) direction requires that an Invasive Plant (formerly called noxious weeds) Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading invasive plants, Forest Service policy requires that decision documents must identify control measures that will be undertaken during project implementation (FSM 2081.03, 29 November 1995).

This analysis is tiered to a broader scale analysis, the Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program (USFS 2005). The associated Record of Decision amended the Deschutes National Forest Plan by adding management direction relative to prevention and treatment of invasive plants. The Deschutes and Ochoco National Forest Invasive Plant Treatments Environmental Impact Statement (USFS 2012a) also applies to the project area in approving treatments to existing invasive plant populations in the project area, and providing a process (Early Detection Rapid Response) for allowing new infestations to be controlled.

Invasive plants are identified from the Deschutes National Forest Invasive Plant List (See Appendix B). Effects of the activities of the project on the introduction, spread and enhancement of invasive plant populations and required mitigation measures for projects that have a moderate to high risk of introducing or spreading invasive plants (FSM 2081.03, 1995) are addressed in the Invasive plant Risk Assessment section of this document.

Analysis Methods

Risk factors and vectors are considered in determining the level of potential harm in the introduction or spread of invasive plants. The direct and indirect effects of the action alternatives are evaluated and the cumulative effects of the project, considered with other activities in the past or near future, are also discussed.

Prefield Review: Analysis of the project included a pre field review of existing information on invasive plants. The area has been surveyed several times in the past 20 years and existing information was available for spatial analysis using Geographic Information Systems (GIS).

Survey Results: The area was surveyed in 2007 and portions were reexamined in 2011 and 2012. No invasive species were found in the project area.

Invasive Plant Species Risk Assessment: Forest Service Manual direction requires that Invasive plants Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading invasive plants, Forest Service policy requires that decision documents must identify invasive plants control measures that will be undertaken during project implementation.

Risk Ranking

Deschutes National Forest has developed a standardized invasive plants risk assessment process to be conducted as a part of the project planning process. Risk rankings are based on the following sets of criteria.

High Risk results if (all 3):

1. Known invasive plants in or adjacent to project area. YES on lower portions of access routes

2. Any of vector #s 1-8 in project area. YES
3. And Project operations in or adjacent to invasive plant sites. NO

Moderate Risk results if:

1. Any of vector #s 1-5 are present in project area. YES

Low Risk results if:

1. Any of vector #s 6-8 present in project area,
2. OR
3. Known invasive plants present in or adjacent to project area, even if vectors lacking.

Vectors ranked in order of invasive plant introduction/spread risk:

1. Heavy equipment (implied ground disturbance). YES
2. Importing soil/cinders/gravel. NO
3. Use by OHVs. YES
4. Grazing (long-term disturbance). NO
5. Pack animals (short-term disturbance) NO
6. Plant restoration. NO
7. Use by recreationists. YES
8. Presence of USFS project vehicles. YES

Using this system of analysis, the risk of introduction and spread of invasive plants due to the implementation of this project has been determined to be **MODERATE**. This rating is attributable to the presence of weed populations and vectors. Mitigation measures are required to reduce this risk.

Existing Condition

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

There are no known populations of invasive plants in the project area, however, invasive plants such as diffuse and spotted knapweed are known within the subwatersheds adjacent to the project and on lower portions of major roads such as Rd 16. Control efforts are ongoing through the Forest Invasive Plant Program and manual control is occurring at these sites to hand pull plants before flowering occurs. Invasive species can spread into forest areas along roads and can be introduced by vehicles and equipment. There is a moderate risk of introduction and spread from activities which open forest canopies, use prescribed fire, and utilize heavy equipment without mitigation.

Effects Analysis

Alternative 1- Direct and Indirect Effects

Under the No action alternative the risk of Invasive Plant introduction is likely to continue as motorized use and some minor recreation use in the area continues (see assessment below). Seeds are spread by

vehicles, wildlife, wind and water movement. Peoples clothing and shoes can also act as vectors which spread invasive plant seeds (Mount and Pickering 2009).

Of the three alternatives associated with this project, the No Action Alternative poses the least risk of introducing, exporting, or moving existing weeds about within the project area because of the lack of ground disturbance, fire, and vehicles and the retention of tree canopy/shade.

Alternative 2- Direct and Indirect Effects

Alternative 2 poses the greatest risk of invasive plant introduction and spread because the most acres are treated (4,435 acres) with ground disturbance by heavy equipment and prescribed fire. Of that, 892 acres are treated to create openings which will be more vulnerable to early seral species, including invasive plants, than a thinned forest with more canopy shade. Actions to reduce, but not eliminate this risk, are included in the project Design Criteria/Mitigations section of this document.

Alternative 2- Cumulative Effects

This analysis considers the cumulative effects of invasive species risk within Whychus watershed (specifically the Headwaters, Upper, and Middle Whychus, Deep Canyon, Snow Creek Ditch, and Three Creek subwatersheds) over the past 100 years to 10 years into the future. This analysis area was chosen because invasive species disperse by a number of agents but the most relevant project related cumulative effects for invasive species expansion and its impacts on rare and riparian habitats is concentrated in these subwatersheds. The effect being considered is the increased risk of invasive plant introduction and spread.

Past management which has affected invasive plant risk in the cumulative effects analysis area over the past 100 years includes: timber harvest, livestock use, fire suppression, wildfires, recreation, utility line installations, development on private lands, and trail and road use and construction. There are over 2,785 acres of land with invasive species in the cumulative effects analysis area. With the knapweed species, both species are often found in the same areas and these acres are double counted. Densities vary and populations are generally light and widely scattered with some areas of higher concentrations.

The heaviest concentrations of invasive plant populations are associated with areas of past timber harvest (Upper Whychus) and with the irrigation district system (Middle Whychus) or associated with the urban interface (Deep Canyon, Middle Whychus). Table 191displays invasive plants found in the cumulative effects area.

Table 191 Invasive plants in the Melvin Butte cumulative effects analysis area.

Invasive Species in the Melvin Butte Cumulative Effects Analysis Area		
Species	*Subwatershed*	*Acres*
Diffuse knapweed	Deep Canyon	177
	Middle Whychus	611
	Upper Whychus	790
	Headwaters	1
	TOTAL	**1579**
Spotted knapweed	Deep Canyon	25
	Middle Whychus	416
	Upper Whychus	721
	TOTAL	**1162**

Tansy Ragwort	Upper Whychus	32
	TOTAL	**32**
Canada Thistle	Upper Whychus	12
	TOTAL	**12**
TOTAL		**2,785**

Invasive plant populations are expanding in the subwatershed on public and private lands stimulated by timber harvest, grazing, wildfires, prescribed fires, and land developments. Two large wildfires since 2010 (Rooster Rock, 6119 acres and Pole Creek, 26,538 acres) created more open conditions in the analysis area and fire suppression may have introduced invasive species. Highest risk areas of these two fires and the Pole Creek Fire salvage (discussed below) are being monitored and new invasive starts removed.

Large scale thinning/fuels reduction projects such as the Highway 20 Project, Black Butte Ranch Fuels Project, and the Glaze Forest Restoration Project have improved habitat conditions for invasive plants with thinning and prescribed fire. Mechanical entries and resultant soil disturbance associated with road repairs, utility installations, have further promoted establishment and spread. Numerous invasive plant sites occur along roadsides and within areas experiencing moderate to heavy recreational use by vehicles and equestrians which provide additional opportunities for invasive plant introduction and dispersal

Forest Service streamside restoration activities within the cumulative effects analysis area in the past 15 years have begun to improve riparian and forest conditions vulnerable to invasive plant invasion reducing riparian trampling and devegetation, by defining access and closing streamfords at 59 sites along Whychus Creek. Increased management controls in riparian areas, roads and trails, along with revegetation of unneeded roads with native plants would combine with other efforts of streamside and forest restoration in the watershed to cumulatively improve vegetative conditions and native plant habitat quality by restoring habitat and reducing impacts from unmanaged recreation. The Whychus Portal project reduced vehicle access and unmanaged use along Whychus Creek and has reduced invasive plant risk by removing vectors for spread and restoring devegetated areas.

The largest area of invasive plant infestation in the watershed is in the ongoing Whychus Floodplain project which is restoring altered channels and floodplain of Whychus Creek to their historic function. About 11,000 plants of diffuse and spotted knapweed (*Centaurea diffusa* and *Centaurea stoebe*) were found scattered over 81 sites in the Whychus Floodplain project area. Intensive management by hand removal has occurred yearly for the past decade on a portion of these populations. New populations were discovered in 2011. The ground disturbance involved with the restoration includes: digging channels and filling areas and increases some habitats likely to be invaded by invasive plants (like new floodplain) while reducing others (such as eroding streambanks). The project will reduce actively eroding streambanks (from 75% to 10%) and thus reduce vulnerable habitats next to the creek. Active revegetation of 34 acres will also reduce invasive plant habitat. Riparian vegetation will increase from 18 acres to 42 acres, however 24 acres of reconnected floodplain will be more vulnerable as seeds are a carried across the floodplain. These effects add to the effects of other watershed restoration projects in the creek channels area upstream and downstream and restore hydrological function to benefit native plants and reduce disturbed habitats for invasives but also provide new ways for seeds to be carried.

Climate change is expected to affect invasive species in the future. A comprehensive review (Vose, et.al 2012) concluded that invasive species will likely become more widespread, especially in areas of

disturbance and in dry forest ecosystems. Vose notes that plant invasions can be influenced by warmer temperatures, earlier springs and earlier snowmelt, reduced snowpack, changes in fire regimes, elevated nitrogen deposition, and elevated carbon dioxide concentrations. Invasive species common to the Sisters Ranger District, such as spotted and diffuse knapweeds (*Centurea* spp.), Canada thistle (*Cirsium arvense*), and cheatgrass (*Bromus tectorum*) showed increased productivity in response to elevated carbon dioxide under controlled conditions. Risk of exotic invasive plants entering forests is likely highest in mountainous ecosystems, such as the cumulative effects analysis area, where historically cooler temperatures and closed-canopy forests may have limited invasives.

Funding, monitoring, and control efforts for invasive plants have increased over the past decade with the designation of the Collaborative Forest Landscape Restoration Act area for the Whychus watershed. Fewer plants are being allowed to produce seed. As stream flows are incrementally restored, less habitat would be available for invasive plants. If the mitigation measures are followed the invasive populations should stabilize or be reduced.

Other ongoing and foreseeable actions in the next 10 years that may affect invasive species risk in the subwatershed include 1) Continuation of the Sisters Area Fuels Reduction (SAFR) project and the Pole Creek Salvage project will create ground disturbance and open conditions favorable for invasive plant spread over 18,000 acres , 2) The Travel Management Plan, will reduce vehicle access and reduce risk of invasive plant spread and 3) Invasive plant control on public lands through the Deschutes/Ochoco Invasive Plant program, which will reduce invasive plant species abundance and the risk of spread.

Considered as a whole, the factors which most influences invasive plant spread in the analysis area are vectors that spread invasive plants in vulnerable habitats such as open canopied forests and disturbed soil. The project will add incrementally to the risk of invasive plant populations being introduced to new areas. The project will cause a cumulative increase in the risk of invasive plant populations expanding in the subwatersheds as equipment and project vehicles enter 4,435 acres of land. This risk can be partly mitigated but increased monitoring and control efforts will be needed.

Alternative 3 - Direct and Indirect Effects

Alternative 3 poses the second greatest risk of invasive plant introduction and spread because areas treated (4,364 acres) with ground disturbance by heavy equipment and prescribed fire will be vulnerable to early seral species, such as invasive plants. It is slightly less of a risk than Alterative 2 because there are no openings or temporary roads created. Actions to reduce, but not eliminate this risk, are included in the project Design Criteria/Mitigations section of this document.

Cumulative Effects

The cumulative effects of Alternative 3 are similar to Alternative 2- see discussion above.

Conclusion

There is an increased risk of invasive plant introduction and spread under all Alternatives. This risk is highest in Alternative 2, followed by Alternative 3, and then Alternative 1. The project adds incrementally to the cumulative increase in invasive species risk from past practices, wildfire, and ongoing projects. Actions to reduce, but not eliminate this risk, are included in the project Design Criteria/Mitigations section of this document.

RECREATION

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Recreation specialist report and other technical documentation used to support the analysis and conclusions of this

environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This report addresses the effects of the proposed Melvin Butte Vegetation Management Project on the existing social character and condition (setting), as well as on recreation opportunities and experiences for the area. This report supports the analysis and conclusions of the Melvin Butte environmental assessment.

The primary recreation activities and opportunities that occur within the Melvin Butte project area is winter recreation use including cross-country skiing and snowmobiling. The area also includes Forest Road 16 with provides access to a popular summer and winter recreation area south of the project area. There are no non-motorized/summer trails and limited dispersed camp sites known in the project area. There is some evidence of unauthorized off-road recreational all-terrain vehicle use in the project area.

Vegetation management activities such as tree thinning, group openings, mowing of shrubs, prescribed burning, and reforestation may affect recreation areas and access routes. Changes in road status (closure or decommission) may affect recreational activities within the project area.

There is one outfitter and guide in the project area and recreation events. Occasional group use activities may be authorized within the project area, but are infrequent and non-recurring. Permit holders typically use the two developed sno-parks and Forest Road 16 within the project area.

Regulatory Framework / Management Direction

Management Plans

Management direction is contained in the Deschutes National Forest Land and Resource Management Plan (LRMP), as amended. Recreation activities within the project area occur in lands designated for MA-18 Front Country and MA-9 Scenic Views. The LRMP also provides standards and guidelines for Trail System Management which also applies to trails within the project area. The LRMP was amended in 1994 by the Northwest Forest Plan which further allocated the Scenic Views (MA-9) and Front Country (MA-18) Management Areas as Matrix.

MA-9 Scenic Views (includes Upper and Lower Three Creeks Sno-Parks; FSR 16, and Cross-District and Three Creek Lake XC Trails)

MA-9 Goal/Theme The overall goal for MA 9 is “To provide Forest visitors with high quality scenery that represents the natural character of Central Oregon” (LRMP 4-121). The general theme and objectives of Scenic Views is for landscapes seen from selected travel routes and use areas to be managed to maintain or enhance the appearance of the areas being viewed. To the casual observer, results of activities would either not be evident or would be visually subordinate to the natural landscape.

MA-9 Standards and Guidelines

M9-1 New recreational developments and changes to existing developments are permitted as long as they are consistent with the desired visual condition. When viewed from significant viewer locations, recreational facilities will meet the established visual quality standards. For viewer locations within the recreational development being viewed, established visual quality standards may not always be met.

MA-18 Front Country (includes portions of the Triangle Tie and Triangle Hill Loop snowmobile trails)

MA-18 Goal/Theme The overall goal for MA-18 is "To provide and maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim while providing high and sustainable levels of timber production".

MA-18 Standards and Guidelines

M18-18 New recreational developments and changes to existing developments are permitted as long as they are consistent with the desired visual condition.

M18-21 Traditional informal campsites, hunter camps, or areas where concentrated recreation use occurs will be recognized as being significant in producing and utilizing dispersed recreation opportunities. Prescriptions for harvesting, cleanup, site preparation, and thinning will consider the environmental setting that contributes to the attraction of these sites for recreation purposes. The attempt will be made to retain this attractive character during and after treatments.

Forest-wide: Trail System Management

Goal To maintain the existing trail system and provide additions or modifications to the system which will meet the increasing and changing demands in dispersed recreation. To the extent possible this system will provide trails of all difficulty levels, trails in visually appealing settings, and trails for those modes of travel appropriate for the Forest in both winter and/or summer.

TR-3 Trails will be located or relocated whenever possible where they will not be disrupted by developmental activities such as logging or road building. Where disturbance of a trail cannot be avoided cleanup should be concurrent. Reassurance markers and signing will be maintained to avoid inconveniencing trail users.

TR-6 Volunteer groups and individuals will be encouraged to maintain and construct parts of the trail system.

TR-21 In addition to winter use of OHV's, the Forest will provide additional opportunities for summer use of OHV's and other OHV's such as motorcycles. Part of the Forest service road system that is not maintained for public use and that is not involved in logging operations may be opened for this use.

TR-25 The trail will coexist in harmony with all other uses and activities of the land as determined through the land management process.

TR-26 When resource activities occur immediately adjacent to or across the trail the integrity of the trail proper will be protected by modified management practices as needed.

Travel Management

In accordance with the Deschutes National Forest and Ochoco National Forest and Crooked River National Grassland Final Environmental Impact Statement and Record of Decision (8/4/2011), summer-time motorized access off of the open designated road system (cross-country travel) is, with some exceptions, prohibited. Exceptions include over-snow vehicles (winter only); and motorized access for emergencies or authorized by permit. The Deschutes and Ochoco National Forests Motor Vehicle Use Maps (2011) prohibit motorized access off designated roads and establishes access conditions for dispersed camping. Summer motorized use for both highway legal and non-highway legal vehicles is currently allowed on most Maintenance Level 2 roads within the project area (See Roads Analysis report). Conditions of use established by these new regulations are considered part of the existing condition for the Melvin Butte project.

Recreational Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a description of various attributes that contribute to a particular recreational setting. The ROS describes recreational settings in terms of the, "combination of physical, biological, social, and managerial conditions that give value to a place." (Clark and Stankey 1979). Figure 33 shows the ROS settings for the project area. The ROS settings that apply to the Melvin Butte project include:

Roaded Natural – This is the setting for most (>99%) of the project area. "The area is characterized by predominately natural-appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction among users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. Large mammals tolerant of humans may be present; those not tolerant present infrequently. There is a prevalence of smaller species." (Deschutes National Forest LRMP, Appendix 2-1)

Roaded Modified – This is a very small portion of the project area (< 1%) and does not contain any recreation resources.

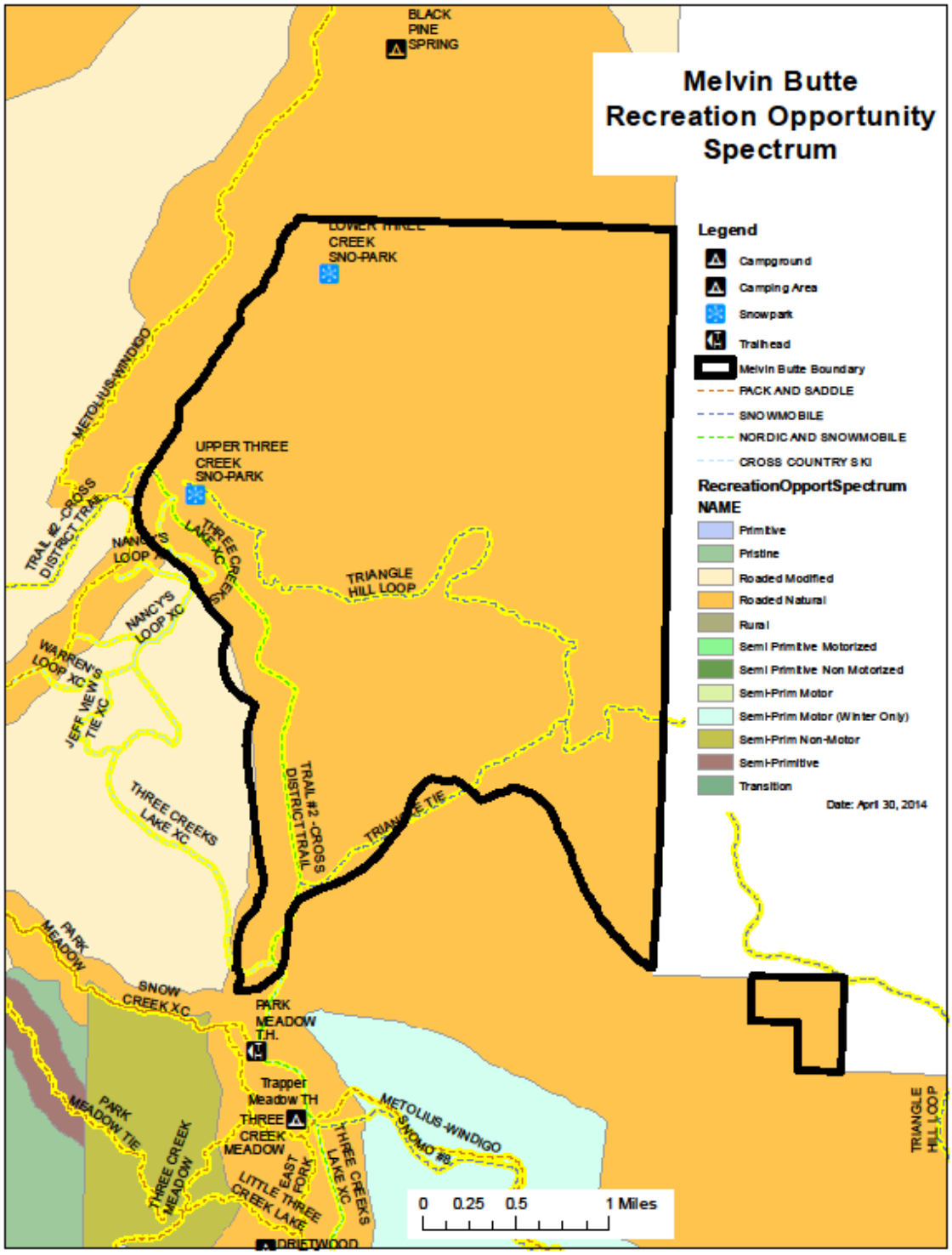


Figure 33 Recreation opportunity spectrum.

Analysis Methods

Direct, indirect, and cumulative effects to recreation resources were analyzed by determining the degree of disturbance directly associated with the different types of proposed activities, any secondary effect indirectly associated with the proposed action, and the cumulative effects of all actions affecting the resource within the area of potential effect. Project design criteria are shown in Table 192.

A. Analysis Assumptions and Methodology

The analysis of effects of the action alternative is based on the following assumptions:

A. Detailed descriptions of the proposed action and alternatives are included in Chapter 2 of the Melvin Butte EA. Effects of the alternatives are based on those descriptions.

B. Public access to the Three Creek Recreation Area via Forest Road 16 would be allowed during the operational period.

C. FSR 16 would not be used for vegetation management operations during the winter recreation season (snow dependent from November to May) from the Upper Three Creek Sno-Park to the southern end of the project boundary. An alternate route using FSR 1628 and 1620 would be used. Portions of FSR 1628 are also used as the Triangle Tie and Triangle Hill Loop snowmobile routes. Winter recreation on these roads/trails would temporarily be closed on these snowmobile trails.

D. Within the project boundary, FSR 16 would not be used during the summer recreation months (snow dependent from June to October) on holidays or weekends for vegetation management operations.

E. Public safety concerns resulting in public access would be mitigated as deemed necessary by the Forest Service.

F. Effects of the action alternative is based on the assumptions that the following recreational resource project design criteria would be incorporated:

Project Design Criteria

Table 192 Recreation project design criteria.

To avoid significant disruption of the current valued scenery and recreation experience:	
Whenever possible, landings, slash piles, and other discordant visual evidence of harvest and treatment activities should not be visible from sno-parks facilities following completion of operations. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
Do not approve long-term storage of bundles or decks where they would affect the function or use of the sno-parks. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
To avoid, minimize or reduce impact to recreational use and safety:	
Avoid creating sharply diverse vegetation conditions immediately adjacent to sno-parks. Emphasize a "natural" look of the forest as viewed from the sno-parks. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
Do not approve slash piles or storage of decks along trails that may create a hazardous situation for snowmobile users. For example, a slash pile covered by snow may appear to be a small hill/obstacle to a snowmobile user, not an unstable slash pile. Mitigate these hazards as necessary. (Forest-wide Standards and Guidelines, TR-3)	Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114

During tree-marking, or tree or brush removal activities within 300 feet of sno-parks, coordinate with recreation staff to emphasize retention and improvement of natural site-defining features. Site boundaries for designated sno-parks are defined by trees, brush, rocks, or down logs. This helps define the edge of where parking is allowed. Maintaining this vegetation entirely or partially or replacing these site-controlling features is critical to future effective site management. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
Retain trees that hold signs (including diamonds that mark winter trails). Replace trail signs that may be damaged or removed during project operations. (Forest-wide Standards and Guidelines, TR-3)	Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114
Whenever possible, in accordance with this EA, remove hazard trees within a tree length near sno-parks. (FSM 2332)	Sno-parks (Units 109 and 39)
To avoid indirect, unintended disruption or modification of recreation activities or unintended impact from recreation activities on other resources following completion of treatment activities:	
Painted trees should not be visible from sno-parks within a reasonable time period following completion of project activities. Techniques to accomplish could include, but are not limited to, favoring blue paint marking techniques where possible to mark 'take' trees rather than 'leave' trees for units containing or adjacent to sno-parks, or removing leave tree paint within sight of sno-parks. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
Avoid creating vegetative conditions that would facilitate creation of unauthorized trails, or that would facilitate unauthorized motorized access from Forest Road 16 or Sno-parks. (M9-1, M18-18) Place boulders (preferred) or other natural features bounding sno-parks to deter cross-country travel.	Sno-parks (Units 109 and 39) Forest Road 16
Obliterate unauthorized travelways adjacent to the sno-parks. (M9-1, M18-18)	Sno-parks (Units 109 and 39)
Ensure that temporary roads used for project administration do not become future unauthorized trails by effective obliteration after use.	See Transportation Effects Analysis
To ensure that there is no inadvertent effect to use of designated snowmobile routes, to the extent that snowplowing is needed during the operating period:	
Assure snow berms created by snowplowing activities do not coincide with winter recreationist routes that create a hazard for snowmobile groomers or recreational users. Coordinate trail closures with the recreation staff.	Forest Road 16 Units: 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114
In order to avoid surprises to recreational users of the area:	
Provide information about timing and location of treatments on websites and at the sno-parks, including information on specific trail or area closures.	Sno-parks (Units 109 and 39)
To avoid, minimize or reduce impact to special use operations:	
Coordinate with the special use administrator to identify recreation events permitted for the season. Coordinate conflicts with timing and location.	Forest Road 16 Sno-parks (Units 109 and 39)
Do not use Upper Three Creek Sno-Park as a staging area as it receives heavy use and serves as a temporary office location for Three Creeks Backcountry outfitter/guides under special use permit by the Forest Service.	Sno-park (Units 109 and 39)
To avoid significant disruption of the Three Creek recreation area south of the project area:	
Implement traffic control and safety measures on Forest Road 16 during summer recreation use as necessary.	Forest Road 16

B. Key attributes that contribute to the recreational value of the area

The key attributes that contribute to the recreational value of this area that would be affected by proposed Melvin Butte project activities include scenery from recreational infrastructure; timing and access to recreational activities and permitted special use activities, public safety, and revenues that could be affected by the changes from the proposed action and alternatives.

Scenery – How might scenery as viewed from the Sno-Parks and trails, and FSR16 be changed by the proposed actions? How does that affect the physical recreational setting and people's perception of the "natural" quality of their recreational experience? (See Scenic Views Analysis)

Access – What kind of access (motorized or non-motorized) is affected by the project, what is the timing or season when recreational access may be affected, and what access to what facilities or opportunities may be affected? How might changes in access affect user convenience and recreational opportunities, or access for facility maintenance?

Safety – How might the proposed project affect the public's safety, including ingress and egress to the Three Creek recreation area south of the project area?

Existing Condition

The Melvin Butte project area includes developed sites, including two sno-parks, groomed snowmobile trails, cross-country ski trails, and roads (Figure 33). There are no non-motorized/summer trails or inventoried dispersed camping sites in the project area. There is some evidence of dispersed recreation such as camping that occurs in the area.

Within the project area is the Upper and Lower Three Creek Sno-Parks and 10.55 miles of winter ski and snowmobile trails (Table 192 and Table 193). Lower Three Creek Sno-Park receives limited use in the summer, and has not been plowed or received use in the winter for more than 5 years. The Upper Three Creek Sno-Park is heavily used in the winter and gated closed in the summer. Many snowmobile and ski trails originate from the Upper Three Creek Sno-Park. The Triangle Hill/Tie complex of snowmobile trails inside the project area offer winter snowmobile opportunities and receives limited use and has not been groomed for the past 5 years due to poor snow conditions. The Triangle Hill/Tie complex connects to Snowmobile Trail #8 outside of the project area. A small portion of the Three Creeks Lake XC trail originates from Upper Three Creek Sno-Park inside of the project area and connects to a system of cross-county Nordic ski trails west of the project area.

During the winter Forest Road 16 is gated from around November to May (snow dependent) and converts to a popular groomed snowmobile and cross-country ski trail. These trails connect to the Cascade Lakes snowmobile trail complex, outside of the project area.

During the summer Forest Road 16 provides access to the Three Creek Lake Recreation Area, an intensive recreation area south of the project area for summer activities such as overnight camping, hiking, lakeside day use, non-motorized boating, and riding horses. FSR16 also provides access to Three Sisters Wilderness trailheads during the summer.

Three Sisters Backcountry Incorporated uses the Upper Three Creek Sno-Park as a temporary office location under special use permit by the Forest Service. They offer avalanche courses and outfitter services for backcountry ski huts. Other special uses in the area include recreation events such as cycling on Forest Road 16, Boy Scout adventure race and training events near the sno-parks. The Upper Three Creek Sno-Park is closed during the summer unless permitted for a special use. The Lower Three Creek Sno-Park remains open. Another special use, non-recreational, is the Snow Creek Irrigation Ditch which is no longer in use with no valid water rights on file within the eastern portion of the project boundary

(Forest Road 480). See Table 195 for Special Use permits in the project area. Table 194 shows trails in the project area.

Dispersed recreation opportunities that may occur in the project area, besides use of the winter trails already mentioned, include driving for pleasure, birding, hunting, and other types of dispersed activities.

Although there are no designated summer trails in the project area, the Metolius-Windigo Trail and Petersen Ridge Mountain trail systems receive heavy mountain biking and equestrian use and are located the west and northeast and of project area.

Within project area, the primary facilities that are used by recreationists in the area and are likely to be affected by the proposed action and alternatives are:

- Upper and Lower Three Creek Snow-Parks
- Forest Roads 16 and other portions of the roads system provide snowmobile and cross-country ski trail opportunities
- Outfitter and Guide operations, and recreation events permitted
- Snowplow and facility maintenance operations at the Sno-Parks
- Motorized-access to undocumented dispersed recreation opportunities along Forest Roads (driving for pleasure, birding, hunting, target shooting)

Outside of the project area, the primary facilities that are used by recreationists in the area and are likely to be affected by the proposed action and alternatives are:

- The Metolius-Windigo trail west of the project area
- Forest Road 16 access to Three Creek Lake recreation area and trails south of the project area

Table 193 Developed sites in the Melvin Butte Project area.

Facility Name	Facility Type and Capacity	Management Area
Upper Three Creek Sno-Park	70 car parking capacity	Scenic Views
Lower Three Creek Sno-Park	70 car parking capacity	Scenic Views

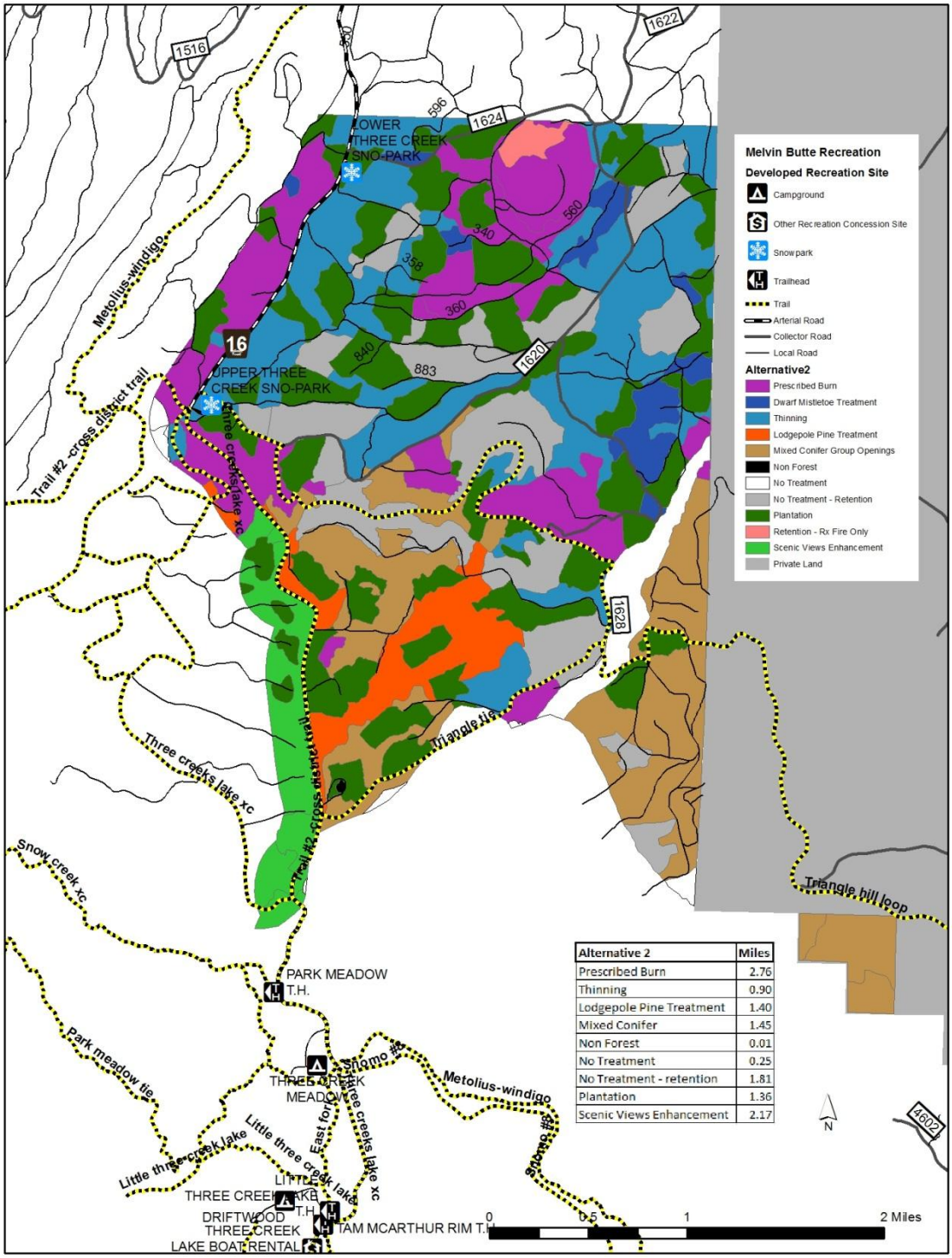
Table 194 Trails in Melvin Butte Project area.

Trail Type	Name	Miles of Trail Within Project Area	Total Trails Miles (within and outside of project area)	Deschutes LRMP Management Area/NWFP Allocation
Snowmobile	Cross-District Trail	3.03	38.95	Scenic Views/Matrix
Snowmobile	Triangle Hill Loop	5.16	15.6	Scenic Views/Matrix, Front Country/Matrix
Snowmobile	Triangle Tie	1.34	1.7	Scenic Views/Matrix, Front Country/Matrix
Total Snowmobile		**9.53**	**56.25**	
X-C Ski	Cross-District Trail	(3.03*)		Scenic Views/Matrix, Front Country/Matrix
X-C Ski	Three Creek Lake XC	1.02	5.5	Scenic Views/Matrix Front Country/Matrix
Total X-C Ski		**1.02**	**5.5**	
Grand Total		**10.55**	**61.75**	

*Mileage not included in "Total X-C" as this trail mileage was accounted for under the snowmobile.

Table 195 Special uses in Melvin Butte Project area.

Special Use Permit	Type of Use	Season of Use	Associated Facilities
Three Sisters Backcountry	Outfitter & Guide, Yurt rental, snowmobile and XC Ski	October to May	Upper Three Creeks Sno-Park, FSR16, Cross-District Trail.
Recreation Events (differ year-to-year) Examples: *Boy Scout Freeze-O-Ree *Cascade Cycling Classic *Trainings *Adventure Race	Biking Youth Education Training		Upper and Lower Three Creeks Sno-Parks, FSR16



Alternative 2	Miles
Prescribed Burn	2.76
Thinning	0.90
Lodgepole Pine Treatment	1.40
Mixed Conifer	1.45
Non Forest	0.01
No Treatment	0.25
No Treatment - retention	1.81
Plantation	1.36
Scenic Views Enhancement	2.17

Figure 34 Alternative 2 recreation infrastructure within Melvin Butte Project area, Melvin Butte project treatments.

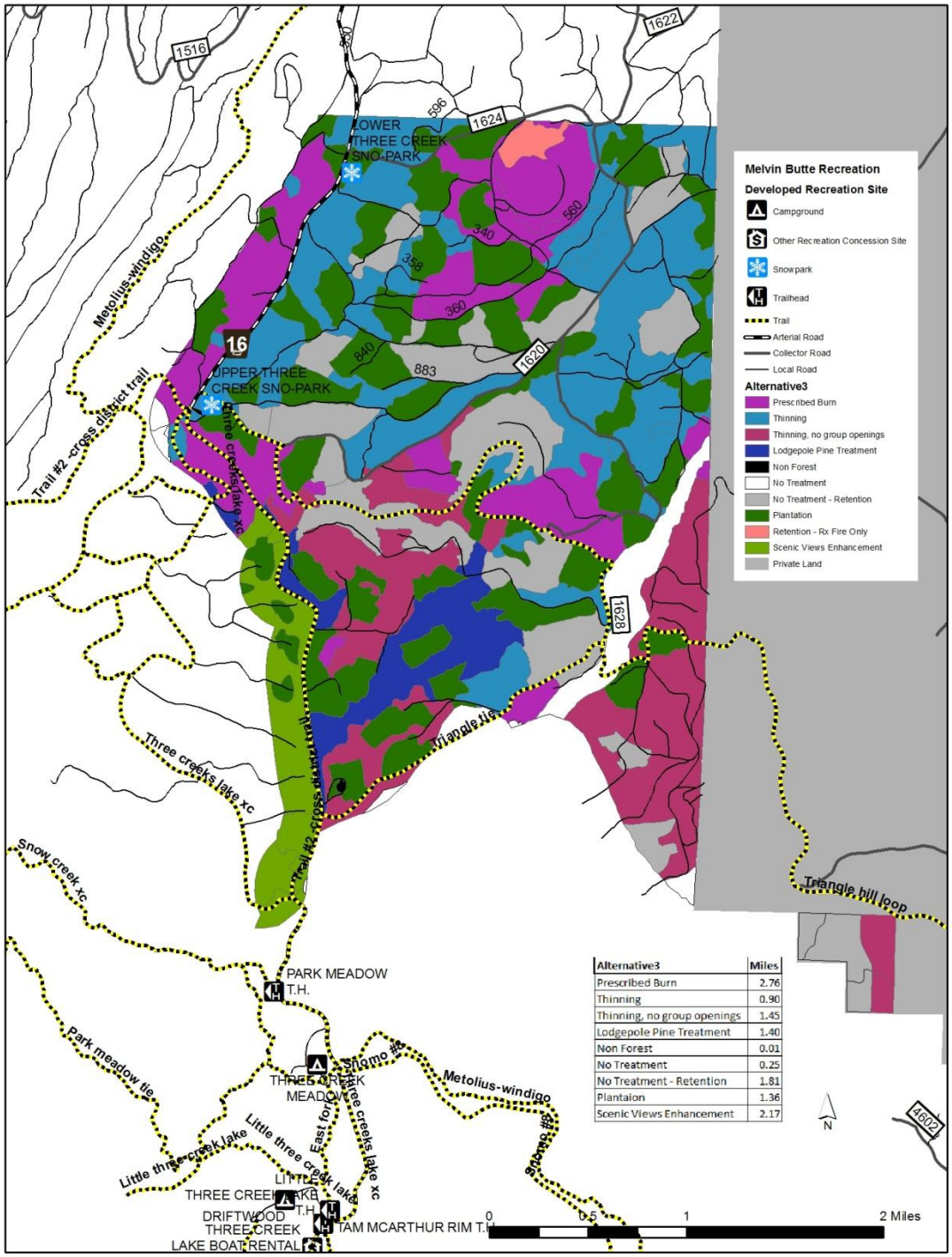


Figure 35 Alternative 3 recreation infrastructure within the Melvin Butte Project area, Melvin Butte Project treatments.

