United States
Department of
Agriculture

Forest
Service

February 2014

Rocket Vegetation Management Project

Environmental Assessment

and Forest Plan Amendments

Bend/Ft. Rock Ranger District, Deschutes National Forest
Deschutes County, Oregon

Legal Location: Township 19 South, Range 11 East; T. 19 S., R.12 E., T. 20 S., R. 11 E., T. 20 S., R. 12 E.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Table of Content

Introduction 5
Purpose and Need for Action 7
Planning and Management Direction 8
Proposed Action 12
Public Involvement and Issues 14
Decision to be Made 19
Description of Alternatives 20
Comparison of the Alternatives Considered in Detail 49
Environmental Impacts of the Alternatives 52
Fuels, Fire Behavior, and Air Quality 57
Forested Vegetation & Silviculture 84
Wildlife: Introduction 142
Wildlife: Threatened, Endangered, Proposed, and Sensitive Species 144
Wildlife: Management Indicator Species (MIS) 183
Soil Resources 292
Botany: Threatened, Endangered, and Sensitive Species 318
Invasive Plants / Noxious Weeds 318
Roads and Access 321
Recreation 323
Scenic Views 329
Potential Wilderness and Other Undeveloped Lands 340
Cultural Resources 342
Economic and Timber Sale Feasibility Analysis 344
Other Findings 350
Interdisciplinary Team 355
Agencies and Persons Consulted 355
References 358
Appendix A – Unit and Prescription Lists by Alternative 373
Appendix B –Stands with Large Tree Structure Treated by Alternative 393
Appendix C – Soils Estimated Detrimental Conditions by Unit and Alternative 396

***Appendix D – Landscape Analysis*.....400**

***Appendix E – Fire Regime and Condition Class Descriptions*.....403**

***Appendix F – Consideration of Comments Submitted during the 30-day Public Comment Period*.....405**

Introduction

The vicinity map below shows the location of the Rocket project area. It includes approximately 22,682 acres located south of the city of Bend and predominately east of US 97. Approximately 5,248 acres of the project area are covered by lava flows, most of that lying within the boundaries of the Newberry National Volcanic Monument (NNVM). Elevations range from approximately 4,200 feet above sea level to almost 6,200 feet on Mokst Butte. The legal description is as follows: T 19 South, R 11 East, Sec. 11-14, 24-26, and 34-36; T 19 South, R 12 East, Sec. 3-9, 16-21, and 27-34; T 20 South, R 11 East, Sec. 1-3 and 11-13; and T 20 South, R 12 East, Sec. 3-11, 14-18, 20-22, and 28; Willamette Meridian, Deschutes County Oregon.

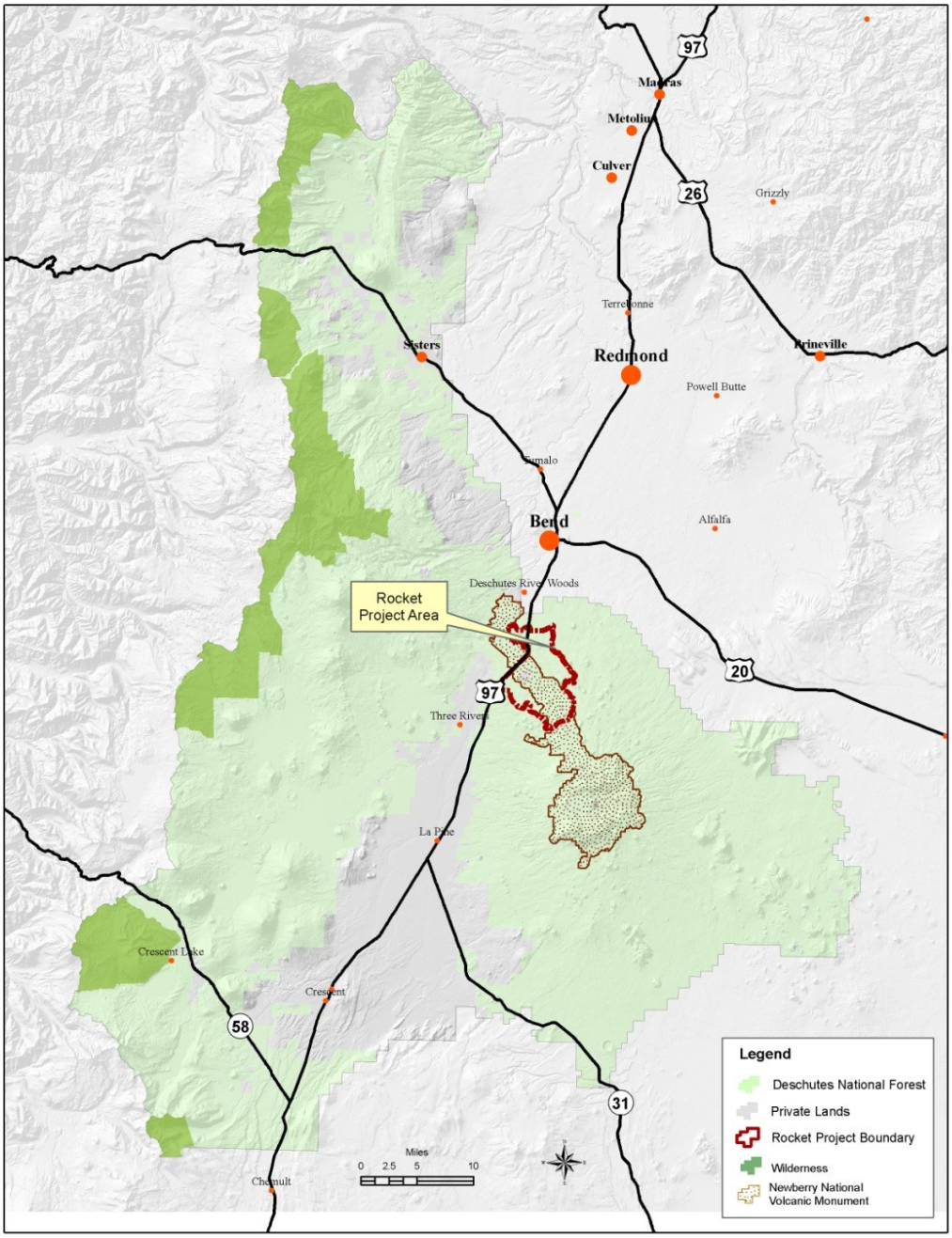


Figure 1. Vicinity of the Rocket Project Area within the Deschutes National Forest.