Effects Analysis

Alternative 1 Social Trends - Direct and Indirect Effects

No vegetation management activities would occur under the No Action alternative. There would be no change in current management direction or in the level of management activities. General recreational use and special use authorizations within the Melvin Butte project area would continually occur. The greatest threat to winter recreation trail and sno-park infrastructure would be from wildfire. The high risk of wildfire that exists within the area would not be reduced if no treatments are conducted. Wildfire could damage or destroy trail and facility infrastructure such as site identification features, restrooms, and trail markers.

Alternatives 2 and 3 - Direct and Indirect Effects

The effects to recreation resources would be similar for alternatives 2 and 3 and are combined in this narrative, with any marked changes between the alternatives specifically described as needed.

Sno-Parks

The two developed sno-parks, Upper Three Creek Sno-Park and Lower Three Creek Sno-Park are located within Thinning or Plantation vegetation management units. This proposed thinning and fuel treatment would open up treated areas that could facilitate an increase in use, and unauthorized access, construction to, or expansion of dispersed campsites, trials, and roads. This is a concern at both sno-parks since unauthorized cross-country motorized travel is already occurring at the sno-parks. Mitigation measures to these effects are described in the Analysis Methods, Project Design Criteria section of this report.

Views would be opened adjacent to the sno-parks which may increase the satisfaction for visitors where views and forest access are improved. The aesthetic value surrounding the sno-parks would be changed by thinning and residual stumps and slash. Burning adjacent to the sno-parks would leave the area with affects from blackened ground vegetation and potential scorching of trees from pile burning.

Sno-parks would not be used for staging or landing areas, thus alleviating direct effects from such use. Access to the sno-parks by way of Forest Road16, a haul route, could result in the direct effect of a temporary delay for forest visitors and increased truck traffic along the shared corridor. This will be mitigated by limited vegetation operations during weekends and holidays, and informing the public of timing and locations of treatments as described in the Analysis Methods, Project Design Criteria section of this report.

Winter Trails

Snowmobile and cross-county ski trails within the proposed project area include portions of the Cross-District trail, Triangle Hill Loop trail, Triangle Tie, and Three Creek Lake XC trail (total 10.55 miles).

Treatments along trails (units 4, 10, 12, 28, 31, 35, 39, 40, 41, 42, 44, 48, 49, 50, 56, 57, 72, 76, 85, 86, 87, 90, 108, 110, 113, 114) include thinning, pruning, mowing of shrubs, prescribed fire, and patch cuts. There is increased mixed-conifer group opening treatment near snowmobile trails in Alternative 2 (MCGO - 1.86 miles) where Alternative 3 has increased harvest thinning (HTH).

- Short-term effects (0 to 3 years) include evidence of treatment operations including painted trees and temporary roads. Evidence of ground disturbance such as log skidding and hauling and evidence of stumps is hidden by snow.
- Mid-term effects (3 to 10 years) include evidence of harvest operations and treatments. The effect to scenery would be most evident in group openings. In many cases, removal of vegetation provides new opportunities for snow play because the more open areas collect more snow and

allow for easier access from the trails. The reduction of vegetation may also encourage off-highway vehicle users to illegally travel cross-country. Removal of dead and dying trees would benefit the scenic values throughout the area. Some areas would also benefit from expanded view sheds.

- Longer-term effect includes the reduced risk of catastrophic wildfire and invasive plants, improving overall forest health, would maintain the scenic quality surrounding these trails in the long-term.

Access: The most popular route, the Cross-District trail/Forest Road 16 would stay open during winter operations. Proposed haul routes are use Forest Road 1628 and Forest Road 1620. Snowmobilers and other winter users may be displaced from portions of the Triangle Tie (Forest Road 1628) and Triangle Hill Loop (Forest Roads1620/300) snowmobile trails because these trails would be temporarily closed during hauling operations to increase public safety and reduce conflicts with recreationists. Due to the lower elevation, snow conditions on these trails can be poor and have received limited use. Grooming occurs by Forest volunteers although the Triangle Tie and Triangle Hill Loop trails have not been groomed in at least 4 years due to poor snow conditions. If the trail is closed in the winter, volunteers would not be able to groom the trail and snowmobilers would not be able to access the trail. Snowmobilers will be informed to use other open trail systems.

Dispersed Use/General Recreation Use

Although there are no inventoried dispersed campsites within the project area, camping is known to occur. If roads are closed during implementation, the closure would be temporary and campers would likely find alternate sites to use in the surrounding area, or ignore road closures and continue to access the sites with motorized vehicles. Decommissioning of campsites is not proposed; the sites would continue to be available for camping or be allowed to naturally return to an untrammeled condition. Logging traffic, chainsaw and timber felling noise, and smoke would likely disrupt recreational activities in the project area. This will be mitigated by informing the public of timing and locations of treatments as described in the Analysis Methods, Project Design Criteria section of this report.

Public access to the Three Creek Recreation Area (south of the project area) via Forest Road16 would be allowed during the operational period. The indirect effect to recreationist utilizing this area may include the temporary delay and increased truck traffic along the Forest Road16.

Special Use Permits

Three Sisters Backcountry, Inc. outfitter and guide operation that stages at Upper Three Creek Sno-Park from October through May and may be impacted by sight and sound of hauling trucks passing on nearby roads or thinning operations surrounding the Sno-Park.

Effects to other existing Special Use permit holders and gatherers of special forest products would be similar to those of general recreational users. The most likely effects would be temporary travel delays along access routes which are also used as haul routes. Future requests for Special permits that would occur during vegetation management operations could be accommodated by authorization use in alternate locations, avoiding areas under temporary use restrictions, and/or informing the proponent of potential impacts to the propose special use activity. Summer events may occur on the weekend or holidays when hauling would not occur.

Travel Management

Alternatives 2 and 3 would reduce the total miles of open system roads from 49.20 miles to 37.65 miles, a reduction of 11.55 miles. There is no inventoried or developed recreation infrastructure on or along these roads. The use of these roads for activities such as sight-seeing is unknown. Motorized vehicle

recreationists will have less miles of road to travel on, and management activities would reduce the amount of area available to motorized access. This would result in a reduction of motorized routes on the Motor Vehicle Use Map designated 36 CFR 212.51. See the Transportation Analysis section for effects and mitigation measures.

Recreation Opportunity Spectrum

More than 99% of the project area is located within the ROS category Roaded Natural. The management actions proposed in Alternative 2 and 3 will not change the Roaded Natural recreational setting. Long term, the environment shall stay predominately natural appearing. Interaction among users may increase due the reduction of vegetation cover which increases visual range, dispersed camping opportunity, and cross-county travel (e.g., snowmobile use, hiking).

Cumulative Effects

Cumulative effects are associated with past, present, and future projects that overlap in time and space. The cumulative effects area for the recreation analysis is the boundaries of the Melvin Butte project area.

Alternatives 2 and 3 – Cumulative Effects

Recreation use in the area is expected to grow as both population and the outdoor recreation based economy grows in central Oregon. With this increased use comes an increase in risk of human-caused fire. Past projects within and surrounding the project area have not resulted in large enough fuels treatments to reduce the high risk of wildfire. Without actions as proposed in alternatives 2 and 3, there is increased risk that these fires would be larger and burn more intensely, and impact recreation experience and infrastructure.

The existing condition (recreational physical setting) described earlier is a composite of completed and ongoing activities. Some of the ongoing activities of note are hazard tree removal and maintenance at the sno-parks, grooming of the snowmobile trails, and ongoing administration of special permits which would not likely have a lasting effect on forest visitors.

The closure and decommissioning of approximately 14 miles of existing roads within the project area is also included in the proposed action. This proposal coupled with the Forest Travel Management plan which designate open roads and trails for motorized uses, would further reduce the amount of area available to motorized access and connected dispersed camping opportunities. Off-highway vehicle enthusiasts would likely use alternate routes or ignore restoration efforts on closed roads. Proposed closures would likely result in the dissatisfaction of some visitors that once used the roads for dispersed camping, hunting, gathering of forest products, or other recreational activities.

Proposed and approved projects adjacent to the Melvin Butte project area include Ursus vegetation project that may displace snowmobilers and other winter users from snowmobile Trail #8 and Triangle Hill #88 during operations. Winter recreationists use the Triangle Tie Trail (in the project area) to access Triangle Loop Trail #88 on the Bend-Fort Rock Ranger District south of the project area (via private property). Depending on the Melvin Butte and Ursus implementation operations timeframe, temporary snowmobile trail closures within the same region may occur. The snowmobile trails impacted are low use due to snow conditions. Forest visitors who recreate within the project area may choose alternate locations during implementation. Cumulatively, in the longer term, reduction of forest densities typically would enhance winter recreation opportunities – both motorized and non-motorized.

Conclusion

Direct and indirect effects to forest visitors of Alternative 2 and 3 would occur due to the presence of machinery, which would create added noise, dust, possible traffic delays, and visual evidence such as

marked trees and skid trails. Snowmobilers and other winter users may be displaced from portions of the Triangle Tie (FSR1628) and Triangle Hill Loop (1620/300) snowmobile trails because these trails would be temporarily closed during hauling operations. Short-term impacts to Three Sisters Backcountry, Inc. outfitter and guide operation may also occur at the Upper Three Creek Sno-Park staging area due to the sight and sound of hauling trucks passing on nearby roads, or implementation operations surrounding the Sno-Park.

Cumulatively, the effects of the proposed action are not likely to have a long-term adverse effect to forest visitors accessing the area, or in the recreational experience they seek when coming to or travelling through the area. While access to snowmobile trails may be affected in the short-term depending on the project length of operations, this would not have an adverse effect far into the future. The spatial effects of the projects which relate to scenery, recreation use, and experience, would be positive effects in the long-term, as the area would experience improved forest health. Reduction in forest densities typically also enhances winter recreation opportunities and dispersed camping opportunities. Removal of hazard trees near sno-parks would increase visitor safety. The Forest Plan standards and guidelines would be met through the project design criteria.

SCENIC VIEWS

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Scenic Views specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This scenic resources report is an effects analysis for a proposed restoration and maintenance of forest health in stands that provide habitat for interior forest wildlife species and present a potential risk of large scale wildfires in the Melvin Butte area. Proposed actions developed include general strategies for conifer retention and the wildland urban interface with specific treatment options similar to those developed for the Popper Vegetation Management Project. This analysis describes anticipated effects on scenery, aesthetics, and visitor experience within the Scenic Views and Front Country management areas that are visible from main scenic travel routes such as Forest Road 16, other access roads, recreation sites, trails and overlooks, and from the Three Sisters Wilderness to the west, Whychus Wild and Scenic River corridor to the north, and from viewer locations along US Highway 20 to the northeast of the planning area.

The 5,375 acre planning area is located south of the city of Sisters, Oregon. The western portion of the planning area is approximately 1,000 feet west of Forest Road 16 into the Pole Creek Fire boundary, the southern portion is bounded by the Three Creeks LSR and Inventoried Roadless Area, the eastern portion is bounded by private lands owned by Fidelity Insurance Company, and the northern portion is bounded by the Sisters Area Fuels Reduction (SAFR) project area and the Whychus Wild and Scenic River Corridor.

Management Direction

The Forest Plan for the Deschutes National Forest provides standards and guidelines for an array of land uses referred to as management areas. This analysis focuses on the management areas for Scenic Views and Front Country which are referred to by page number in the Deschutes National Forest Land and Resource Management Plan and described in terms of desired future conditions for various settings and how these are to be met by specified activities or actions. The Scenery Management System (SMS) is the methodology used by Forest Service landscape architects since 1996 to provide a visual impact

assessment of effects to scenic resources which integrates social impacts to recreation visitors with physical impacts to the visitor experience.

The previous outdated Visual Management System (VMS) of 1974 which continues to be referenced in Forest Plans has not yet been updated to reference the currently applied Scenery Management System (SMS). To facilitate this change in methodology to SMS, a crosswalk is used to reference both systems in the following manner with current SMS methodology in bold and outdated VMS in parentheses: ***High Scenic Integrity - SMS*** (Retention - VMS)

There are 5,375 acres within the planning area which include 1,265 acres in the Scenic Views (MA-9) management area, 3,942 acres in the Front Country Seen/Unseen (MA-18) management area, and 167 acres in the Old Growth (MA-15) management area.

Scenic Views - MA9 (LRMP page 4-121): The goal of the Scenic Views management area is to provide high quality scenery representing the natural character of Central Oregon. The general theme and objectives of Scenic Views is for landscapes seen from selected travel routes and use areas to be managed to maintain or enhance the appearance of the areas being viewed. To the casual observer, results of activities will either not be evident or will be visually subordinate to the natural landscape.

Timber harvest is permitted but only to protect and improve the scenic quality for the stands in both the short-term and long-term time frames. Timber stands, which have remained unmanaged in the past because of their visual sensitivity, will begin receiving treatment to avoid loss of the stand to natural causes. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors, will be rehabilitated.

The desired condition for ponderosa pine is to achieve and maintain visual diversity through variation of stand densities and size classes. Large, old-growth pine will remain an important constituent, with trees achieving 30 inches in diameter or larger and having deeply furrowed, yellow bark characteristics.

For other species, the desired condition requires obtaining visual diversity through either spatial distribution of age classes and mix of species through density manipulation or openings, or through a mixture of age classes within stands.

Ponderosa Pine in Scenic Views - Foreground M9-4 (LRMP page 4-122): Ponderosa pine in Scenic Views - Foreground management areas will be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering visual diversity and a sense of depth in landscapes viewed from travel routes, recreation use areas and other sensitive viewer locations.

Old growth characteristics, such as yellow, deeply-fissured bark are desirable. Diversity in species, where biologically possible, is desirable. Species such as vine maple, aspen and occasional stands of fir or lodgepole pine are desirable for added visual interest. Shrubs and groundcover species are also a desirable component. Small natural-appearing open spaces help provide a sense of depth and are a desirable visual component in these landscapes.

In Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), visual changes will not be noticeable to the casual forest visitor. The casual forest visitor is the recreation-oriented person or motorist traveling through a portion of the forest who would relate to the visual environment based on the context of a landscape viewed, rather than focusing on an individual acre within a landscape. For the occasional pedestrian who wanders off a designated trail and views an individual acre where a management activity has recently taken place, visual changes will be noticeable, even in Scenic Views - Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS).

In Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), the timing of clean-up activities, slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In regards to stand densities for immature trees, management practices will normally not focus on maximum growth, due to the emphasis on scenic quality. As a result, stand densities may be heavier or lighter than what would be considered necessary for optimum growth.

Visual openings in Scenic Views management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS) areas will result from management activities which harvest natural mortality (dying or severely diseased trees which occur in scattered pockets.) Some of these pockets may be enlarged by removing overstory trees, including large trees, where necessary to permit ponderosa pine regeneration where understory is lacking, or to release existing reproduction where it is suppressed.

Openings in Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS) will range from ¼ acre to 2 acres. An opening is visually in an "open" or untimbered condition until trees are an average of 10 feet tall on slopes less than 30 percent, and an average of 15 feet tall on slopes greater than 30 percent. Openings in Scenic Views management areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS) areas will range from ¼ acre to 5 acres and may include additional openings where size class diversity is visually insufficient.

Immature trees in Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS) and as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS) are to be thinned to maintain acceptable health and vigor of stands, with the objective of eventually producing replacement trees of 24 inch diameter and larger. In Scenic Views - Foreground areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), thin to slightly closer than normal spacing in order to provide full crowns and some screening. In areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), normal silviculturally prescribed spacing are acceptable.

Ponderosa Pine in Scenic Views – Middleground and Background M9-15 (LRMP page 4-124): The desired condition for ponderosa pine is to provide a strong textural element when visible from viewer locations. Large full-crowned individual trees are a primary visual element to this landscape along with immature stands which add strong contrasts in color, texture and size. Over time, the immature stands will gradually replace the larger, old growth trees that perpetuate the desired coarsely-textured character. Small and natural appearing openings are also desired especially in areas where similar openings exist.

Immature stands are also important in Scenic Views – Middleground and Background management areas because of the dramatic effect provided with color contrasts, and they eventually become replacements for the larger, old growth trees that perpetuate the desired coarsely-textured character. Visible untimbered openings are desirable where the natural landscape contains similar openings, or where natural-appearing openings can provide additional diversity in landscapes where diversity is visually lacking. Immature trees, groundcover vegetation and mature overstory trees will remain important elements in these landscapes.

In Scenic Views – Middleground and Background management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.

In Scenic Views – Middleground and Background management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), the scale of man-caused openings must be similar to naturally-occurring

openings. If natural openings do not exist, and there is a need to create openings, the openings will be designed to be as small as possible (considering the biological condition, technical feasibility, economics, etc.), and be designed to appear as naturally-occurring openings. In areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), man-caused openings, where visually appropriate, will normally range from ¼ acre to 20 acres.

Lodgepole Pine in Scenic Views - Foreground M9-51 (LRMP page 4-127): Lodgepole Pine in Scenic Views - Foreground management areas are often older trees lacking diversity in species and size class. These older trees tend to have a deteriorating appearance with relatively small crowns so the management emphasis is on managing for healthier and fuller crowned younger trees instead of producing larger diameter, older trees.

The desired visual condition is a mosaic of even-aged stands with additional visual diversity provided by occasional groups of other tree and shrub species. Natural-appearing openings of varying sizes as well as the re-introduction of ponderosa pine whenever biologically feasible in stands that have reverted to pure lodgepole pine are desirable. The forest floor is often open and park-like with ground litter, shrubs and grasses providing additional variety.

Diversity in size classes, and the presence of natural-appearing openings that appear to rotate through time as younger stands grow up, will permit more of a visual perception of “depth” especially when viewing these Scenic Views - Foreground management areas from scenic travel routes or trails. Instead of the traditional “wall” of mature lodgepole along travel routes and adjacent to recreation use areas, younger lodgepole stands will eventually replace the older mature trees to create a transitional effect. The viewer will have views looking through a forested setting instead of an unnatural “wall” or an unsightly clearcut. Many of the mature and over mature lodgepole stands on the Forest have been heavily impacted by the ongoing mountain pine beetle epidemic. Some landscapes have been severely changed as a result of catastrophic losses due to mountain pine beetles.

In Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In Scenic Views management areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.

Lodgepole Pine in Scenic Views - Middleground and Background M9-64 (LRMP page 4-129): In Scenic Views - Middleground and Background management areas, lodgepole pine provides a primarily textural landscape element. Individual trees and the size of trees are not visually as important as the constant and often uniform texture and color the trees provide. For this reason, the desired visual condition in these viewing distances is a mosaic of relatively uniform textures created by maintaining canopy closure and healthy crowns. Variety is provided by the overall affect of the mosaic.

On the Forest, options to manage lodgepole stands for long periods of time are limited. By the time lodgepole stands reach about 80 to 100 years of age, increased susceptibility to insect and disease normally requires a regeneration treatment to maintain these landscapes in a healthy appearance. Because the life expectancy for these trees is relatively short, more acres will be in a recently-regenerated appearance at any single point in time. Natural-appearing openings in the forest canopy are desirable as long as they are shaped so that soil color contrasts do not dominate the landscape when viewed from significant viewer locations.

In Scenic Views – Middleground and Background management areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), LRMP standards and guidelines will be met where

regeneration openings appear to be natural, follow the horizontal character of the landscape and are of a proper scale as to not dominate the landscape. These natural-appearing openings will appear to rotate through time as younger stands mature.

Many of the mature and over mature lodgepole stands on the Forest have been heavily impacted by the ongoing mountain pine beetle epidemic. Some landscapes have been severely changed as a result of catastrophic losses due to mountain pine beetles, and may require many years to meet the desired visual condition.

Logging residue resulting from management activities will not be visible to the casual forest visitor two years after the work has been completed. Management practices will focus on healthy, full-crowned trees and as a result, stand densities may be lighter than they presently are. Openings resulting from regeneration activities will normally range from 3 acres to 40 acres. Larger openings may be necessary to deal with mountain pine beetle problems.

The desired condition for lodgepole pine is to provide primarily a textural element in the landscape. A larger swath of uniform texture and color in a middleground zone often provides a more positive visual effect. A mosaic of relatively uniform textures created by maintaining tree canopy closure is an essential part of achieving this level of high quality scenery. Natural appearing openings are also desired as opposed to large shapes and sizes that provide too much contrast in soil color or sharp edges.

Mixed Conifer in Scenic Views - ***Foreground M9-20*** *(LRMP page 4-124)*

The desired condition for mixed conifer is to provide diversity in tree and shrub species, various age and size classes in order to perpetuate and enhance the character of the surrounding and natural landscape.

In Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In Scenic Views management areas classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.

Small, natural-appearing openings, where they are lacking, should be created to achieve the desired visual character. These openings shall be planted with species that will result in visual variety and especially species offering fall color. In Scenic Views – Foreground management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), these openings will range from less than ¼ acre to 2 acres. In Scenic Views management areas classified as ***Moderate Scenic Integrity- SMS*** (Partial Retention - VMS), openings will range from less than ¼ acre to 5 acres.

Mixed Conifer in Scenic Views - Middleground and Background M9-34 (LRMP page 4-126): Mixed conifer stands viewed as Middleground and Background will be managed to maintain or create a mosaic of stands with essentially continuous tree canopies with visual diversity provided by occasional natural-appearing openings which resemble those openings found in the natural landscape. From these viewing distances, immature trees are visually more important than larger old-growth trees, because the crowns of the younger trees are normally fuller and contribute to the overall textural element when viewed from a distance. However, some scattered larger trees will provide textural diversity and are sometimes discernible as indivuidual forms on these landscapes.

Species and size class diversity is also important in these viewing distances, but only when viewed as relatively small, natural appearing patches on the landscape, rather than isolated, individual trees or shrubs. These patches create a visual mosaic that may provide additional visual variety through the changing seasons. Trees of all sizes may be removed from mixed conifer middleground and background

where necessary to perpetuate the desired visual condition, control or prevent major insect and disease problems, enhance uunique landscape features, and provide access for recreation, special uses, mineral activities, and administrative purposes. Large diameter trees (24 inches d.b.h. or greater) will remain a significant component in mixed conifer within Scenic Views – Middleground and Background management areas.

In Scenic Views - Middleground and Background management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), the scale of man-caused openings must be similar to naturally-occurring openings. If natural openings do not exist, and there is a need to create openings, the openings will be designed to be as small as possible (considering the biological condition, technical feasibility, economics, etc.), and be designed to appear as naturally-occurring openings. In ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), man-caused openings, where visually appropriate, will normally range from ¼ acre to 20 acres.

In Scenic Views – Middleground and Background management areas classified as ***High Scenic Integrity - SMS*** (Retention - VMS), slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS), logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.

Front Country Seen/Unseen – MA18 (LRMP page 4-159): The goal of the Front Country management area is to provide and maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim while providing high and sustainable levels of timber production. This management area occupies a place between Scenic Views and General Forest which calls for a greater emphasis on timber production rather than on scenic views. The Scenery Management System objective for Front Country management areas is ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS) as compared to ***Low Scenic Integrity - SMS*** (Modification - VMS) in General Forest management areas which may apply to areas which are "unseen" from the viewing locations described in the next paragraph.

Certain viewer locations are considered important toward maintaining the desired visual condition of this management area. These significant viewer locations are along the Three Creeks Road, west from Highway 20 between Bend and Sisters, Awbrey Butte, the Redmond-Sisters Highway (126), and to the south from McKenzie Scenic Byway (242) west of Sisters.

The lower slopes of the viewed area are predominately Ponderosa pine and the upper portion ranges from Ponderosa pine overstory with dense white fir to pure lodgepole pine understory. Viewer distance to these areas ranges from 6 to 20 miles, making individual trees and tree sizes indistinguishable. These stands are visually important because they provide a strong textural element that forefronts the dramatic Three Sisters.

The desired visual condition is a landscape where color contrasts are minimal and the full crowns of younger trees create a visually uniform, primarily dark green, gently rolling landscape. Management activities should not result in shapes or lines that are visible from significant viewer locations. Openings and textural changes are, and should be, generally small and remain subordinate in this landscape except during the winter months, when snow, weather and lighting conditions exaggerate color contrasts making openings more evident.

Scenic Views M18-1 (LRMP page 4-159): In areas visible from significant viewer locations, management emphasis will focus on maintaining a uniform tree canopy. Openings are acceptable but should not dominate the landscape when uniform tree canopies cannot be maintained because of biological or topographic conditions.

Scenic Views M18-2 (LRMP page 4-160): Openings resulting from vegetative management activities in areas viewed from significant viewer locations will be designed to follow natural topographic features, to avoid geometric shapes and straight lines, and to be sized to simulate naturally occurring openings. For management activities which may result in visible openings in the forest canopy, consult a landscape architect on the location, size and configuration for treatment units.

Scenic Views M18-3 (LRMP page 4-160): Portions of the area which cannot be seen from the significant viewer locations will be managed similarly to land in the General Forest management area.

Scenic Views for Fire M18-27 (LRMP page 4-162): Low intensity prescribed fires will be used to meet and promote the scenery objectives. This and other fuel management techniques will be used to minimize the hazard of a large high-intensity fire. If at any time during the course of the prescribed burn it appears that the objectives for the burn are not being met, all burning will cease.

Scenic Views for Fire M18-28 (LRMP page 4-162): Wildfires can be suppressed using standard techniques. Control strategies will be developed to minimize impacts from suppression activities on the landscape. Visual contrasts will not be created through suppression techniques unless absolutely necessary.

Scenic Views for Fire M18-30 (LRMP page4-162): A landscape architect shall be consulted for recommended restoration measures following wildfire suppression activities in this management area.

Analysis Methods

Methodology used for analyzing impacts to scenic resources is the Scenery Management System (SMS) which uses ***"Landscape Aesthetics: A Handbook for Scenery Management"*** issued in 1996. This new handbook replaces ***"Agriculture Handbook 462 – The Visual Management System (VMS)"*** issued in 1974. While many of the basic inventory elements of the Visual Management System are retained, the Scenery Management System incorporates both the natural and human processes into the ideas of managing for ecosystems and is the current methodology used by the Forest Service to inventory and evaluate impacts to scenic resources.

Scenery Management Objectives are defined in terms of Scenic Integrity Levels which describe existing conditions and whether the landscape is visually perceived to be "complete" or not. The most complete or highest rating for Scenic Integrity Levels means having little or no deviation from the landscape character that makes it appealing and attractive to visitors and local residents. In addition to describing existing conditions, Scenic Integrity Levels also describe the level of development allowed and ways to mitigate deviations from the area's landscape character.

The Forest Service implementing regulations currently establish a variety of Scenic Integrity Levels for Scenic Views – MA9 (LMRP page 4-121). These standards and guidelines include:

- **High Scenic Integrity - SMS** - Natural Appearing Landscape (Retention – VMS) - MA 9, SV-1 Foreground, SV-3 Middleground
- **Moderate Scenic Integrity - SMS** - Slightly Altered Landscape (Partial Retention – VMS) - MA 9, SV-2 Foreground, SV-4 Middleground
- **Low Scenic Integrity - SMS** - Altered Landscape (Modification – VMS or General Forest) - MA 8, GFO within Foreground as well as Middleground

The distance zones for Scenic Views management areas for an observer are as follows:

- Immediate Foreground 0 - 300 feet

- Foreground 0 - ½ mile
- Middleground ½ mile - 4 miles
- Background 4 miles - horizon

Existing Condition

The planning area is visible from the top of Black Butte, Tam McArthur Rim, adjacent recreation trails and roads, and from the main travel corridor US Highway 20 located to the north of the planning area between Sisters and Bend. Dispersed camping, hiking, mountain biking, and hunting in this area provide a more wilderness-type of recreational experience than in other surrounding recreation areas on the Forest. Previous landscape treatments and the recent Pole Creek Fire have created larger openings and an ever increasingly mottled forest canopy that are visible from higher elevation recreation sites and viewpoints and for those traveling along the Forest Road 16, the main scenic travel access to the highly popular Three Creeks Lake recreation campground complex.

Other nearby popular recreation areas with scenic views include the Metolius-Windigo Trail for bikers and equestrians and the Whychus Creek Wild and Scenic River Corridor located to the northwest of the planning area. It has a Scenic section which is designated for its Outstandingly Remarkable Value of its unique geological and hydrological features. Most visitors access Whychus Creek from Forest Road 16.

There are 1,265 acres of Scenic Views management area classified as ***High Scenic Integrity - SMS*** (Retention - VMS) within the planning area. Most of these Scenic Views - Foreground management areas are along Forest Road 16.

There are 3,942 acres of Front Country Seen/Unseen management classified as ***Moderate Scenic Integrity - SMS*** (Partial Retention - VMS) within the planning area. Most of the Front Country Seen areas are located on the east side of the planning area on the lower slopes of the Cascades Range. These areas are mostly visible from significant viewer locations along Highway 20 between Bend and Sisters. Most of the Front Country Seen/Unseen management areas are located to the east of the Scenic views management area along Road 16.

Environmental Consequences

The purpose of the proposed action is to restore and maintain forest health in stands that provides habitat for interior forest wildlife species and present a potential risk of large scale wildfires in the Melvin Butte area. Proposed actions developed include general strategies for conifer retention and the wildland urban interface with specific treatment options similar to those developed for the Popper Vegetation Management Project.

There is a need to reduce fuel loadings and forest vegetation density to lessen the risk of large wildfires to nearby communities and key ecosystem components, such as large old trees. Recent large wildfires have dramatically changed the landscape leaving the project area isolated and thereby increasing the urgency to protect what remains as unburned forest. The project area is currently at risk of stand replacement wildfire associated with insects, disease, and overstocking. This project would also meet a need to provide wood products to the local and regional economy.

Direct, indirect, and cumulative effects on scenic resources are analyzed for possible impacts to scenic views and whether proposed actions and mitigations will meet the standards and guidelines in the LRMP for Scenic Views and Front Country Seen/Unseen management areas. Cleanup must occur within one or two years depending upon the Scenery Management classification. Prescribed fire must be less than 5 acres with a naturally appearing shape and scorching must be limited to the lower 1/3 of the forest

canopy. If the requirements for the timing of cleanup, size of burn area, and amount of scorch cannot be met, the Forest Plan may be amended if reasons for the proposed actions are justified in accomplishing Forest goals.

Within the Scenic Views management areas, impacts that potentially affect the visitor expectations and experience are analyzed within short-term (within 5 years) and long-term (beyond 5 years) timeframes. Often the short-term impacts are most evident to visitors within immediate Scenic Views – Immediate Foreground landscapes (0-300 feet) as well as Foreground landscapes (300 feet to ½ mile) along main access roads, scenic travel corridors, recreation trails, and developed or dispersed recreation sites. These are the most critical corridors requiring cleanup as soon as possible or other mitigation measures to ensure restoration or recovery of scenic views within a reasonable timeframe.

The Front Country Seen/Unseen management areas are often middleground (1/2 mile to 4 miles) and background landscapes (4 miles to horizon). There are usually prominent landscape features such as buttes or mountain range slopes and foothills that are visible from viewer locations along major travel corridors or from recreational trails, sites, and overlooks. Cleanup usually occurs within two years of proposed actions in order to provide and maintain a uniform tree canopy as seen from major travel corridors or viewpoints.

Alternative 1

There would be no reduction of hazardous ladder fuels in foreground areas of Forest Roads 16, 1620, and 1628 and there would be no reduction of hazardous ladder fuels along the western boundary of the Cascade Timberlands property and along the eastern edge of the project area would help prevent fires from moving from national Forest lands onto private property and vice versa.

Although previous treatments along Road 16 have opened up some views in Scenic Views - Foreground management areas and enhanced visibility of old growth trees in the past, the lack of future treatments would result in diminished scenic views to the desired natural character of the surrounding landscape and a changed visitor experience for those anticipating and expecting to see open views and a healthy forest with safe easy access to recreation areas.

Alternative 2 and 3 - Direct and Indirect Effects

In Scenic Views – Foreground management areas along Forest Road 16 classified as High Scenic Integrity – SMS (Retention – VMS), the blackening and scorching of vegetation and tree trunks and slash cleanup would be visible for more than one year and would not meet standards and guidelines for scenic quality. In Scenic Views – Foreground management areas along Forest Road 16 classified as Moderate Scenic Integrity – SMS (Partial Retention – VMS), the blackening and scorching of vegetation and tree trunks and slash cleanup would be visible for more than two years and would not meet standards and guidelines for scenic quality. A Forest Plan amendment would be required to increase this from one year and two years to a five year period.

In Scenic Views – Foreground management areas along Road 16, prescribed fire is proposed to reduce the risk of wildfire, create a defensible fuel break, and provide for safe ingress of fire suppression resources and egress of the public in the event of a wildfire event. Allowing for prescribed burn units exceeding the five acre limitation for fuels treatments would not meet standards and guidelines for scenic quality. A Forest Plan amendment would be required to exceed the five acre limitation for fuels treatment.

About 1,217 acres in the Scenic Views – Foreground management area are included in this proposed Forest Plan amendment for Alternative 2 and Alternative 3. All units would be prescribed burned with an average unit size of 48 acres. The proposed underburning units are: Units 2, 4, 5, 6, 18, 19, 29, 31, 38,

39, 40, 41, 42, 43, 44, 48, 49, 52, 56, 63, 64, 66, 67, 68, 69, 70, 75, 82, 84, 85, 88, 91, 92, 94, 97, 108, 109, and 110.

Scenic Views Enhancement Treatment Area (241 acres): The goal is to meet the direction for the Scenic Views management area.

Due to a stand replacement fire that occurred during the 2012 Pole Creek Fire along a Scenic Views - Foreground management area adjacent to and west of Forest Road 16, scenic quality standards and guidelines are not being met. The recreating public travels on Forest Road 16 to recreation sites in the area. In order to meet the long-term goals for this Scenic Views – Foreground management area that is classified as High Scenic Integrity – SMS (Retention – VMS), green trees and scattered clusters of fire killed trees would remain in order to slowly transition the area to become scenic once again in the future. It would also require removal of some of the fire killed trees to create a random cluster grouping and feathered edge instead of a uniformed shape and straight edge appearance of trees when viewed from the road. Newly planted trees in the open areas surrounding the scattered clusters of dead trees would restore scenic quality over time by eventually changing the appearance of this edge of the forest over time from burned to green. Logging debris would be disposed of adjacent to the road to meet scenic quality standards and guidelines.

Cumulative Effects

Cumulative effects to the Scenic Views and Front country Seen/Unseen management areas would impact scenic quality during the short-term (0 to 5 years). Over the long-term (more than 5 years) overall scenic quality would be met due to treatments and management of overstocked stands, improved forest health, lower density, and less fuel loading.

With Forest Plan amendments to extend cleanup activities beyond one-year and two-year time frames to five years and to exceed the five acre limitation for fuels treatments would meet scenic quality standards and guidelines in Scenic Views – Foreground management areas classified as High Scenic Integrity – SMS (Retention – VMS) and Moderate Scenic Integrity – SMS (Partial Retention – VMS).

HERITAGE

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Heritage specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Existing Condition

A review of the proposed work and known archaeological sites was conducted, along with a literature review to determine the possible presence of unknown cultural sites. The Deschutes National Forest high probability model was used to help establish survey areas within the APE. One hundred percent of the identified high probability areas have been surveyed while forty percent of identified low probability areas have been surveyed. The low probability areas surveyed were chosen as a representative sample of all low probability areas within the Area of Potential Effect (APE).

Seventeen previous surveys have taken place within the APE and as part of those surveys eleven cultural sites were identified. Monitoring of the eleven previously identified sites took place when sites had the potential to be impacted by proposed treatments. Two of the previously identified sites have been determined ineligible for inclusion to the National Register of Historic Places (NRHP). The remaining eight sites have not been evaluated for their eligibility for listing on the NRHP. Therefore, the sites will

be treated as eligible until a formal determination of eligibility can be made. The sites will be flagged for avoidance prior to commencement of the project.

Consultation History

On August 14, 2014 the heritage report completed for the Melvin Butte vegetation Management project was sent to the Oregon State Preservation office (SHPO). This constituted the initiation of the formal consultation with the Oregon SHPO. No formal response was received from the Oregon SHPO within the 30-day period open for response. Because of changes to the project, a second addendum report was sent to the Oregon SHPO om August 13, 2015 and a second 30-day response period was initiated. Oregon SHPO did not respond to the second period. A “no response” form the Oregon SHPO is considred to be concurrence with the heritage reports finding of effect.

Effects Analysis

Alternative 1

No treatments of any type would occur under this alternative. There would be no change in current management direction or in the level of ongoing management activities.

Effects would derive from unmanaged fuels consumed during a wildfire event. By not treating the fuels, burn temperatures in many areas would likely be extreme, endangering cultural resource sites and artifacts. The analysis value of obsidian artifacts for chronology and sourcing information would be compromised by extreme temperatures. Metal artifacts would be further oxidized, becoming more brittle. Glass melts and fractures. Ceramic objects fracture and lose decorative elements from smoke and heat. Organic materials such as wood shell, bone, antler, horn, leather and fabric may be consumed by fire or altered by smoke.

The loss of surface litter from intense wildfire combined with increased hydrophobic soil conditions could lead to erosion due to runoff of surface water. Erosion across sites can remove artifacts or deposit sediment from slopes above. Increased trampling from deer and elk on thinner forest floors has also resulted from wildfires.

Alternative 2 and 3 - Direct and Indirect Effects

Known eligible or potentially eligible heritage sites would be avoided and/or protected; therefore, no known heritages resources would be affected by this project. Because 60 percent of low probability areas for cultural resources were not surveyed as part of this project, mitigation measures are in place that would be part of contract specification should any new cultural sites be discovered during project activities. In areas of the project not surveyed there is a possibility of inadvertent direct or indirect effects to unknown cultural resources by some of the proposed actions.

Mechanical harvesting of trees within the project area could include various types of machinery. Harvesters, Feller Bunchers and Skidders are the most common equipment used. Harvesters and Feller Bunchers operate in a similar manner with the only real difference being the length of the equipment arm. Both machines are often tracked but can have rubber tires. Both machines have a hydraulic arm with a device that grabs and cuts a tree which allows the machine to carry and stack the logs without the tree touching the ground. The impacts from Harvester and Feller Bunchers comes from off road travel where the tracked version can cause direct effects in the form of displacing, crushing, breaking, or otherwise affecting the integrity of site materials, especially while turning. The rubber tire variant can have significantly less impact but still has the potential for similar direct effects as tracked variants. Rubber tire variants also cause less damage to brush then tracked versions and can lead to less indirect effects in the form of post operations erosion. Yarders are used to move larger

trees or piles of trees to landings. This involves grappling the tree or trees and dragging the trees. Yarders also have a cable attached that can be used to drag a tree or trees to a landing area. Yarders can cause a direct effect on a cultural resource site by gouging, displacing, crushing, breaking, or otherwise affecting the integrity of site materials.