The Bend/Ft. Rock Ranger District is proposing to thin trees, mow shrubs, and prescribe burn surface fuels within the Rocket project area. The Forest Service has prepared this Environmental Assessment (EA) to disclose effects of the proposal and additional alternatives. It addresses the proposed action and three additional alternatives, including No Action; the major issues associated with the proposal; and the direct, indirect, and cumulative effects of implementation of each of the alternatives.

The interdisciplinary team (IDT) completed a brief landscape analysis process as a means to review broad-based goals and objectives that are often over-lapping within a project area. The analysis process was similar to the methodology devised by Diaz and Apostle (USDA 1992) and the resulting map and table are included in Appendix D.

Stand History

The planning area is located within the dry eastside forests of central Oregon. Prior to the start of active fire suppression in the early 1900s, low intensity wildfire frequently burned this ecosystem reducing stand density and natural fuels. Historic fire intervals were generally less than 30 years, and as often as every seven years. Large ponderosa pine (diameters greater than 21 inches) dominated the landscape.

During the 1930s and 1940s, much of the area was owned and clearcut by either the Shevlin-Hixon or Brooks-Scanlon Lumber Companies. These activities left few residual large trees and very few small stands of larger, older ponderosa pine. The Forest Service acquired these private lands during the ensuing years. These lands reforested primarily through the natural regeneration of ponderosa pine.

The project area is now dominated by relatively young (70-80 year old) ponderosa pine stands. There is some lodgepole pine and white fir in the southeast portion of the project area. Plantations dating from 1970 to 1985 are scattered throughout the project area. Larger diameter (> 21 inches), older trees (> 150 years) are uncommon, occurring as scattered individual trees or scattered groups of trees.

Why here? Why now?

The Forest Service recently conducted an analysis of federal lands in central Oregon and prioritized watersheds for fuels hazard reduction, ecosystem restoration, and production of forest products. The Rocket project area falls within the Deschutes River-Pilot Butte watershed which ranks high for the combination of restoration potential, fuel hazard, and timber product potential (USFS 2011). Specific reasons it is a high priority are as follows:

- Stands proposed for treatments are densely-stocked with density high enough to make them susceptible to bark beetle attack (see side bar on UMZ). Diameter growth rate is one measure of tree vigor, growth and competition (Hall 1987). In portions of the project area, competition for limited site resources is resulting in reductions in diameter growth rates. Also, tree mortality from insects is already occurring in some of these high density stands.
- Dwarf mistletoe infection is also contributing to reductions in tree vigor and growth. Mistletoe distribution across the project area is variable, but some stands are severely infected which affects the health, vigor, and growth of the trees which can in turn increase susceptibility to attack by insects.
- Research has shown that stands like those in the Rocket project area would be responsive to thinning. Thinning has been shown to reduce the amount of ponderosa pine mortality caused by mountain pine beetles (Fettig 2007) and Cochran and Barrett (1999) showed that tree growth increased following thinning in young ponderosa pine stands.

Upper Management Zone

Bark beetle hazard can be gauged by tree stocking density (Fettig et al. 2007). Cochran et al. (1994) used the stand density index (SDI) concept to establish stand densities above which mortality from mountain pine beetle can become serious. This UMZ can be used to identify stands whose density contributes to susceptibility to bark beetle attack and to guide management for sustaining healthy stand conditions. Using Cochran's concepts, UMZs have been established specifically for plant associations on the Deschutes National Forest. Tree density within most stands proposed for thinning is above the UMZ.

- Research has also shown that thinning is an important first step in restoring fire-resilient ponderosa pine forests. This is especially true in young, densely stocked, even-aged stands common in the Rocket project area (Busse et al. 2009).
- Hazardous fuels conditions across the project area have developed over the years. Nearly all of the project area is departed from its historic fire regime and is at risk of being lost during a wildfire event. Particular concern for fuels hazard is public and firefighter safety during a wildfire event, the potential loss of larger trees that are not common in the project area, destruction of wildlife habitat, negative impacts to scenery, as well as safe ingress and egress on heavily-used routes.
- The location of the project area makes it an important movement corridor for mule deer. US Highway 97 creates a barrier to big game movement, but newly constructed highway undercrossings are showing evidence of use by wildlife. Although the project area has sufficient hiding cover available as recommended for the various management allocations, the Rocket project must consider big game movement through the area and ways to improve the distribution of deer hiding cover in the project area. It is the right time to consider these objectives because the highway undercrossing project recently began to facilitate movement.
- Over half of the project falls within the Newberry National Volcanic Monument. The Monument's Management Plan was written nearly 20 years ago. It's important for the Forest to work towards meeting the goals of the plan which include sustaining or restoring ecosystems and ensuring ecosystem resiliency within the Monument while providing natural ecological succession of vegetation to the maximum extent practical. Stands proposed for treatment within the Monument are not sustainable in their current condition and the reintroduction of fire would not be possible in most cases without thinning first. Treatments can create stand conditions that are more resilient and sustainable and provide an opportunity to allow natural ecological processes to occur without a large-scale loss of the overstory.

Purpose and Need for Action

In order to address existing conditions within the project area and move those conditions towards the desired condition described by the Forest and Monument Plans:

There is a need to improve vegetative resilience to disturbance agents such as insects, disease, and fire, and lessen the risk that such disturbance events result in large scale loss of forest. There is a need to reduce stand density, improving health and growth of residual trees and moving the structural stages on the landscape closer to the historic range of variability (HRV).

Many of the stands in the Rocket project area, including previously thinned stands, have stocking levels high enough to slow diameter growth and increase the risk of mortality from bark beetle attack. Across the project area, fuel loadings and ladder fuels increase the risk of a high intensity and/or stand-replacing wildfire event. Where large tree structure exists, the purpose is to maintain and enhance it. Within the Newberry National Volcanic Monument (NNVM) the purpose is to create conditions that will promote old growth ponderosa pine, allow the reintroduction of fire, and allow fire to play a key role in the future.

The amount of single-story ponderosa pine late and old structural (LOS) stage is less than the historic range of variability (HRV), due to historic harvesting practices. Past thinning has placed some mid-seral stands on a trajectory towards becoming ponderosa pine LOS. This trajectory, however, can be adversely affected by slowing diameter growth rates, mortality from beetles, and high intensity and/or stand-replacing wildfires. The purpose of this project is to maintain or accelerate that trajectory in previously thinned stands, start it for those that have not been previously thinned, and for some stands, hasten the process by reducing stand densities to LOS stocking levels now, and reintroducing fire to maintain those conditions over time.

There is a need to improve deer habitat conditions in the project area, including the arrangement of forage, cover, and thermal habitat.

Although the amount of deer hiding cover is sufficient to meet LRMP standards, the distribution of cover is important for deer movement. There is a need to initiate development of new patches of hiding cover and increase vertical stand diversity in the Deer Habitat management allocation and to maintain viable migration corridors in the NNVM.

There is a need to contribute to local and regional economies by providing timber, other wood and fiber products, and associated jobs in both the short and long term.

The management of timber resources is supported by the Deschutes Land and Resource Management Plan (LRMP). It does so by recognizing the value of those resources in a way and manner that is consistent with other resource values, objectives, environmental constraints, and economic efficiencies (LRMP page 4-37). Management allocations in the project area either emphasize timber production (General Forest) or allow it where necessary to meet management area objectives (Scenic Views, Deer Habitat, and Newberry National Volcanic Monument). One purpose of the project is to provide a variety of products and services that support the local and regional economies.

What is Resilience?

The Forest Service Manual defines resilience as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change (FSM 2000 Chapter 2020.5).

In their paper "Basic principles of forest fuels reduction treatments" Agee and Skinner define resiliency as a forest capable of maintaining substantial live basal area after being burned by a wildfire (2005). Fitzgerald defines fire-resiliency as the ability of ponderosa pine forests to survive wildfires relatively intact, as typically occurred during pre-settlement times (2005).

In the context of this site-specific project, resiliency is considered ***the ability of a forested area to survive a disturbance event, specifically wildfire and insect attack, relatively intact and without large scale tree mortality.*** By using the term "relatively intact," this recognizes that the intent of the proposed treatments is not to fire-proof the area, but to set the area on a trajectory to where natural processes such as fire and insects can play a role in the system without causing large scale mortality.

Planning and Management Direction

Planning

Planning for this project was done in accordance with the National Environmental Policy Act (NEPA) of 1969. Procedures described in the Council on Environmental Quality's implementing regulations for NEPA (Title 40; CFR Parts 1500-1508) and the Forest Service's implementing regulations for NEPA (Title 36; CFR Part 220) were used to ensure compliance with NEPA.

To avoid duplication of analysis that has already been completed, this document is tiered to and relies upon the analysis in:

- The 1990 Final Environmental Impact Statement for the Deschutes National Forest Land and Resource Management Plan (hereafter referred to as the Forest Plan) (USDA 1990); and

- The 1994 Final Environmental Impact Statement for the Newberry National Volcanic Monument (hereafter referred to as the Monument Plan) (USDA 1994).

Management Direction

Deschutes Land and Resource Management Plan

The Deschutes Land and Resource Management Plan (LRMP), as amended, provides guidance and direction for management activities on all lands managed by the Deschutes National Forest, with the exception of lands guided by the Newberry National Volcanic Monument Plan (see below). The LRMP establishes goals, objectives, and standards and guidelines on both a forest-wide as well as on a management area specific basis. The Rocket project area includes several management allocations, as displayed in Table 1 and Figure 2. Table 1 states briefly the management area goals and objectives.

Newberry National Volcanic Monument

The Monument legislation supersedes the Forest Plan; therefore direction provided by the Monument Plan will take precedence over the Forest Plan where there is overlap (Monument Plan page 4). The Monument covers about 50,000 acres of the Deschutes National Forest, and 20% of it lies within the Rocket project area.

The Monument Plan lists specific forest-wide standards and guidelines from the 1990 Forest Plan that are applicable within the monument boundaries (listed on Monument Plan page 77) and notes that unless otherwise indicated in the management direction for the management zones, no other Forest Plan standards and guidelines would apply (Monument Plan page 78). The Record of Decision for the Monument Plan calls for 3,700 acres or 37% of the ponderosa pine to be restored (NNVM ROD p. 10).

Forest and Monument Plan management areas (MAs) are displayed together in the following table.

Table 1: Forest and Monument Plan Management Areas and their Goals/Objectives

Management Area	Summary of Goals/Objective	Acres
Forest Plan		
Deer Habitat (MA-7)	Manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality, and recreation opportunities.	2,873
General Forest (MA-8)	Emphasize timber production while providing forage production, visual quality, wildlife habitat, and recreational opportunities.	4,985
Scenic Views (MA-9)	Provide Forest visitors with high quality scenery that represents the natural character of Central Oregon	
	• Retention Foreground	970
	• Retention Middleground	1102
	• Partial Retention Foreground	2,062
	• Partial Retention Middleground	111
Old Growth (MA-15)	Provide naturally evolved old growth forest ecosystems for 1) habitat for plant and animal species, 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.	247
	Forest Plan Subtotal	**12,351**