Two types of machinery are used for mechanical shrub treatments (mowing). The first is a rubber tired tractor using a rotary mower for slopes under 20%. Steeper slopes require a light tracked machine with a front-mounted mow deck that provides greater stability. The weight rating for the equipment is low, between 4-5 pounds per square inch (psi), and has a limited potential to cause damage more typical of the heavier skidders, shearing machines, and biomass machinery. The one function of the mowing equipment that causes some churning, mixing, and displacement of soils is when the machinery makes a turn; the tighter the turn the greater the amount of disturbance. The only direct effect that could occur from mowing would be when the equipment turns around.

Slash disposal using burn piles directly effect the more “durable” artifacts (made of inorganic materials) as well as perishable artifacts (made from organic materials). Burn temperatures reached in slash piles (up to 800 degrees F) are much higher than those in a broadcast underburn in light fuels conditions (250 to 300 degrees F).

Underburning poses a potential effect where fuels are greater than 2.5 tons per acre, or classified as more than light fuels. Research on prescribed fire and obsidian indicates that hydration rind analysis results are not affected when temperatures are 149 degrees C (300 degrees F) or less. Obsidian sourcing analysis using trace elements does not appear to be affected at temperatures below 100 degrees C. Obsidian hydration rinds are obliterated at temperatures over 425 degrees C (797 degrees F). If underburning is kept to temperatures below 100 degrees C then a positive effect could take place since the reduced fuel load will mitigate intense wildfires that would have a negative effect on unknown cultural resources.

Fire line construction by hand poses a potential for direct effects on significant cultural resource sites from displacement, churning, mixing, and breakage of artifacts. Loss of artifact associations and context are examples of lost site integrity. Hand line construction is more limited in effect than using machinery, since it is generally a much smaller fuel break.

Road reconstruction, road maintenance, and temporary road development in or through a previously unknown cultural resource site would have a direct effect on site integrity with damage from crushing, breaking, mixing, displacing, compacting, and otherwise disturbing the context of the artifacts. Road reconstruction effects may be limited to potential impacts from restoring drainage features when they are related to the out sloping or water barring needed in association with culverts as well as without culverts. Activities that occur within an established road prism, including applying surface treatments of any sort, watering and blading, or slope stabilization within the road prism would generally have a positive effect since the maintenance would reduce erosion and the possibility of a road blowout.

Temporary road development through an unknown site could have a direct effect on site integrity from crushing, breaking, mixing, displacing, compacting, and otherwise disturbing the unknown site’s context.

Felling danger trees along travel routes and where units border roads may have a direct effect on cultural resource sites due to the potential use of equipment off of existing disturbed areas. The effects of machinery on site integrity would be similar to other proposed treatments using heavy equipment. Additionally, there may be a direct effect similar to that from skidding if the trees or portions thereof are dragged to the road.

Should any new cultural resource site be discovered during project implementation, there would likely be an effect because the site was not discovered in advance. An example of this could be a small site that had previously only been identified as an isolated find due to a limited number of artifacts (less than 10 items) observed at the time of initial discovery. Often, by the time that such a site is relocated, some physical damage has already occurred, since increased visibility through mechanical disturbances lead to discovery.

Mowing shrubs and underburning the resulting slash material would reduce fuel loads and positively affect cultural materials sensitive to high intensity fires. Underburning would also remove vegetation that currently obscures artifacts on the ground surface and increases surface visibility. Greater visibility that exposes sensitive materials affects site integrity, since these materials could become more vulnerable to looting and vandalism.

Cultural resource sites located on sloping ground below treatment units may experience erosion and run-off of surface water, melting snow, and heavy rains. While not a direct effect of harvest, fuels, or reforestation activities, a site located down slope and outside of a harvest unit may be affected by either erosion or the depositing of sediments from outside the site proper, or both

With the design criteria included written for this project, this Alternative 2 and Alternative 3 is consistent with those federal laws and guidelines for the protection of NRHP eligible sites.

Cumulative Effects – All Alternatives

There are no direct or indirect effects to heritage resources from any alternatives. There would be no cumulative effects from this project.

INVENTORIED ROADLESS AREAS

This environmental assessment incorporates by reference (as per 40 CFR 1502.21) the Inventoried Roadless Areas specialists report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office, Sisters, Oregon.

Effects of the Action Alternatives on Inventoried Roadless Areas

This environmental assessment incorporates by reference (as per 40 CFR 1502.21) the Inventoried Roadless Area specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Issue: The action alternatives have the potential to affect Inventoried Roadless Areas by harvesting trees and conducting post-harvest activities in the project area.

Measure: Measures used to address this issue include acres of Inventoried Roadless Areas located within the project area, the distance from harvest units to Inventoried Roadless Areas, and activities associated with the harvesting of trees.

Affected Environment

Inventoried Roadless Areas (IRAs) are areas identified in the 2001 Roadless Area Conservation Rule in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps (36 CFR

294.1). These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of inventoried roadless areas. Most IRA boundaries are substantially identical to those identified as “Roadless Areas”, referred to in the 1982 planning rule (36 CFR 219.17) and identified by the Forest Plan and Final Environmental Impact Statement (FEIS), Appendix C; however, some localized, minor differences in the boundaries may exist.

The following list outlines roadless area characteristics as defined by the January 12, 2001 Roadless Rule

Resources or features that are often present in and characterize inventoried roadless areas, including:

(1) High quality or undisturbed soil, water, and air;

(2) Sources of public drinking water;

(3) Diversity of plant and animal communities;

(4) Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land;

(5) Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation;

(6) Reference landscapes;

(7) Natural appearing landscapes with high scenic quality;

(8) Traditional cultural properties and sacred sites; and

(9) Other locally identified unique characteristics.

There are two Inventoried Roadless Areas in the general vicinity of the project area. The acres associated with these Inventoried Roadless Areas are shown below in Table 196.

Table 196 Inventoried roadless areas in the general vicinty of the Melvin Butte Vegetation Management Project.

Name of IRA	Total Size
Bearwallows	7,316 acres
Three Sisters	2,690 acres
Total	10,006 acres

Actions and Effects Common to All Action Alternatives

Timber Harvest and Associated Activities

The action alternatives would harvest trees of all species to meet forest restoration goals as well as to realize their economic value. The planning area is about 5,375 acres. Alternative 2 would treat about 4,469 acres and harvest about 6.6 million board feet of timber. Alternative 3 would treat about 4,405 acres and harvest about 6.3 million board feet of timber. In addition, each action alternative would close about 6 miles of Forest System roads and decommission about 8 miles of Forest System roads. Alternative 2 would construct about 0.80 miles of temporary road; no temporary road would be constructed in Alternative 3

Figure 36 that shows the relationship of the action alternatives to the Inventoried Roadless Areas in the general vicinity of the project area.

Alternative 1 – No Action

There would be no management actions under the No Action alternative. Biological and ecosystem functions would continue

Alternatives 2 and 3 - Direct and Indirect Effects

There would be no direct effects to the Three Sisters or Bearwallows Inventoried Roadless Areas; no trees would be harvested in any Inventoried Roadless Area as a result of the action alternatives. There would be no direct effects to the roadless characteristics such as soil, water, sources of drinking water, habitat for Threatened and Endangered and candidate species, dispersed recreation, cultural properties, unique characteristics, and plant and animal community diversity.

Five timber harvest units (units 12, 51, 53, 54, and 57) are contiguous with the Bearwallow Inventoried Roadless in Alternative 2; three timber harvest units (units 12, 53, and 57) are contiguous with the Bearwallow Inventoried Roadless Area in Alternative 3. The location of these harvest units in the forest in any of the action alternatives would be determined using a GPS device to ensure the integrity of the Bearwallow Inventoried Roadless Area.

No timber harvest units are contiguous with the Three Sisters Inventoried Roadless Area. Three timber harvest units (units 31, 40, and 48), however, are in close proximity to the Three Sisters Roadless Area. Table 197 shows their distance in feet from the IRA.

Table 197 Harvest units in proximity to the Three Sisters Inventoried Roadless Area.

Unit	Distance to the Three Sisters IRA
31	1,092 feet
40	397 feet
48	666 feet

There may be indirect effects to the Three Sisters and Bearwallow Inventoried Roadless Area as a result of the action alternatives. Timber harvest activities may generate dust and noise that are usually associated with ground-based logging systems. This effect would be limited to the duration of a timber sale; likely 1 year at the most. Those recreating in an Inventoried Roadless Area would potentially hear noise associated with heavy equipment. Dust may also be seen by recreationists in an Inventoried Roadless Area as a result of a timber sale.

Wildlife species such as mule deer and black-backed woodpecker, both of which represent a broad range of Management Indicator Species (MIS), may be affected by disturbance. These species may disperse from the area while operations are being conducted, likely returning after operations have ceased as habitat in the Inventoried Roadless Area would not be affected by timber harvest operations.

Table 198 shows the number of acres of Inventoried Roadless Area impacted by the project.

Table 198 Inventoried roadless areas that overlap Alternative 2 and Alternative 3.

	Alternative 2	Alternative 3	Acres
Timber Harvest in an Inventoried Roadless Area	0	0	0
Total	**0**	**0**	**0**

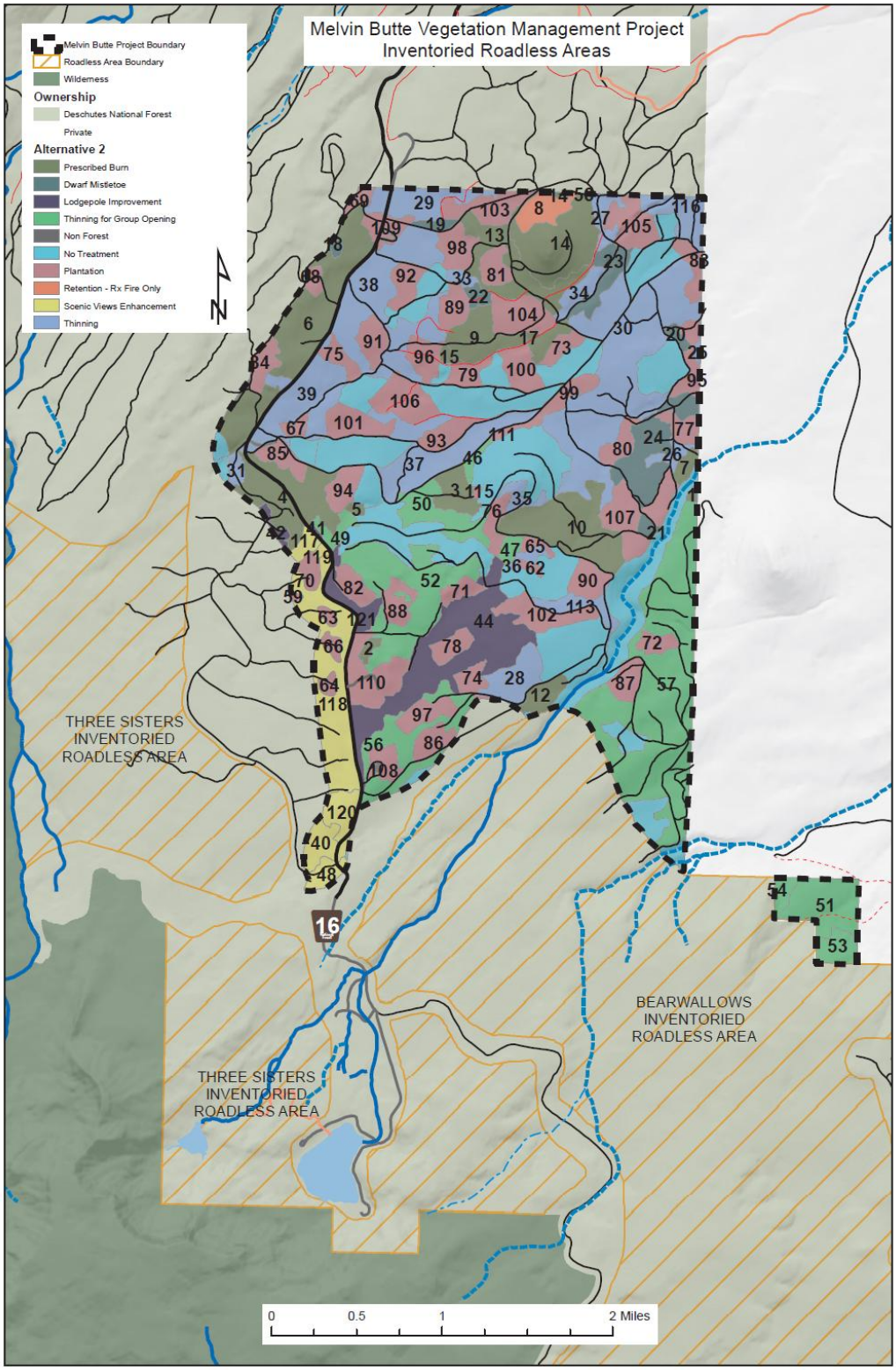


Figure 36 The relationship of the IRAs to the action alternatives.

Cumulative Effects

The cumulative effects area is the Melvin Butte Vegetation Management project area and the time frame is the next 5 years.

There are no planned future foreseeable actions that would take place in the Three Sisters and Bearwallows Inventoried Roadless Areas. These areas would maintain their roadless and ecological characteristics. Any necessary timber cutting or any road construction or road reconstruction in emergency situations involving wildfire suppression, search and rescue, or other threats to public health and safety in inventoried roadless areas would require review by the Regional Forester.

There may be indirect effects to the Inventoried Roadless Areas as a result of the action alternatives because of the dust and noise that are usually associated with ground-based logging systems. These indirect effects would be limited in duration and intensity and would not affect the integrity of Inventoried Roadless Areas located outside the project area boundary.

Conclusion

The action alternatives may have indirect effects to Inventoried Roadless Areas as a result of the Melvin Butte Vegetation Management Project.

POTENTIAL WILDERNESS AREAS

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Potential Wilderness Areas specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

Regulatory Framework/Management Direction

To comply with the requirements established in the Forest Service Handbook (FSH) 1909.12, Chapter 70, Wilderness Evaluation, the Forest Service is required to conduct an inventory to identify areas meeting the potential wilderness criteria using the criteria found in FSH Chapter 71.1. The inventory is conducted to assess whether project related actions have impacts on the ability of an undeveloped area to be considered in a future potential wilderness inventory. In an effort to streamline the inventory and analysis, a Geographic Information System (GIS) model was built considering corporate data in FACTS and INFRA to draw information regarding past tree cutting activities and to identify roads and other major elements to be considered while conducting the inventory. The process is composed of GIS analysis with validation of the model utilizing satellite imagery, local knowledge, field reconnaissance and or a combination of the above. The GIS model produces a preliminary layer of polygons without past tree cutting activities and outside of a road effect area. A road effect is defined as an area adjacent to the road where impacts from past firewood cutting, danger tree removal, brushing and other road maintenance activities have most likely occurred considering topography, vegetative conditions and soil characteristics. Further site specific analysis is needed, polygon by polygon, to make a final determination if the polygon meets the criteria established in Chapter 71.1.

Analysis Method

Four basic criteria are used to evaluate individual polygons for inclusion as meeting the inventory criteria for potential wilderness (FSH 1909.12 Chapter 71.1):

(1) Area is more than 5,000 acres in size;

(2) Area contains less than 5,000 acres but can meet one or more of the following criteria:

2a. Area can be preserved due to physical terrain and natural conditions

2b. Areas are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the Natural Wilderness preservation System

2c. Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless their size. The Forest Service relied on local knowledge and judgment regarding unique, site specific conditions of each area being considered for placement on the inventory of potential wilderness. Delineation of areas for potential wilderness inventory; locate boundaries at prominent natural or semi-permanent human-made features to facilitate easy of the ground identification

3. Areas do not contain forest roads (36 CFR 212.1) or other permanently authorized roads, except as permitted east of the 100th meridian (sec. 71.12).

The model includes tables for data entry to capture the disposition of each polygon on whether it meets the criteria for inclusion in the potential wilderness inventory. It should be noted that wilderness evaluation is not to be conducted with this analysis, only the identification of areas meeting the potential wilderness area inventory criteria. The final disposition of potential wilderness would take place during Forest Plan revision.

Results

The analysis looked at 72 individual polygons regardless of size to determine if they met the inventory criteria as potential wilderness areas.

Seven polygons met the inventory criteria found at FSH 1909.12 Chapter 71.1. Five polygons (#57, 58, 59, 62, and 64) meet criteria 2a (area can be preserved due to physical terrain and natural conditions) and criteria 2c (areas are contiguous to existing wilderness). One polygon (#16) meet criteria 2a and criteria 3 (areas do not contain roads); and one polygon (#56) met criteria 2a, criteria 2c, and criteria 3. This resulted in about 7,395 acres that met the inventory criteria for wilderness. See the Table 199 for the final results of the Potential Wilderness Area analysis.

Table 199 Final results of the potential wilderness analysis.

Potential Wilderness Polygon	FSH Inventory Criteria	GIS Acres	Acres after Analysis
16	2a and 3	4199	4151
56	2a, 2c, and 3	3356	3238
57	2a and 2c	10	6
58	2a and 2c	0.0002	0.0002
59	2a and 2c	0.003	0.003
62	2a and 2c	0.002	0.002
64	2a and 2c	0.01	0.01
	Total	**7,565 acres**	**7,395 acres**

As mentioned above, potential wilderness area polygons were initially screened using the FACTS database. This database is a record of all timber harvest or other stump producing activities on the ranger district. However, the database is incomplete. Many past or ongoing timber harvest activities such as firewood cutting or sanitation-salvage cutting were not recorded in FACTS. To facilitate a more detailed

review of the polygons that were not recorded in FACTS, district personnel were consulted who had a long tenure on the ranger district and who had knowledge of past timber harvest practices in the project area. This review resulted in forty nine polygons not meeting the criteria for the inventory. These polygons either had extensive firewood cutting or some form of sanitation-salvage cutting in which dead and dying trees were harvested according to a risk rating system. In addition, many of these polygons are isolated by the Forest Road system.

This analysis process also resulted in the creation of potentially more logical subdivisions. These subdivisions were initially part of an original polygon (s) that met one or more of the FSH handbooks criteria but in which some portions of the polygon had been subjected to firewood cutting, other types of timber practices, or created a more logical subdivision that would better fit the landscape.

Three polygons were subject to this process. Polygon 56 could be divided into five subdivisions at a narrow "necks" resulting in PWA polygon that better fit the landscape; this created polygons 68, 69, 70, 71, and 73. Polygon 16 could be divided into three subdivisions at a narrow "necks" also resulting in a PWA polygon that better fit the landscape; this created polygons 65, 66, and 67. Last, polygon 57 could be divided into one subdivision; this created polygon 72.

It should be noted that the creation of these subdivisions are *strictly provisional* and does not imply any sort of management decision. A table outlining the ranking of each individual polygon is contained in Appendix H.

Existing Condition

About 8,800 acres were evaluated using the inventory criteria found at FSH 1909.12, Chapter 71.

Effects of the Action Alternatives on Areas meeting the inventory Criteria for Potential Wilderness Areas

Issue: The action alternatives have the potential to adversely affect the areas meeting the inventory criteria for potential wilderness.

Measure: the number of acres of areas meeting the criteria for potential wilderness area affected by the proposed harvest activities in each of the action alternatives.

Alternative 1 – -Ecological Trends

No management activities associated with the purpose and need for the project would occur under the No Action alternative.

Alternative 2 and 3 - Direct and Indirect Effects

The Melvin Butte Vegetation Management Project proposes to silviculturally treat conifer stands to increase their resiliency and to restore and maintain fire climax ponderosa pine.

The silviculture treatment of unit 57 would directly affect about 16 acres of polygon 16 that meet the criteria found at Forest Service Handbook 1909.12 Chapter 72. Depending on stand conditions, these areas maybe thinned from below or have a group opening under Alternative 2 or thinned from below only under Alternative 3. Harvest would remove this 16 acre area from the Potential Wilderness Area (PWA) database. This area is located outside of the Inventoried Roadless Area (IRA) boundary.

An indirect effect of harvesting the 16 acres in unit 57 is the effect to the 13 acres that are immediately adjacent to unit 57 to the northwest. This portion of polygon 16 is located in a Riparian Reserve and

would not be treated in the action alternatives. However, the configuration of this this area may preclude it from future consideration as a potential wilderness area.

Other Indirect effects to areas identified as PWA are expected to be minimal.

Polygon 56 is located west of Forest Road 16; no timber harvest would occur in the vicinity of this polygon. This area was burned at various intensities during the 2012 Pole Creek fire; no harvest units for the salvage operation were located in this polygon. Polygon 16 would be affected as described above but additional harvest units are located north of Forest Road 1628, are outside the Inventoried Roadless Area (IRA) and some noise or dust from logging activities maybe noticed.

See the Table 200 for a summary of effects of the action alternatives.

Table 200 Summary of the effects of the action alternatives on the final PWA inventory.

Total Number of Acres that meet FSH Handbook Inventory Criteria (2a; 2c; and 3)	FSH Handbook Inventory Criteria Acres Affected by Alternative 2	FSH Handbook Inventory Criteria Acres Affected by Alternative 3
7,395 acres	16 acres	16 acres

See the Figure 37 and Figure 38 for the final disposition of the polygons meeting FSH evaluation criteria and their relationship to the action alternatives.

Cumulative Effects

The analysis area is the PWA analysis area and the time frame is the next ten years. The majority of areas that meet the PWA requirements as potential wilderness areas are located either in Inventoried Roadless Areas (IRA) or immediately adjacent to designated Wilderness. No ongoing or reasonably foreseeable actions such as timber sales or fuels reduction projects are planned for these areas. These areas could experience wildfire; however, wildfire in and of its self would not effect the PWA status for these areas but fire suppression efforts such as dozer line construction, if authorized, could affect the wilderness quality of these areas.

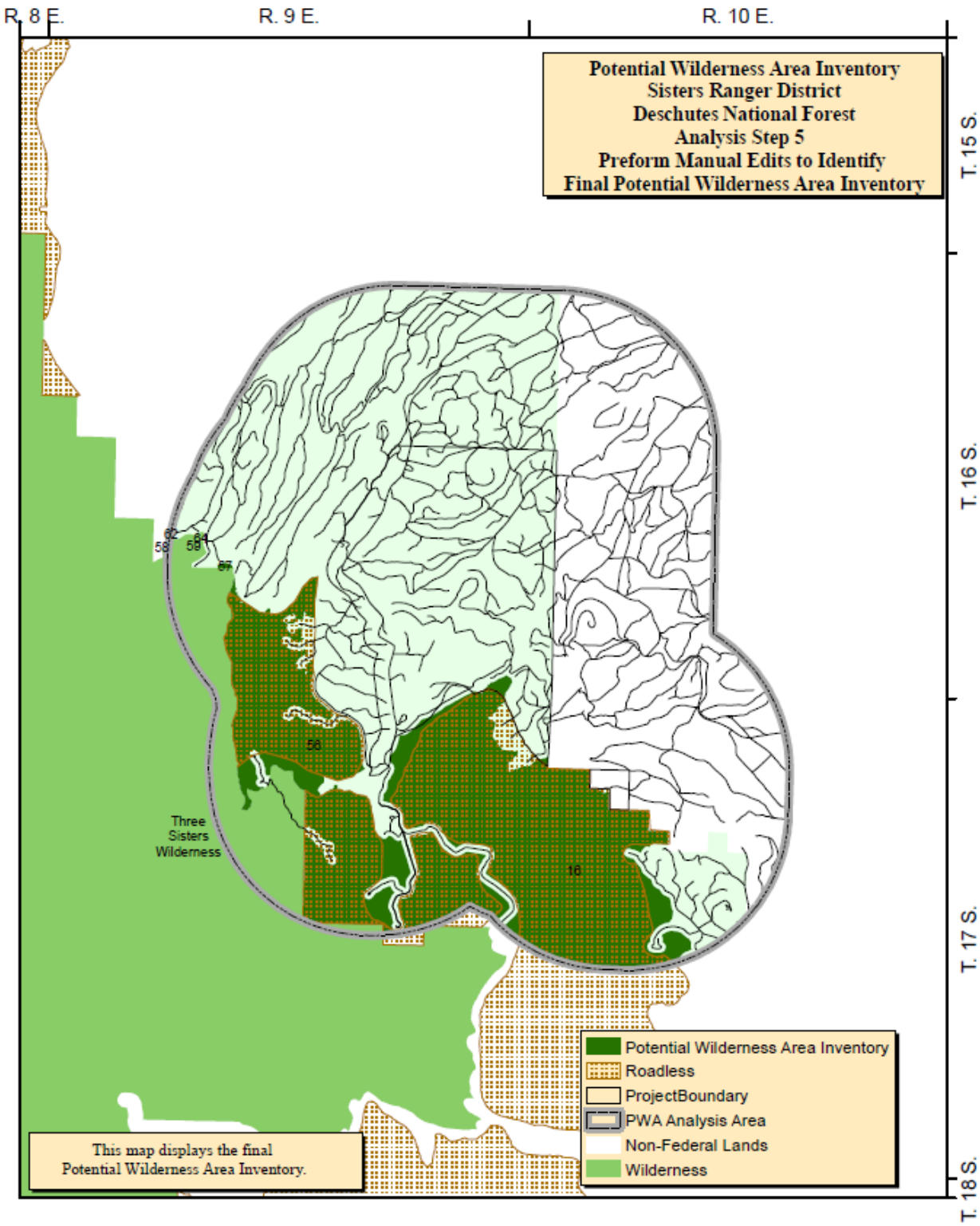


Figure 37 Final map of the potential wilderness area inventory.

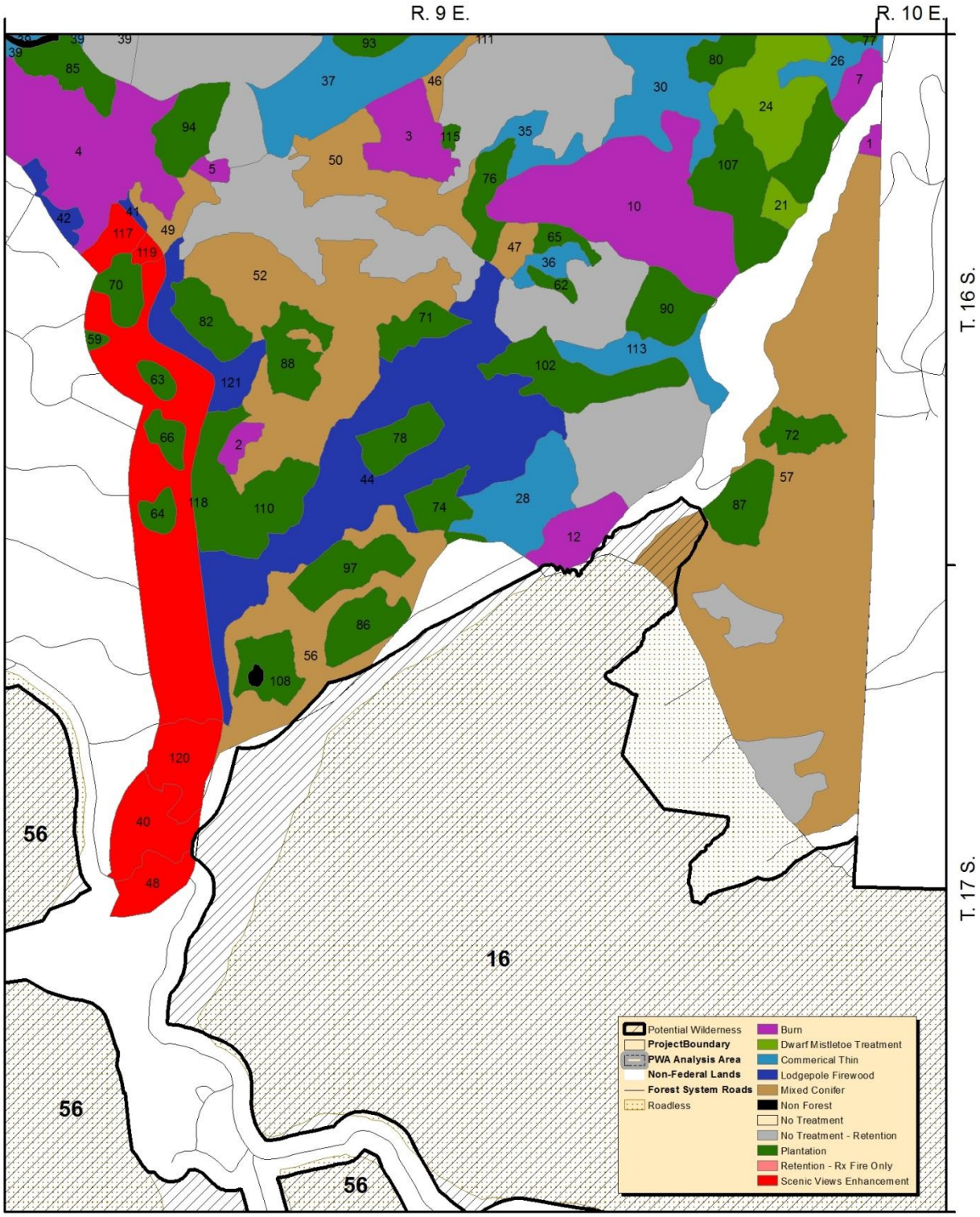


Figure 38 Effects on Alternative 2 and 3 on the potential wilderness inventory.

CITIZEN UNROADED AREAS

This environmental assessment incorporates by reference (as per 40 CFR 1502.21) the Citizen Identified Unroaded Areas specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District in Sisters, Oregon.

In the early 2000s Oregon Wild, an Oregon state environmental interest group, conducted their own unroaded area inventory across Oregon, including the Deschutes National Forest, using inventory criteria they developed for their own purposes. A map of Oregon Wild's unroaded areas was provided in response to the scoping letter for the proposed action for the Melvin Butte Vegetation Management Project in March 2014. The majority of lands included in the Oregon Wild unroaded inventory overlap with Inventoried Roadless Areas (IRA).

Effects of the Action Alternatives on Citizen Identified Unroaded Areas

Issue: The action alternatives have the potential to effect areas identified as unroaded in the Oregon Wild unroaded forest inventory.

Measure: the number of acres of unroaded forest inventory affected by project activities in each of the action alternatives.

Alternative 1 – No Action

There would be no management actions implemented in the Oregon Wild unroaded areas under the No Action alternative. Biological and ecosystem functions would continue in the project area. Areas could be affected by fire management activities in the event of a wildfire.

Actions and Effects Common to All Action Alternatives

Silviculture and Associated Activities

The action alternatives would silviculturally treat stands and use prescribed fire to maintain and restore fire climax ponderosa, provide stand diversity in plantations, and manage in-growth of trees. Alternative 2 would treat about 4,435 acres and includes management of dwarf mistletoe in ponderosa pine stands. Alternative 2 would require about 0.80 miles of temporary road to facilitate stand treatments. Alternative 3 would treat about 4,364 acres. Each action alternative would administratively close about 6 miles of roads; and decommission about 8 miles of road. See Chapter 2 of the environmental assessment for a more complete discussion of the action alternatives.

Alternatives 2 and Alternative 3 - Direct and Indirect Effects

The action alternatives would impact about 46 acres of the Oregon Wild Unroaded Area inventory (Table 201). The Oregon Wild roadless inventory that would be affected does not include any Inventoried Roadless Areas (IRA). No temporary roads would be built in the Oregon Wild unroaded inventory areas.

Harvest units in the inventory that would be affected include units 4, 31, 40, 48, and 56. Unit 4 would be Burn Only. The other units would be thinned from below depending on the harvest prescription. Table 201 describes harvest units by acres.

Table 201 Oregon Wild unroaded inventory affected by stand level prescriptions.

Unit Number	Silviculture Prescription	Acres
4	Prescribed Fire (Burn Only)	26.12
31	Thinning	2.36
40	Scenic Views Enhancement	1.80
48	Scenic Views Enhancement	7.87
56	Mixed Conifer Treatment	7.86

Table 202 Oregon Wild unroaded areas that overlap Alternative 2 and Alternative 3.

Alternatives 2 and 3	Total Acres
	46

There may be indirect effects to the Oregon Wild Unroaded inventory that is outside the project area as a result of the action alternatives because of the dust and noise that are usually associated with ground-based logging systems. These indirect effects would be limited in duration and intensity and would not affect the integrity of the Oregon Wild Unroaded inventory.

Figure 39 shows the relationship of the Oregon Wild Unroaded Areas to the action alternatives.

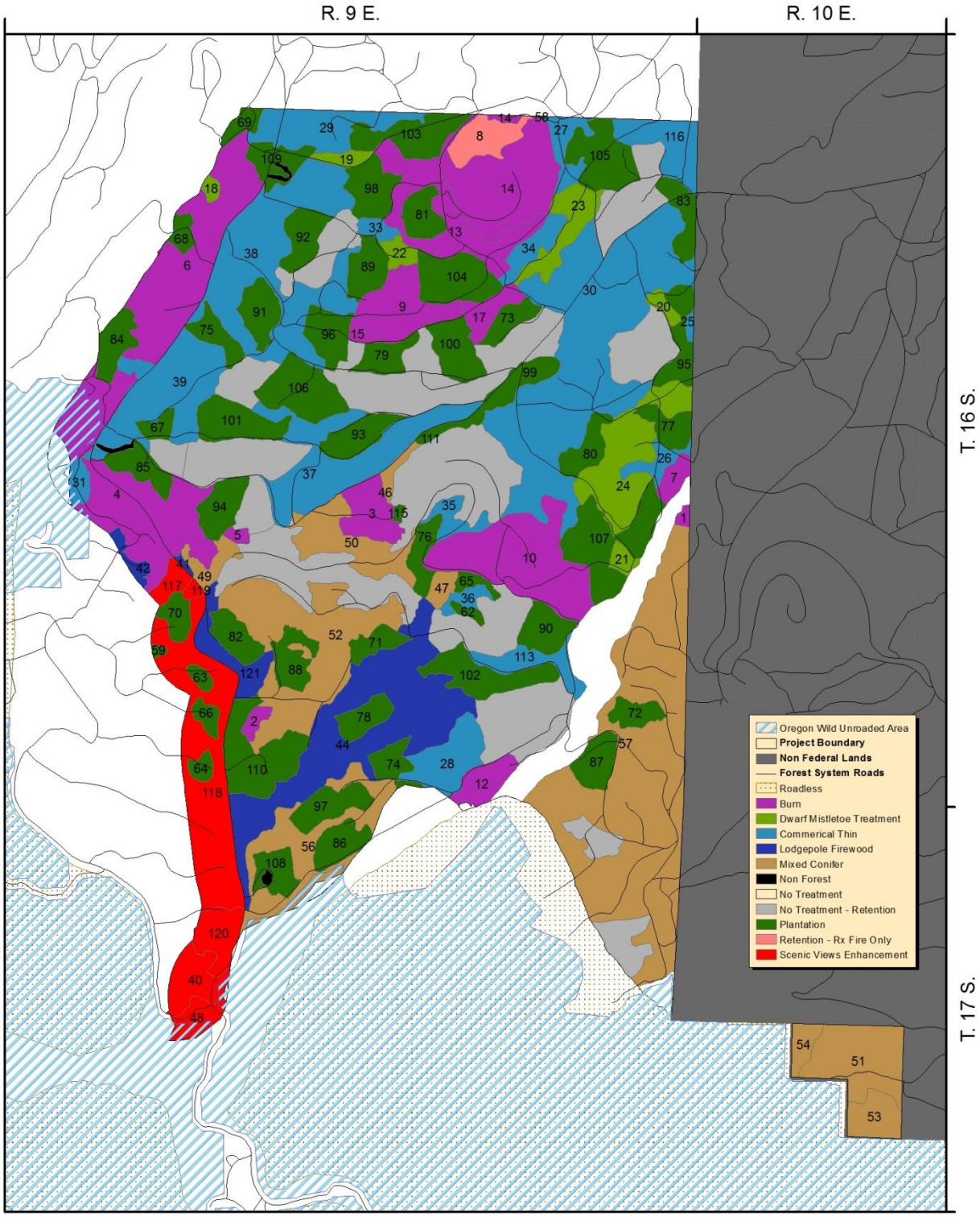


Figure 39 Oregon Wild unroaded inventory and impacts of the action alternatives.

Cumulative Effects

The cumulative effects area is the Melvin Butte Vegetation Management Project and 2012 Pole Creek fire areas and the time frame is the past ten years and the next ten years. Future foreseeable management activities that could occur over the next ten years include maintenance underburning of previously thinned areas and thinning of small diameter trees and associated pile burning in stands located in the Wildland Urban Interface. Areas that were thinned from below for the Melvin project would most likely see their next entry for thinning at year 15 or 25. Stands that are located in the Oregon Wild Unroaded Inventory would continue to receive treatment over the long term and would be recorded in the district silviculture database. Fire suppression activities may also occur in the Oregon Wild unroaded inventory.

Past actions that have affected the Oregon Wild inventory include the 2012 Pole Creek fire. The fire burned through the unroaded inventory at various intensities. The 2013 Pole Creek Fire Timber Salvage project did not harvest stands in the Oregon Wild inventory.

The proposed action, combined with cumulative effects, is not considred a significant effect on the Oregon Wild roadless inventory.

Conclusion

The action alternatives would impact about 46 acres of the Oregon Wild Unroaded inventory as a result of the Melvin Butte Vegetation Management Project.

CLIMATE CHANGE

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Climate Change specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

This report discusses potential interactions between the Melvin Butte Vegetation Management Project and climate change. It focuses on predicted regional changes to temperature and precipitation patterns in central Oregon that can influence vegetation and therefore the ecosystem services forested landscapes provide.

Forests play are integral in the global carbon cycle as atmospheric carbon is fixed during photosynthesis and stored in biomass, detritus and soil organic matter. In 2011 U.S. forests and associated wood products absorb and store the equivalent of 16% of the Carbon Dioxide (CO2) emitted by fossil fuels in the U.S. each year (Joyce Et Al. 2014). Forest carbon sequestration can help mitigate climate change effects by capturing future emissions and greenhouse gasses. Carbon stored in coniferous forests has been estimated to account for a third of terrestrial carbon (Kashian et al. 2006). These environments are dynamic and constantly changing and consequently the ability for them to sequester carbon varies as the stand develops.

Chapter 21: Northwest (Mote et al 2014) of Climate Change Impacts in the United States (Melillo Et Al. 2014) predicts an increase in annual temperature of 3.3°F to 9.7°F by 2070 to 2099 with the largest increase in the summer months. They also predict an 11-12% decrease in annual precipitation for 2030 to 2059. These predictions have potential impacts to water resources such as changes in the timing of streamflows related to snowmelt and potential reductions in the total supply of water and competing demands. Increase in summer temperature and potential changes in water availability is predicted to impacts forest environments through increased wildfire (frequency, duration and intensity), insect and

disease outbreaks. It could also lead to long-term forest type transformations as suitable growing conditions change.

Regulatory Framework

The Forest Service does not currently have a national policy or guidance for managing carbon, and the tools for estimating carbon and sequestration are not fully developed. Current direction for addressing climate change issues in project planning and the NEPA process is provided in the document *Climate Change Considerations in Project Level NEPA Analysis* (USDA FS 2009). This document outlines the basic considerations for assessing climate change in relation to project-level planning.