Management Area	Summary of Goals/Objective	Acres
Monument Plan		
Lava Butte Zone	A primary purpose of this zone is reintroduction of fire through prescribed burning and reestablishment of fire-based, historic ponderosa pine old growth. Migration routes, high quality forage, and cover for deer should also be provided.	1,697
Transition Zone	A primary purpose of this zone is reintroduction of fire through prescribed burning and reestablishment of fire-based, historic ponderosa pine old growth. Migration routes, high quality forage, and cover for deer should also be provided. The majority of this zone is covered by lava flow.	6,814
Research Natural Area (Mokst Butte)	Located within the Monument's Transition Zone, the goal of this area goal is to preserve examples of naturally occurring ecosystems in an unmodified condition for non-manipulative research and education.	1,310
Other Ownership	The State of Oregon owns a single block in the west-central portion of the project area, entirely within the Monument boundary. It is almost entirely lava flow.	510
	Monument Plan Subtotal	**10,331**
	Total	**22,682**

Eastside Screens

In 1995 the Regional Forester amended Forest Plans east of the northern spotted owl range. The Rocket project area outside of the Monument is subject to this amendment, also known as the Eastside Screens. The EA for the Screens stated the primary purpose was "to conserve those components of the landscape – old forest abundance, wildlife habitat in late and old structural stages – in relation to larger ecosystem management to protect habitat for certain species of wildlife and to promote the vigor and health of the forests." (Revised Environmental Assessment for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, p. 5). Although intended to be interim direction, the Eastside Screens are still in effect for timber sale planning on the Deschutes National Forest east of the range of the spotted owl and contain guidelines for management of timber sales in late and old structure (LOS) relative to the Historic Range of Variability (HRV), wildlife connectivity corridors, snags, coarse woody debris, and goshawk management. The Regional Forester has encouraged the consideration of Forest Plan amendments in cases where the proposed treatments would move landscape conditions towards HRV.

Northwest Forest Plan, INFISH, and Water Resources

The project area is entirely east of the area covered by the Northwest Forest Plan; therefore, direction in the Northwest Forest Plan does not apply to this project.

The project area does not contain any surface water. There are no streams, lakes, or reservoirs; therefore there is no habitat for any fish species. There is no riparian vegetation and no Riparian Habitat Conservation Areas; therefore, INFISH direction is not applicable to the project area. Because there is no potential for effects to water or fisheries, these resources are not considered further in this EA.

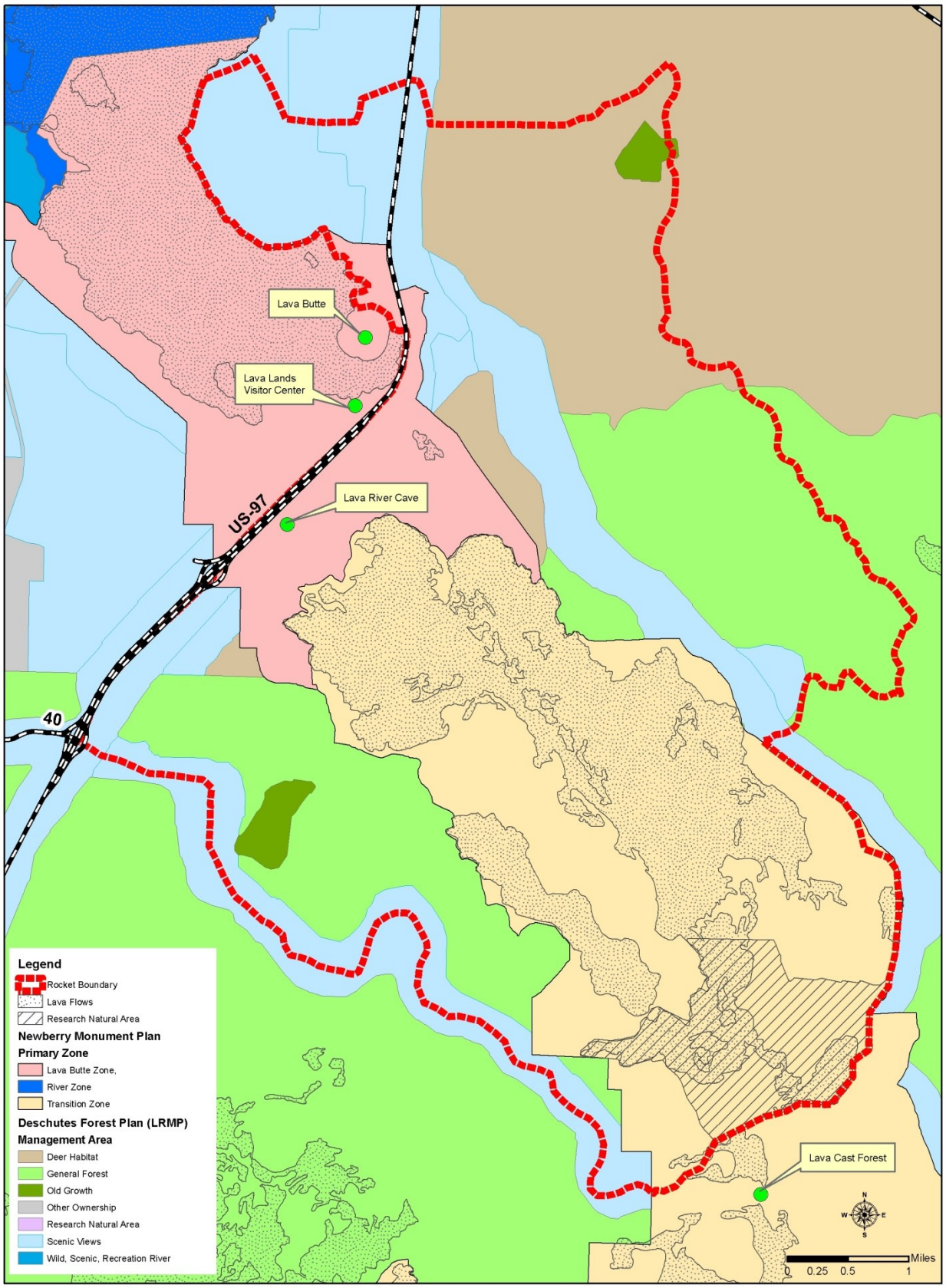


Figure 2: Forest Plan and Monument Plan Management Areas

Other Resource Guidance and Considerations

Roads Analysis

In 2002, a Roads Analysis was completed for a larger area within which the Rocket project is located. The analysis was updated in 2004 following the 18 Fire. The report concluded that a sufficient transportation system can be kept in place while at the same time road closures and decommissioning can move towards Forest Plan standards and guidelines for road density, and providing net benefits for wildlife and associated habitat. The roads analysis addressed concerns about wildlife habitat effectiveness, access that allows efficient response for fire suppression activities, historical use, and management considerations. During the current project planning effort, the ID Team has identified additional road closures in the project area that address changes in emphasis since 2004 such as the need to encourage use of the Highway 97 wildlife undercrossings by big game as well as the stated purpose and need to improve habitat effectiveness.

Community Wildfire Protection Plans

The Rocket project area includes portions of two Community Wildfire Protection Plans (CWPPs): the Greater Bend CWPP and the East and West Deschutes County CWPP. The Greater Bend CWPP, originally signed May 16, 2006, and updated August 29, 2011 includes only those National Forest system lands from the Lava Lands Visitor Center north and primarily west of US 97. The East and West Deschutes County CWPP, originally signed December 18, 2007 and updated July 30, 2012, covers the remaining lands east of US 97 within the project area boundaries. Both CWPPs were prepared under the authorities of the Hazardous Fuels Reduction Act (HFRA) by a collaborative group of representatives of federal, state, and local governments and private entities.

The CWPPs identify prioritized wildland-urban interface (WUI) areas for hazardous fuels reduction and the preferred fuels treatment methods. The overall fuels treatment standard in both CWPPs is to decrease the risk of uncharacteristic wildland fire behavior by reducing fuels to that which can produce flame lengths of less than four feet. This standard is to be applied starting within a ¼ mile buffer of adjacent WUI areas and within 500 feet of any critical transportation routes or ingress/egress that could serve as an escape route from adjacent communities at risk.

Priority WUI areas relevant to the Rocket planning area include Lava Lands Visitor Center, Lava River Cave, Lava Butte, and critical transportation routes. Although both the visitor center and the butte are outside the project area boundary, the quarter mile WUI buffer around these areas extends into the project area. U.S. Highway 97, the access roads to both Lava Lands Visitor Center and the Lava River Cave recreation site, and Forest Road 9720 meet the critical transportation route definition in the CWPPs.

Deschutes Collaborative Forest Project

The Deschutes Collaborative Forest Project (DCFP) encompasses a 258,000-acre landscape, including the Rocket project area. Recommendations for restoration in second-growth ponderosa pine, mistletoe management, and for incorporating recreation and tourism values into vegetation management planning have been reviewed in the context of the Rocket project area. The complete list of recommendations is located in the project file. Additional information about the Collaborative Forest Restoration Program can be found on the web at http://www.fs.fed.us/restoration/CFLRP.

Proposed Action

Objectives for Development of the Proposed Action

Based on the purpose and need, management direction, and other guiding documents, the following objectives were applied across the project area and in the context of the larger landscape to develop a proposed action:

- Address forest restoration activities at a landscape scale. Because past harvest practices of the early 20th century affected such a large amount of central Oregon forests, there are large tracts of second-

growth ponderosa pine forests that are in need of restoration. Stand delineation and treatments should maintain trajectory of stands that have been thinned before, provide diversity in stocking levels, and be configured into larger blocks to increase efficiency in treatment and prescribed fire use.

- The Newberry National Volcanic Monument (NNVM) should receive special consideration for achieving the goal of creating conditions where natural ecological succession of vegetation can occur to the maximum extent practical. Little work has been done within the NNVM to address this goal.
- Within the Deer Habitat management allocation, the proposed action should maintain the proportion of cover consistent with Forest Plan guidelines. Distribute openings for developing hiding cover to account for deer movement and highway underpass locations, and improving the arrangement of hiding cover in relation to thermal cover.
- Across the project area, reduce the amount of open roads. Road closure and decommissioning should focus on recent changes such as highway widening project and underpass construction, and areas where hiding cover is lacking. Use a variety of methods to reduce off-road and trail travel and return unauthorized trails and unneeded roads to a productive condition.

The Forest Service proposes to address the purpose and need by using vegetation treatments, primarily commercial and small tree thinning, mechanical shrub treatments (mowing or mastication), and underburning to maintain and enhance forest health, to promote ponderosa pine LOS, and to provide a diversity of wildlife habitats with specific emphasis on goshawk and mule deer habitat.

Table 2: Proposed Action* Treatments and Related Acreages.

Activities Proposed	Description	Approximate Acres
Thin to approximately 60 square feet basal area	**What:** Tree density reduction and fuels reduction. Thin trees to approximately 60 square feet basal area. Includes removal of commercial wood products. Thinning followed with mowing and/or underburning. **Where and Why:** Treatments proposed within: 1) Deer Habitat MA to provide canopy cover at the highest percentage that will maintain healthy stand conditions with a low risk of damage due to beetles, 2) General Forest MA to utilize site growth potential while maintaining conditions with a low risk of damage due to beetle, and 3) Old Growth MA or portions of Scenic Views MA to provide higher canopy cover for wildlife habitat while maintaining a low risk of damage due to beetle.	3,614
Thin to approximately 40 square feet basal area	**What:** Tree density reduction and fuels reduction. Thin trees to approximately 40 square feet basal area. Includes removal of commercial wood products. Thinning followed with mowing and/or underburning. **Where and Why:** Treatments proposed within: 1) NNVM to reduce risk to bark beetles while moving towards dominant tree stocking associated with historic ponderosa pine old growth, 2) Scenic Views to reduce risk to bark beetles while enhancing development of large diameter trees and creating open stand conditions that create a sense of depth in landscapes viewed from travel corridors, and 3) Old Growth MA to reduce risk to bark beetle while perpetuating or enhancing old growth characteristics.	2,931
	Total Commercial Thinning	**6,545**
Thin to about 90 – 170 trees per acre in	**What:** Tree density reduction and fuels reduction. Thin trees to approximately 90 to 170 trees per acre. Removal of wood fiber could occur depending on opportunities for small wood utilization.	565

Activities Proposed	Description	Approximate Acres
plantations	**Where and Why:** Treatments proposed within existing plantations to maintain or improve diameter growth rates and improve trajectory for developing LOS.	
Natural fuels reduction and prescribed fire	**What:** Natural fuels reduction without thinning, including shrub mowing, ladder fuel reduction, and prescribed fire. **Where and Why:** Treatments proposed within areas where either: 1) tree stocking levels are not high enough to need thinning at this time, or 2) high stocking levels are desired to meet wildlife habitat needs.	647
	Total Plantation Thinning and Natural Fuels Reduction	**7,757**

*The Proposed Action has been modified to become Alternative 2 (p. 16). Description of individual activities begins on page 26. Acres are approximate.