- **Effect of the project on climate change**

  This specifically considers effects to greenhouse gas emissions and carbon cycling. This may include pyrogenic emissions associated with prescribed burning, changes in biogenic emissions through thinning and forest management, avoidance of large pyrogenic emissions associated with wildfire through forest management, and carbon cycle alterations though reforestation and forest management.

- **Effect of the project on climate change**

  This includes effects of climate change on the seed stock selection for reforestation, potential changes in natural forest regeneration, and effects of decreased snow fall on recreation or stream flows.

Forest Service Strategic Framework for Responding to Climate Change

The USDA Forest Service mission is to sustain the health, diversity and productivity of National Forests and Grasslands to meet the needs of present and future generations. The agency has developed a strategic framework for Responding to Climate Change (USDA FS 2008) because climate change threatens the ability of the Forest Service to fulfill that mission. The framework (Table 203) describes interrelated programs of the agency to help forests, grasslands, and humans mitigate and adapt to global climate change.

Table 203 Seven goals from *Strategic Framework for Responding to Climate Change* (USFS 2008).

Foundational	**Science**	Advance our understanding of the environmental, economic, and social implications of climate change and related adaptation and mitigation activities on forests and grasslands.
	Education	Advance awareness and understanding regarding the principles and methods for sustaining forests and grasslands, and sustainable resource consumption, in a changing climate.
Structural	**Alliances**	Establish, enhance, and retain strong alliances and partnerships with federal agencies, State and local governments, Tribes, private landowners, non-governmental organizations, and international partners, to provide sustainable forests and grasslands for present and future generations.
	Policy	Integrate climate change, as appropriate, into Forest Service policies, program guidance, and communications and put in place effective mechanisms to coordinate across and within Deputy Areas.
Action	**Sustainable Operations**	Reduce the environmental footprint of Forest Service operations and be a leading example of a green organization.
	Adaptation	Enhance the capacity of forests and grasslands to adapt to environmental stresses of climate change and maintain ecosystem services.
	Mitigation	Promote the management of forests and grasslands to reduce the buildup of greenhouse gases, while sustaining the multiple benefits and services of these ecosystems.

Climate Change Research

The National Climate Change Assessment (Melillo Et Al. 2014) assessed the science of climate change and predicts potential impacts across the United States. Mote et al. (2014) predict some of the potential water challenges for the Pacific Northwest. They note that since 1950 the area-averaged snowpack for the Cascade Range decreased about 20% and spring snowmelt occurred 0-30 days earlier depending on location. They also describe studies showing late winter/early spring streamflows increased from 0-20% and summer flow decreased 0-15% as annual flow. They also note that hydrologic response to climate change will depend on factors such as the dominant form of precipitation in a watershed, elevation, aspect, geology, vegetation and land use.

Evergreen coniferous forests dominate the Pacific Northwest and potential changes in precipitation and temperature are expected to affect these environments. Climate change is expected to alter Pacific Northwest coniferous forests through increasing wildfire risk and insect or disease outbreaks in the near future. Long-term changes could include shifts in forest types and species as environmental conditions change. Much of the potential changes are associated with changes in water availability which can result in drought stressed trees that are less resilient to disturbance agents.

Wildfire activity is expected to increase in duration and frequency as changes in water availability are likely to result in an earlier onset for wildfire activity and the end of fire season depends on season ending precipitation events. Mote et al. (2014) predicts that the median annual area burned in the Pacific Northwest will quadruple by 2080 with a 50% probability that 2.2 million acres would burn in a year. Predictions about fire activity are very general since the potential for any given acre to burn is dependent on a number of factors that vary across the Pacific Northwest.

Insect activity predictions focus on the mountain pine beetle and their impact to drier coniferous forests. Mountain pine beetle activity is increase pine mortality in the Pacific Northwest and the trend is expected to continue. Mountain pine beetle are often limited by elevation and associated temperatures. By the end of the century the upper limit of beetle activity is expected to increase with predicted temperature increases (Mote et al. 2014). The potential interactions between climate change and beetle activity are uncertain as beetle occurrence changes there are expected landscape changes that may affect the availability of host trees and ultimately the beetle.

Existing Conditions

The Melvin Butte Vegetation Management is within the Dry Coniferous Forest biome in Peterson et al (2014). Vegetation in this zone is characterized by ponderosa pine (*Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) as dominant species, but can have a significant percentage of true firs and lesser amounts of other conifer species. Typical weather patterns are warm, dry summers with hot daytime temperatures and cool nighttime temperatures. Winters tend to be cold and moist. Most of the annual precipitation is in the form of snow and during spring rainstorms. Rainfall amounts across the zone are highly variable but typically range between 35 cm/year to over 100 cm/year. Snowpack duration varies across this zone and ranges from 1 to 5 months. Snowpack is essential to capturing winter precipitation and converting that to available soil moisture during spring snowmelt.

The combination of cold winters and warm, dry summers results in vegetation that has the highest periods of growth in the spring and early summer when soil moistures are higher and temperatures are lower (Peterson et al. 2014). Limited soil moisture in this vegetation zone creates competition among plant species and can have large impacts on stand development.

Wildfires are a common disturbance agent in central Oregon with substantial activity on the Sisters Ranger District. Over 40% of the Sisters Ranger District has experienced wildfire over the past 12 years.

Many of these fires tend to be low or mixed severity, but can be high severity patches. The Melvin Butte Vegetation Management project area is adjacent to the Pole Creek Fire of 2012 and has similar stand characteristics as areas affected by that wildfire. It is reasonable to assume that the project area could display similar fire behavior under environmental conditions experienced during the Pole Creek fire.

Stine et al. (2014) summarized potential changes to the moist mixed conifer forests of eastern Oregon and Washington under a scenario of increased temperature and decreased snowpack. This could include changes to growing season length and timing, timing of bud break (phenology), and seasonal soil moisture availability. Changes on a local scale could be variable as topographic features, such as drainages, can have substantially different environmental conditions than adjacent areas.

Effects Analysis

Alternative 1

The effect of the proposed project on climate change

Under this alternative stands will continue to develop and stocking levels will increase. Carbon will continue to be sequestered in currently accessible reservoirs but the rate of sequestration is expected to decrease as stands become overstocked to a point where growth becomes severely restricted from competition. This will lead to stands susceptible to insect and disease outbreaks associated with drought stress that will further reduce the stands ability for carbon fixation.

The effect of climate change on the proposed project

Predicted changes to precipitation and temperature are expected to affect the dry coniferous biome. Potential increased duration and intensity of summer drying can affect disturbance regimes in the biome. A reduced snowpack is expected to melt earlier and with increases spring and summer temperatures this could result in early drought conditions. Changes to snowpack and summer precipitation will likely result in reduced productivity for the dry coniferous forests at lower elevations.

Using predicted changes to precipitation and temperature combined with current stocking levels the project area would be at increased risk of wildfire. If a large fire occurs in the area the current stand conditions indicate a higher severity fire under similar environmental conditions to the Pole Creek Fire. Any large fire in the area would release a substantial amount of greenhouse gas. While predicting wildfire contributions to greenhouse gas is highly uncertain as the emissions depend on the specific environmental variables when the fire occurs recent fire history on the Sisters Ranger District indicates a potentially substantial amount of greenhouse gas emissions. The fuels report for this project calculated the potential emissions for a wildfire as 6,204 Tons $PM_{2.5}$ and 7,320 Tons $PM_{10.}$

Alternatives 2 and 3 - Direct and Indirect Effects

Since the action alternatives are similar with respect to potential effects associated with climate change they will be analyzed together.

The effect of the proposed project on climate change

Over the short-term (less than five years) implementation of the proposed project on climate change would remove above ground live woody biomass that currently acts as a carbon reservoir. The no treatment areas of the project are identified for habitats that area suitable for northern spotted owl and will continue to fix carbon.

Prescribed burning could potentially occur across the project area and the carbon released by these activities is difficult to calculate as the amount of burning that can occur in any year is dependent on

getting suitable weather. The fuels report calculates prescribed burning as releasing 200,323 tons of CO_2. This is based on every potential action burn happening which may not occur since burning depends on getting the appropriate weather conditions. It is also important that the potential release would occur over many years rather than a predicted large pulse associated with a wildfire.

Several treatments (especially plantation treatments) are expected to release currently suppressed trees so they can accelerate growth and continue capturing carbon over the long-term. Any areas that do not meet minimum stocking standards post-harvest will be replanted and these stands will continue to capture carbon as the seedlings grow.

Removal of above ground woody biomass would be a direct reduction in the ability of forests in the project area to perform carbon sequestration over the short-term. However, over the long-term the forest will regenerate and stands treated to improve tree health will allow currently overstocked stand to maximize growth and capture carbon. Stands without treatment identified will continue to have the highest potential for carbon storage as the soils identified in these stands has favorable properties to develop multi-story complex stands.

The effect of climate change on the proposed project

Potential effects of climate change on the proposed project are difficult to predict. As stated above, the expected changes in temperature and precipitation are expected to affect the drier coniferous forest biome. Stands that are categorized as moist mixed conifer may continue to be exposed to impacts from climate change as the current temperature and precipitation regimes that support them change. Soil moisture availability will continue to result in competition for resources and some stands.

Summary

The Pacific Northwest is predicted to have increases in annual temperatures and changes in water availability associated with climate change. Alternative 1 would allow the project area to continue carbon fixation but would likely place the area at increased risk of wildfire, insects or disease. Alternatives 2 and 3 would remove above ground carbon stores but would reduce the potential for a large pulse input of CO_2.

TRANSPORTATION

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Transportation specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

A roads analysis is an integrated ecological, social, and economic science based approach to transportation planning that addresses existing and future road management options. A completed science-based roads analysis will inform management decisions about the benefits and risks of constructing new roads in unroaded areas; relocating, stabilizing, changing the standards of, or decommissioning unneeded roads; access issues; and increasing, reducing, or discontinuing road maintenance. See the Melvin Roads Analysis Report for more details.

Regulatory Framework

The goal pursuant to the Deschutes National Forest Plan, page 4-71 is:

"*To plan, design, operate and maintain a safe and economical transportation system providing efficient access for the movement of people and materials involved in the use and protection of National Forest lands."*

Part of the Standard and Guidelines for meeting the goal is to meet certain road densities as stated on page 4-72, Deschutes National Forest Plan, Section TS-12:

"*Some management areas include open road density guidelines. If not included in the management area direction, the deer summer range guideline of 2.5 miles per square mile, as an average over the entire implementation unit, is assumed. Guideline densities will be used as thresholds for a further evaluation and will not serve as the basis for assessing conformance with the Forest Plan.*

None of the land management allocations within the Melvin Butte Vegetation Management Project area indicates any systematic reduction of road miles or densities except M15 – Old Growth. From Section M15, under the Standard and Guidelines for Transportation M15-14 states:

"Access by road or trail will be limited to the minimum standard and density that meets the objectives of this Management Area. Roads no longer needed will be closed and allowed to revegetate naturally. Helispots and transmission corridors will not be allowed.

CFR 36 212.5b

(b) Road system—(1) Identification of road system. For each national forest, national grassland, experimental forest, and any other units of the National Forest System (§212.1), the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. In determining the minimum road system, the responsible official must incorporate a science-based roads analysis at the appropriate scale and, to the degree practicable, involve a broad spectrum of interested and affected citizens, other state and federal agencies, and tribal governments. The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR part 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

Analysis Methods

- Review existing conditions for potential haul routes
- Review the Melvin Butte Vegetation Management Roads Analysis (Walker 2014)
- Review the current Yearly District Road Maintenance Plan
- Calculate miles of road (before and after Roads Analysis recommendations)
- Calculate road density (before and after Roads Analysis recommendations) with the project area

Existing Conditions

The majority of roads within the analysis area have been in existence for over 100 years, and many date back to the early decades of the 20th century. The roads within the analysis area were, by and large, constructed to provide access for timber harvest.

The existing transportation system in the Melvin Butte Vegetation Management Project contains a total of up to 52.51 miles of Forest System roads. All roads within the planning area are forest roads ranging from standard from primitive, wheel tracks to two lane paved Arterials. This also includes 3.31miles of existing administratively closed roads.

About 9.2% of the system involved consists of Highway Safety Act Roads maintained at a higher standard to accommodate low clearance passenger vehicles. This system has historically been designed and maintained to accommodate the mix of traffic resulting from resource activities and a significant amount of recreation traffic, thus there is a fairly good road system in place which can handle most existing or proposed traffic generating scenarios. Some additional reconstruction or heavy maintenance would be needed if restoration projects concentrate haul volume onto localized segments of these roads.

The remaining 90.8% of the system consists of typically lower standard, high clearance only or closed single lane roads. These roads receive little or no routine maintenance. The roads receive only what is necessary to correct safety problems, when environmental damage is detected or when they are being used for commercial activity. Traditionally, maintenance associated with commercial use (commercial haul) has been the primary means of maintaining these otherwise low use roads. See Table 204 for a summary of road maintenance levels in the project area.

System Road Maintenance Levels

Level 5 - Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double-lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is "encourage."

Level 4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is "encourage." However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Level 3 - Assigned to roads open and maintained for travel by prudent drivers in a standard passenger cars. User comfort and convenience are low priorities.
Roads in this maintenance level are typically low speed, single lane with turnouts, and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Level 2 - Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles.

Level 1 – Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate."

Table 204 Current road status in the project area.

MAINTENANCE LEVEL	TOTAL
1 – Basic Custodial Care (Closed Roads)	3.31
2 – Maintained for High Clearance Vehicles	44.39

3 – Maintained Suitable for Passenger Cars, Low User Comfort, Aggregate Surface	0.26
4 – Maintained For Passenger Cars, Moderate Degree of User Comfort	4.55
5 - High Standard Paved Passenger Car Road, High degree of User Comfort	0.0
Undetermined	0.0
TOTALS	52.51

Definitions of the objectives of closing and decommission a road are:

Closed Road (Level 1) – A closed road is a road is closed at one entrance (spur road) or both ends by means of using natural resources (dead fallen trees, boulders) or by man made resources (gates). A closed road remains a Forest System Road and will have a identification number associated with it. A closed road can be utilized by the Forest Service for emergency purposes such as access to fire situations or administratively for a timber sale.

Decommission Road – A decommissioned road is a road which will be treated and removed from the Forest Transportation system. The identification number shall be removed and the road shall be obliterated, if necessary, to transform the road back to the surrounding natural environment.

The leading reason for the creation of the majority of the existing road system was to provide access for timber harvest. As timber harvest has significantly declined on national forests over the past several years, the general use of the system roads has changed.

Today the road system sees some administrative use; however the primary use is public access to multiple summer and winter recreation opportunities on the forest. The largest recreation attraction adjacent to the analysis area is the Three Creek area which provides opportunities for camping, fishing, hiking, horseback riding, and snowmobiling. Road 16 is the primary arterial in the analysis area and serves as the main access to the Three Creek area. Outside of the Three Creek area, other recreation opportunities exist including several trailheads that provide access to wilderness trails.

From late spring through fall, firewood collection and mushroom harvesting contribute an increase amount of seasonal traffic to the road system. During fall the road system sees a high amount of traffic from various deer and elk hunting seasons.

The existing management objectives for roads within the Melvin Butte Vegetation Management Project can be split into two definitive areas: administrative/land management access, and recreation access. The bulk of roads, are managed primarily for administrative access and are only secondarily managed to facilitate public usage. Arterials and collectors, regardless of Maintenance Level, are managed to allow for a mix of commercial and private traffic.

Maintenance Level 2 roads are generally managed to be primarily used by high clearance vehicles. During periods of commercial haul, they are intended to be single user facilities, given the narrow roadbeds and lack of frequent turnouts preclude any opportunity to safely provide for mixed commercial/public traffic during commercial haul periods. This would occur on most Maintenance Level 2 roads within the project area. There are exceptions to this as some Maintenance Level 2 roads serve as 2 lane collector roads in which would not be restrictive.

Road Restrictions

Commercial Road Rules Deschutes National Forest

Forest Road 16 – Snow 3 – "Snow plowing and vehicle use prohibited from Dec. 1 through April 30". The District Ranger could choose to waive this restriction.

Reconstruction

Prior to implementation of the project, a road maintenance appraisal will be conducted for each unit in the stewardship and/or timber sale. In the maintenance appraisal, the Road Manager will estimate the required maintenance and which transportation routes the contractor shall utilize with each sale unit. This maintenance appraisal does not take into consideration required road reconstruction for the commercial haul routes.

Road 1628000 – a section of curved road in which the curve radius might be too small for chip trucks to maneuver around and might need reconstruction to reduce the curve radius and allow passage. A section of the 1628, north of 1628800.might need reconstruction due to water erosion down the center of the road and need to be repaired if the road is utilized for commercial hauling.

Issue Statement

The Melvin Butte Vegetation Management Project has the potential to plan, operate, and maintain a safe and economical transportation system providing efficient access for the movement of people and materials involved in the use and protection of National Forest Lands, specifically in the Melvin Butte Vegetation Management Project area.

Measures

1. Total miles of system roads and total miles of open system roads within the project area
2. Miles per square mile of open road density within the project area.

Both measurements will be analyzed with the "no action" alternative and with alternatives 2 and 3.

Effects Analysis

Closing and Decommissioning of Forest System Roads

Alternative 1

With this alternative, none of the recommend road closures and decommissioning would take place. The open roads are not currently maintained but would still remain open to public use. The project area encompasses 5,375 acres (8.40 square miles) along with a current mileage of all Level 2 through 5 open roads is 49.20 miles. This number will not change with Alternative 1 (No Action). This equates to an open road density of 5.86 miles of road per square mile of project area (miles/miles^2). This is above the recommended guideline of 2.5 miles of road per square mile of area as stated Section TS-12 of the Deschutes National Forest Plan. This will have not any effects on the current transportation system. Road maintenance currently is focused on Maintenance Level 3 roads and above and funding for maintaining Maintenance Level 2 roads are at minimum levels. Alternative 1 will not change the current road maintenance levels.

Alternative 2 and 3 - Direct and Indirect Effects

A direct effect of this project will be the decommissioning and closing of analyzed Forest System Roads. The team revisited the Popper portion of the Sky Roads Analysis. It was agreed amongst team members the recommendations from the Sky Roads Analysis is the current recommendation with the exception of

Forest Roads 1610480, 1610455 1620570, and 1620850. For this reason, the Melvin Butte Vegetation Management Project Roads Analysis was completed (Walker, 2014)

Forest Road 1610480 is an existing open Maintenance Level 2 road located on the east side of the project area. Current recommendations from the Melvin Butte Vegetation Management Project suggest the decommissioning of Forest Road 1610455 would essentially isolate Forest Road 1610480 with no connection points at either end. It was decided in the roads analysis process to decommission Forest Road 1610480 (Figure 40).

Figure 40 Forest road 1610480.

The Pole Creek Fire, 2012, and its effects created increased drainage in the area due to the lack of vegetation to slow water flow across the landscape. Part of this effect was increased drainage flow paralleling Forest Road 1600700 and eventually flowing onto Forest Road 16. Forest Road 16 is defined as a route suitable for passenger vehicle use. The resulting water flow deposited debris (in the form of sediment and small boulders) onto Forest Road 16, making the route impassible for passenger vehicles. To alleviate this problem, a large culvert was installed at the intersection of Forest Roads 16 and 1600700. It is also important to note this road services many campgrounds and trailheads in the Three Creek area. It was discovered this flow affected some roads within the Melvin Butte Vegetation Management Project area with erosion and scouring to the point the roads were unusable to motorized traffic. After several field visits and discussions with fisheries, hydrologist and wildlife it was determined this scenario was an ephemeral stream. It was also determined the roads affected by this scenario would be best served decommissioned. The recommendations from the Sky Roads Analysis (2009 in association with West Trout and Popper projects, which did not have Record of Decisions) recommended Forest Road 1620570 as Maintenance Level 1 status and Forest Road 1620850 as no change in Maintenance Level (Figure 41). With the erosion damage which occurred on both roads it was concurred that both Forest Roads be recommended for decommissioning with the Melvin Butte Vegetation Management Project.

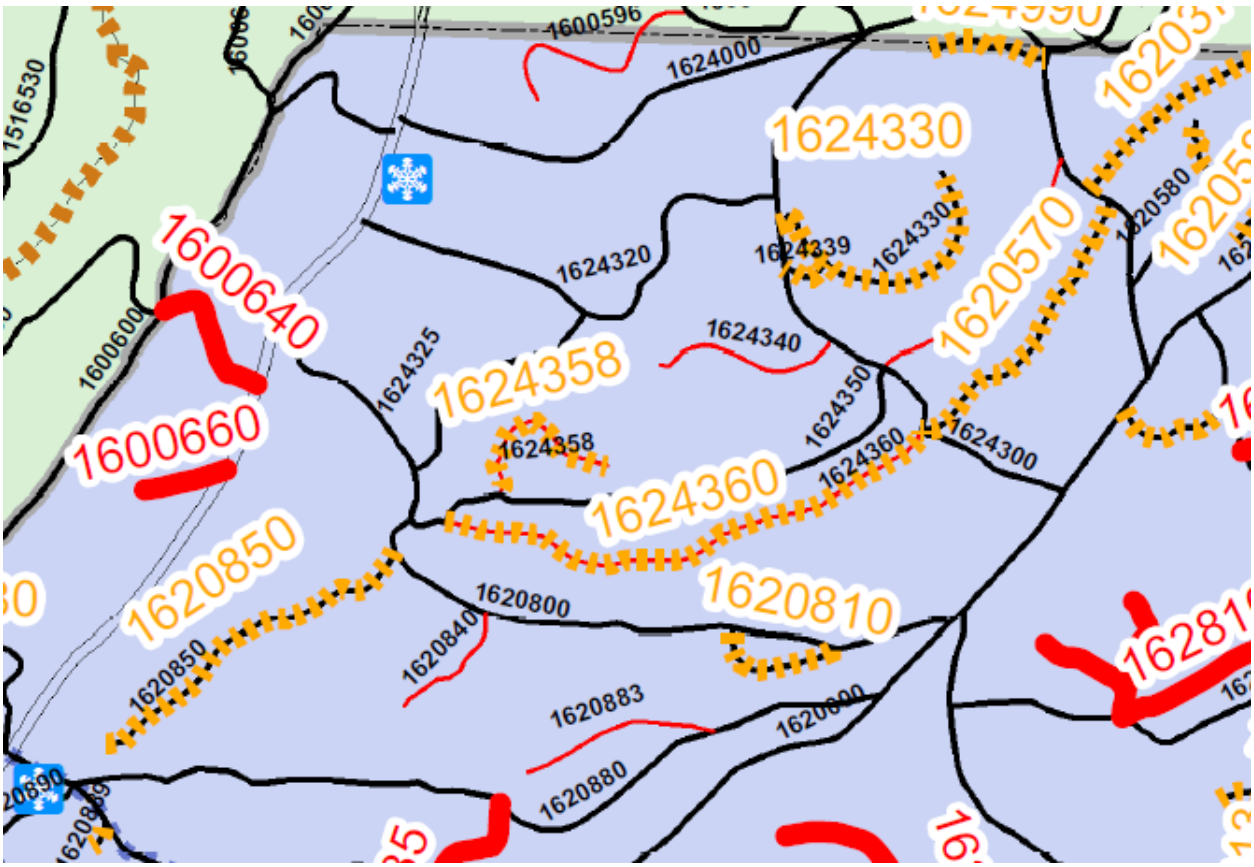


Figure 41 Pole Creek fire affected Forest road 1620850 and 1620570.

With Alternatives 2 and 3 the total miles of open system roads will be reduced from 49.20 miles to 37.00 miles, a reduction with a change of density from 5.86 miles/miles^2 to 4.40 miles/miles^2. During the implementation of closing and decommissioning roads, the Forest Service could close user created and breached closed (Maintenance Level 1) roads when the opportunity arises. This does not mean all user created and breached closed roads will be closed within the Melvin Butte Vegetation Management Project area but when the user created and breached closed roads are located during the field review and process of closing/decommissioning system roads, they too could be closed. The roads will be evaluated on the ground during the process of closing/decommissioning roads. If a road prism has naturally grown in with vegetation (trees, brush, native grasses) a determination will be made between closing/decommissioning the road by mechanically means or leaving the road in its current state. See Figure 42 for roads analysis recommendations.

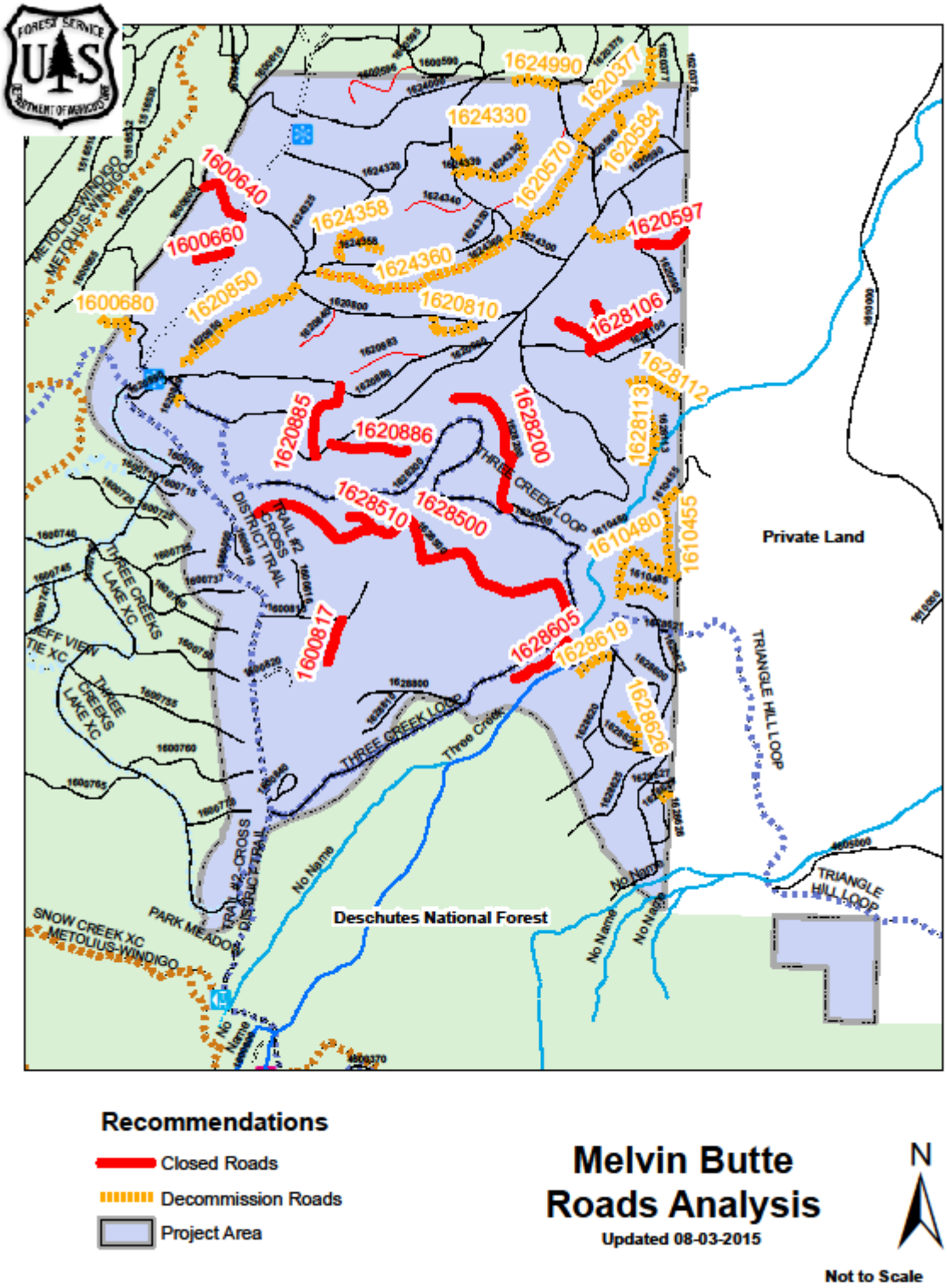


Figure 42 Melvin Butte Vegetation Management Project roads analysis recommendations.

If roads recommended for decommissioning are creating resource damage (i.e. water erosion) appropriate mitigation shall take place to reduce the resource damage. The mitigation techniques would include construction of water bars across the road to dissipate water runoff, construction of lead out ditches to channel the water to the native landscape for dissipation purposes, the removal of culverts (decommissioned roads) to return the natural drainage channel to its natural state, and other best management practices.

As stated with Alternative 1, the current open road density is 5.86 miles/miles^2 of project area. With a reduction in open road mileage from 49.20 miles to 37.00 and using a project area of 8.40 square miles, the road density equates to 4.40 miles/miles^2 of project area, a net decrease of 1.46 miles/miles^2. Table 205 displays route miles, stream crossings and routes in the project area.

Table 205 Route miles, stream crossings and routes in the Melvin Butte Vegetation Management Project area.

Route Miles, Stream Crossings, and Routes in RHCAs	Existing Condition	Alternatives 2 & 3	Amount of Change
Project Acres	5375	5375	0
Project Acres Open to Motorized Cross-Country Travel	0	0	0
Grand Total Motorized Route Miles:	52.51	44.80	-7.71
1. Total Miles of Roads	52.51	44.80	-7.71
a. Miles designated as open yearlong	47.48	36.17	-11.31
b. Miles designated as open seasonally	1.72	0.83	-0.89
c. Miles designated as closed yearlong (ML 1)	3.31	7.80	4.49
2. Total Miles of Motorized Trails	0	0	0
a. Miles of designated roads open year round for use by OHVs	42.66	31.97	-10.69
b. Miles of designated roads open seasonally for use by OHVs	1.72	0.83	-0.89
c. Miles of trail available for use by OHVs <50 in wide	0	0	0
d. Miles of trail available for use by OHVs >50in wide	0	0	0
e. Miles of trail designated for motorcycle use	0	0	0
3. Total Miles of Routes in RHCAs	0.35	0.22	-0.13
a. Total miles of designated OHV routes in RHCA	0	0	0
b. Total miles of designated open roads in RHCA	0.35	0.22	-0.13
c. Total miles of designated closed OHV trails in RHCAs	0	0	0
d. Total miles of designated closed roads in RHCAs (ML 1)	0	0.08	0.08
4. Total Stream Crossings by Designated Route	1	1	0
a. Total number of open OHV trail stream crossings	0	0	0
b. Total number of open road stream crossings	1	1	0
c. Total number of closed OHV trail system crossings	0	0	0
d. Total number of closed road (ML1) stream crossings	0	0	0
5. Total Miles of Designated Routes Available to OHVs	44.38	32.80	-11.58

Temporary Roads

A direct effect of this project is the creation of temporary roads. A temporary road is by definition a road for the purposes of implementing management objectives for the surrounding land. Temporary roads are not part of the Forest Transportation network and as the name implies exist for a limited amount of time. These roads shall be constructed when appropriate during the duration of the project for access to

silvicultural and fuels reduction treatment areas. Once the treatment area prescription has been complete, the temporary road will be decommissioned and rehabilitated. The amount of required temporary roads shall vary between each alternative due to the fact the number of treatment areas in each alternative are different. There shall be no temporary roads constructed in the inventoried roadless areas.

Alternative 1 – No Action

Alternative 1 (no action) would not construct any temporary roads.

Alternative 2 - Direct and Indirect Effects

Alternative 2 would produce 0.80 miles of temporary roads for the purpose of access to prescription units. This alternative would use existing roads that are not currently on the transportation system. The use of the temporary roads would not create environment disturbance for the reason of there would be no new road construction for the implementation of the temporary roads. Maintenance work on the temporary roads would include installation or rehabilitation of drainage structures and grading the road for drainage purposes which the roads will be rehabilitated back into the landscape thus having short term disturbance effects. Rehabilitation efforts would include removing any existing culverts that are present, scarifying the soil to reduce the compaction effects, and placement of existing debris (rock, downed wood) to prevent access to the road once the project is completed. Figure 43 shows the location of the temporary roads for Alternative 2.

Alternative 3 - Direct and Indirect Effects

Alternative 3 would produce 0.0 miles of temporary roads for the purpose of access to prescription units. This would not have any effect in the area.

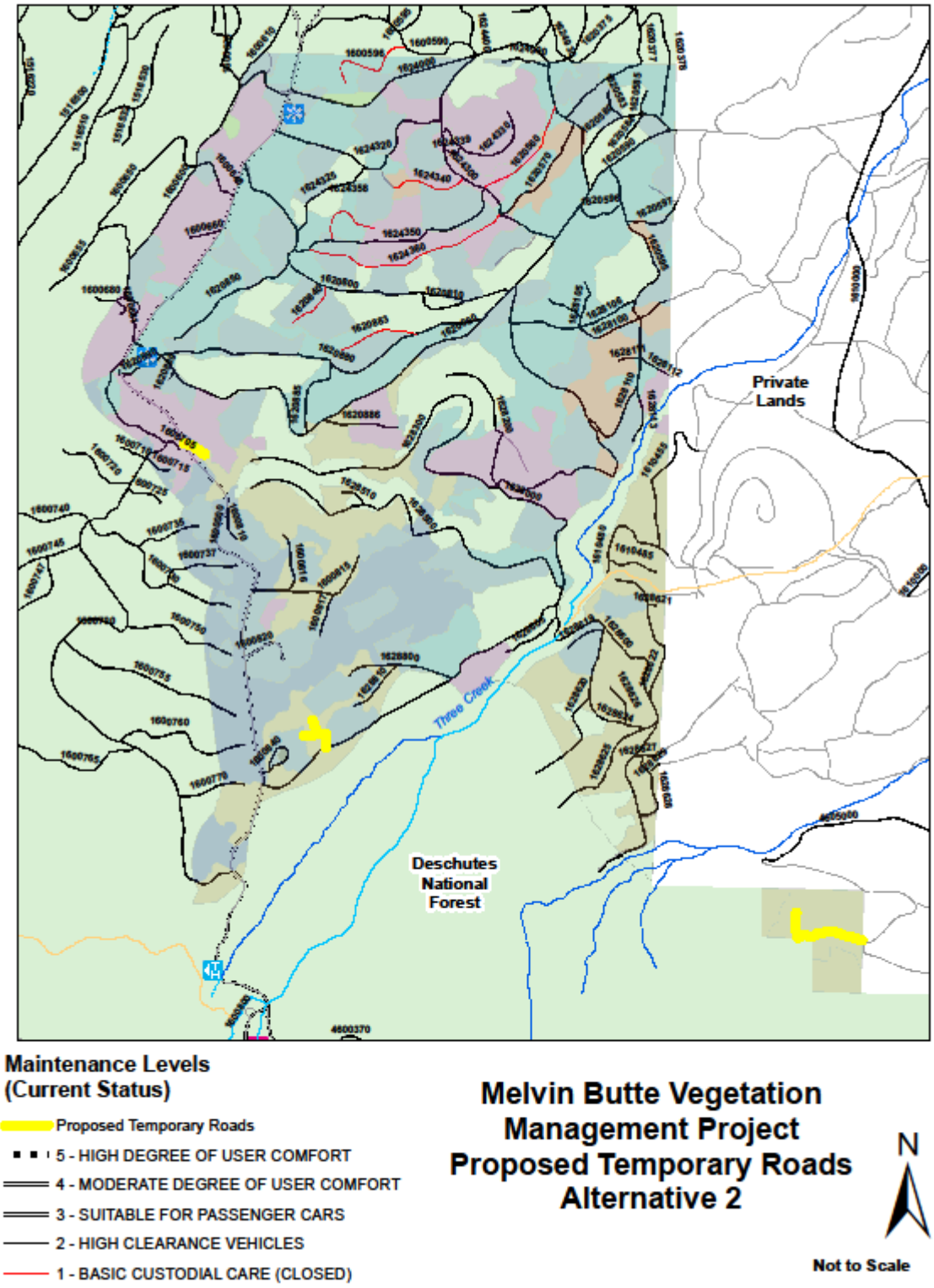


Figure 43 Proposed temporary roads, Alternative 2.

Maintenance

Alternative 1 – No Action

There would be no additional maintenance on roads within the project area.

Alternative 2 and 3 - Direct and Indirect Effects

A short term direct effect would be the opportunity to provide maintenance to roads in association with commercial hauling. Most of the roads anticipated in being utilized for this project, for the purposes of haul logs, biomass, and wood chips, have not been maintained for a number of years. This project will create the opportunity to provide the much needed maintenance for the roads involved.

- Road maintenance will include some of the following:
- Blading – Shaping the surface of the road for proper water drainage
- Culvert and other Drainage Facilities – Cleaning out existing relief culverts, ditches, and creation of water bars to improve the water drainage of the roads.
- Hazard Tree Removal – During the term of prescription projects, contractors will have the authority to removal hazard trees deemed unsafe along haul routes.
- Brushing – The contractor would be authorized to trim and remove impeding brush such as low tree limbs, small trees and bushes encroaching into travel lanes of the roads.

Not all Forest System roads would be involved with this maintenance. At a minimum, 12 miles of system roads would require maintenance. Only roads utilized for commercial haul involving the Melvin Butte Vegetation Management Project would be subject to road maintenance.

Cumulative Effects

The physical space is defined by the project area boundary and time will be 3 years, past and future. There are no projects from the past or foreseeable future projects in the area.

Past

No projects in the last 3 years have occurred affecting the transportation system including activities presented in the report.

Present

There are currently no projects in the Melvin Butte Vegetation Management Project area in which road closures and decommissioning would occur.

Activates are consistent within this area. The Deschutes and Ochoco National Forest Road Crew plans and has in the past provide maintenance on select roads within the Melvin Butte Vegetation Management Project area. Each year the crew, District road manager, and discipline specialist plan out maintenance activity across the District. Maintenance items for fiscal year 2014 in the Melvin Butte Vegetation Management Project area are:

- Patching asphalt pot holes along Forest Road 16.
- Watering and blading Forest Road 1620 from Forest Road 16 to Forest Road 1600376 (adjacent to the Melvin Butte Vegetation Management Project)
- Forest Road 1628 erosion repair.
- Forest Road 16 culvert repair

- Forest Road 1620 shoulder repair
- Erosion mitigation of Forest Roads 1624300 and 1620

There are currently no projects in the area within Melvin Butte Vegetation Management Project area in which temporary non system roads would be created.

Future

There is no foreseeable future (3 years) projects in the project which would affect the transportation system including activities presented in the report.

Conclusion

The Melvin Butte Vegetation Management Project would have the following effects depending on the alternative;

1. Current road maintenance would remain the same (Alternative 1)
2. Reduce road system mileage (Alternatives 2 and 3)
3. Reduce road densities (Alternatives 2 and 3)
4. Increase road maintenance opportunities (Alternatives 2 and 3)
5. Create temporary roads (Alternative 2)
6. Not create temporary roads (Alternative 1 and 3)
7. Not close or decommission system roads (Alternative 1)

ECONOMICS

This environmental assessment incorporates by reference (as per 40 CFR 152.21) the Economics specialist report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report is in the project record which is located at the Sisters Ranger District office in Sisters, Oregon.