The scoping notice also described the proposal to create up to five openings of 4 to 12 acres in order to provide areas of vertical and horizontal tree diversity and to improve the spatial arrangement of forage, cover, and thermal habitat. Openings were proposed within the Deer Habitat management allocation. Openings are created by removing all trees less than 21" dbh, underburning, and then planting ponderosa pine to regenerate new cover stands.

Public Involvement and Issues

The Rocket Vegetation Management project was initially announced to the public in a letter mailed to 210 individuals and organizations, including representatives of the Confederated Tribes of the Warm Springs, the Burns Paiute Tribe, and the Klamath Tribes, on March 2, 2012. It was subsequently published in the Spring 2012 edition of the Schedule of Projects for the Deschutes and Ochoco National Forests. The scoping letter was also posted on the Deschutes National Forests NEPA project web site: http://www.fs.fed.us/nepa/nepa_projects?forest=110601.

During the scoping period, a total of 17 responses were received from individuals, organizations, agencies and tribes. Responses varied from support for the proposal, to recommended changes to the proposed action, to strong disagreement with certain components of the proposal. Those who contacted the Forest Service about the proposed action include: Karen Coulter (Blue Mountains Biodiversity Project), Bodie Dowding (Interfor), Neal Dunbar, Claude H. Smith III (Warm Springs Forest Products), Lilliann Watah (the Klamath Tribes), Glen Ardt (ODFW), Larry Ulrich, Linda Driskill (Grant County Conservationists), Dick Artley, Joe Stutler (Deschutes County), Michael Krochta, Lydia Garvey, Nick Cady, Alexander Reid Ross, Doug Heiken (Oregon Wild), Douglas Perry (Davenport Newberry Holdings LLC), and Rod Adams.

All comments were considered and then categorized as either a key issue, an analysis issue, or a non-significant issue that would not be considered further. The project record contains the results of the categorization. Alternatives were developed using the key issues. The interdisciplinary team used comments from the public, other agencies, and others consulted, as well as information gained from the field reconnaissance to identify issues for this project. Issues are used to focus planning and analysis efforts as described below under Key Issues.

Appendix F describes the 30-day public comment period that was provided on the EA and also provides narrative responses to substantive comments.

Key Issues

Key issues are those that represent a point of debate or concern that cannot be resolved without consideration of the trade-offs involved. These issues spur the design of alternatives to the proposed action that provide a

different path to achieve project objectives. Trade-offs can be more clearly understood by developing alternatives and displaying the relative impacts of these alternatives weighed against the proposed action.

1. Tree Stocking Level Following Thinning: Thinning to 40 ft.^{2} of basal area is proposed within both the Scenic Views land allocation and the NNVM under the proposed action because thinning to a lower basal area would increase the length of time until the stand reaches the upper management zone (UMZ) and when combined with mowing and prescribed burning, it would create conditions that could be maintained with fire over time. Trade-offs include the loss of some intermediate harvest opportunities because the stands would not need to be re-thinned as soon or as often as with higher basal areas. It would create a more open character but the visual character would be dependent on the size (diameter) of the trees. The lower residual basal area would also favor the greater distribution and quantities of bitterbrush and therefore increase browse for wintering deer. Higher residual stand densities would require longer time periods to create conditions where stand conditions could be maintained by the use of fire alone.

Some public comments expressed concern that basal areas of 40 ft^2/acre are too low, not typical or "natural" for this age of ponderosa pine, that it does not enhance old growth characteristics in Old Growth Management Areas (OGMAs), and that goals and objectives for Scenic Views and NNVM may not be met. Some comments suggested adopting a range of basal areas (e.g. 40-60-80-100).

Alternatives 3 and 4 address this issue by prescribing a range of basal areas in all thinning units. Measurement criteria: post-thin stocking level relative to UMZ; average post-thin trees per acre; years before a thinned stand reaches UMZ.

2. Treatments within Newberry National Volcanic Monument: Some members of the public feel that the natural ecological succession should be allowed in the Monument, that commercial harvest should not occur and that thinning to 40 ft.^{2} of basal area as in the proposed action is not natural for these stands of ponderosa pine and treatment could violate visual quality objectives. The Monument Plan does emphasize the ability to allow natural ecological processes to occur, but recognizes that burning alone is not feasible where fire exclusion has led to dense, brushy stands and that mechanical treatments may be needed before fire can be used safely. Re-introducing fire into those stands without mitigating current stand conditions with mechanical treatment would increase the risk and likelihood of fire moving into the overstory and severely damaging or killing many or all of the trees in the stand.

This issue is addressed with Alternative 3 where stands inside the Monument that require mechanical thinning prior to introducing fire are dropped. Measurement criteria: Acres of mechanical thinning within the Newberry National Volcanic Monument and proportion of NNVM inside project area that remains above the UMZ.

3. Openings Created for Developing Deer Cover: The project proposed creating five openings ranging from 4 to 5 acres in size to improve hiding cover in the MA-7, Deer Habitat land allocation as well as the Lava Butte Zone of the Monument. Openings are created by removing all trees < 21" dbh. To insure adequate and uniform regeneration and meet management and legal requirements, the openings would be replanted following harvest. Some members of the public oppose creating openings greater than 1.5 acres, stating that larger openings would not mimic natural openings. Conversely, the Oregon Dept. of Fish and Wildlife is supportive of the proposal and would prefer to see openings created in more than just the MA-7.

Alternatives address this issue by varying the number of openings created and the allocations in which they are located. Measurement criteria: number, size, and total acres of small openings created for deer cover development.

4. Treatment within Old Growth Management Areas: The proposed action includes thinning within portions of two OGMAs where they have previously been thinned and are in need of thinning again. The two OGMAs are 98 and 155 acres in size. Comments received during scoping indicated opposition to mechanical treatment in OGMAs with the perception that it would not be a "naturally evolved old growth forest ecosystem." Comments also suggested that snags should be a priority in the OGMAs; thinning to reduce beetle risk should not be a goal unless old growth characteristics are at risk.

There has been limited past management in either of the OGMAs: 11 acres in one, 44 in the other. Continuing to manage those acres within each OGMA would retain those investments while continuing those portions on the trajectory toward future LOS while minimizing the risk of damage or loss to insects, disease or wildfire.

This issue is addressed with Alternative 3 where commercial harvest acres within OGMAs are dropped from treatment. And under Alternative 4, more acres within the OGMA are treated. Measurement criteria: Acres of mechanical harvest within OGMAs and proportion of OGMAs that remains above the UMZ.

5. Treating within Historic Goshawk Post-Fledging Areas (PFAs): The proposed action includes treatments within currently unoccupied post-fledging areas (PFAs). Scoping comments expressed concern that forest management is reducing habitat by reducing the amount of dense forest and stated that there should be no thinning, burning, or widespread precommercial thinning within PFAs. Commenters are concerned that vegetation management across the Forest/region is reducing dense forest and goshawk habitat. Reference is made to a number of scientific publications, including Beier 2008, stating that goshawks tend to prefer complex forests rather than thinned areas. Not treating in the PFA would slow or delay the recruitment of larger diameter trees and long term quality habitat. It would also reduce the supply of material to local/regional mills and limit local/regional job opportunities. Under all alternatives, core nest stands are not treated.

This issue is addressed with Alternative 3, where tree treatments within historic goshawk post-fledging areas are dropped; and Alternative 4, where more acres of the PFA are treated. Measurement criteria: Acres treated within PFAs; and proportion of project-wide goshawk reproductive habitat acres impacted.

6. Scenic Views / Aesthetics for Recreation: The project area is bounded on all sides by scenic corridors. The proposed action involves activities within all of these corridors. Some commenters expressed the concern that treatments would be too visible, and that we should choose burning areas where the risk cannot be avoided with non-commercial thinning alone. They also suggested that the purpose of the Scenic Views management allocation would not be met with thinning because it isn't natural. Some were also concerned about the visual impacts of intensive management around recreation sites.

This issue is addressed with Alternative 3, where the amount of underburning proposed would be greatly reduced and units would be treated only with thinning and mowing. It also is addressed with Alternatives 3 and 4 by applying variable thinning prescriptions rather than 40 ft^2 BA.

7. Size of project / Ratio of treated to untreated— allowing for "Natural Processes" and conversely, providing an increased economic impact and doing more restoration by harvesting more areas: The proposed action would treat about 7,405 acres, or 33% of the project area (45% of available forested area). Scoping comments suggested that this level of treatment has the potential to affect the perceived "natural" characteristics of the forest. Some commenters are concerned that the scale of the proposed treatment would not meet long-term needs for dense forests, snags, and dead wood. Scoping comments also expressed the importance of finding an "optimal" mix of treated and untreated areas and suggested that we should consider a variety of combinations such as 60/40, 50/50, and 20/80. Conversely, some commenters felt that there are ways to increase economic impact and feasibility of the project, such as including all stands in need of thinning in the project.

The existing condition of the Rocket project area does not reflect a "natural" development that would have occurred historically; it resulted from clear-cut logging in the first half of the 20th century and subsequent regeneration, fire exclusion, and some thinning. All action alternatives used similar measures to address snag and down wood needs recommended by the DecAID tool and as guided by the Forest Plan. Dense areas are left with each action alternative and snags will continue to occur in the project area. Thinning would also increase individual tree size thus increasing potential snag sizes in the future.

This issue is addressed with the range of Alternatives 1, 2, 3 and 4 because they provide different proportions of treated/untreated. Fewer areas are entered with Alternative 3 than the proposed action, and conversely, more stands that need thinning were added to Alternative 4. Alternative 4 would also conduct prescribed

underburning on larger blocks which simplifies implementation and therefore would reduce the cost per acre. The alternatives have a reasonable range of footprints on the vegetated portions of the project area, as displayed in the following chart (Figure 3). An analysis of this issue measures the acres of each density class remaining for each alternative.

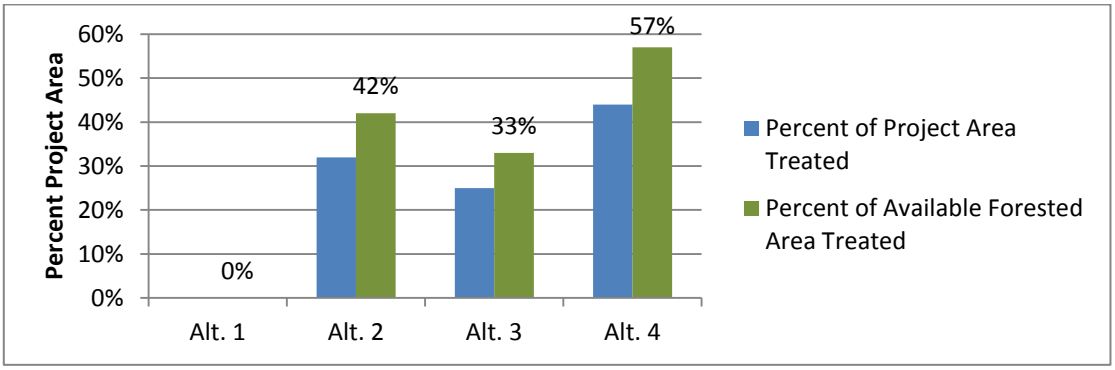


Figure 3: Columns display the percent of project area and percent of available forested portion of project area treated by alternative. Available forested portion does not include lava flows, study areas, or Research Natural Areas.