Introduction

Forest Service Handbooks 1909.17 and 2409.18 direct the evaluation of Economic Efficiency for proposed projects. To assess economic efficiency of Alternatives 2 and 3, harvest volumes (merchantable and unmerchantable), were derived from FVS modeled cut trees. These trees come from inventoried trees on project and representative stands. Specific information on the analysis methodologies, assumptions, and limitations of analysis and other details are contained in the Silviculture report. This report just covers the economic outputs from the analysis described in the Silviculture report. The analysis can be used to compare alternatives, not to give an absolute number for the outputs. Numbers useful for comparing alternatives include a benefit/cost ratio, discounted benefits, discounted costs, and present net value. Effects on the local economy include estimated number of jobs created or maintained.

Estimated volumes were calculated for each alternative and treatment type within an alternative by using FVS stand summary tables. Estimated volumes were calculated for each alternative and the direct revenue and costs are identified for each measuring the value of wood products to determine the estimated value of each alternative and viability of the Melvin Butte Project with the alternatives identified.

While there are other (direct and indirect) economic benefits from the implementation of this project to wildlife (terrestrial, aquatic), recreation, roads, soil, water and vegetation, these values are outside the

scope of this timber analysis. Therefore, given the scope of this analysis CCF and MMBF are used as a surrogate to compare the benefits to cost ratio to move towards the desired future condition.

This analysis does not place a value on indirect benefits which may occur such as increased future yields resulting from reduced stocking; reduced risk of stand replacing wildfire; and/or reduced risk of interior forest habitat loss.

Effects Analysis

Alternative 1 – No Action

With this alternative, no commercial forest products would be provided to the economy. There would be no net sale value, and no additional jobs would be created or maintained. There would be no benefits to the local economy. Although Alternative 1 would generate no current revenues to returns, there is a cost resulting from the expenditure of planning monies. The discounted cost displayed did not discount the costs. Since there are no revenues predicted it is not possible to calculate a benefit/cost ratio.

Alternatives 2 and 3

There are minimal economic factors contributing to differences seen in the benefit/cost ratio and the economic present net value for Alternatives 2 and 3 (Table 206 and Appendix G). These differences include (Alt 2 vs. Alt 3) a slightly higher proportion of late seral (grand/white fir) removal in <4.6% (250 acres) of the project area and select large ponderosa pine tree removal within 160 acres of dwarf mistletoe areas. Select tree ponderosa pine tree removal includes DMR 3+ rated trees that are adjacent to plantation areas and for economic evaluation was estimated to total 160 trees (1 for each acre of Dwarf Mistletoe treatment). As such, these differences resulted in a higher amount of fiber/saw timber proposed for removal under Alt2 and a higher cost for pruning under Alt 3.

The Present Net Value is the value of revenue minus costs. Revenue and costs in the future are discounted to equate to values today using 4% as the discount rate. The discount rate is not the expected rate of inflation but the price of money today discounted to the future. The economics theory is that there is a higher value for money today than in the future. The prices of all products in the economy with relation to each other will be relatively the same in the future thus the lack of use of inflation for the calculation. Included in the analysis is an estimate of the value of the logs ($ 140 CCF delivered). This value is affected by the logging cost and hauling costs. For example, if fuel prices rise, the price paid for timber would likely decrease. The value of timber is constantly changing dependent on local, regional and international supplies and demands. In both alternatives the benefit cost ration is very close to 1 indicating timber values breaking even with restorative work. The expression of volume in this report is in CCF or hundred cubic feet. This is used instead of MBF or thousand board feet because of the low amount of fiber to be removed as sawtimber[23].

The present net value (see Table 206) is positive for both alternatives. The costs associated with the timber sale in alternative 2 is lower than in alternative 3 mostly due to the higher pruning that would take place under alternative 3 and the reduced volume. The fuels treatments added to the costs decreasing the overall benefit cost ratio and decrease the present net value even further for alternatives. This was expected though to treat the fuels without a timber sale would decrease the amount which could be accomplished and would be difficult to accomplish within this decade. Alternative 2 would provide approximately 5 percent less commercial forest products than Alternative 3.

[23] Sawtimber tends to produce a greater economic benefit: cost ratio as compared to non-saw material ("biomass").

The economic efficiency as measured by benefit/cost ratio of alternative 2 is greater than alternative 3 by about 6 percent.

Table 206 Summary of economic effeciency analysis.

Economic Measure	Alternative 1 (No Action)	Alternative 2	Alternative 3
Acres of Commercial Harvest	0	2,482 acres	2,411 acres
Volume (Total CCF (hundred cubic feet)) This includes merch and non-merch	0	20,371	19,274
Volume (total hundred cubic feet CCF) *Merch only*	0	*13,240*	*12,565*
Net present value		$212,297	$79,386
Benefit/cost ratio		1.11	1.04
Jobs maintained or created[2]	0	64	60

[1] Assumes 4% discount rate.

[2] Calculated using figures for the Deschutes National Forest from Appendix B-5 of the FY99 Timber Sale Program Annual Report. Excluding firewood from the volume harvested on the Deschutes National Forest, an estimated 9.6 jobs per million board feet were maintained or created.

The current Deschutes National Forest annual average of timber sold is approximately 45 MMBF. In the near future, the amount of timber offered for sale is expected to be near this annual average. The Deschutes National Forest is expected to continue offering timber for sale and is expected to continue making contributions to the local economy as a result of timber harvest activities. Timber proposed for harvest with Alternatives 2 would be approximately 15 percent of the Forest's annual average timber sale program. Alternative 3 would be approximately 14 percent of the Forest's annual average timber sale program. This is expected to be sold in the course of more than one year.

The economic effects of the fuels treatments beyond the scope of the timber sold are dependent on the risk and probability of wildfire. There will be continued recreational use of the area and if a wildfire is started in the area or approaches the area from the wilderness to the west there is a low risk of loss of recreation facilities or a loss of recreation activity due to the sense of place. This type of fire has occurred in other areas where control has occurred and little change of recreation use of the area. The economic benefits or losses by a fire in the riparian reserves along the length of Three Creek is difficult to calculate. This value of avoidance is difficult to valuate with probabilities of extensive wildfire risk.

OTHER DISCLOSURES

Civil Rights and Environmental Justice

There have been no issues or concerns raised with adverse effects to Native American Tribes.

There are no known direct, indirect, or cumulative effects on Native Americans, minority groups, women, or civil rights beyond effects disclosed in the Deschutes Land and Resource Management Plan.

Executive Order 12898 on environmental justice requires federal agencies to identify and address any disproportionately high and adverse human health or environmental effects on minority and low income populations. The action alternatives would have no disproportionately high or adverse effects to minority or disadvantaged groups qualifying under the environmental justice order. Scoping and widely circulated

media articles have raised no issues or concerns associated with the principles of environmental justice. The action alternatives do not have a disproportionately high and adverse human health effects, high or adverse environmental effects, substantial environmental hazard or effects to differential patterns of consumption of natural resources. All interested parties will continue to be involved with commenting on the project and the decision making process.

Congressionally Designated Areas

No congressionally designated areas such as Wilderness or Wild and Scenic Rivers would be adversely affected by the proposed activities. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3.

Prime Farm and Forest Lands and Wetlands

The Secretary of Agriculture issued Memorandum 1827 which is intended to protect prime farm lands and range lands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy."

Compliance with Other Polices, Plans Jurisdictions

The alternatives are consistent with the goals, objectives and direction contained in the Deschutes National Forest Land and Resource Management Plan except for the described forest plan amendments needed, and the accompanying Final Environmental Impact Statement and Record of Decision dated August 27, 1990 as amended by the Regional Forester's Forest Plan Amendment #2 (6/95) and Inland Native Fish Strategy, and as provided by the provisions of 36 CFR 219.35 (f) (2005), which address Management Indicator Species. The project is also consistent with the *2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*.

Implementation of Alternative 1 (No Action), Alternative 2 (Proposed Acton), or Alternative 3 would be consistent with relevant federal, state and local laws, regulations, and requirements designed for the protection of the environment including the Clean Air and Clean Water Act. Effects meet or exceed state water and air quality standards.

Irretrievable and Irreversible Commitment of Resources

NEPA requires that environmental analysis include identification of "…any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3.

- **Irreversible**: Those resources that have been lost forever, such as the extinction of a species or the removal of mined ore. The proposed activities would result in a commitment of rock for road maintenance.

- **Irretrievable**: Those resources that is 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.

CHAPTER 4 CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals and non-Forest Service persons during the development of this environmental assessment:

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NON-FOREST SERVICE

Deschutes Collaborative Forest Project

REFERENCES

Abbe, T. B. and D. R. Montgomery. 1996. Large woody debris jams, channel hydraulics and habitat formation in large rivers. Regulated Rivers Research and Management 12:201-221.

Abele, S.C., V.A. Saab, and E.O. Garton. (2004, June 29). Lewis's Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Adams, E.M. and M.L. Morrison. 1993. Effects of forest stand structure and composition on red-breasted nuthatches and brown creepers. Journal of Wildlife Management. 57(3):616-629.

Adams, P.W., and H.A Froehlich. 1981. Compaction of forest soils. Pacific Nrothwest Extension Publication-PNW 217. 13p.

Agee, J. K. 1990. The historic role of fire in Pacific Northwest forests. In Walstad, J., et al. (eds.), Natural and prescribed fire in Pacific Northwest forests: pp. 25038. Corvallis: Oregon State University Press.

Agee, J. K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington, D.C.

Agee, J.K. 2002. The fallacy of passive management, managing for firesafe forest reserves. Conservation in Practice. 3: pp. 18-36.

Agee, J.K., and Lolley, M.R. 2006. Thinning and prescribed fire effects on fuels and potential fire behavior in an eastern Cascade forest, Washington. Fire Ecology 2(2). pp. 3-19.

Agee, J.K. and Skinner, C. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology Management. Vol. 211. pp. 83-96.

Ager, A., Vaillant, N., and Finney, M. 2010. A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure. Forest Ecology Management. Article in Press. pp. 15.

Alexander, M., Cruz, M., Vaillant, N., Peterson, D. 2013. Crown fire characteristics and prediction in conifer forests: a state-of-knowledge synthesis. Final Report.

Altman, B. 2000. Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington. Version 1.0. Oregon-Washington Partners in Flight. 81 pp.

Amman, G.D. 1976. Integrated control of the mountain pine beetle in lodgepole pine forest. P. 439-446 in XVI IUFRO World congress proceedings. IUFRO, Div. II, Oslo, Norway.

Angermeier, P. L. and J. R. Karr. 1984. Relationships between woody debris and fish habitat in a small warm water stream. Transactions of the American Fisheries Society 113: 716-726.

Arkle R.S. and D. S. Pilliod. 2010. Prescribed fires as ecological surrogates for wildfires: A stream and riparian perspective. Forest Ecology and Management 259 (2010) 893–903.

Arno, S.F. 1996. The Concept: Restoring Ecological Structure and Process in Ponderosa Pine Forests. The Use of Fire in Fire Restoration. General Technical Report, INT-GTR-341.

Baker, W., Veblen, T., and Sherriff, R. 2007. Fire fuels and restoration of ponderosa pine-Douglas fir forests in the Rocky Mountains. Journal of Bibliography. 34. pp. 251-269.

Bartholow, J. M. 1989. Stream temperature investigations: field and analytical methods. Instream Flow Information Paper Number 13. U.S. Fish and Wildlife Service Biological Report 89 (17), Washington D.C.

Barrett, J.W., and L.F. Roth. 1985. Response of dwarf mistletoe-infested ponderosa pine to thinning: 1. Sampling growth. Research Paper PNW-330. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. 15 p.

Beatty, Jerome S. and Robert L. Mathiasen. 2003. Forest Insect and Disease Leaflet 40, Dwarf Mistletoes of Ponderosa Pine. U.S. Department of Agriculture, Forest Service, R6-NR-FID-PR-01-03, 9 p.

Beaty, K.G. 1994. Sediment transport in a small stream following two successive forest fires. Canadian Journal of Fisheries and Aquatic Sciences. 51:2723-2733.

Bêche, L.A.; Stephens, S.L.; Resh, V.H. 2005. Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone. Forest Ecology and Management. 218: 37-59.

Beechie, T. J. and T. H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126:217-229.

Belt, G.H., J. O'Laughlin, and T. Merrill. 1992. Design of forest riparian buffer strips for the protection of water quality: Analysis of scientific literature. Idaho Forest, Wildlife and Range Policy Analysis Group. Report No. 8. University of Idaho. Moscow, ID.

Benda, L.E., Bigelow, P., and T.M. Worsley. 2002. Recruitment of wood to streams in old-growth and second-growth redwood forests, northern California, USA. Canadian Journal of Forest Research. 32: 1460-1477.

Benda, L. and six others. 2003. Wood recruitment processes and wood budgeting. Pages 49 –74 *in* S. Gregory, K. Boyer, and A. Gurnell editors. The ecology and management of wood in world rivers. American Fisheries Society, Symposium 37, Bethesda, Maryland.

Beschta, R.L.; Bilby, R.E.; Brown, G.W.; Holtby, L.B.; Hofstra, T.D. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. College of Forest Resources. Univ. of Washington. Seattle, WA.

Bigelow, S.W., North, M.P. 2012. Microclimate effects of fuels-reduction and group-selection silviculture: Implications for fire behavior in Sierran mixed-conifer forests. Forest Ecology and Management 264(0): 51-59.

Bilby, R. E. and P. A. Bisson. 2001. Function and distribution of large woody debris. Pages 324-346 *in* R. J. Naiman and R. E. Bilby editors. River ecology and management lessons from the pacific coastal ecoregion. Springer, New York.

Bilby, R. E. and J. W. Ward. 1989. Changes in characteristics and function of woody debris with increasing size of streams in western Washington. Transactions of the American Fisheries Society 118:368-378.

Bisson, P.A.; Bilby, R.E.; Bryant, M.D.; Dolloff, C.A.; Grette, G.B.; House, R.A.; Murphy, M.L.; Koski, K.V.; Sedell, J.R. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. College of Forest Resources. Univ. of Washington. Seattle, WA.

Bolsinger, C.L.1978. The extent of dwarf mistletoe in six principal softwoods in California, Oregon, and Washington, as determined from forest survey records. In: Scharpf, R.F.; Parmeter, J.R. Jr.,eds. Proceedings of a symposium on dwarf mistletoe control through forest management. Gen. Tech. Rep. PSW-GTR-31. Berkley, CA: USDA, Forest Service, Pacific Southwest Forest and Range Experiment Station: 45-54.

Bork, J.L. 1984. Fire history in three vegetation types on the eastern side of the Oregon Cascades, Ph D. Thesis. Oregon State University.

Bower, A. Conversation Record with Western Washington Area Geneticist,R6 Whitebark Pine (WBP) Restoration Program project lead, Olympic National Forest, 1835 Black Lake Blvd. SW Olympia, WA 98512. abower@fs.fed.us, July 25, 2014, Project Record, Sisters Ranger District.

Brown, J.K. 1995. Fire regimes and their relevance to ecosystem management. In: Proceedings of Society of American Foresters National Convention, Sept. 18-22, 1994, Anchorage, AK. Society of American Foresters, Wash. D.C. Pages 171-178.

Brown, R.T., Agee, J.K., Franklin, J.F. 2004. Forest Restoration and Fire: Principles in the Context of Place. Conservation Biology Volume 18, Issue 4, Pages 903-912.

Bull, E.L., R.S. Holthausen, and M.G. Henjum. 1990. Techniques for monitoring pileated woodpeckers. Gen. Tech. Rep. PNW-GTR-269. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 13pp.

Bull, E.L. and M.G. Henjum. 1990. Ecology of the Great Gray Owl IN USDA Forest Service. Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment. General Technical Report RM-253. Rocky Mountain Forest and Range Experiment Station.

Bull, E.L. and R.S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. Journal of Wildlife Management 57(2):335-345.

Bull, E.L., Parks, C.G., and Torgersen, T.R. 1997. Trees and logs important to wildlife in the interior Columbia River basin. Gen. Tech. Report PNW-GTR-391. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55pp.

Busse, M.D; K.R. Hubbert; E.Y. Moghaddas 2014. Fuel reduction practices and their effects on soil quality. Gen. Tech. Rep. PSW-GTR-241 Albany, CA U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 156p.

Camp, A.E. 1999. Age Structure and Species Composition Changes Resulting from Altered Disturbance Regimes on the Eastern Slopes of the Cascade Range, Washington. Journal of Sustainable Forestry, Vol.9(3/4).

Campbell, Sally; Liegel, Leon, tech. cords. 1996. Disturbance and forest health in Oregon and Washington. Gen. Tech. Rep. PNW-GTR-381. Portland, OR: U.S. Department Agriculture, Forest Service, Pacific Northwest Research Station, Pacific Northwest Region; Oregon Department of Forestry; Washington Department of Natural Resources. 105 p.

Clark, Roger N., and George H. Stankey, 1979. Determining the acceptability of recreation impacts: An application of the Outdoor Recreation Opportunity Spectrum. In Proceedings of the Wildland Recreation Impacts Conference, October 27-29, 1978, Seattle, Wash. Ruth Ittner, Dale R. Potter, and James K. Agee, eds. USDA For. Serv. and Natl. Park Serv., Pac. Northwest Reg.

Clayton, J.L., Kellogg, G., Forrester, N. 1987. Soil disturbance-tree growth relations in central Idaho clearcuts. Res. Note INT-372. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.

Cochran, P.H., J.M. Geist, D.L. Clemens, Rodrick R. Clausnitzer and David C. Powell. 1994. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington. USDA Forest Service, Pacific Northwest Region. Research Note PNW-RN-513. 21pp.

Cohen, J. no date. Wildland Urban Fire – A Differnt Approach. RMRS, Missoula, MT. Available online at:
http://www.firewise.org/~/media/Firewise/Files/Pdfs/Research/CohenWildlandUrbanFireApproach.pdf

Cohen J. 2000. Preventing disaster home ignitability in the wildland urban interface. Journal of Forestry. Vol 98(3). pp. 15-21.

Conklin, D.A. 2000. Dwarf mistletoe management and forest health in the southwest. USDA Forest Service, Southwestern Region. 30 p.

Conklin, D.A. and B.D. Geils. 2008. Survival and sanitation of dwarf mistletoe-infected ponderosa pine following prescribed underburning. Western Journal of Applied Forestery 23(4):216-222.

Covington, W.W., P.Z. Fule, M.M. Moore, S.C. Hart, T.E. Kolb, J.N. Mast, S.S. Sackett, M.R. Wagner. 1997. Restoring Ecosystem Health in Ponderosa Pine Forests of the Southwest. Journal of Forestry, Volume 95, Number 4, pp. 23-29.

Craigg, T.L., 2000. Subsoiling to restore compacted soils. In: Proceedings, " Twenty-first Annual Forest Vegetation Management Conference", January, 2000; Redding, CA. Forest Vegetation Management Conference, Redding, CA.

Craigg, T.L., and S.W. Howes. 2007. Assessing quality in volcanic ash soils. In Volcanic-Ash-Derived Forest Soils of the Inland Northwest: Properties and Implications for Management and Restoration. 9-10 November 2005; Coeur d'Alene, ID. Proceedings RMRS-P-44; Fort Collins, CO; U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 220p.

Craigg, T. 2009. Water Utilization and Site Productivity of East Side Forests. Unpublished report. Oregon State University Term Paper.

Csuti, B.A., A.J. Kimerling, T.A. O'Neil, M.M. Shaughnessy, E.P. Gaines, and M.M. Huso. 1997. Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History. Oregon State University Press, Corvallis, OR. 492 pp.

Dachtler, N. 1997. Squaw Creek level II stream survey summary. USDA Forest Service. Deschutes National Forest. Sisters Ranger District. Sisters, OR.

Dachtler, N. 2005. Draft Resource Assessment for Squaw Creek Wild and Scenic River – Fisheries Resource. Sisters Ranger District, Deschutes National Forest.

Dachtler, N. 2001a. Pole Creek level II stream inventory. Sisters Ranger District, Sisters, Oregon.

Dachtler, N. 2001b. Trout Creek level II stream inventory. Sisters Ranger District, Sisters, Oregon.

Dahms, W.G. 1949. How long do ponderosa pine snags stand? Research Notes, No. 57. Pacific Northwest Forest and Range Experiment Station. Deschutes Branch.

Daniels, R. B. and J. W. Gilliam. 1996. Sediment and chemical load reduction by grass and riparian filters. Soil Science Society of America Journal, 60:246-251.

De Groot, J.D., S.G. Hinch, J.S. Richardson. 2007. Effects of Logging Second-Growth Forests on Headwater Populations of Coastal Cutthroat Trout: A 6-Year, Multistream, Before-and-After Field Experiment. Transactions of the American Fisheries Society 136:211–226.

DeRose, R.J., J.N. Long. 2014. Resistance and Resilience: A Conceptual Framework for Silviculture. Forest Science 60(6):1205–1212 http://dx.doi.org/10.5849/forsci.13-507

Deschutes Land Trust. 2014. http://www.deschuteslandtrust.org/ [Accessed August 25, 2014]

Dixon, R.D. 1995. Density, nest-site and roost-site characteristics, home range, habitat use, and behavior of white-headed woodpeckers: Deschutes and Winema National Forests, Oregon. Non-game Project #93-3-01, Oregon Department of Fish and Wildlife.

Dodson, E.K., Peterson, D.W., Harrod, R.J. 2008. Understory vegetation response to thinning and burning restoration treatments in dry conifer forests of the eastern Cascades, USA. Forest Ecology and Management. Vol. 255, Issues 8-9.

Douglass, J.E.; Van Lear, D.E. 1983. Prescribed burning and water quality of ephemeral streams in the piedmont of South Carolina. Forest Science. 29:181-189.

Dudley, T. and N. H. Anderson. 1982. A survey of invertebrates associated with wood debris in aquatic habitats. Melanderia 39: 1-12.

Edmonds, R.L., J.K. Agee, and R.I. Gara. 2000. Forest health and protection. McGraw-Hill. New York.

Eglitis, A. 2014. Conversation Record with Deschutes/Ochoco Forest Entomologist. E-mail (8/4/2014), Project Record, Sisters Ranger District.

Eglitis, A., Maffei, H., Oblinger, B. 2015. Melvin Butte Project – Insect and Disease Specialist Report. Forest Health Protection. 8 pp.

Elliott, K.J., R.L.; Hendrick, A.E. Major, J.M.Vose, and W.T. Swank. 1999. Vegetation dynamics after a prescribed fire in the southern Appalachians. Forest Ecology and Management. 114:199-213.

Evans, A., Everett, R., Stephens, S., Youtz, J. 2011. Comprehensive fuels treatment practices guide for mixed conifer forests: California, central and southern Rockies, and the southwest. The Forest Guild and USDA Forest Service.

Everett, R., J. Lehmkuhl, R. Schellhaas, P. Ohlson, D. Keenum, H. Riesterer, and D. Spurbeck. 1999. Snag dynamics in a chronosequence of 26 wildfires on the east slope of the Cascade Range in Washington state, USA. International Journal of Wildland Fire 9(4): 223-234.

Everett, R.L., Schellhaas, R., Keenum, D. 2000. Fire history in the ponderosa pine/Douglas-fir forests on the east slope of the Washington Cascades. Forest Ecology and Management 129. pp. 207-225.

Fager, C.W. 1991. Harvest dynamics and winter habitat use of the pine marten in southwestern Montana. Bozeman, MT: Montana State University. M.S. thesis. 73 pp.

Fausch, K. D. and T. G. Northcote. 1992. Large woody debris and salmonid habitat in a small coastal British Columbia stream. Canadian Journal of Fish and Aquatic Science 49: 682-693.

Fettig, C.J., K.D. Klepzig, R.F. Billings, A.S. Munson, T.E. Nebeker, J.F. Negron, et al. 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. For. Ecol. Management 238: 24-53.

Fettig, C.J., K.E. Gibson, A.S. Munson, and J.F. Negron. 2014. Cultural Practices for Prevention and Mitigation of Mountain Pine Beetle Infestations. For. Sci. 60(3):450-463.

Fies, T., M. Manion, B. Lewis, and S. Marx. 1996. Upper Deschutes River Sub-basin Fish Management Plan. Oregon Department of Fish and Wildlife. Upper Deschutes Fish District. Bend, OR.

Finney, M.A., et al. 2005. The challenge of quantifying risk analysis for wildland fire. Forest Ecology and Management 211, 97-108.

Finney, M.A. 2006. An overview of FlamMap modeling capabilities. In: Fuels Management-How to Measure Success: Conference Proceedings. 28-30 March 2006; Portland, OR. Proceedings RMRS-P-41. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Fitzgerald, Stephen A. 2002. Personal Communication. Restoration thinning: response of old-growth trees to stand density manipulation. Oregon State University Extension Program.

Fitzgerald, Stephen A., W.H. Emmingham, G.M. Filip and P.T. Oester. 2000. Exploring methods for maintaining old-growth structure in forests with a frequent-fire history: a case study. In: Fire and Forest ecology: Innovative silviculture and Vegetation management, Tall Timbers Fire Ecology Conference Proceedings, No. 21, W.K. Moser, eds. Tall Timbers Research Station, Tallahassee FL. Pages 199-206.

Forristal, C. and V. Saab (unpublished data). White-headed Woodpeckers Monitoring from the Toolbox Fire Salvage. Data was acquired from Kim Mellen, USDA Forest Service, Region Six.

Forsman, E.D. and T. Bryan. 1984. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. Murrelet 68:45-49.

Franklin, J.F. and Johnson, K.N. 2012. A restoration Framework for federal forests in the Pacific Northwest. Journal of Forestry 110: 429-439.

Franklin, J.F., Johnson, K.N., Churchill, D., Hagmann, K., Johnson, D., Johnston, J. 2013. Restoration of dry forests in eastern Oregon: a field guide. Portland, OR: The Nature Conservancy. 202 p.

Frenzel, R.W. 2000. Nest-sites, nesting success, and turnover rates of white-headed woodpeckers on the Deschutes and Winema National Forests, Oregon in 2000. 63 pp.

Frenzel, R.W. 2002. Nest-sites, nesting success, and turnover rates of white-headed woodpeckers on the Deschutes and Winema National Forests, Oregon in 2002. 56 pp.

Frenzel, R.W. 2003. Nest-sites, nesting success, and turnover rates of white-headed woodpeckers on the Deschutes and Winema National Forests, Oregon in 2003. 49 pp.

Frenzel 2004 – White-headed Woodpecker Data specific to Deschutes – Sisters RD. Data was acquired from Kim Mellen, USDA Forest Service, Region Six..

Froehlich, H.A. 1976. The influence of different thinning systems on damage to soil and trees. Proceedings, XVI IUFRO World Congress Division IV, UUFRO Norway. pp. 333-344.

Fry, Danny L and Scott L. Stephens. 2006. Influence of humans and climate on the fire history of a ponderosa pine-mixed conifer forest in the southeastern Klamath Mountains, Califormia. Forest Ecology and Management 223: 428-438.

Gent, J.A., R. Ballard, A.E. Hassan, D.K. Cassel, 1984. Impact of harvesting and site preparation on physical properties of Piedmont forest soils. Soil Sci. Soc. Am. J. 48:173-177.

Gerke, D. and Stewart, S. 2006. Strategic Placement of Treatments (SPOTS): Maximizing the Effectiveness of Fuel and Vegetation Treatments on Problem Fire Behavior and Effects. USDA Forest Service Proceedings RMRS-P-41.

Giffin, J. 2011. DRAFT - Three Creeks flooding of the Plainview area. Oregon Department of Water Resources. Bend, OR.

Gill, L.S. and F.G. Hawksworth. 1954. Dwarf mistletoe control in southwestern ponderosa pine forests under management. Journal of Forestry. 52(5): 347-353.

Goggans, R., R.D. Dixon, and L.C. Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife, Nongame Wildlife Program, Tech. Rep. #87-3-02. 43pp.

Goggans, R. and M. Platt. 1992. Breeding season observations of great gray owls on the Willamette National Forest, Oregon. Oregon Birds 18:35-41.

Gottfried, G.J. and L.F. DeBano. 1990. Streamflow and water quality response to preharvest prescribed burning in and undisturbed ponderosa pine watershed. *In:* Krammes, J.S. [Ed.]. Effects of fire management on southwestern natural resources. RMRS-GTR-191. Fort Collins, CO. USDA Forest Service. Rocky Mountain Research Station: 222-231.

Graham, Russell T., Alan E. Harvey, Theresa B. Jain and Jonalea R. Tonn. 1999. The effects of thinning and similar stand treatments on fire behavior in Western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.

Gresswell R.E. 1999. Fire and Aquatic Ecosystems in Forested Biomes of North America Transactions of the American Fisheries Society. 128:193–221.

Geist, M.J., J.W. Hazard, and K.W. Seidel. 1989. Assessing physical conditions of pacific northwest volcanic ash soils after forest harvest. Soil Sci. Soc. Am. J. 53:946-950.

Groom, J. D., L. Dent, L. J. Madsen and J. Fleuret. 2011. Response of Western Oregon (USA) stream temperatures to contemporary forest management. Forest Ecology and Management. 262 (1618-1629).

Hagmann, Keala R., Jerry F. Franklin and K. Norman Johnson. 2013. Historical structure and composition of ponderosa pine and mixed-conifer forests in south-central Oregon. Forest Ecology and Management 304: 492-504.

Hagmann, Keala R., Jerry F. Franklin and K. Norman Johnson. 2014. Historical conditions in mixed-conifer forests on the eastern slopes of the northern Oregon Cascade Range, USA. Forest Ecology and Management 330: 158-170.

Hall, Fredrick C. 1998. Pacific Northwest ecoclass codes for seral and potential natural communities. USDA Forest Service, PNW Res. Sta., Gen. Tech. Report PNW-GTR-418. 290 p.

Hall, J. D. and R. L. Lantz. 1969. Effects of logging on the habitat of coho salmon cutthroat trout in coastal streams. Pages 355- 375 *in* T. G. Northcote editor. Symposium on salmon and trout in streams. H. R. Macmillan Lectures in Fisheries, University of British Columbia, Vancouver.

Hann, W.J. and D.L. Bunnell. 2001. Fire and land management planning and implementation across multiple scales. International Journal of Wildland Fire. Vol. 10, pp 389-403.

Hardy, C.C. 2005. Wildland fire hazard and risk: Problems, definitions, and context. Forest Ecology and Management. pp. 1-10.

Hawksworth, F.G. 1965b. Life Tables for two species of dwarf mistletoe. I. Seed dispersal, interception, and movement. Forest Science. 11: 142-151.

Hawksworth, F.G. 1977. The 6-class dwarf mistletoe rating system. General Technical Report RM-48. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO, RM-48, 7 p.

Hawksworth, F.G. 1978. Biological factors of dwarf mistletoe in relation to control. In: Scharpf, R.F.; Parmeter, J.R., Jr., tech. cords. Proceedings, Symposium on dwarf mistletoe control through forest management; 1978 April 11-13; Berkeley, CA. General Technical Report PSW-31. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 5-15

Hawksworth, F.G., and B.G. Geils. 1990. How long do mistletoe-infected ponderosa pines live? Western Journal of Applied Forestry 5 (2): 47-48.

Hawksworth, F.G., and D. Wiens. 1996. Dwarf Mistletoes: Biology, Pathology and Systematics. USDA Forest Service, Agriculture Handbook 70,. 410 p.

Heard, A.M. 2005. Effects of landscape scale prescribed fire on hydrology and stream chemistry. M.S. Thesis. Colorado State University. Fort Collins, CO. 146 p.

Helms, John A. 1998. The Dictionary of Forestry. Society of American Foresters. Bethesda, MD. 210 p.

Hessburg, P., Agee J. 2003. An environmental narrative of inland Northwest US forests, 1800-2000. Forest Ecology and Management. 178. pp. 23-59.

Hessburg, Paul F.; Mithcell, Russell G.; Filip, Gregory M. 1994. Historical and current roles of insects and pathogens in eastern Oregon and Washington Forested Landscapes. Gen. Tech. Rep. PNW-GTR-327. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 72 p.

Hessburg, Paul F., James K. Agee and Jerry F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management 211:117-139.

Hessburg, Paul F., R. Brion Salter and Kevin M. James. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecol pp. 22:5-24.

Hessburg, Paul F., Nicholas A. Povak and R. Brion Salter. 2008. Thinning and prescribed fire effects on dwarf mistletoe severity in an eastern Cascade Range dry forest, Washington. Forest Ecology and Management 255:2907-2915.

Heyerdahl et al., 2012. Fire and Forest Histories from Tree Rings in Central Oregon. DRAFT General Technical Report.

Hicks B.J., J. D. Hall, P. A. Bisson, and J. R. Sedell. 1991. Responses of Salmonids to Habitat Changes. Chapter 14. *In:* Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society. Bethesda, MD.

Hillis, M.., V. Applegate, S. Slaughter, M.G. Harrington and H. Smith. 2001. Simulating historical disturbance regimes and stand structures in old-growth ponderosa pine/Douglas-fir forests. In: S.J. Barras, ed. 2001. Proceedings: National Silviculture Workshop, Oct. 5-7, 1999, Kalispell, MT. Proc. RMRS-P-00. Ogden, Utah: USDA Forest Service, Rocky Mountain Research Station.

Hopkins, William J., S. Simon, M. Schafer and T. Lillybridge. 1992. Region 6 Interim Old Growth Definition for Ponderosa Pine Series. USDA Forest Service, Pacific Northwest Region. 12 pp.

Hopkins, William J. 1997. Area IV Ecologist. USDA Forest Service, Pacific Northwest Region. Bend, Oregon. Personal Communication.

Houslet B. S. and M. D. Riehle. 1998. Trends in fine sediment in bull trout spawning and rearing streams of the Metolius River Basin, Oregon, from 1988-1997. Deschutes National Forest. Sisters Ranger District. Sisters, OR.

Hudec, J.L., Peterson, D.L. 2012. Fuels variability following wildfire in forests with mixed severity fire regimes, Cascade Range, USA. Forest Ecology and Management 277 (2012) 11-24.

Interagency Special Status/Sensitive Species Program (ISSSSP) webpage at http://www.fs.fed.us/r6/sfpnw/issssp/planning-tools/#fungi

Issacs, F. B. and R. R. Opp. 1991. Distribution and productivity of Golden Eagles in Oregon, 1965-1982. Oregon Birds 17: 40-42.

Jackman, S.M. and J.M. Scott. 1975. Literature Review of Twenty-three Selected Forest Birds of the Pacific Northwest. USDA Forest Service, Region 6. 382 pp.

Jenny H. 1941. Factors of soil formation: A system of quantitative pedology. Dover Publications, Inc. New York. 281 p.

Kauffman, J.B. et.al. 2004. Plant biomass and species composition along an environmental gradient in montane riparian meadows. Oecologya 2004 Apr 26;139(2):309-17.

Kayes, Lori J. and Daniel B. Tinker. 2012. Forest structure and regeneration following a mountain pine beetle epidemic in southeastern Wyoming. Forest Ecology and Management 263:57-66.

Keane, Robert E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (Pinus albicaulis). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.

Keen, F.P. 1929. How soon do yellow pine snags fall? Journal of Forestry 27:735-737.

Keen, F.P. 1943. Ponderosa pine tree classes redefined. Journal of Forestry 41:249-253.

Keyser, Chad E., comp. 2008 (revised November 17, 2014). South Central Oregon and Northeast California (SO) Variant Overview – Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 92p.

Kovalchik, Bernard L. 1987. Riparian Zone Associations: Deschutes, Ochoco, Fremont, and Winema National Forests. USDA Forest Service, Pacific Northwest Region, R6 ECOL TP-279-87. 171 p.

Kunz, T.H. and R.A. Martin. 1982. *Plecotus townsedii*. Mammallian Species No. 175. The American Society of Mammalogists. [Online version available at http://www.science.smith.edu/ departments/Biology/VHAYSSEN/msi/pdf/i0076-3519-174-01-0001.pdf]

Larson, A., Churchill, D. 2012. Tree spatial patterns in fire-frequent forests of western North America, including mechanisms of pattern formation and implications for designing fuel reduction and restoration treatments. Forest Ecology Management. 267: 74-92.

Larsen, D.M. 1976. Soil Resource Inventory – Deschutes National Forest. Supervisor's Office. Bend, OR.

Latham, P. and J. Tappeiner. 2002. Response of old-growth conifers to reduction in stand density in western Oregon forests. Tree Physiology 22, 137-146.

Laudenslayer, W.F. 2002. Cavity-nesting bird use of snags in eastside pine forests of northeastern California. Pacific Southwest Research Station, Fresno, California. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181.

Littel, Jeremy S. [and others]. 2010. Forest ecosystems, disturbance, and climatic change in Washington State, USA. DOI 10.1007/s10584-010-9858-x.

Litton, S. 2006. Physical characteristics of forest soils after timber harvest and tillage in Central Oregon: A case study. Masters of Forestry Thesis Report, Department of Forest Engineering, Oregon State University, Corvallis Oregon 64p.

Litschert, S.E. and L.H. MacDonald. 2009. Frequency and Characteristics of Sediment Delivery Pathways from Forest Harvest Units to Streams. Forest Ecology and Management. 259 (143-150).

Loomis, J. 2010. Fire Behavior Narrative, Rooster Rock OR-DEF-476, Fire Behavior Analyst. August 2010.

Lovtang J. and M.D. Riehle. 2000. Squaw Creek education and restoration project 1998-1999. Deschutes National Forest. Sisters, OR.

Lutes, D., Keane, R., Caratti, J. 2009 A surface fuel classification for estimating fire effects. International Journal of Wildland Fire. Vol. 18: 802-814.

Maffei, H.M. and F. Jacobi WR. 1986. Growth and mortality effects of dwarf mistletoe on uneven-aged Ponderosa pine stands in Colorado. Phytopathology 76:1113-1113.

Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, OR. 768 pp.

Maxwell, W.G., Ward, F.R. 1980. Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest. Pacific Northwest Forest and Range Experiment Station. USDA Forest Service General Technical Report PNW-105.

McCallum, D.A. and F.R. Gehlbach. 1988. Nest-site preferences of flammulated owls in western New Mexico. Condor 90:653-661.

McDowell, N., Brooks, J. R., Fitzgerald, S. A. and Bond, B. J., 2003. Carbon isotope discrimination and growth response of old Pinus ponderosa trees to stand density reductions. Plant, Cell & Environment, 26: 631–644. doi: 10.1046/j.1365-3040.2003.00999.x

Mellen, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2006. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.0. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf

Merschel, A.G., Spies, T.A., Heyerdahl, E.K., 2014. Mixed-conifer forests of central Oregon: effects of logging and fire exclusion vary with environment. Ecological Applications. http://dx.doi.org/10.1890/13-1585.1.

Merschel, A.G., Spies, T.A., Heyerdahl, E.K. 2014. Mixed-conifer forests of central Oregon: effects of logging and fire exclusion vary with environment. Ecological Society of America. Ecological Applications, 24(7). pp. 1670-1688.

Miller, J..H., D.L. Sirois. 1986. Soil disturbance by skyline yarding vs. skidding in a loamy hill forest. Soil Science Society of America Journal 50:1579-1583.

Miller, J.M. and F.P. Keen. 1960. Biology and Control of the Western Pine Beetle. U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 381 p.

Minshall, G. W. 1978. Autotrophy in stream ecosystems. Bioscience 28: 767-771.

Moldenke, A., M. Pajutee, E. Ingham, 2000. The functional roles of forest soil anthropods: The soil is a lively place. USDA Forest Srvice Gen. Tech Rep. PSW-GTR-178

Moore, K.R. and C.J. Henny. 1983. Nest site characteristics of three coexisting accipiter hawks in northeastern Oregon. Raptor Research 17(3):65-76.

Mount A. & CM Pickering , 2009. Testing the capacity of clothing to act as a vector for non-native seed in protected areas, Journal of Environmental Management, Volume 91, Issue 1, October 2009, Pages 168-179, ISSN 0301-4797, 10.1016/j.jenvman.2009.08.002. (http://www.sciencedirect.com/science/article/pii/S0301479709002631)

National Cohesive Wildland Fire Management Strategy, April 2014. Available online: http://www.forestsandrangelands.gov/strategy [Accessed August 16, 2014].

National Fire Plan, Managing the Impacts of Wildfires on Communities and the Environment, September 8, 2000. http://www.forestsandrangelands.gov/resources/reports/documents/2001/8-20-en.pdf. [Accesses May 10th, 2014].

National Fuel Moisture Database (NFMD) 2014. http://www.wfas.net/nfmd/public/index.php [Accessed August 22, 2014]

National Wildfire Coordination Group (NWCG). October 2014. Glossary of Wildland Fire Terminology. PMS 205. Boise, ID: U.S. Department of Agriculture, U.S. Department of Interior. pp. 75 & 77.

National Wildfire Coordination Group (NWCG). April 2014. Interagency Prescribed Fire Planning and Implementation Procedures Guide. NFES 484. Boise, ID: U.S. Department of Agriculture, U.S.Department of Interior.

National Wildfire Coordination Group (NWCG). 2001. Smoke Management Guide for Prescribed and Wild land Fire 2001 Edition. NFES 1279. Boise, ID: U.S. Department of Agriculture, U.S. Department of Interior, National Association of State Foresters. p. 226.

NatureServe. 2007. Nature Serve Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 22, 2008).

Negron, Jose F. and John B. Popp. 2004. Probability of ponderosa pine infestation by mountain pine beetle in the Colorado Front Range. Forest Ecology and Management 191:17-27.

Nehlsen, W. 1995. Historical salmon and steelhead runs of the upper Deschutes River and their environments. Portland General Electric Consultant Document.

Noonan-Wright, E., Opperman, T., Finney, M., Zimmerman, T., Seli, R., Elenz, L., Calkin, D., Fielder, J. 2011. Developing the US Wildland Fire Support System. Journal of Combustion. Vol. 2011. pp. 14.

OAR 340 200. Oregon Administrative Rules, Department of Environmental Quality, Division 200. General Air Pollution Procedures and Definitions. Available at: http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_200.html [Accessed August 22, 2014]

OAR 340 200-0040. Oregon Administrative Rules. Visibility Protection Plan for Class 1 Areas. Available at: http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_200.html [Accessed August 22, 2014].

OAR 629 048. Oregon Administrative Rules. Department of Forestry. Division 48. Smoke Management. Available at: http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_629/629_048.html [Accessed August 22, 2014]

Oliver, C.D., and B.C. Larson. 1996. Forest Stand Dynamics. John Wiley and Sons, Inc. New York. 520 pp.

Oregon Department of Environmental Quality [ODEQ]. 2011. Oregon Administrative Rules, Water Pollution, Division 41, Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_041.html

Oregon Department of Environmental Quality and U.S. Department of Agriculture, Forest Service [ODEQ and USDA Forest Service]. 2014. Memorandum of Understanding between State of Oregon Environmental Quality and the USDA Forest Service, Pacific Northwest Region. OMB 0596-0217, FS-1500-15. Region 6, Portland, OR. 17 p.

ODEQ (Oregon Department of Environmental Quality). 1996. Procedural Guidance for Water Temperature Monitoring. DEQ. Portland, OR.

ODFW (Oregon Department of Fish and Wildlife). 2014. Metolius River and Tributaries Bull trout redd survey data 1996-2014. High Desert Region Bend Office. Bend, OR.

Oregon Health Authority and Oregon Department of Forestry. 2014. Impacts of the Pole Creek Wildfire on Fish, Wildlife and Aquatic Habitat, and on Public Health. Salem, OR: Oregon Health Authority.

http://www.oregon.gov/odf/docs/20140210_HB3109_ODF-OHA_ImpactsOfPoleCreekWildfire2012_Report.pdf

Oregon Revised Statutes Chapter 477. Oregon Department of Forestry. Fire Protection of Forests and Vegetation. Available at: http://www.oregonlaws.org/ors/477.013 [Accessed August 22, 2014].

Page-Dumroese, D.S. 1993. Susceptibility of volcanic ash-influenced soil in northern Idaho to mechanical compaction. Res.Note INT-409. USDA Forest Service, Intermountain Res. Stn., Ogden, UT. 5p

Parks, C.G., D.A. Conklin, L. Bednar, H. Maffei. 1999. Woodpecker use and fall rates of snags created by killing ponderosa pine infected with dwarf mistletoe. Res. Pap. PNW-RP-515. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11pp.

Pearsons, T. N., H. W. Li., and G. A. Lamberti. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assemblages. Transactions of American Fisheries Society 121:427-436.

Peterson, D.L., et al. 2007. Guide to fuel treatments in dry forests of the Western United States: assessing forest structure and fire hazard. General Technical Report PNW-GTR-686. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. p. 322.

Phelps, S.R., S. Cierebeij, B. Baker and K. Kostow. 1996. Genetic relationships and estimation of hatchery introgression 28 collections of redband trout from the Upper Deschutes River and Crooked River, Malhuer Lake Basin and Goose Lake Basin, Oregon. Washington Department of Fish and Wildlife. Olympia, WA.

Project Wildfire 2014. Greater Sisters Country Community Wildfire Protection Plan (CWPP). Sisters Camp Sherman Fire District, U.S. Department of Agriculture [USDA] Forest Service, U.S. Department of Interior [USDI] Bureau of Land Management [BLM], Deschutes County, and Oregon Department of Forestry [ODF]. May 2014.

Pollet, J., Omi, P.N. 2002. Effect of Thinning and Prescribed Burning on Wildfire Severity in Ponderosa Pine Forests. The Joint Fire Science Conference and Workshop. p. 5.

Potyondy, J.P. and T.W. Geier. 2010. Forest Service Watershed Condition Classification Technical Guide. Washington Office.

Powers R.F.,P.E. Avers 1995. Sustaining forest productivity through soil quality standards: A coordinated U.S. effort. P. 147-190. In C.B. Powter et al. (de.) Environmental soil science: Anthropogenic chemicals and sol quality criteria. Canadian Soc. Soil Sci., Brandon, Manitoba.

Powers, R.F., T.M. Alves, T.H. Spear. 1999. Soil Compaction: Can it be mitigated? Reporting a work in progress. In: "Healthy Forests for the 21st Century. New Technologies in Integrated Vegetation Management. Proceedings, Twentieth Annual Forest Vegetation Management Conference, January 19-21, 1999; Redding, CA. Forest Vegetation Management Conference, Redding, CA.

Prichard, S.J., D. L. Peterson, and K. Jacobson. 2010. Fuel treatments reduce the severity of wildfire effects in dry mixed conifer forest, Washington, USA. Can. Jor. For. Res. 40: 1615–1626

Raffa, K.F., Aukema, B.H., Bentz, B.J., Carroll, A.L., Hicke, J.A., Turner, M.G., Romme, W.H. 2008. Cross-scale drivers of natural disturbances prone to anthropogenic amplifications: the dynamics of bark beetle eruptions. BioScience 58: 501-517.

Ralph, S.C., G.C. Posle, L.L. Conquest, and R.L. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. Can. Jor**.** Fish. Aquat. Sci. 51 : 37-51.

Ramond, C. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, University of Washington.

Raphael M.G. and L.L.C. Jones. 1997. Characteristics of resting and denning sites of American martens in central Oregon and western Washington. Pp 146-165 In: *Martes*: taxonomy, ecology, techniques, and management. G.Proulx, H.N. Bryant, and P.M. Woodard, editors. 1997. Provincial Museum of Alberta, Edmonton, Alberta, Canada.

Rashin, E. B., C. J. Clishe, A. T. Loch, and J. M. Bell. 2006. Effectiveness of Timber Harvest Practices for Controlling Sediment Related Water Quality Impacts. Journal of the American Water Resources Association (JAWRA) 42(5):1307-1327.

Regelbrugge, J.C., Conrad, S.G. 1993. Modeling Tree Mortality Following Wildfire in Pinus Ponderosa Forests in the Central Sierra Nevada of California. International Journal of Wildland Fire. 3(3). pp. 139-148.

Reiser, D.W. and R. G. White. 1988. Effects of Two Sediment Size-Classes on Survival of Steelhead and Chinook Salmon Eggs. North American Journal of Fisheries Management 8:432-437.

Reeves, G. H., J. E. Williams, K. M. Burnett, and K. Gallo. 2006. The aquatic conservation strategy of the Northwest Forest Plan. Conservation Biology, 20(2): 319-329.

Reynolds, R.T. 1975. Distribution, density, and productivity of three species of Accipiter hawks in Oregon. M.S. Thesis. Oregon State University, Corvallis, OR.

Reynolds, R.T., R.T. Graham, M. Hildegard Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1991. Management Recommendations for the Northern Goshawk in the Southwestern United States. USDA Forest Service, Southwestern Region. 182 pp.

Robichaud P. R., L.H. MacDonald and R. B. Foltz. 2010. Fuel Management and Erosion. Chapter 5. *In:* Cumulative Watershed Effects of Fuel Management in the Western United States. Rocky Mountain Research Station. USDA Forest Service RMRS-GTR-23.

Robichaud, P.R. 2000. Fire effects on infiltration rates after prescribed fire in northern Rocky Mountain forests, USA. Journal of Hydrology. 231-232(1-4): 220-229.

Rose, C.L., B.G. Marcot, T.K. Mellen, J.L. Ohmann, K.L. Waddell, D.L. Lindley, and B. Schreiber. 2001. Decaying wood in Pacific Northwest forests: concepts and tools for habitat management. Pp. 580-623 IN: D.H. Johnson and T.A. O'Neil, ed. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis OR. http://www.nwhi.org/nhi/whrow/chapter24cwb.pdf

Roth, L.F., and J.W. Barrett. 1985. Response of dwarf mistletoe-infected ponderosa pine to thinning: 2. Dwarf mistletoe propagation. Research Paper PNW-331. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. 20 p.

Rothermel, R. 1972. A mathematical model for predicting fire spread in wildland fuels. Res. Pap. INT-115. Ogden, UT: U.S. Department of Agriculture. January.

Rothermel, R.C. 1991. Predicting fire behavior and size of crown fires in the northern Rocky Mountains. Res. Pap. INT-438. Ogden, UT: U.S. Department of Agriculture. January.

Ruggerio, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech eds. 1994. The Scientific Basis for Conserving Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States. Gen. Tech. Rep. RM-254. Ft. Collins, CO: U.S. Dept. of Ag, Forest Service, Rocky Mountain Forest and Range Experiment Station. 184 pp.

Saab, V.A. and J. Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. Res. Pap. RMRS.RP.11. Ogden, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 17pp.

Saab, V.A., R. Brannon, J. Dudley, L. Donohoo, D. Vanderzanden, V. Johnson, and H. Lachowski. 2002. Selection of fire-created snags at two spatial scales by cavity-nesting birds. Gen. Tech. Rep. PSW-GTR-181. Pacific Southwest Research Station, USDA Forest Service. 14 pp.

Saab, V.A., J. Dudley, and W.L. Thompson. 2004. Factors influencing occupancy of nest cavities in recently burned forests. Condor 106:20-36.

Saab, V.A., R.E. Russell and J.G. Dudley. 2007. Nesting densities of cavity-nesting birds in relation to post-fire salvage logging and time since wildfire. *Condor* 109:97-108.

Sallabanks, R. 1995. Effects of wildfire on breeding bird communities in coniferous forests of Northeast Oregon. 1995 Annual Report to the Blue Mountains Natural Resources Institute. 44 pp.

Scharph, R.F. and L.F. Roth. 1992. Resistance of ponderosa pine to western dwarf mistletoe in central Oregon. Research Paper PSW-RP-208. USDA Forest Service Pacific Southwest Research Station, Albany, CA. 9 p.

Schwilk et al. 2009. The National Fire and Fire Surrogate Study: effects of fuel reduction methods on forest vegetation structure and fuels. Ecological Applications, 19(2). pp. 285-304.

Scott, J.H., Reinhardt, E.D. 2001. Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior. RMRS-RP-29. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Scott, J. and Burgan, R. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Seybold, C.A., J.E. Herrick and J.J. Brejda. 1999. Soil resilience: a fundamental component of soil quality. Soil Sci. 164(4):224-234.

Shaw, D., Hollingsworth, L., Woolley, T., Fitzgerald, S., Eglitis, A., Kurth, L. 2012. Fuel Dynamics and Potential Fire Behavior in Lodgepole Pine following Mountain Pine Beetle Epidemics in south-central Oregon. Joint Fire Science. Oregon State University. Rocky Mountain Research Station, Deschutes and Freemont-Winema National Forests.

Smith, R.B. 1985. Hemlock dwarf mistletoe biology and spread. In: Muir, J., ed. Proceedings, Workshop on management of hemlock dwarf mistletoe; 1983 August 15-16; Burnaby, BC. Pest Management Report 4. Victoria, BC; British Columbia Ministry of Forests: 4-10.

Snider, M.D., R.F. Miller. 1985. Effects of tractor logging on soils and vegetation in eastern Oregon. Soil Sci. Soc. Am. J. 49:1280-1282.

Spence, B.C., G. A. Lolimicky, R. M. Hughes and R. P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. Mantech Environmental Technology. http://www.calwater.ca.gov/Admin_Record/D-051874.pdf

Spies et al., 2010. T.A. Spies, T.W. Giesen, F.J. Swanson, J.F. Franklin, D. Lach, K.N. Johnson. Climate change adaptation strategies for federal forests of the Pacific Northwest USA: ecological policy and socio-economic perspectives. Landscape Ecology, 25 (8) (2010), pp. 1185–1199

Straw, D and M. Riehle. 1992. Snow Creek level II stream inventory. Sisters Ranger District. Sisters, Oregon.

Straw, D and M. Riehle. 1990a. Trout Creek level II stream inventory. Sisters Ranger District. Sisters, Oregon.

Straw, D and M. Riehle. 1990b. Pole Creek level II stream inventory. Sisters Ranger District. Sisters, Oregon.

Stephens, S.L., Moghaddas, J.J. 2005. Fuel treatment effects on snags and coarse woody debris in a Sierra Nevada mixed conifer forest. Forest Ecology and Management 214, 53-64.

Stephens, S.L. et. al. 2012. Effects of forest fuel reduction treatments in the United States. Scientific Journal. Bioscience 62:549-560.

Stine, P.A., Hessburg, P.F., Spies, T.A., Kramer, M.G., Fettig, C.J., Hansen, A.J., Lehmkuhl, J.F., O'Hara, K.L., Polivka, K.M., Singleton, P.H., 2014. The ecology and management of moist mixed-conifer forests in eastern Oregon and Washington, a synthesis of the relevant biophysical science and implications for future land management. Gen. Tech. Rep. PNW-GTR-897. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 254 p

Stratton, R. 2004. Assessing the effectiveness of landscape fuel treatments on fire growth and behavior. Journal of Forestry. Oct/Nov.

Stratton, R. 2009. Guidebook on LANDFIRE Fuels Data Acquisition, Critique, Modification, Maintenance, and Model Calibration. RMRS-GTR-220. February.

Stratton, R. 2014. Two Bulls Fire (June 2014) Short-term Model Calibration & West Wind Scenario. Power Point Presentation.

Swanston, D. N. 1991. Natural processes. American Fisheries Society Special Publication 19: 139-179.

Sussmann, P. 1995. Tractor mowing bitterbrush. Deschutes National Forest. Sisters Ranger District. Sisters, OR.

Tallmon, D. and L.S. Mills. 1994. Use of logs within home ranges of California red-backed voles on a remnant of forest. Journal of Mammalogy 75(1):97-101.

Tappeiner, J.C., D. Huffman, D. Marshall, T.A. Spies, and J.D. Bailey. 1997. Density, ages, and growth rates in old-growth and young-growth forest in costal Oregon. Can. J. For. Res. 27:638-648.

Thomas, J. ed. 1979. Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington. USDA Forest Service. Agriculture Handbook 553. 512 pp.

Thompson, J.R., Spies, T.A. 2009. Vegetation and weather explain variation in crown damage within large mixed-severity wildfire. Forest Ecology and Management 258, 1684-1694.

U.S. Department of Agriculture, Forest Service. 1990. Deschutes National Forest Land and Resource Management Plan (LRMP), Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 1990. Final Environmental Impact Statement, Deschutes National Forest Land and Resource Management Plan. Deschutes National Forest, Supervisors Office, Bend, OR.

U.S. Department of Agriculture, Forest Service. 1991. Forest Service Handbook (FSH) 2090.11, Ecological Classification and Inventory Handbook.

U.S. Department of Agriculture, Forest Service. 1991. Region 6 Soil Quality Standards. FSM 2509.18 Supplement No. 2500-98-1 Soil Management Manual, chapter 2, Soil Quality Monitoring. United States Department of Agriculture, Forest Service, Portland, Oregon. 12p.

U.S. Department of Agriculture, Forest Service. 1993. Determining the risk of cumulative watershed effects resulting from multiple activities. Unpublished USFS Report. Pacific Northwest Regional Office, Portland, OR. 18 p.

U.S. Department of Agriculture, Forest Service. 1994. Watershed Evaluation and analysis for Viable Ecosystems. Deschutes National Forest, Bend, Oregon. 24 p.

U.S. Department of Agriculture, Forest Service. 1994. Deschutes National Forest Wildlife Tree and Log Implementation strategy. Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 1994. Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment. General Technical Report RM-253. Rocky Mountain Forest and Range Experiment Station.

U.S. Department of Agriculture, Forest Service. 1995. unpublished data night snorkel surveys. Deschutes National Forest. Sisters Ranger District. Sisters, OR.

U.S. Department of Agriculture, Forest Service. 1995. Deschutes National Forest – A Late Successional Reserve Overview. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

U.S. Department of Agriculture, Forest Service. 1996. Status of the Interior Columbia Basin: Summary of Scientific Findings. USDA Forest Service, Pacific Northwest Research Station. USDI Bureau of Land Management. PNW-FTR-385. 144 p.

U.S. Department of Agriculture, Forest Service. 1996. Management of Ponderosa Pine Infected with Western Dwarf Mistletoe in Northeastern Oregon. USDA Forest Service, Pacific Northwest Region. BMZ-96-07.

U.S. Department of Agriculture, Forest Service. 1998. Whychus Watershed Analysis. Deschutes National Forest Sisters Ranger District. Sisters, Oregon.

U.S. Department of Agriculture, Forest Service. 2000. Forest Service Landbird Strategic Plan. Washington Office. Washington, DC.

U.S. Department of Agriculture, Forest Service. 2001. Final Supplemental Environmental Impact Statement for Amendment to the Survey and Manage Protection Buffer, and other Mitigation Measures Standards and Guidelines. U.S. Dept. of Ag, Portland, OR.

U.S. Department of Agriculture, Forest Service. 2004. Survey protocol for the great gray owl within the range of the Northwest Forest Plan. Version 3.0. Portland, Oregon. U.S. Forest Service, Bureau of Land Management, and U.S. Fish and Wildlife Service.

U.S. Department of Agriculture, Forest Service. 2005. Preventing and Managing Invasive Plants. Final Environmental Impact Statement. Pacific Northwest Region.

U.S. Department of Agriculture, Forest Service., 2005. Unpublished soil monitoring data from the Lower Jack Contract Re-offer Salvage sale. Sisters Ranger District.

U.S. Department of Agriculture, Forest Service. 2007. Whychus Creek Wild and Scenic River Resource Assessment. Sisters Ranger District. Deschutes National Forest. U.S. Forest Service. Sisters, OR.

U.S. Department of Agriculture, Forest Service. 2009. Conservation Strategy for Peck's penstemon. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

U.S. Department of Agriculture, Forest Service. 2009. Whychus Watershed Analysis Update. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

USDA Forest Service, 2010. Rooster Rock Fire Burned Area Emergency Response Hydrology Report. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

U. S. Department of Agriculture Forest Service. 2011. Deschutes National Forest 2011BMP summary report. Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 2011. Regional Foresters Sensitive Species List, Region 6 ISSSSP website, http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/.

U.S. Department of Agriculture, Forest Service. 2011. Deschutes National Forest 2011 BMP summary report. Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 2011. USDA Forest Service Watershed Condition Framework, FY2011 Transition Watershed Restoration Action Plan -Upper Whychus Creek Subwatershed. Deschutes National Forest. Sisters Ranger District, Sisters, OR. 12 p.

U.S. Department of Agriculture, Forest Service. 2012. Deschutes National Forest Management Indicator Species Habitat Assessment. Deschutes National Forest. Bend, OR.

U. S. Department of Agriculture Forest Service. 2012. BMP monitoring of ground-based harvest in glaze unit 5. Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. Volume 1: National Core BMP Technical Guide. Washington Office, Washington D.C. 164 p.

U.S. Department of Agriculture, Forest Service. 2012. Pole Creek Fire Burned Area Emergency Response Hydrology Report. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

U.S. Department of Agriculture, Forest Service. 2012. Final Environmental Impact Statement. Deschutes and Ochoco National Forests, Crooked River National Grassland Invasive Plant Treatments. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5371246.pdf .

U. S. Department of Agriculture Forest Service. 2012. National best management practices for water quality management on national forest system lands, volume 1: National core BMP technical guide. 164p.

U. S. Department of Agriculture Forest Service. 2012. BMP monitoring of ground-based harvest in glaze unit 5. Deschutes National Forest. Bend, OR.

U.S. Department of Agriculture, Forest Service. 2012. Category B Fungi Equivalent Effort Survey Protocol RIEC transmittal memo (PDF)

U.S. Department of Agriculture, Forest Service. 2012. Survey & Manage Category B Fungi Equivalent-Effort Survey Protocol, Version 1.0, February 2012. Attachment 1 - Category B Fungi Equivalent Effort Survey Protocol, Version 1 (PDF)

U.S. Department of Agriculture, Forest Service. 2012. National best management practices (BMP's) for water quality management on national forest system lands. Mechanical Vegetation Management Activities (Volume 1: National Core BMP Technical Guide 164p).

U.S. Department of Agriculture, Forest Service. 2013. Notices. Federal Register.78(177):56202–56208.

U.S. Department of Agriculture, Forest Service. 2013. Whychus Watershed Analysis Update. Deschutes National Forest Sisters Ranger District. Sisters, Oregon.

U. S. Department of Agriculture Forest Service. 2013. Water quality protection on national forests in the pacific southwest region: Best management practices evaluation program, 2008-2010. 42p.

U. S. Department of Agriculture Forest Service. 2013. Water quality protection on national forests in the pacific southwest region: Best management practices evaluation program, 2008-2010. 42p.

U.S. Department of Agriculture, Forest Service. 2013b. Whychus Watershed Analysis Update. Deschutes National Forest. Sisters Ranger District, Sisters, OR.

U.S. Department of Agriculture, Forest Service. Region 6 Interim Old Growth Definition (PDF)

U.S. Department of Agriculture, Forest Service. Soil Monitoring Reports, 1994-2001. Unpublished soil monitoring reports on file at the Deschutes National Forest Supervisor's office.

USDA Forest Service. Forest Service Manual, FS2332 – Safety Provisions on National Forests System Developed Sites

U.S. Department of Agriculture, Forest Service. Draft Whychus Late Successional Reserve Assessment Deschutes National Forest, Sisters, Oregon.

U.S. Department of Agriculture, Forest Service. Forest Service Manual 2600, Wildlife, Fish, and Sensitive Plant Habitat Management. Available online: http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsm?2600

U.S. Department of Agriculture, Forest Service. Sisters Ranger District Project Surveys and Wildlife Sightings Records.

U.S. Department of Agriculture, Forest Service. Draft Upper Deschutes and Little Deschutes Sub-basins Water Quality Restoration Plan. Deschutes National Forest, Bend, Oregon.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management [USDA Forest Service and USDI Bureau of Land Management]. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents in the range of the northern spotted owl and standards and guidelines for management of habitat for late-successional and old growth forest related species in the range of the northern spotted owl. [Place of publication unknown]. 74 p. [plus Attachment A: standards and guidelines].

U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management [USDA Forest Service and USDI Bureau of Land Management]. 1995. Notice/decision record for the interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. Washington DC.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management [USDA and USDI]. 2006. Joint Aquatic and Terrestrial Programmatic Biological Assessment for Lands within the Deschutes Basin Administered by Bureau of Land Management Prineville Office and the Deschutes and Ochoco National Forests. Deschutes National Forest. Bend, Oregon.

U.S. Fish and Wildlife Service. 2002. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia. 99 pp. [Online version available at http://migratorybirds.fws.gov/reports/bcc2002.pdf

U.S. Fish and Wildlife Service. 2004. U.S. Shorebird Conservation Plan – 2004. High Priority Shorebirds – 2004. Unpublished Report. USFWS 4401 N. Fairfax Drive, MBSP 4107, Arlington, VA, 22203 USA. 5 pp.

Vaillant, N. M., Ager, A. A., Anderson, J., and Miller, L. B. 2013. ArcFuels User Guide. Internal Report. Prineville, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Western Wildland Environmental Assessment Center.

Vannote, R. L, G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushing. 1980. The river continuum concept. Canadian Journal of the Fish and Aquatic Sciences 37:130-137.

Van Wagner, C. 1977. Conditions for the start and spread of a crown fire. Canadian Journal of Forest Research. 7: 23-24.

Volland, Leonard A. 1985. Plant Associations of the Central Oregon Pumice Zone. USDA Forest Service, Pacific Northwest Region, R6 ECOL 104-1985. 138 p.

Vose, James M.; Peterson, David L.; Patel-Weynand, Toral, eds. 2012. Effects of climatic variability and change on forest ecosystems: a comprehensive science synthesis for the U.S. forest sector. Gen. Tech. Rep. PNW-GTR-870. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 265 p.

Waltz, A., Fule, P., Covington, W., Moore, M. 2003. Diversity in Ponderosa Pine Forest Structure Following Ecological Restoration Treatments. Forest Service. 49(6). pp. 885-900.

Weatherspoon, C. 1996. Fire-silviculture relationships in Sierra forests. In: Sierra Nevada Ecosystem Project, Final Report to Congress, II: Assessments, scientific basis for management options, ed., vol. II: Assessments and scientific basis for management options. Center for Water and Wildland Resources, University of California, Davis, Water Resources Center Report No. 37. pp. 1167-1176.

Weatherspoon, C.P., Skinner, C.N., 1995. An Assessment of Factors Associated with Damage to Tree Crowns from the 1987 Wildfires in Northern California. Forest Science, Vol. 41, No.3. pp. 430-451.

Wickman, B.E. 1992. Forest health in the Blue Mountains: the influence of insect and disease. Gen. Tech. Rep. PNW-GTR-295. Portland, OR: USDA Forest Service Pacific Northwest Forest and Range Experiment Station. 15 p.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. Gen. Tech. Rep. PNW-GTR-485. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 3 Vol.

Wondzell, S. M. and J. G. King. 2003. Post fire erosional processes in the Pacific Northwest and the Rocky Mountain regions. Forest Ecology and Management 178:75-87.

Wright, C.S., Agee, J.K. 2004. Fire and Vegetation History in the Eastern Cascade Mountains, Washington. Ecological Society of America. Ecological Applications 14:443-459.

Youngblood, A., et al. 2008. Changes in fuelbed characteristics and resulting fire potential after fuel reduction treatments in dry forests of the Blue Mountains, northeastern Oregon. Forest Ecology Management.

APPENDIX A - SOILS

Alternative 2: Melvin Butte planning area estimates of detrimental soil conditions following mechanical treatments by activity areas.

Appendix A 1 Detrimental soil conditions in the Melvin Butte Project area for Alternative 2

EA Unit Number	Proposed Activity		Unit Acres	Existing Detrimental Soil Conditions		Estimated Detrimental Soil Condition after Treatment	
	Silviculture Rx	Fuels Rx		Acres	Percent of Unit	Acres	Percent of Unit
1	Prescribed Fire	None	3.0	0.1	3	0.1	3
2	Prescribed Fire	None	6.9	.2	3	.2	3
3	Prescribed Fire	None	34.9	1.0	3	1.0	3
4	Prescribed Fire	None	159.6	5.0	3	5.0	3
5	Prescribed Fire	None	4.2	.1	3	.1	3
6	Prescribed Fire	None	136.1	4.1	3	4.1	3
7	Prescribed Fire	None	12.0	0.4	3	0.4	3
8	Prescribed Fire	None	29.8	1.5	5	1.5	5
9	Prescribed Fire	None	54.6	2.7	5	2.7	5
10	Prescribed Fire	None	126.5	3.8	3	3.8	3
12	Prescribed Fire	None	22.3	.7	3	.7	3
13	Prescribed Fire	None	56.5	2.8	5	2.8	5
14	Prescribed Fire	None	111.8	3.4	3	3.4	3
15	Prescribed Fire	None	5.7	0.2	3	0.2	3
17	Prescribed Fire	None	19.5	0.6	3	0.6	3
18	Dwarf Mistletoe 1	MMPB	4.5	0.2	5	0.9	20
19	Dwarf Mistletoe 1	MMPB	8.7	0.4	5	1.7	20
20	Dwarf Mistletoe 2	MMPB	7.1	0.4	5	1.4	20
21	Dwarf Mistletoe 2	MMPB	7.6	0.4	5	1.5	20
22	Dwarf Mistletoe 2	MMPB	9.9	0.5	5	2.0	20
23	Dwarf Mistletoe 2	MMPB	35.8	1.8	5	7.1	20
24	Dwarf Mistletoe 2	MMPB	85.4	4.3	5	17.1	20
25	Thinning	MMPB	2.7	0.1	5	0.5	18
26	Thinning	MMPB	14.0	0.7	5	2.5	18
27	Thinning	MMPB	21.0	1.0	5	3.8	18
28	Thinning	MMPB	44.4	2.2	5	8.0	18
29	Thinning	MMPB	57.5	2.9	5	10.4	18
30	Thinning	MMPB	426.3	21.3	5	76.7	18
31	Thinning	MMPB	10.0	0.5	5	1.8	18
33	Thinning	MMPB	8.4	0.4	5	1.5	18
34	Thinning	MMPB	20.4	1.0	5	3.7	18
35	Thinning	MMPB	15.8	0.8	5	2.8	18
36	Thinning	MMPB	9.1	.5	5	1.6	18

37	Thinning	MMPB	112.4	5.6	5	20.2	18
38	Thinning	MMPB	183.9	9.2	5	33.1	18
39	Thinning	MMPB	103.4	5.2	5	18.6	18
40	Scenic Views Enhance	MMPB	33.4	0.7	2	6.7	20
41	Lodgepole Pine Imp	MMPB	1.8	0.1	2	.4	20
42	Lodgepole Pine Imp	MMPB	8.2	0.2	2	1.6	20
44	Lodgepole Pine Imp	MMPB	208.5	4.2	2	41.7	20
46	Thinning with Group	MMPB	7.6	0.4	5	1.5	20
47	Thinning with Group	MMPB	9.8	0.5	5	2.0	20
48	Scenic Views Enhance	MMPB	19.0	1.0	5	3.8	20
49	Thinning with Group	MMPB	15.6	.8	5	3.1	20
50	Thinning with Group	MMPB	57.6	2.9	5	11.5	20
51	Thinning with Group	MMPB	74.4	3.7	5	14.9	20
52	Thinning with Group	MMPB	156.3	7.8	5	31.3	20
53	Thinning with Group	MMPB	26.9	1.3	5	5.4	20
54	Thinning with Group	MMPB	13.2	0.7	5	2.6	20
56	Thinning with Group	MMPB	86.3	4.3	5	17.3	20
57	Thinning with Group	MMPB	392.3	19.6	5	78.5	20
58	Plantation	MMPB	0.3	0.1	8	0.1	12
59	Plantation	MMPB	1.9	0.2	8	0.2	12
62	Plantation	MMPB	4.3	0.3	8	0.5	12
63	Plantation	MMPB	5.5	0.4	8	0.7	12
64	Plantation	MMPB	7.0	0.6	8	0.8	12
65	Plantation	MMPB	7.0	0.6	8	0.8	12
66	Plantation	MMPB	8.5	0.7	8	1.0	12
67	Plantation	MMPB	9.3	0.7	8	1.1	12
68	Plantation	MMPB	9.4	0.8	8	1.1	12
69	Plantation	MMPB	1.0	0.8	8	1.2	12
70	Plantation	MMPB	14.1	1.1	8	1.7	12
71	Plantation	MMPB	15.0	1.2	8	1.8	12
72	Plantation	MMPB	15.1	1.2	8	1.8	12
73	Plantation	MMPB	16.1	1.3	8	1.9	12
74	Plantation	MMPB	16.7	1.3	8	2.0	12
75	Plantation	MMPB	17.7	1.4	8	2.1	12

76	Plantation	MMPB	18.5	1.5	8	2.2	12
77	Plantation	MMPB	18.8	1.5	8	2.3	12
78	Plantation	MMPB	18.8	1.5	8	2.3	12
79	Plantation	MMPB	19.3	1.5	8	2.3	12
80	Plantation	MMPB	20.9	1.7	8	2.5	12
81	Plantation	MMPB	20.6	1.6	8	2.5	12
82	Plantation	MMPB	21.2	1.7	8	2.5	12
83	Plantation	MMPB	21.5	1.7	8	2.6	12
84	Plantation	MMPB	22.6	1.8	8	2.7	12
85	Plantation	MMPB	21.8	1.7	8	2.6	12
86	Plantation	MMPB	22.7	1.8	8	2.7	12
87	Plantation	MMPB	22.9	1.8	8	2.7	12
88	Plantation	MMPB	24.1	1.9	8	2.9	12
89	Plantation	MMPB	24.6	2.0	8	3.0	12
90	Plantation	MMPB	24.8	2.0	8	3.0	12
91	Plantation	MMPB	24.8	2.0	8	3.0	12
92	Plantation	MMPB	24.8	2.0	8	3.0	12
93	Plantation	MMPB	25.4	2.0	8	3.1	12
94	Plantation	MMPB	25.7	2.1	8	3.1	12
95	Plantation	MMPB	26.3	2.1	8	3.2	12
96	Plantation	MMPB	26.3	2.1	8	3.2	12
97	Plantation	MMPB	27.4	2.2	8	3.3	12
98	Plantation	MMPB	29.8	2.4	8	3.6	12
99	Plantation	MMPB	21.6	1.7	8	2.6	12
100	Plantation	MMPB	31.0	2.5	8	3.7	12
101	Plantation	MMPB	36.0	2.9	8	4.3	12
102	Plantation	MMPB	41.7	3.3	8	5.0	12
103	Plantation	MMPB	40.3	3.2	8	4.8	12
104	Plantation	MMPB	43.4	3.5	8	5.2	12
105	Plantation	MMPB	44.4	3.6	8	5.3	12
106	Plantation	MMPB	46.8	3.7	8	5.6	12
107	Plantation	MMPB	65.8	5.3	8	7.9	12
108	Plantation	MMPB	19.6	1.6	8	2.4	12
109	Plantation	MMPB	22.2	1.8	8	2.7	12
110	Plantation	MMPB	59.0	4.7	8	7.1	12
111	Plantation	MMPB	8.7	0.7	8	1.0	12
113	Thinning	MMPB	26.7	1.3	5	4.8	18
115	Plantation	MMPB	2.2	.2	8	.4	12
116	Thinning	MMPB	42.4	2.1	5	7.6	18
117	Scenic Views Enhance	MMPB	12.0	.6	5	2.4	20
118	Scenic Views Enhance	MMPB	144.0	7.2	5	28.8	20

119	Scenic Views Enhance	MMPB	3.6	.2	5	.7	20
120	Scenic Views Enhance	MMPB	28.7	1.4	5	5.7	20
121	Lodgepole Pine Imp	MMPB	30.6	.6	2	6.1	20

Alternative 3: Melvin Butte planning area estimates of detrimental soil conditions following mechanical treatments by activity areas.

Appendix A 2 Detrimental soil conditions in the Melvin Butte Project area for Alternative 3

EA Unit Number	Proposed Activity		Unit Acres	Existing Detrimental Soil Conditions		Estimated Detrimental Soil Condition after Treatment	
	Silviculture Rx	Fuels Rx		Acres	Percent of Unit	Acres	Percent of Unit
1	Prescribed Fire	None	3.0	0.1	3	0.1	3
2	Prescribed Fire	None	6.9	.2	3	.2	3
3	Prescribed Fire	None	34.9	1.0	3	1.0	3
4	Prescribed Fire	None	159.6	4.8	3	4.8	3
5	Prescribed Fire	None	4.2	.1	3	.1	3
6	Prescribed Fire	None	136.1	4.1	3	4.1	3
7	Prescribed Fire	None	12.0	0.4	3	0.4	3
8	Prescribed Fire	None	29.8	1.5	5	1.5	5
9	Prescribed Fire	None	54.6	2.7	5	2.7	5
10	Prescribed Fire	None	126.5	3.8	3	3.8	3
12	Prescribed Fire	None	23.3	.7	3	.7	3
13	Prescribed Fire	None	81.5	4.1	5	4.1	5
14	Prescribed Fire	None	111.8	3.4	3	3.4	3
15	Prescribed Fire	None	5.7	0.2	3	0.2	3
17	Prescribed Fire	None	19.5	0.6	3	0.6	3
18	Thinning	MMPB	4.5	0.2	5	0.7	15
19	Thinning	MMPB	8.7	0.4	5	1.3	15
20	Thinning	MMPB	7.1	0.4	5	1.1	15
21	Thinning	MMPB	7.6	0.4	5	1.1	15
22	Thinning	MMPB	9.9	0.5	5	1.5	15
23	Thinning	MMPB	35.8	1.9	5	5.6	15
24	Thinning	MMPB	85.4	4.3	5	12.8	15
25	Thinning	MMPB	2.7	0.1	5	0.5	18
26	Thinning	MMPB	14.0	0.7	5	2.5	18

27	Thinning	MMP B	28.2	1.4	5	5.1	18
28	Thinning	MMP B	44.4	2.2	5	8.0	18
29	Thinning	MMP B	57.5	2.9	5	10.4	18
30	Thinning	MMP B	326.3	16.3	5	58.7	18
31	Thinning	MMP B	10.0	0.5	5	1.8	18
33	Thinning	MMP B	8.4	0.4	5	1.5	18
34	Thinning	MMP B	20.4	1.0	5	3.7	18
35	Thinning	MMP B	15.8	0.8	5	2.8	18
36	Thinning	MMP B	9.1	.5	5	1.6	18
37	Thinning	MMP B	112.4	5.6	5	20.2	18
38	Thinning	MMP B	183.9	9.2	5	33.1	18
39	Thinning	MMP B	103.4	5.2	5	18.6	18
40	Scenic Views Enhance	MMP B	33.4	0.7	2	6.7	20
41	Lodgepole Pine Imp	MMP B	1.8	0.1	2	.4	20
42	Lodgepole Pine Imp	MMP B	8.5	0.2	2	1.7	20
44	Lodgepole Pine Imp	MMP B	208.5	4.2	2	41.7	20
46	Thinning without Group	MMP B	7.6	0.4	5	1.4	18
47	Thinning without Group	MMP B	9.8	0.5	5	1.8	18
48	Scenic Views Enhance	MMP B	19.0	1.0	5	3.4	18
49	Thinning without Group	MMP B	15.6	.8	5	2.8	18
50	Thinning without Group	MMP B	57.6	2.9	5	10.4	18
51	Thinning without Group	MMP B	31.0	1.6	5	5.6	18
52	Thinning without Group	MMP B	155.9	7.8	5	28.1	18
53	Thinning without Group	MMP B	13.1	0.7	5	2.4	18
56	Thinning without Group	MMP B	86.3	4.3	5	15.5	18
57	Thinning without Group	MMP B	392.3	19.6	5	70.6	18
58	Plantation	MMP B	0.3	0.1	8	0.1	12

59	Plantation	MMP B	1.9	0.2	8	0.2	12
62	Plantation	MMP B	4.3	0.3	8	0.5	12
63	Plantation	MMP B	5.5	0.4	8	0.7	12
64	Plantation	MMP B	7.0	0.6	8	0.8	12
65	Plantation	MMP B	7.0	0.6	8	0.8	12
66	Plantation	MMP B	8.5	0.7	8	1.0	12
67	Plantation	MMP B	9.3	0.7	8	1.1	12
68	Plantation	MMP B	9.4	0.7	8	1.1	12
69	Plantation	MMP B	10.0	0.8	8	1.2	12
70	Plantation	MMP B	14.1	1.1	8	1.7	12
71	Plantation	MMP B	15.0	1.2	8	1.8	12
72	Plantation	MMP B	15.1	1.2	8	1.8	12
73	Plantation	MMP B	16.1	1.3	8	1.9	12
74	Plantation	MMP B	16.7	1.3	8	2.0	12
75	Plantation	MMP B	17.4	1.4	8	2.1	12
76	Plantation	MMP B	18.5	1.5	8	2.2	12
77	Plantation	MMP B	18.8	1.5	8	2.3	12
78	Plantation	MMP B	18.8	1.5	8	2.3	12
79	Plantation	MMP B	19.3	1.5	8	2.3	12
80	Plantation	MMP B	20.9	1.7	8	2.5	12
81	Plantation	MMP B	20.6	1.7	8	2.5	12
82	Plantation	MMP B	21.2	1.7	8	2.5	12
83	Plantation	MMP B	21.5	1.7	8	2.6	12
84	Plantation	MMP B	22.6	1.8	8	2.7	12
85	Plantation	MMP B	21.8	1.7	8	2.6	12
86	Plantation	MMP B	22.7	1.8	8	2.7	12
87	Plantation	MMP B	22.9	1.8	8	2.7	12

88	Plantation	MMP B	24.1	1.9	8	2.9	12
89	Plantation	MMP B	24.6	2.0	8	3.0	12
90	Plantation	MMP B	24.8	2.0	8	3.0	12
91	Plantation	MMP B	24.8	2.0	8	3.0	12
92	Plantation	MMP B	24.8	2.0	8	3.0	12
93	Plantation	MMP B	25.4	2.0	8	3.1	12
94	Plantation	MMP B	25.7	2.1	8	3.1	12
95	Plantation	MMP B	26.3	2.1	8	3.2	12
96	Plantation	MMP B	26.3	2.1	8	3.2	12
97	Plantation	MMP B	27.4	2.2	8	3.3	12
98	Plantation	MMP B	29.8	2.4	8	3.6	12
99	Plantation	MMP B	21.6	1.7	8	2.6	12
100	Plantation	MMP B	31.0	2.5	8	3.7	12
101	Plantation	MMP B	36.0	2.9	8	4.3	12
102	Plantation	MMP B	41.7	3.3	8	5.0	12
103	Plantation	MMP B	40.1	3.2	8	4.8	12
104	Plantation	MMP B	43.4	3.5	8	5.2	12
105	Plantation	MMP B	44.4	3.6	8	5.3	12
106	Plantation	MMP B	46.8	3.7	8	5.6	12
107	Plantation	MMP B	65.8	5.3	8	7.9	12
108	Plantation	MMP B	19.6	1.6	8	2.4	12
109	Plantation	MMP B	22.2	1.8	8	2.7	12
110	Plantation	MMP B	59.0	4.7	8	7.1	12
111	Plantation	MMP B	8.7	0.7	8	1.0	12
113	Thinning	MMP B	26.7	1.3	5	4.8	18
115	Plantation	MMP B	2.2	.2	8	.3	12
116	Thinning	MMP B	42.4	2.1	5	7.6	18

117	Scenic Views Enhance	MMP B	12.0	.6	5	2.2	18
118	Scenic Views Enhance	MMP B	144.0	7.2	5	25.9	18
119	Scenic Views Enhance	MMP B	3.6	.2	5	.7	18
120	Scenic Views Enhance	MMP B	28.7	1.4	5	5.2	18
121	Lodgepole Pine Imp	MMP B	30.6	.6	2	6.1	20

APPENDIX B - BOTANY

Pre-field review summary of Deschutes Forest Sensitive Plant List for the project area

Appendix B 1 R6 Sensitive Plant speices pre-field review summary for the Melvin Butte Project area.

R6 Sensitive Plant Species Documented or Suspected on the Deschutes National Forest	Range	Habitat	Known occurrence on Sisters RD? On Forest?	Probability of Occurrence in Project Area
Agoseris elata (vascular plant)	Washington and Oregon Cascades	Forest openings and forest edges adjacent to wet/moist meadows, lakes, rivers, and streams	Yes/Yes	Low; little suitable habitat
Alpova alexsmithii (fungus) *	Cascades, Central OR to WA	Associated with various Pinaceae sp., incl. Pacific silver fir, lodgepole, Engelmann spruce, and mountain hemlock	Yes/Yes	None; no suitable habitat
Anastrophyllum minutum (liverwort)	Circumboreal	Typically associated with other bryophytes in tight mats on ledges or at the base of cliffs in the mountain hemlock zone	No/No	None; no suitable habitat
Anthelia julacea (liverwort)	Northern hemisphere in boreal and montane regions, found at Diamond Peak/Yoran Lake area of Crescent RD	Found on peaty soil in subalpine/alpine habitats above 5,000 ft. Grows on wet crags, streamsides and areas where snow lies late in the year. In Oregon often associated with low ericaceous shrubs	No/Yes	None; no suitable habitat
Arabis suffrutescens var. *horizontalis* (vascular plant)	South-Central Oregon	Meadows, woods, summits, ridges, and exposed rock outcrops	No/No	None; no suitable habitat
Arnica viscosa (vascular plant)	South-Central Oregon Cascades, California	Scree, talus gullies, lava flows and slopes w/ seasonal runoff. May be in moraine lake basins or crater lake basins	No/Yes	None; no suitable habitat
Astragalus peckii (vascular plant)	South-Central Oregon	Basins, benches, gentle slopes, and meadows.	Yes /Yes	None; no suitable habitat
Barbilophozia lycopodiooides (liverwort) *	Circumboreal, south to Oregon and Idaho	High elevation peaks, peaty soil	No/No	None; no suitable habitat
Botrychium pumicola (vascular plant)	Central Oregon	Alpine-subalpine ridges, slopes, and meadows. Lodgepole forests in basins with frost pockets, pumice flats	Yes/Yes	None; no suitable habitat
Brachydontium olympicum (moss) *	Alaska through Oregon, Cascade Mountains	Subalpine to alpine boulder fields, moraines and cliff faces	No/No	None; no suitable habitat
Calamagrostis breweri (vascular plant)	Oregon North Cascades and California	Non-forest moist-to-dry subalpine and alpine meadows, open slopes, streambanks, lake margins	No/No	None; no suitable habitat

Carex abrupta (vascular plant) *	Oregon, California, Nevada	Moist meadows and stream banks at moderate to high elevations	No/No	None; no suitable habitat
Carex capitata (vascular plant) *	Circumboreal	Wet meadows, fens and bogs	Yes /Yes	None; no suitable habitat
Carex diandra (vascular plant) *	Circumboreal, south to California	Swamps, sphagnum bogs, lake margins	No/No	None; no suitable habitat
Carex lasiocarpa var. Americana (vascular plant) *	S Cascades of Washington, Idaho, Montana, Utah, irregularly to Oregon	Mid elevation swamps and wet meadows	No/Yes	None; no suitable habitat
Carex livida (vascular plant)	Oregon Washington, California, Idaho	In peatlands, including fens and bogs; wet meadows with still or channeled water	No/No	None; no suitable habitat
Carex retrorsa (vascular plant) *	Nevada, Oregon, Washington, Idaho, to the north and east	Bogs, swamps, wet meadows, stream margins	No/No	None; no suitable habitat
Carex vernacula (vascular plant) *	Washington, Oregon, California, Idaho	Alpine, moist meadows, open slopes	No/No	None; no suitable habitat
Castilleja chlorotica (vascular plant)	Oregon east Cascades	LP-PP, mixed conifer forest openings. PP at lower and LP at mid, and mixed conifer at highest elevations	No/Yes	Moderate; somel suitable habitat
Cephaloziella spinigera (liverwort)	Widespread around the northern hemisphere in boreal and montane regions	Bogs and fens; boreal and montane. Known from Fremont/Winema National Forest. In moss-dominated communities.	No/no	None; no suitable habitat
Cheilanthes feei (vascular plant) *	Widespread western states, barely in Oregon	Limestone rocky areas	No/No	None; no suitable habitat
Chyloscyphus gimmiparis (liverwort) *	Oregon, Alaska, Utah	High elevation montane streams, aquatic	No/No	None; no suitable habitat
Collomia mazama (vascular plant)	South-Central Cascades, Oregon	Meadows (dry to wet, level to sloping); stream banks and bars, lakeshores and vernal pool margins; forest edges and openings; alpine slopes	No /No	None; no suitable habitat
Conostomum tetragonum (moss) *	Circumboreal; from BC through California	Subalpine to alpine boulder fields, moraines, and cliff ledges	No/No	None; no suitable habitat
Cyperus acuminatus (vascular plant) *	Western states, west cascades Oregon	Margins wet areas, lake edges	No/Yes	None; no suitable habitat
Cyperus lupulinus ssp.*lupulinus* (vascular plant) *	Idaho, Eastern Washington, Oregon	Rocky slopes adjacent to streams, low elevation	No/No	None; no suitable habitat
**Dermatocarpon luridum* (lichen)	Oregon, Washington	On rocks or bedrock in streams or seeps, usually submerged or inundated for most of the year	No/No	None; no suitable habitat

Elatine brachysperma (vascular plant) *	Washington, Oregon, California, Nevada	Wet to drying muds	No/No	None; no suitable habitat
Encalypta brevipes (moss)	Circumboreal, British Columbia to Oregon. Known from Rogue River/Siskiyou National Forest.	In soil on cliff ledges/ crevices; sites may have frequent fog penetration; apparently restricted to unglaciated regions; +/- Associated with Pacific silver fir, subalpine fir, and mountain hemlock communities	No/No	None; no suitable habitat
Entosthodon fascicularis (moss)	British Columbia, Idaho, Washington, Oregon, California (Arizona, Europe, North Africa.	Grassland, oak savanna, grassy balds and rock outcrops. Individual plants / small patches on seasonally wet, exposed soil in seeps/ intermittent streams.	No/No	None; no suitable habitat
Eucephalus gormanii (vascular plant)	Northern West Cascades	Subalpine to alpine; Rocky ridges, outcrops, or rocky slopes	No/Yes	None; no suitable habitat
Gastroboletus vividus (fungus)	Rogue River N.F., Crater Lake NP, CA	Associated with the roots of Pinaceae sp. such as Shasta red fir and mountain hemlock	No/No	None; no suitable habitat
Gentiana newberryi var. *newberryi* (vascular plant) *	Oregon east and west Cascades, California	Wet to dry alpine, subalpine, and mountain mixed conifer zones, in forest openings and meadows, commonly with tufted hairgrass	Yes/Yes	None; no suitable habitat
Haplomitrium hookeri (liverwort)	Widespread but irregularly distributed over temperate and boreal regions, northern and southern hemispheres, Linton Meadows Three Sisters wilderness	On soil in open areas, intermixed with other liverworts and hornworts.	Yes/No	None; no suitable habitat
Harpanthus flotovianus (liverwort)	Widespread in the northern hemisphere in boreal and montane regions. In western North America reaching the southern edge of its range in Oregon	Bogs and fens. On Deschutes, at about 5600' in a smallish, low gradient, persistently groundwater-fed community in the Three Sisters Wilderness Area, south of South Sister	No/Yes	None; no suitable habitat
Helodium blandowii (moss) *	Circumboreal, south through Cascades to Sierra Nevada, and through Rockies to Arizona	Montane fens with calcareous groundwater.	No/Yes	None; no suitable habitat
Heliotropium curassavicum (vascular plant) *	Western United States	Alkaline, saline playas, receding ponds and clay soils	No/No	None; no suitable habitat

Helvella crassitunicata (fungus) *	Cascades, central Oregon to northern WA	On soil, along trails in montane regions with sp. such as Pacific silver fir, grand fir, and mountain hemlock	Yes /No	None; no suitable habitat
Hygrophorus caeruleus (fungus) *	Cascades, central Oregon (Jefferson Co.) to central WA	On soil in association with roots of Pinaceae sp. near melting snowbanks	Yes /Yes	Moderate; little suitable habitat
Jungermannii polaris (liverwort)	Circumboreal and south to California, found at Diamond Peak/Yoran Lake area of Crescent RD. Also found within Waldo Lake at depths up to 330 ft.	Subalpine to alpine habitats above 5,000 ft. Forms small to sometimes extensive mats over peaty soil on damp ledges and crevices of rocks, sometimes along streams and rivulets, sometimes aquatic.	No/Yes	None; no suitable habitat
**Leptogium cyanescens* (lichen)	Oregon, Washington	Generally riparian but recently documented in upland settings on vine maple, big leaf maple and Oregon white oak	No/No	None; no suitable habitat
Lipocarpha aristulata (vascular plant) *	Washington, Oregon, California, Idaho	Low elevation streamsides, gravel bars	No/No	None; no suitable habitat
Lobelia dortmanna (vascular plant)	Oregon East Cascades, Washington	Shallow water at margins of lakes, ponds, and rivers or in standing water of bogs and wet meadows	Yes/Yes	None; no suitable habitat
Lophozia gillmanii (liverwort)	Widespread around the northern hemisphere in boreal and montane regions, in western North America	Cliffs and ledges; boreal and montane. One Oregon site in wet meadow at 6500'	No/No	None; no suitable habitat
Lycopodiella inundata (vascular plant)	Oregon, Idaho, California, Montana – Circumboreal	Deflation areas in coastal backdunes; montane bogs, including sphagnum bogs; less often wet meadows	No/Yes	None; no suitable habitat
Lycopodium complanatum (vascular plant)	Oregon, Idaho, Washington +	Edges of wet meadows; dry forested midslope with >25% canopy cover	No/No	None; no suitable habitat
Marsupella sparsifolia (liverwort)	Polar and alpine regions in Northern Europe and northern North America, South Africa ,New Zealand. Rare in the Pacific Northwest, south to Mt. Hood in Oregon and possibly California.	Alpine exposed sites, occasionally flooded sands, sandy soils along streams or acidic soils in late snow areas. Siliceous	No/No	None; no suitable habitat
Muhlenbergia minutissima (vascular plant) *	Western United States	Thin lava soils, associated with Typha, sedges	No/No	None; no suitable habitat

Nardia japonica (liverwort)	In the North Pacific arc from Japan, through Siberia and British Columbia south to Oregon	Subalpine habitats on peaty soil on rock ledges or in rocky meadows	No/No	None; no suitable habitat
Ophioglossum pusillum (vascular plant)	Oregon, Washington, California, Idaho +	Dune deflation plains; marsh edges; vernal ponds and stream terraces in moist meadows	No/No	None; no suitable habitat
Penstemon peckii (vascular plant)	Central Oregon east Cascades	PP openings, open PP forests; mixed conifer openings; recovering fluvial surfaces	Yes/Yes	Moderate; adjacent populations
Pilularia americana (vascular plant)	Oregon, California +	Alkali and other shallow vernal pools, not recently used stock ponds, reservoir shores	No/No	None; no suitable habitat
Pinus albicaulis (vascular plant)	Western US and Canada	Rocky, exposed sites with shallow, well-drained soils. In upper portions of mountain hemlock vegetation series or above, in subalpine parkland.	Yes/Yes	Moderate; adjacent populations
Polytrichum sphaerothecium (moss) *	East Asia-Western North America through Alaska to Oregon; highest Cascade peaks	Subalpine to alpine, forming green to brown sods on igneous rocks in exposed or sheltered sites.	No/No	None; no suitable habitat
Potamogeton diversifolius (vascular plant)	Oregon, Idaho, Nevada, California	Aquatic, pond edges	No/No	None; no suitable habitat
Preissia quadrata (liverwort)	Circumboreal in temperate to boreal regions. In western North America extending south to California	On soil with little organic material, often on cliff ledges or in crevices in rocky areas	Yes/No	None; no suitable habitat
Pseudocalliergon trifarium (moss) *	Circumboreal; British Columbia, Alberta, Montana, Oregon	Montane fens, submerged to emergent or on saturated ground, usually in full sunlight	No/No	None; no suitable habitat
**Ramaria amyloidea* (fungus) S&M	Central OR Cascades (Wiliamette and DES NF); WA Cascades, NW CA	Mycorrhizal with true firs, Douglas fir, and western hemlock in humus or soil.	No/Yes	Moderate; some suitable habitat
**Rhizomnium nudum* (bryophyte) S&M	Oregon, Washington +	Moss found in moist coniferous forests. On DNF associates include lodgepole pine, Engelmann spruce, mountain hemlock, and western white pine	No/Yes	Low; little suitable habitat
Rorippa columbiae (vascular plant)	Oregon, California, Washington	Wet to vernally moist sites in meadows, fields, playas, lakeshores, intermittent stream beds, banks of perennial streams, along irrigation ditches, river bars and deltas, roadsides.	No/Yes	None; no suitable habitat

Rotala ramosior (vascular plant) *	Washington, Oregon, California, Idaho	Low elevation low gradient shores, pond edges, river bars	No/No	None; no suitable habitat
Scheuchzeria palustris var. *americana* (vascular plant)	Oregon, Washington, California, Idaho +	Open to canopied bogs, fens, and other wetlands where often in shallow water	Yes/Yes	None; no suitable habitat
Schistidium cinclidodonteum (moss)	Washington, Idaho, Oregon, California, Nevada and Europe	In large loose mats on wet or dry rocks / soil in rock crevices, often along intermittent streams. . Ponderosa pine, grand fir, Pacific silver fir, subalpine fir, mountain hemlock and possibly whitebark pine communities.	No/No	None; no suitable habitat
Schistostega pennata (bryophyte) S&M	Oregon, Washington, circumboreal	Mineral soil in crevices on lower and more sheltered parts of root wads of fallen trees near streams or other wet areas	Yes/Yes	None; no suitable habitat
Schofieldia monticola (liverwort)	Oregon, Washington, Russia	Subalpine meadows to alpine areas. On peaty soils under heather or beside small streams.	No/No	None; no suitable habitat
Schoenoplectus subterminalis (vascular plant)	Oregon, Washington, California, Idaho +	Generally submerged to emergent in quiet water 2-8 decimeters deep, in peatlands, sedge fens, creeks, ditches, ponds and lakes	No/Yes	None; no suitable habitat
**Scouleria marginata* (bryophyte) S&M	Pacific Northwest endemic; Oregon, Washington, Idaho, northern California, southwestern British Columbia	Exposed or shaded rocks in streams; seasonally submerged or emergent	No/No	None; **no plants or suitable habitat was found during survey**
Splachnum ampullaceum (moss) *	Circumboreal; from Alaska through Oregon, and Alberta	Peatlands, wetlands, on old ungulate dung	No/No	None; no suitable habitat
Texosporium sancti-jacobi (lichen) *	Western North America	In Oregon, late seral dry shrub/grassland	No/No	None; no suitable habitat
Tholurna dissimilis (lichen)	Scandinavia, Northwest Territories, Yukon, and British Columbia south into Washington and Oregon. On Black Butte, Sisters District,	- Open Pinus albicaulis stand on moderate slope, with dense understory of shrubs; also open Abies lasiocarpa forest with low stunted trees.	Yes/Yes	None; no suitable habitat
Tomentypnum nitens (moss) *	Circumboreal, Alaska through Oregon	Montane fens at slightly elevated (stumps, logs, hummocks)	Yes/Yes	None; no suitable habitat
Trematodon boasii (moss)	British Columbia through California, Japan, Newfoundland	Subalpine stream, trail and pond edges.	No/No	None; no suitable habitat

Tritomaria exsectiformis (liverwort)	Alaska through Oregon, to Montana, Wyoming and Colorado	Open to shaded coniferous forest along perennial flowing water from springs and seeps	Yes/Yes	None; no suitable habitat
Utricularia minor (vascular plant) *	Western United states north through Canada	Aquatic plant of pools, ponds, bogs, marshes, wet meadows	Yes/Yes	None; no suitable habitat

APPENDIX C – GNN MODELING AND DECAID

GNN MODELING, DECAID ANALYSIS FOR THE WHYCHUS AND DEEP CANYON WATERSHEDS

The purpose of this analysis was to provide an estimate of small (10-20 inches dbh) and large (20 inches dbh and greater) diameter snags in both the Whychus Creek and Deep Canyon watersheds within both green stands as well as post fire habitat that containing stand-replacement, mixed severity, and underburned areas on National Forest lands. The effects of removing dead wood habitat assocaied with the Scenic Views Ehancemetn Treatment on about 240 acres acres were also evaluated.

Assumptions/Limitations of Analysis

1. Analysis considered stand-replacement, mixed, and underburned severities.
2. Given the short time since the fire, substantial fall-down of snags was assumed not to have occurred.
3. The minimum size class for the GNN analysis was 10”dbh, therefore plantation in most cases were not include in the analysis due to the fact that the majority of the trees associated with plantations are less than 10”dbh.

All vegetation mortality for this analysis utilized the Burn Intensity GIS layer that was created during the Pole Creek Fire Burned Area Emergency Response (BAER). The soils report from the BAER categorized the burn intensity to vegetation mortality. Table Appendix C 1 has the cross walk that the Soils report outlines.

Appendix C 1 Burn Intensity to vegetation mortality for post fire areas.

Burn Intensity	Vegetation Mortality Class	Percent Mortality
High	Stand Replacement	100%
Moderate	Stand Replacement	75 to 100%
Low	Mixed Severity	25 to 75%
Underburned / Unburned	Underburned / Unburned	< 25%

Gradient Nearest Neighbor (GNN) Modeling

GNN maps consist of 30 meter pixel (grid) maps with associated data (tree size, density, snag density, canopy cover, percent down wood cover, etc.). The maps used for this analysis were developed by the Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) team as part of the GNNPAC Pacific States Forest Vegetation Mapping project. This project involves developing detailed maps of existing forest vegetation across all land ownerships in the Pacific Coast States (Oregon, Washington, and parts of California). It is being conducted by the LEMMA team (Pacific Northwest Research Station (PNW) and Oregon State University) at the Corvallis Lab, in close collaboration with the Western Wildlands Environmental Threats Assessment Center, the Interagency Mapping and Assessment Project (IMAP), Northwest Forest Plan Effectiveness Monitoring, the Remote Sensing Applications Center, and Forest Inventory and Analysis at the PNW Research Station.

The process to create the maps involves using gradient imputation (Gradient Nearest Neighbor, or GNN). GNN uses many variables on a gradient along with satellite imagery to assign data from known field plots to pixels with no data that have the same satellite imagery signature (i.e. it “looks” the same to the computer). The species-size GNN model was used in the Pole Creek Fire analysis. This model uses

species composition and stand structure as components for developing maps. Accuracy of the modeling depends on how "like" pixels match up based on numerous variables. Generally speaking, forest types that had more samples like white-fir were more accurate than those with fewer samples like mountain mahogany (Ohman et al. 2008). Information on GNN accuracy, the LEMMA group, IMAP and the GNNPac project is available at the project website: http://www.fsl.orst.edu/lemma/gnnpac.

To determine snags densities from the GNN data, pre-fire stand structure and composition data was used and associated with the vegetation mortality mapping for post fire areas. Once vegetation mortality was applied GNN stand structure and composition data could estimate snag numbers in areas containing both post fire snag numbers and sizes on all acres of stand replacement, mixed severity, underburned stands.

In areas where post fire salvage occurred, snag densities were reduced to the residual density of the proposed action for those project areas.

DecAID Analysis

Explanation of the DecAID advisory tool and how it was applied to the Melvin Butte Vegetation Management Project

Snag management guidelines were developed for the Melvin Butte Vegetation Management Project using a variety of information including scientific literature, standards and guidelines outlined in the Forest Land and Resource Management Plan, the Deschutes NF Wildlife Tree and Log Implementation Strategy, the NWFP, local knowledge of the area, and information contained in the DecAID advisory tool. DecAID is a web-based advisory tool to help managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. DecAID is not a simulation model, it is a compilation of the best available, though imperfect, empirical data on wildlife relationships with dead and decaying wood. "DecAID is not a population viability analysis model. There is more to viability of populations than the dead wood habitat component. DecAID can help managers decide how much, and what sizes, of dead wood to provide for this part of species' habitat needs. It is up to the user to understand the underlying data and determine if the data are appropriate to their local situation and conditions. This is why DecAID was designed to allow the user to drill down into increasingly finer details of the data. The user is urged to carefully read the Summary Narratives which discuss and provide red flags, where appropriate, for the basis of underlying studies" (Mellen et al 2006).

DecAID contains two major data sets which are summarized by wildlife habitat types. The *inventory data* is composed of statistical summaries of forest inventory data on snags and down wood in unharvested forests and entire landscapes across Oregon and Washington. The *wildlife data* is derived from a thorough review of published literature and other available data on wildlife use of snags and down wood, primarily in Oregon and Washington. DecAID provides a statistical synthesis of data showing levels of use by individual wildlife species of snags and down wood. **For this analysis the wildlife data was used.**

DecAID will not be used to analyze snags, but DecAID will be used to evaluate habitat to individual species that utilize snags. **"Forest inventory data are not available for recent post-disturbance habitats** (emphasis added). High snag densities resulting from disturbances are temporary because snag densities decline rapidly as snags fall in the first decade or so after the disturbance. As a result, stands which have recently sustained a stand-replacing disturbance are not well represented in the inventory data in DecAID, even those from unharvested plots; they are an extremely small proportion of the landscape at any one point in time. Plots occurring in areas experiencing recent fire or other stand replacing disturbance likely are included in the inventory data from one of the other three structural condition

classes and are likely plots with high levels of down wood (i.e., the right side of the distribution histograms). It was not possible to separate out plots occurring in these disturbed areas. As a result, inventory data are not available for recent post-fire habitats." (Mellen 2006).

Use of DecAID Wildlife Data

The wildlife data in DecAID is provided in the form of tolerance levels of 30 percent, 50 percent, or 80 percent. A **tolerance interval** is similar to a confidence interval but with a key difference: tolerance intervals are estimates of the percent of all *individuals* in the population that are within some specified range of values. In the DecAid Advisor tolerance *levels* are used. Levels are one-sided intervals with the lower limit of the interval being zero. Thus, an 80% tolerance level indicates 80% of the individuals in the population have a value for the parameter of interest between 0 and the value for the 80% tolerance level. Or conversely, 20% of the individuals in the population have a value for the parameter of interest greater than the 80% level.

DecAID tolerance levels "may be interpreted as three levels of "assurance": low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level)" (Mellen et al. 2006). The higher the tolerance level, the higher the "assurance" that snag habitat is being provided.

Referring to the array of wildlife data collected (for all habitats, not just post-fire habitats) DecAid notes: "The wildlife studies, on which the wildlife portion of DecAID is based, were conducted in a variety of landscapes and site conditions. Typically, the studies (a) did not report how the general study areas and specific study sites were chosen relative to others, and (b) did not describe how the vegetation conditions within the general study areas and specific study sites differed from conditions within a broader area, especially within the wildlife habitat and vegetation condition classes used in DecAID. Thus, there is no way to know to what degree the study areas and sites varied from conditions generally present, and thus no way to gauge the bias in study area and site selection. In turn, this means there is no way to estimate the degree of bias in the wildlife data summarized in DecAID (Mellen et al. 2006)".

DecAID goes on to suggest that this unknown bias can be reduced to acceptable levels by either 1) examining the underlying data and evaluate whether the component studies either pertain to their locations or vegetation conditions of interest, or 2) by determining if the number and breadth of studies may adequately capture the range of conditions within a wildlife habitat and structural condition.

Therefore, it is important to consider how plant communities and conditions at the local site differ from plant communities and conditions in the studies used in DecAID. The primary study used to assess wildlife use of post-fire habitat was Saab and Dudley (1998). These data are from habitat fairly similar to post fire conditions found in the Whychus and Deep Canyon Watershed areas. However, there were more areas of very high snag density in the Saab and Dudley (1998) study than found in Whychus and Deep Canyon Watersheds. For other habitat types, the underlying study information was considered appropriate except where noted in the discussion of effects.

DecAID was used to assist with the analysis of impacts on snag dependent wildlife species. DecAID was used as a:

1. Thorough review of published literature and other available data on wildlife use of decayed wood elements, primarily in Oregon and Washington.
2. Statistical synthesis of data showing levels of use by individual wildlife species of decayed wood elements.
3. Summary of the patterns of use of decayed wood elements by wildlife species in Oregon and Washington (number of species using specific snag or down wood sizes or amounts).

4. Helpful tool for making informed decisions.

DecAID was not used as a:

1. To determine forest stand structure and composition of snags for Whychus and Deep Canyon watersheds.
2. To model snag and down wood recruitment.
3. DecAID was not used to simulate populations or as a viability analysis.
4. Substitute for making professional decisions based on experience.

DecAID Analysis

Using the corporate Plant Association Group layer the following PAGS were put into the following DecAID wildlife habitat types (Table Appendix C 2). The PAG layer was clipped to the Whychus and Deep Canyon Watersheds.

Appendix C 2 PAGs converted to DecAID wildlife habitat types.

DecAID Wildlife Habitat Type	PAG
Eastside Mixed Conifer**	Mixed Conifer Wet
	Mixed Conifer Dry
	Riparian that occurs within MCW and MCD
Lodgepole	Lodgepole Pine Dry
	Lodgepole Pine Wet
	Riparian that occurs within LPW and LPD
Montane Mixed Conifer Forest	Mountain Hemlock Dry
	White Bark Pine Dry
	Riparian occurring within MHD and WBPD
Ponderosa Pine/Douglas-fir**	Ponderosa Pine Wet
	Ponderosa Pine Dry
	Riparian occurring within PPW and PPD
Non-forest	Alpine Meadow
	Cinder
	Meadow
	Hardwood
	Lava
	Meadow
	Mesic Shrubland
	Rock
	Water

Wildlife data located in DecAID can be utilized by habitat type and structural class. For the Melvin Butte project there are four habitat types: eastside mixed conifer (EMC), lodgepole (LPP), montane mixed conifer (MMC), and ponderosa pine/Douglas-fir (PP). The Melvin Butte project was broken into these four habitat types by utilizing the plant association groups (Table 4). However, the cumulative effects analysis only discussed incremental impact to EMC, LPP, and PP since there are no treatments associated with MMC.

Structural class was broken into two categories. All stand replacement areas were analyzed with the post-fire structural class as outlined by Mellen et al. (2006). All mixed severity, underburned, and unburned areas were analyzed with the small and medium structural class (Table *).

Stand data for snag numbers (from GNN) were then overlayed to the habitat types and structural classes.

SNAG DEPENDENT SPECIES

DecAID synthesized data from research studies to create cumulative species curves for wildlife use of snags by habitat type and structural condition. From these curves tolerance levels were determined. Tables 5 through 13 are compilations of synthesized data for wildlife use of snag densities from various studies by habitat type and structural condition located in DecAID.

STAND REPLACEMENT FIRE

There is no available wildlife species use data within DecAID for the lodgepole pine habitat type. The GNN modeling only modeled snags 10 inches and greater, due to majority of the project being within EMC and PP habitat types. Very little of the project occurs within the LPP habitat type. Synthesized data for the post fire montane mixed conifer habitat type only has data for snags 3 inches dbh or greater, so post-fire montane mixed conifer was not evaluated. It is assumed that all post-fire lodgepole and montane mixed conifer habitat types will be providing habitat for species. Tables Appendix C 3 through Appendix C 6 are compilations of synthesized data for wildlife use of snags found within DecAID. There are other species identified in DecAID as using various habitat types and structural classes that were not analyzed, as they are not Management Indicator Species on the Deschutes National Forest.

Appendix C 3 Synthesized data for wildlife use of snags densities from various studies for 10 inch and greater snags in recent post fire eastside mixed conifer forest wildlfie habitat type.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Black-backed Woodpecker	56.1	81.1	117.6
Hairy Woodpecker	39.2	63.3	100.0
Lewis' Woodpecker	24.8	43.0	71.0
Mountain Bluebird	38.1	63.2	101.4
Northern Flicker	25.0	48.0	83.1
Western Bluebird	28.8	49.8	81.6
White-headed Woodpecker	0.0	40.0	118.4
Data acquired from DecAID Tables EMC_PF.sp-22			

Appendix C 4 Synthesized data for wildlife use of snag densities from various studies for 20 inch and greater snags in recent post fire eastside mixed conifer.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Cavity Nesting Birds	NA	8.4	NA
Lewis' Woodpecker	0.0	6.2	16.1
Mountain Bluebird	0.0	12.4	38.0
Northern Flicker	2.2	17.4	39.6
Data acquired from DecAID Tables EMC_PF.sp-22			

Appendix C 5 Synthesized data for wildlife use of snag densities from vaious studies for 10 inch and greater snags in recent post-fire ponderosa pine/Douglas fir forest wildlife habitat type.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Black-backed Woodpecker	37.4	52.8	76.5
Hairy Woodpecker	39.2	63.3	100.0
Lewis' Woodpecker	24.7	42.7	70.6
Mountain Bluebird	38.1	63.2	101.4
Northern Flicker	25.0	44,9	83.1
Western Bluebird	28.8	49.8	81.6
White-headed Woodpecker	22.2	40.9	68.3
Data acquired from DecAID Tables PPDF_PF.sp-22			

Appendix C 6 Synthesized data for wildlife use of snag densities from various studies for 20 inch and greater snags in recent post-fire ponderosa pine/Douglas fir forest wildlife habitat type.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Cavity Nesting Bird	NA	8.4	NA
Lewis' Woodpecker	0.0	6.2	16.1
Mountain Bluebird	0.0	12.4	38.0
Northern Flicker	2.2	17.4	39.6
Data acquired from DecAID Tables PPDF_PF.sp-22			

MIXED SEVERITY, UNDERBURNED, AND UNBURNED

Tables Appendix C 7 through Appendix C 12 are compilations of synthesized data for wildlife use of snags found within DecAID.

Appendix C 7 Synthesized data for wildlife use of snag densities from various studies for 10 inch and greater snags in eastside mixed conifer small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
American Marten	11.8	12.8	14.4
Black-backed Woodpecker	2.5	13.6	29.2
Pileated Woodpecker	14.9	30.1	49.3
Pygmy Nuthatch	1.1	5.6	12.1
White-headed Woodpecker	0.3	1.9	4.3
Williamson's Sapsucker	14.0	28.4	49.7
Data acquired from DecAID Table EMC_S/L.sp-22.			

Appendix C 8 Synthesized data for wildlife use of snag densities from various studies for 20 inche and greater snags in eastside mixed conifer small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
American Marten	3.7	4.0	4.5
Black-backed Woodpecker	0.0	1.4	5.7
Cavity Nesting Birds	NA	2.4	NA
Pileated Woodpecker	3.5	7.8	18.4
Pygmy Nuthatch	0.0	1.6	4.0
White-headed Woodpecker	0.0	1.5	3.8
Williamson's Sapsucker	3.3	8.6	16.6
Data acquired from DecAID Table EMC_S/L.sp-22.			

Appendix C 9 Synthesized data for wildlife use of snag densities from various studies for 10 inch and greater snags in ponderosa pine/Douglas fir small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Black-backed Woodpecker	2.5	13.6	29.2
Cavity Nesting Birds	1.2	4.7	10.0
Hairy Woodpecker	0.0	17.0	44.4
Pileated Woodpecker	14.9	30.1	49.3
Pygmy Nuthatch	1.1	5.7	12.1
White-headed Woodpecker	0.0	3.9	11.9
Williamson's Sapsucker	14.0	28.4	49.7
Data acquired from DecAID Table PPDF S/L.sp-22.			

Table *: Synthesized data for wildlife use of snag densities from various studies for 20 inch and greater snags in Ponderosa Pine/Douglas Fir Small and Medium Structure Classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
Black-backed Woodpecker	0.0	1.4	5.7
Cavity Nesting Birds	0.0	1.0	2.8
Pileated Woodpecker	3.5	7.8	18.4
Pygmy Nuthatch	0.0	1.6	4.0
White-headed Woodpecker	0.5	1.8	3.8
Williamson's Sapsucker	3.0	8.4	16.3
Data acquired from DecAID Table PPDF S/L.sp-22.			

Appendix C 10 Synthesized data for wildlife use of snag densities from various studies for 20 inch and greater snags in montane mixed conifer small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
American Marten	3.7	4.0	4.5
Data acquired from DecAID Tables MMC_S/L.sp-22.			

Appendix C 11 Synthesized data for wildlife use of snag densities from various studies for 10 inch and greater snags in lodgepole small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
American Marten	11.8	12.8	14.4
Data acquired from DecAID Tables LP_S.sp-22.			

Appendix C 12 Synthesized data for wildlife use of snag densities from barious studies for 20 inch and greater snags in lodgepole small and medium structure classes.

Species	30% t.l. Snag Density (#/acre)	50% t.l. Snag Density (#/acre)	80% t.l. Snag Density (#/acre)
American Marten	3.7	4.0	4.5
Data acquired from DecAID Tables LP_S.sp-22.			

For more detailed information about the wildlife data and associated research see the DecAid Advisor www.fs.fed.us/wildecology/decaid/decaid_background/decaid_home.htm

Whychus Creek and Deep Canyon watersheds Wildlife Species Analysis

Using data from GNN and data within DecAID, an analysis was conducted to rate habitat quality for individual species. Since the Melvin Butte project does not propose to remove snags and any reduction is snags will be incidental, there is no measurable difference to snag densities at the watershed level by alternative. Thus, there the following table displays habitat quality for the watersheds. The following assumptions were used for this analysis.

1. GNN data accurately depicts snags numbers.
2. "It is our fundamental assumption that patterns of species' use and selection of dead wood size and amounts represent behaviors that have adaptive advantage fore the species and that serve to bolster individual fitness" (Mellen et al. 2006).
3. Synthesized data for wildlife use of snag densities from Mellen et al. (2006) represent wildlife use within the Whychus and Deep Canyon watersheds.

GNN acres within the Whychus and Deep Canyon watersheds were stratified for each species depending on habitat type and structural composition. Table

Appendix C 13 displays estimated acres by quality of habitat for snag dependent species.

Table *: Comparison of habitat for species that utilize stand replacement, mixed severity, underburned fire and unburned areas.

Appendix C 13 Conparison of habitat species that utilize stand replacement, mixed severity, underburned fire, and unburned areas.

Species	0-30% Poor Quality	>30-50% Low Quality	>50-80% Moderate Quality	>80% High Quality	Grand Total
American Marten	266,230	28,008	25,988	123,088	443,314
Black Backed Wood Pecker	429,942	149,257	50,378	28,526	658,103
Cavity Nesting Birds	316,492	46,795	7,988	5,662	376,938
Hairy Woodpecker	232,395	142,230	1,410	903	376,938
Pileated Woodpecker	583,976	45,890	14,162	14,075	658,103
Pygmy Nuthatch	375,737	99,878	75,101	107,388	658,103
White-headed Woodpecker	269,801	147,231	60,970	180,100	658,103
Williamson's Sapsucker	582,173	46,110	15,745	14,075	658,103

APPENDIX D – WILDLIFE MANAGEMENT INDICATOR SPECIES

Management Indicator Species

Management Indicator Species from the Deschutes LRMP Species	Scientific Name
Northern Goshawk	*Accipiter gentiles*
Coopers Hawk	*Accipiter cooperii*
Sharp-shinned Hawk	*Accipiter striatus*
Golden Eagle	*Aquila chrysaetos*
Great Gray Owl	*Strix nebulosa*
Great Blue Heron	*Ardea herodias*
Red-tailed Hawk	*Buteo jamaicensis*
Osprey	*Pandion haliaetus*
Elk	*Cervus elephas*
Mule Deer	*Odocoileus hemionus*
American Marten	*Martes americana*
Western Big-eared Bat (Townsend's)	*Plecotus townsendii*
Woodpeckers (MIS)	
Black-backed Woodpecker	*Picoides arctus*
Hairy Woodpecker	*Picoides villosus*
Lewis' Woodpecker	*Melanerpes lewis*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Pymy Nuthatch	*Sitta pygmaea*
White-headed Woodpecker	*Picoides albolarvatus*
Waterfowl (MIS)	
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*

Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
American Wigeon	*Anas Americana*
Canvasback	*Aythya valisineria*
Redhead	*Aythya Americana*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Green-winged Teal	*Anas carolinensis*
Ring-necked Duck	*Aythya collaris*
Barrow's Goldeneye	*Bucephala islandica*

APPENDIX E – SURVEY AND MANAGE WILDLIFE

DESCHUTES NATIONAL FOREST SURVEY & MANAGE TRACKING FORM

Wildlife Species Survey and Site Management Summary

Project Name: Melvin Butte Project **Prepared By:** Monty Gregg

Project Type: Thinning to improve forest health and reduce fire risk, prescribed fire, road decommissioning.

Date: September 17, 2015

Location: T16S, R09E and T17S, R09E

This is a Survey and Manage (S&M) species checklist and form to track compliance with the 2001 Record of Decision. For each project within the Northwest Forest Plan Area, fill out the Checklist, Tracking Form, Statement of Compliance and Summary of Survey Results. Sign and Date the form at the end of this document.

> This checklist and format are not intended to replace the effects analysis section of you National Environmental Policy Act (NEPA) document. Include the tracking forms as an appendix to the NEPA document, summarize the projects S&M conformance with the 2001 ROD S&Gs in the NEPA document itself. If you have questions or believe your project has a high litigation risk, pleas work with the S&M Contact for your National Forest/BLM District and the appropriate program leads in you FS Regional or BLM State Office to finalize your tracking form for greatest accuracy and defensibility.

The Deschutes National Forest compiled the species listed below (Table Appendix E 1) from the 2001 Record of Decision. This list includes those wildlife species with pre-disturbance survey requirements (Category A or C species), who's known or suspected range includes the Deschutes National Forest.

Table Appendix E 1 identifies Category A, B, C, D, and E species with known sites located within the Project Area.

Appendix E 1 Survey and Manage wildlife species evaluation for the Melvin Butte Project on the Sisters Ranger District, Deschutes National Forest.

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
EXAMPLE Ramaria thiersii	***Fungus***	***B[2]***	***Yes***	***Yes***	***Yes***	***Yes***	***6/12, 10/12, 6/13, 10/13***	***Yes***	***Three sites found. Around each site, placed a 100 ft. no-activity area (Cushman and Huff 2007; USDA FS & USDI BLM 1994 Standards & Guidelines, C-41)***
Pristiloma arcticum crateris	Mollusk	A[1]	Yes	Yes	No	No[5]	N/A		
Deroceras hesperium	Mollusk	B[2]	Yes	Yes	No	No[6]	N/A		
Strix nebulosa	Vertebrate	C[3]	Yes	No	No	No [4]	N/A		

[1] Pre-disturbance surveys and management of all known sites are required for Category A species.

[2] Equivalent effort surveys required for this mollusk species.

[3] Although the great gray owl is within management Category C (which indicates that only high-priority sites require management) all known sites will require management and be considered high-priority. The Category C designation indicates however, that not all sites need to be discovered through surveys, and allows for a reduced survey effort as identified below.

Pre-disturbance surveys: Pre-disturbance surveys will follow Version 3.0 of the Great Gray Owl Survey Protocol (or future revisions/amendments), except for only 1 year of surveys are required. Pre-disturbance surveys of suitable nesting habitat are required only for proposed activities:

- That fall potential trees within 600 feet of natural openings that are 10 acres or greater and provide suitable conditions for great gray owl nesting (good foraging base); OR

- Where disturbance above ambient levels (or other activities that may impact potential nesting owls) will occur within 300 feet (or up to 1-mile for blasting) of suitable nesting habitat associated with natural openings 10 acres or greater between March 1st and July 31st.

Management Recommendations: Until new Management Recommendations are developed, the following serve as management requirements for this species. Around known (see Protocol definition) and future sites provide:

- A 30 acre management area encompassing the best available nest trees. Within the 30 acre area, management treatments are limited to protection or improvement of nesting habitat.

- A 0.25 mile radius protection zone. Within protection zone,

  - Provide a 300 foot buffer around natural openings greater than 10 acres that have nesting habitat associated with them. Within this 300 foot buffer, treatments are limited to protection or improvement of nesting habitat.

  - Prohibit disturbance from management activities within 300 feet of nesting habitat (1 mile radius for blasting) from March 1st-July 31st, or until fledging, whichever is later, unless surveys of the nesting habitat indicate no presence or no nesting.

[4] Pre-disturbance surveys for Great Gray Owls are not required since there is no suitable nesting habitat within the project area or within proximity of the project area that would be impacted by disturbance. The required habitat characteristics of suitable habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004; and mitigation language in the 2011 Settlement Agreement Species List). The stands in the Melvin Butte project do not have proximity to natural-openings $\geq$10 acres (Name, staff review, 2011) and pre-disturbance surveys are not suggested in suitable nesting habitat adjacent to man-made openings at this time (pg. 14, Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004).

[5] Suitable habitat for the Crater Lake tightcoil is "perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 meters of open water in wetlands, springs, seeps and riparian areas…" (pg. 43, Survey Protocol for S&M Terrestrial Mollusk Species v3.0, 2003). Within the project, there is no suitable habitat.

[6] Suitable habitat for the evening fieldslug is "perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris…" (pg. 4, *Conservation Assessment for Deroceras hesperium Evening fieldslug*, 2005). Within the project, there is no suitable habitat.

STATEMENT OF COMPLIANCE

The Deschutes National Forest applied the 2011 Settlement Agreement Species List to the Melvin Butte project, completing pre-disturbance surveys, equivalent effort surveys (if old growth habitat is disturbed) and management of known sites (Table A) required by Survey Protocols and Management Recommendations to comply with the *2001 Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidelines*.

SUMMARY OF SURVEY RESULTS

Project surveys discovered sites for the following Survey and Manage wildlife species:

- _N/A_____

Known sites are present within the project area for these additional species:

- _N/A_____

APPENDIX F – SURVEY AND MANAGE BOTANY

Deschutes National Forest
Survey & Manage Botany Checklist and Tracking Form

Project Name: Melvin Butte Forest Management Project

Describe Project Type: Thinning to improve forest heath and reduce fire risk, prescribed fire, road decommissioning.

Prepared By: Maret Pajutee **Date:** September 22, 2014

District: Sisters

Location: Melvin Butte

This is a Survey and Manage (S&M) species checklist and form to track compliance with the 2001 Record of Decision. For each project within the Northwest Forest Plan Area, fill out Sections A-D (Checklist, Tracking Form, Statement of Compliance and Summary of Survey Results). Sign and date the form at the end of this document.

This checklist and format are not intended to replace the effects analysis section of your National Environmental Policy Act (NEPA) document. Include the tracking forms in your project NEPA. If you include the tracking forms as an appendix to the NEPA document, summarize the project's S&M conformance with the 2001 ROD S&Gs in the NEPA document itself. If you have questions or believe your project has a high litigation risk, please work with the S&M Contact for your National Forest/BLM District and the appropriate program leads in your FS Regional or BLM State Office to finalize your tracking forms for greatest accuracy and defensibility.

A. CHECKLIST – complete this checklist for each project within the NW Forest Plan Area.

☒ **Species List:**

☒ 1. For project decisions, check which box, below, applies:

☒ Surveys were completed using: the December 2003 species list (i.e., 2001 Record of Decision species list. with the Annual Species Reviews).

☒ "Special Consideration" was given for the following species suspected or documented to occur on the Deschutes NF

☒ Lichen *Cheanotheca furfuracea*

☒ Lichen *Cladonia norvegica*

☒ Fungus *Clavariadelphus truncatus*

☒ Surveys were not completed (In a subset of the project area) because the project applied one of the four Pechman Exemptions; therefore the project is exempt from Survey &Manage pre-disturbance surveys and known site management. The following Pechman Exemption was applied:

☒ Thinning forest stands < 80 years old

☐ Culvert replacement/removal

☐ Riparian/stream improvement projects

☒ Hazardous fuel treatments applying prescribed fire for noncommercial projects.

The exemption was applied to plantations less than 80 years old and areas which were slated for fuels reduction, small tree thinning and prescribed fire.

☒ 2. Double check S&M categories and species names for correctness and accuracy.

☒ **Survey Protocols:**

☒ 1. Use survey protocols and any Annual Species Review (ASR) range extensions/contractions to determine if the project is in the species range, has suitable habitat, is a "habitat-disturbing activity" and, hence, needs pre-disturbance surveys.

☒ 2. Identify and list the survey protocols used. Note the survey protocol name in the preceding bullets to Table A.

Fungi- USFS, 2012. Survey & Manage Category B Fungi Equivalent-Effort Survey Protocol, Version 1.0, February 2012

☒ 3. Confirm survey results are entered into the appropriate Agency database.

☒ 4. Confirm forms are in the project record. The survey forms are evidence that surveys were conducted within protocol parameters and demonstrate survey findings.

☒ **Survey Requirements:**

☒ 1. Include the following species in Table A:

a. Category A and C flora species **known or suspected** to occur within the National Forest/BLM District (pre-disturbance surveys).

☒ 2. For habitat-disturbing projects within old-growth forests (2001 ROD S&Gs, pp. 79-80), list the following species in Table A:

☒ Include Category B bryophyte and lichen species **known or suspected** to occur within the National Forest/BLM District (if your project has a Decision in FY06 or later and strategic surveys are not completed for the province that encompasses the project area, then equivalent effort surveys are required in old-growth habitat to be disturbed; 2001 ROD S&G, p. 9). Do not list the 8 lichen and bryophyte species where strategic surveys are considered complete. See IM-2006-38 for further information about these species and about Equivalent Effort surveys.

☒ Include Category B fungi species **known or suspected** to occur within the National Forest/BLM District if your project has a Decision in FY11 or later (if your project has a Decision in FY06 or later and strategic surveys are not completed for the province that encompasses the project area, then equivalent effort surveys are required in old-growth habitat to be disturbed; 2001 ROD S&G, p. 9).

☒ 3. Although you are listing all species with pre-disturbance and equivalent effort survey requirements that are **known or suspected** within your National Forest/BLM District, Table A should reflect how the species information is applied to the [PROJECT] specifically. For instance, some of the species may be known or suspected within your National forest/BLM District, but the project may not be within the range of the species, and therefore the species is not known or suspected within the specific project.

☒ 4. Review consistency of responses in consecutive columns of Table A for a given species. If a project is not within the range of the species, you can't have suitable habitat in the project (i.e. doesn't make sense to put "No" in the first column for "within range of the species" and then have "Yes" in second column for "project contains suitable habitat").

☒ **Known Site Management:**

☒ 1. Include in Table A any species with **known sites that** occur **within the project area**.

☐ Indicate what site management the unit implemented and what information the National Forest/BLM District utilized in determining appropriate site management (management recommendations, conservation assessments, species fact sheets, Appendix J-2, etc.). Be specific when describing exact management applied; for example, "placed a 100 ft. no-activity area around the site (source citation)."

☒ 2. For Category D and E species, only the "Sites Known or Found" and "Site Management" sections of Table A need to be filled out (all other fields should be N/A).

☐ Indicate what site management the unit implemented and what information the National Forest/BLM District utilized in determining appropriate site management (management recommendations, conservation assessments, species fact sheets, Appendix J-2, etc.). Be specific when describing exact management applied; for example, "placed a 100 ft. no-activity area around the site (source citation)."

☒ 3. For species not requiring site management (non-high priority sites, occasional site of a rare species not needed for persistence, Category F species), indicate that site management is not required and why.

(Note: While a "yes/no/NA" answer is sufficient in the column titled "Site Management" for Table A, provide the more detailed information identified above in 1-3 in either a footnote to Table A or the Statement of Compliance-Summary of Survey Results section at the end of the form.)

☒ **Information Regarding Unique Circumstances:**

Use the footnotes section of Table A for information that describes unique circumstances in your National Forest/BLM District or for further clarification. Don't use them to restate something that is already clear from the table. For example, it may be helpful to more completely explain that the range of the species bi-sects the National Forest/BLM District and the specific project is outside the range.

☒ **Final Statement of Compliance:**

Include a summary in the Statement of Compliance to include identification of:

☒ 1. Species list applied 2003

☒ 2. Species surveyed: See Table A

☒ 3. Species found or with known sites in the project area NONE

☒ 4. Information demonstrating application of management recommendations

Survey Protocols Used:
Equivalent effort FUNGI- USFS, 2012. Survey & Manage Category B Fungi Equivalent-Effort Survey Protocol, Version 1.0, February 2012.
http://www.blm.gov/or/plans/surveyandmanage/files/sp-fu-catB-equiv-effort-2012.pdf
Cladonia norvegica- Supplemental Guidance for Pre-Disturbance Surveys Under the Northwest Forest Plan Survey and Manage Standard and Guidelines *Cladonia norvegica*, USDA Forest Service Regions 5 and 6, USDI Bureau of Land Management, Oregon and California, September 2012. http://www.blm.gov/or/plans/surveyandmanage/files/sp-li-cladonia-norvegica-enc.pdf

- Identify the management recommendation or other information utilized.
- Clearly describe on-the-ground application of known site management. What management/protective measures were specifically applied to provide for the persistence of the species at the known site.

Botany Species Survey and Site Management Summary

C. <u>TRACKING FORM</u> – Use this form to track compliance with surveys and known site management.

D.

The Deschutes National Forest compiled the species listed below (**Table A**) from the 2001 Record of Decision. This list includes those vascular and non-vascular plant species with pre-disturbance survey requirements (Category A or C species), whose known or suspected range includes the Deschutes National Forest according to the references listed in **Appendix B.**

IF YOUR PROJECT IS A HABITAT-DISTURBING ACTIVITY IN OLD GROWTH, KEEP THIS SECTION: This list also includes species with Equivalent Effort pre-disturbance survey requirements, including Category B lichen and bryophytes and Category B fungi species whose known or suspected range includes the Deschutes National Forest according to the references listed in **Appendix A**.

All other survey and manage species that are on the 2011 Settlement Agreement list but are not included in Table A, are not known or suspected to occur on the Deschutes NF either because the Forest is outside the known or expected range of the species or the Forest does not contain suitable habitat for the species.

Equivalent effort surveys are not required for this project for Category B lichen, bryophyte and fungi species because:

___ Old growth habitat does not occur with the project area

_X_ Old growth habitat occurs but the project will not cause a significant negative impact on species' habitat, life cycle, microclimate, or life support requirement.

***Explanation*: The old growth to be affected in the project area falls under the Pechman Exemption for fuel reduction. Thinning small trees under 8" dbh and prescribed fire would be used.**

Table A identifies Category A, B, C, D, and E species with known sites located within the Project Area. The references listed in **Appendix A** were used to determine appropriate known site management.

Survey & Manage plant species evaluation for the Melvin Butte Project. Species highlighted in yellow need Special Consideration.

Appendix F 1 Survey & Manage plant speices evaluation for the Melvin Butte Project on the Sisters Ranger District, Deschutes National Forest.

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Schistostega pennata	Bryophyte	A[1]	yes	yes	yes	yes	8/07	no	
Leptogium cyanescens	Lichen	A	yes	yes	yes	yes	8/07	no	
Rhizomnium nudum	Bryophyte	B[3]	yes	yes	yes	yes	8/07	no	
Tritomaria exsectiformis	Bryophyte	B[2]	yes	yes	yes	yes	8/07	no	
Calicium abietinum	Lichen	B[3]	yes	no	yes	yes	8/07	no	
Chaenotheca Chrysocephala	Lichen	B[3]	yes	no	yes	yes	8/07	no	
Chaenotheca ferruginea	Lichen	B[3]	yes	no	yes	yes	8/07	no	
Cladonia norvegica	Lichen	B[8]	yes	no	yes	yes	8/07	no	
Dermatocarpon luridum (now called D. meiophyllizum)	Lichen	B[2]	yes	no	yes	yes	8/07	no	
Tholurna dissimilis	Lichen	B[2]	yes	no	yes	yes	8/07	no	

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Albatrellus caeruleoporus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Albatrellus ellisii	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Alpova alexsmithii	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Arcangeliella crassa	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Arcangeliella lactarioides	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Boletus pulcherrimus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Choiromyces alveolatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Chroogomphus loculatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Clavariadelphus ligula	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Clavariadelphus occidentalis	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Clavariadelphus sachalinensis	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Clavariadelphus truncatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Cortinarius magnivelatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Cortinarius olympianus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Cortinarius verrucisporus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Cortinarius wiebeae	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Cudonia monticola	Fungus Litter saprobe	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Elaphomyces anthracinus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Elaphomyces subviscidus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Fayodia bishpaerigera	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Fevansia aurantiaca (= Alpova aurantiaca)	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gastroboletus ruber	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gastroboletus subalpinus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gastroboletus turbinatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gastroboletus vividus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Gautieria magnicellaris	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gomphus bonarii	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gomphus clavatus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gymnomyces abietis	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gymnomyces nondistincta	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Gyromitra californica	Fungus Wood/litter saprobel	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Helvella crassitunicata	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Hydnotrya inordata	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Hygrophorus caeruleus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Leucogaster citrinus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Polyozellus multiplex	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria amyloidea	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria aurantiisiccescens	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Ramaria botrytis var. aurantiiramosa	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria coulterae	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria largentii	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria maculatipes	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria rubrievanescens	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Ramaria thiersii	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Rhizopogon abietis	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Rhizopogon atroviolaceus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Rhizopogon evadens var. subalpinus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Rhizopogon exiguous	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Rhizopogon flavofibrillosus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Sarcodon fuscoindicus	Fungus Mycorrhizal	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	Project Contains Suitable Habitat or Old Growth Forest?	Project Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	Describe applied management and what information used to determine this management
Spathularia flavida	Fungus Litter saprobe	B[2]	yes	yes	yes	yes	6/11, 10/11, 5/12, 10/12	no	
Cypripedium montanum	Vascular	C[4]	yes	yes	yes	yes	8/07		
Chalciporus piperatus	Fungus Mycorrhizal	D[5]	yes	N/A	N/A	No[2]	N/A		
Mycena overholtsii	Fungus Wood saprobel	D[5]	yes	N/A	N/A	No[2]	N/A		
Phaeocollybia attenuata	Fungus Mycorrhizal	D[5]	yes	N/A	N/A	No[2]	N/A		
Ramaria rubripermanens	Fungus Mycorrhizal s	D[5]	yes	N/A	N/A	No[2]	N/A		
Rhizopogon truncatus	Fungus Mycorrhizal	D[5]	yes	N/A	N/A	No[2]	N/A		
Sparassis crispa	Fungus Wood saprobe	D[5]	yes	N/A	N/A	No[2]	N/A		
Tremiscus helvelloides	Fungus Litter saprobe	D[5]	yes	N/A	N/A	No[2]	N/A		
Chaenotheca subroscida	Lichen	E[6]	yes	N/A	N/A	No[6]	N/A		
Chaenothecopsis pusilla	Lichen	E[6]	yes	N/A	N/A	No[6]	N/A		

Species	Group	S&M Category	Survey Triggers			Survey Results			Site Management
			Project Within Species Range?	**Project Contains Suitable Habitat or Old Growth Forest?**	**Project Habitat Disturbing?**	**Surveys Required?**	**Survey Date (month/year)**	**Sites Known or Found?**	**Describe applied management and what information used to determine this management**
Leptogium teretiusculum	Lichen	E[6]	yes	N/A	N/A	No[6]	N/A		
Chaenotheca furfuracea	Lichen	F[7]	yes	N/A	N/A	No[7]	N/A		*Not required to manage known sites but if apply site management, describe:*
Collema nigrescens	Lichen	F[7]	yes	N/A	N/A	No[7]	N/A		*Not required to manage known sites but if apply site management, describe:*
Collybia bakerensis	Fungus Litter saprobe	F[7]	yes	N/A	N/A	No[7]	N/A		*Not required to manage known sites but if apply site management, describe:*
Gomphus clavatus	Fungus Mycorrhizal	F[7]	yes	N/A	N/A	No[7]	N/A		*Not required to manage known sites but if apply site management, describe:*

[1] Pre-disturbance surveys and management of all known sites are required for Category A species
[2] Equivalent effort surveys required if old growth habitat disturbed and manage all known sites (Category B species)
[3] Strategic surveys completed; therefore equivalent effort surveys are **not** required (memo titled, *Category B Lichens and Bryophytes where Strategic Surveys are Considered Complete*, March 24, 2006).
[4] Pre-disturbance surveys and management of high priority sites are required for Category C species
[5] Pre-disturbance surveys are not required for Category D species, but required to manage high priority sites
[6] Pre-disturbance surveys are not required for Category E species, but required to manage all known sites
[7] Pre-disturbance surveys and management of known sites are not required for Category F species
[8] Special Consideration given to this species per Letter of Direction dated May 13, 2014

APPENDIX G – ECONOMICS

Alternative 2 net present value analysis

Net present Value Analysis				**Net present Value**	**$ 212,297.32**							
Alternative 2				**Benefit cost ratio**	**1.11**							
				Revenues								
				Delivered log price								
Project area acres	5375			**$ 140.00**	**Market Discount Rate**	4%						
				Pulp/chip per ton								
				$ 30.00								
									Total		Discounted	
Year	time	Activity	unit	No of units	Acres (multiplier)	Total No. units	Cost per unit	Revenue per unit	cost	revenue	Cost	Revenue
2015	0	Planning	5375 acres	5375	NA	1	$ 300,000.00		$ 300,000.00	$ -	$ 300,000.00	
2015	0	Sale prep/admin	CCF	20371	1	20371	$ 20.00		$ 407,420.00	$ -	$ 407,420.00	
2015	0	Road Maintenance	CCF	20371	1	20371	$ 6.00		$ 122,226.00	$ -	$ 122,226.00	
2015	0	Removal of 4-7"material	CCF	7131.0	1	7131.00		$ 30.00	$ -	$ 213,930.00	$ -	$ 213,930.00
2015	0	Saw logs	CCF	13240	1	13240.00		$ 140.00	$ -	$ 1,853,600.00	$ -	$ 1,853,600.00
2015	0	PCT (whipping) <4"dbh	acre	3786	1	3786.00	$ 100.00		$ 378,600.00	$ -	$ 378,600.00	$ -
Sub-totals									$ 1,208,246.00	$ 2,067,530.00	$ 1,208,246.00	$ 2,067,530.00
2016	1	mowing/mastication	Acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 117,115.38	
2016	1	Burn landing piles	landings	150	1	150	$ 30.00		$ 4,500.00		$ 4,326.92	
2016	1	Pruning	Acres	1166	1	1166	$ 100.00		$ 116,600.00		$ 112,115.38	
Sub-totals									$ 242,900.00	$ -	$ 233,557.69	$ -
2017	2	Pruning	acres	1166	1	1166	$ 100.00		$ 116,600.00		$ 107,803.25	
2017	2	under burn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 112,610.95	
Sub-totals									$ 238,400.00	$ -	$ 220,414.20	$ -
2018	3	Planting (KV)	acres	250	1	250	$ 400.00		$ 100,000.00		$ 88,899.64	
2018	3	under burn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 108,279.76	
Sub-totals									$ 100,000.00	$ -	$ 88,899.64	$ -
2019	4	Underburn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 104,115.15	
									$ 121,800.00	$ -	$ 104,115.15	$ -
Grand totals									$ 1,911,346.00	$ 2,067,530.00	$ 1,855,232.68	$ 2,067,530.00
											Cost	Revenue
										Per acre	$ 345.16	$ 384.66

Alternative 3 net present value analysis

Net present Value Analysis				**Net present Value**	**$ 79,386.45**							
Alternative 3				**Benefit cost ratio**	**1.04**							
				Revenues								
				Delivered log price								
Project area acres	5375			**$ 140.00**	**Market Discount Rate**	4%						
				Pulp/chip per ton								
				$ 30.00								
									Total		Discounted	
Year	time	Activity	unit	No of units	Acres (multiplier)	Total No. units	Cost per unit	Revenue per unit	cost	revenue	Cost	Revenue
2015	0	Planning	5375 acres	5375	NA	1	$ 300,000.00		$ 300,000.00	$ -	$ 300,000.00	
2015	0	Sale prep/admin	CCF	19274	1	19274	$ 20.00		$ 385,480.00	$ -	$ 385,480.00	
2015	0	Road Maintenance	CCF	19274	1	19274	$ 6.00		$ 115,644.00	$ -	$ 115,644.00	
2015	0	Removal of 4-7"material	CCF	6709.0	1	6709.00		$ 30.00	$ -	$ 201,270.00	$ -	$ 201,270.00
2015	0	Saw logs	CCF	12565	1	12565.00		$ 140.00	$ -	$ 1,759,100.00	$ -	$ 1,759,100.00
2015	0	PCT (whipping) <4"dbh	acre	3786	1	3786.00	$ 100.00		$ 378,600.00	$ -	$ 378,600.00	$ -
Sub-totals									$ 1,179,724.00	$ 1,960,370.00	$ 1,179,724.00	$ 1,960,370.00
2016	1	mowing/mastication	Acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 117,115.38	
2016	1	Burn landing piles	landings	150	1	150	$ 30.00		$ 4,500.00		$ 4,326.92	
2016	1	Pruning	Acres	1351	1	1351	$ 100.00		$ 135,100.00		$ 129,903.85	
Sub-totals									$ 261,400.00	$ -	$ 251,346.15	$ -
2017	2	Pruning	acres	1351	1	1351	$ 100.00		$ 135,100.00		$ 124,907.54	
2017	2	under burn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 112,610.95	
Sub-totals									$ 256,900.00	$ -	$ 237,518.49	$ -
2018	3	under burn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 108,279.76	
Sub-totals									$ 121,800.00	$ -	$ 108,279.76	$ -
2019	4	Underburn	acres	1218	1	1218	$ 100.00		$ 121,800.00		$ 104,115.15	
									$ 121,800.00	$ -	$ 104,115.15	$ -
Grand totals									$ 1,941,624.00	$ 1,960,370.00	$ 1,880,983.55	$ 1,960,370.00
											Cost	Revenue
										Per acre	$ 349.95	$ 364.72

APPENDIX H – POTENTIAL WILDERNESS AREA CLASSIFICATION

Appendix H 1 Evaluation of potential wilderness area poloygons based on FSH 1909.12 Chapter 71 Inventory Criteria.

ParentPolyID	PolyID	Analysis_Acres	PWAreaAnalyzed	PWA	PWAComment	Regulation1	Regulation2a	Regulation2b	Regulation2c	Regulation 3
1	1	7.3	Yes	no	firewood cutting	no	no	no	no	no
2	2	18.9	Yes	no	firewood cutting	no	no	no	no	no
3	3	4.7	Yes	no	firewood cutting	no	no	no	no	no
4	4	71.9	Yes	no	firewood cutting	no	no	no	no	no
5	5	42.4	Yes	no	firewood cutting	no	no	no	no	no
6	6	44.6	Yes	no	firewood cutting	no	no	no	no	no
7	7	3.7	Yes	no	firewood cutting	no	no	no	no	no
8	8	21.3	Yes	no	firewood cutting	no	no	no	no	no
9	9	4.1	Yes	no	firewood cutting	no	no	no	no	no
10	10	11.5	Yes	no	firewood cutting	no	no	no	no	no
11	11	60.8	Yes	no	firewood cutting	no	no	no	no	no
12	12	4.9	Yes	no	firewood cutting	no	no	no	no	no
13	13	1.4	Yes	no	firewood cutting	no	no	no	no	no
14	14	8.6	Yes	no	firewood cutting	no	no	no	no	no
16	16	7.3	Yes	no	firewood cutting	no	no	no	no	no
17	17	2.1	Yes	no	firewood cutting	no	no	no	no	no
18	18	1.1	Yes	no	firewood cutting	no	no	no	no	no
19	19	1.8	Yes	no	firewood cutting	no	no	no	no	no
20	20	116.7	Yes	no	firewood cutting	no	no	no	no	no
21	21	20.4	Yes	no	firewood cutting	no	no	no	no	no
22	22	8.0	Yes	no	firewood cutting	no	no	no	no	no
23	23	95.1	Yes	no	firewood cutting	no	no	no	no	no
24	24	48.1	Yes	no	firewood cutting	no	no	no	no	no
25	25	5.8	Yes	no	sanitation-salvage	no	no	no	no	no
26	26	1.2	Yes	no	sanitation-salvage	no	no	no	no	no

27	27	23.6	Yes	no	firewood cutting	no	no	no	no	no
28	28	1.6	Yes	yes	ADJ. WILDERNESS	no	no	no	yes	yes
ParentPolyID	**PolyID**	**Analysis_Acres**	**PWAreaAnalyzed**	**PWA**	**PWAComment**	**Regulation1**	**Regulation2a**	**Regulation2b**	**Regulation2c**	**Regulation 3**
29	29	13.3	Yes	no	sanitation-salvage	no	no	no	no	no
30	30	23.6	Yes	no	firewood cutting	no	no	no	no	no
31	31	3.2	Yes	no	sanitation-salvage	no	no	no	no	no
32	32	15.4	Yes	no	sanitation-salvage	no	no	no	no	no
33	33	2.2	Yes	no	sanitation-salvage	no	no	no	no	no
34	34	2.1	Yes	no	sanitation-salvage	no	no	no	no	no
35	35	60.6	Yes	no	sanitation-salvage	no	no	no	no	no
36	36	24.2	Yes	no	sanitation-salvage	no	no	no	no	no
37	37	10.2	Yes	no	sanitation-salvage	no	no	no	no	no
38	38	3.3	Yes	no	sanitation-salvage	no	no	no	no	no
39	39	4.4	Yes	no	sanitation-salvage	no	no	no	no	no
40	40	8.7	Yes	no	sanitation-salvage	no	no	no	no	no
41	41	1.2	Yes	no	sanitation-salvage	no	no	no	no	no
42	42	27.1	Yes	no	sanitation-salvage	no	no	no	no	no
43	43	8.1	Yes	no	sanitation-salvage	no	no	no	no	no
44	44	4.3	Yes	no	sanitation-salvage	no	no	no	no	no
45	45	1.3	Yes	no	sanitation-salvage	no	no	no	no	no
46	46	14.3	Yes	no	sanitation-salvage	no	no	no	no	no
47	47	2.0	Yes	no	sanitation-salvage	no	no	no	no	no
48	48	24.6	Yes	no	sanitation-salvage	no	no	no	no	no
49	49	12.9	Yes	no	sanitation-salvage	no	no	no	no	no
50	50	1.6	Yes	no	sanitation-salvage	no	no	no	no	no
51	51	40.8	Yes	no	sanitation-salvage	no	no	no	no	no
52	52	11.9	Yes	no	sanitation-salvage	no	no	no	no	no
53	53	10.7	Yes	no	sanitation-salvage	no	no	no	no	no
54	54	14.6	Yes	no	sanitation-salvage	no	no	no	no	no
55	55	15.9	Yes	no	sanitation-salvage	no	no	no	no	no

ParentPolyID	PolyID	Analysis_Acres	PWAreaAnalyzed	PWA	PWAComment	Regulation1	Regulation2a	Regulation2b	Regulation2c	Regulation 3
56	56	12.0	Yes	no	sanitation-salvage	no	no	no	no	no
57	57	14.1	Yes	no	sanitation-salvage	no	no	no	no	no
58	58	7.0	Yes	no	sanitation-salvage	no	no	no	no	no
59	59	5.4	Yes	no	sanitation-salvage	no	no	no	no	no
60	60	28.1	Yes	no	sanitation-salvage	no	no	no	no	no
61	61	1.9	Yes	no	sanitation-salvage	no	no	no	no	no
62	62	5.4	Yes	no	sanitation-salvage	no	no	no	no	no
63	63	6.7	Yes	no	sanitation-salvage	no	no	no	no	no
64	64	2.1	Yes	no	sanitation-salvage	no	no	no	no	no
65	65	2.0	Yes	no	sanitation-salvage	no	no	no	no	no
66	66	13.9	Yes	no	sanitation-salvage	no	no	no	no	no
67	67	6.1	Yes	no	sanitation-salvage	no	no	no	no	no
68	68	5.1	Yes	no	sanitation-salvage	no	no	no	no	no
69	69	7.5	Yes	no	sanitation-salvage	no	no	no	no	no
70	70	21.9	Yes	no	sanitation-salvage	no	no	no	no	no
71	71	68.5	Yes	no	sanitation-salvage	no	no	no	no	no
72	72	1.1	Yes	no	sanitation-salvage	no	no	no	no	no
73	73	22.5	Yes	no	sanitation-salvage	no	no	no	no	no
74	74	2.7	Yes	no	sanitation-salvage	no	no	no	no	no
75	75	64.1	Yes	no	sanitation-salvage	no	no	no	no	no
76	76	1.7	Yes	no	sanitation-salvage	no	no	no	no	no
77	77	2.7	Yes	no	sanitation-salvage	no	no	no	no	no
78	78	14.3	Yes	no	sanitation-salvage	no	no	no	no	no
79	79	12.1	Yes	no	sanitation-salvage	no	no	no	no	no
80	80	17.0	Yes	no	sanitation-salvage	no	no	no	no	no
81	81	1.3	Yes	no	sanitation-salvage	no	no	no	no	no
82	82	15.6	Yes	no	sanitation-salvage	no	no	no	no	no
83	83	4.2	Yes	no	sanitation-salvage	no	no	no	no	no
84	84	1.5	Yes	no	sanitation-salvage	no	no	no	no	no

ParentPolyID	PolyID	Analysis_Acres	PWAreaAnalyzed	PWA	PWAComment	Regulation1	Regulation2a	Regulation2b	Regulation2c	Regulation 3
85	85	4.2	Yes	no	sanitation-salvage	no	no	no	no	no
86	86	9.8	Yes	no	sanitation-salvage	no	no	no	no	no
87	87	55.3	Yes	no	sanitation-salvage	no	no	no	no	no
88	88	6.4	Yes	no	sanitation-salvage	no	no	no	no	no
89	89	3.8	Yes	no	sanitation-salvage	no	no	no	no	no
90	90	81.2	Yes	no	sanitation-salvage	no	no	no	no	no
91	91	2.4	Yes	no	sanitation-salvage	no	no	no	no	no
92	92	35.8	Yes	no	sanitation-salvage	no	no	no	no	no
93	93	18.5	Yes	no	sanitation-salvage	no	no	no	no	no
94	94	77.9	Yes	no	sanitation-salvage	no	no	no	no	no
95	95	4.0	Yes	no	sanitation-salvage	no	no	no	no	no
96	96	3.1	Yes	no	sanitation-salvage	no	no	no	no	no
97	97	5.6	Yes	no	sanitation-salvage	no	no	no	no	no
98	98	11.6	Yes	no	sanitation-salvage	no	no	no	no	no
99	99	3.2	Yes	no	sanitation-salvage	no	no	no	no	no
100	100	4.9	Yes	no	sanitation-salvage	no	no	no	no	no
101	101	19.8	Yes	no	sanitation-salvage	no	no	no	no	no
102	102	1.6	Yes	no	sanitation-salvage	no	no	no	no	no
103	103	26.0	Yes	no	sanitation-salvage	no	no	no	no	no
104	104	6.6	Yes	no	sanitation-salvage	no	no	no	no	no
105	105	18.3	Yes	no	sanitation-salvage	no	no	no	no	no
106	106	12.6	Yes	no	sanitation-salvage	no	no	no	no	no
107	107	9.2	Yes	no	sanitation-salvage	no	no	no	no	no
108	108	19.0	Yes	no	sanitation-salvage	no	no	no	no	no
109	109	20.0	Yes	no	sanitation-salvage	no	no	no	no	no
110	110	17.8	Yes	no	sanitation-salvage	no	no	no	no	no
111	111	14.6	Yes	no	sanitation-salvage	no	no	no	no	no
112	112	1.0	Yes	no	sanitation-salvage	no	no	no	no	no
113	113	3.3	Yes	no	sanitation-salvage	no	no	no	no	no

ParentPolyID	PolyID	Analysis_Acres	PWAreaAnalyzed	PWA	PWAComment	Regulation1	Regulation2a	Regulation2b	Regulation2c	Regulation 3
114	114	1.1	Yes	no	sanitation-salvage	no	no	no	no	no
115	115	6.1	Yes	no	sanitation-salvage	no	no	no	no	no
116	116	2.5	Yes	no	sanitation-salvage	no	no	no	no	no
117	117	2.2	Yes	no	sanitation-salvage	no	no	no	no	no
118	118	19.8	Yes	no	sanitation-salvage	no	no	no	no	no
119	119	2.1	Yes	no	sanitation-salvage	no	no	no	no	no
121	121	66.1	Yes	no	sanitation-salvage	no	no	no	no	no
122	122	6.6	Yes	no	sanitation-salvage	no	no	no	no	no
123	123	1.1	Yes	no	sanitation-salvage	no	no	no	no	no
15	15	57.4	Yes	no	sanitation-salvage	no	no	no	no	no
120	120	1605.1	Yes	yes	ADJ. WILDNERNESS	no	yes	no	yes	yes
120	124	14.8	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	125	0.0	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	126	0.0	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	127	0.0	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	128	0.8	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	129	37.3	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes
120	130	307.0	Yes	yes	ADJ. WILDNERNESS	no	yes	no	yes	yes
120	131	924.1	Yes	yes	ADJ. WILDNERNESS	no	yes	no	yes	yes
120	130	260.0	Yes	yes	ADJ. WILDNERNESS	no	yes	no	yes	yes
120	129	11.9	Yes	yes	ADJ. WILDNERNESS	no	no	no	yes	yes

Note: ADJ. WILDERNESS = The polygon is adjacent to an existing Wilderness area.