Non-Significant Issues

The Council on Environmental Quality (CEQ) NEPA regulations require delineation of non-significant issues. Sec. 1501.7 directs us to "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)...." The following is a list of reasons that identified issues are non-significant:

1. Issue is outside the scope of the proposed action;
2. Issue is already decided by law, regulation, Forest Plan, or other higher level decision;
3. Issue is adequately addressed in all alternatives; or
4. Issue is conjectural and not supported by scientific or factual evidence.

Table 3: Non-significant issues and rationale.

Issue	Rationale
Size of Trees / Diameter Limits: Some commenters suggested that the largest trees in the upper canopy should be retained, regardless of their condition, that all trees over 15 inches dbh should also be retained, and trees with old growth characteristics regardless of size be retained. Some voiced the suspicion that trees between 15 and 21 inches dbh are being thinned to prevent them from becoming old growth trees. Conversely, other commenters expressed concern that the 21 inch dbh limit would hinder our ability to meet stand objectives, particularly where there are trees infected with dwarf mistletoe. It was	As stated previously, the project area is dominated by relatively young (70-80 year old) ponderosa pine stands where large trees are not common. This issue is already decided by Forest Plan direction. The Eastside Screens limit timber harvest to trees 21 inches dbh and smaller (outside the Monument). All action alternatives adhere to the Screens' 21" diameter limit. Within the Monument, vegetation management should protect large old trees and reestablish open, park-like stands of large old-growth ponderosa pine over time. This can be accomplished with thinning trees up to 21" dbh. Diameter limits below 21" would result in higher residual basal areas after thinning. Stands proposed for thinning are above the UMZ. Depending on residual tree diameters, thinning to a lower diameter limit could

Issue	Rationale
also noted that the 21" diameter limit would not allow harvest of more valuable high-quality timber thereby potentially increasing costs and decreasing economic returns.	result in the stand being either at the upper end or above the UMZ, which would leave the stand susceptible to beetles. Increasing residual stocking levels associated with a lower diameter limit would require increasingly shorter re-entry periods with the resultant increase in impacts to other resources. Higher stand densities would also limit the extent and effectiveness of mowing and underburning requiring additional entries before fire could be re-introduced with minimal risk to the overstory stand and delay the use of fire as the primary method of stand management. Non-significant reason #2.
Recent Thinning: Some members of the public that responded to the scoping notice were concerned that it is too early to re-enter the project area where stands have been thinned as recently as 20 to 30 years ago. It was suggested that this would prevent snag recruitment and limit the amount of dense forest. It was also suggested that thinning would prevent stands from reaching late and old structure by removing trees before they have the chance to grow large.	Previous thinning in the project area was often of non-commercial size trees. Stands proposed for thinning in this project have grown to a point of being overly dense and would benefit from thinning again, whether commercial size or smaller understory trees. There are varying amounts of thinning proposed by alternative. The assessment of each alternative's ability to meet the purpose and need and how much dense forest remains in the project area will address this issue. Additionally, thinning would not prevent stands from reaching late and old structure; rather it will improve the survivability of large trees into the future. Non-significant reason #3.
Deer Habitat and Deer Cover/Forage: Some commenters oppose thinning within Deer Habitat (MA-7) stating that they believe deer are lacking thermal cover. Other commenters suggested that the project should focus on reducing recreation and road impacts to deer and to increase forage by thinning the overstory.	All action alternatives are designed to retain thermal cover within Deer Habitat management area (MA-7) inside the project area at the level recommended in the Forest Plan. MA-7 within the project area is not lacking thermal cover. Each alternative addresses the importance of the arrangement of hiding cover and forage in the area which are important components of the objectives in MA-7. And each alternative incorporates a substantial amount of road closures which will improve habitat effectiveness. Non-significant reason #2 and reason #3.

Analysis Issues

In addition to the key issues, other environmental components will be considered in the environmental consequences section as a way to compare the alternatives, though they did not result in differing design elements between alternatives. These issues are important for providing the Responsible Official and public with complete information about the effects of the project and how well each alternative meets the purpose and need.

- Fire/Fuels and Air Quality including purpose and need elements
- Forested Vegetation and Silviculture including purpose and need elements
- Wildlife: Threatened, Endangered, and Sensitive species; Management Indicator Species; Focal Landbird Species; and Birds of Conservation Concern
- Soil Resources
- Scenery Resources
- Threatened, Endangered, and Sensitive Botanical Species
- Invasive Plants
- Cultural Resources
- Recreation

- Transportation and Access
- Economics and Timber Sale Feasibility Analysis

Decision to be Made

The scope of decision to be made is limited to vegetation management, fuels treatments, road management, and connected actions within the Rocket Project Area. The project is limited to National Forest System lands within the project area.

The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. Based on responses to the Draft EA, changes made to the Draft, the analysis disclosed in this document, and information from the pre-decisional administrative review process, the Responsible Official will make a decision and document it in a Decision Notice (DN) and Finding of No Significant Impact (FONSI). The Responsible Official can decide to:

- Select an action alternative that has been considered in detail, or
- Modify an action alternative, or
- Select the no-action alternative.
- Identify what resource protection measures will apply.

The selected alternative will be determined by comparing how alternatives meet the elements of the purpose and need and how alternatives address the key issues.

Description of Alternatives

Alternative 1 (No Action)

This alternative provides a basis for comparison to evaluate changes in the existing condition associated with the action alternatives. Under the No Action alternative, current management plans would continue to guide management of the project area. No commercial or non-commercial thinning activities would be implemented to accomplish the project purposes. No surface or ladder fuels reduction activities would be implemented to accomplish project purposes. The existing road network would remain unchanged. Road closure or decommissioning would not occur. The objective of providing wood products would not be realized. Restoration of about 35 miles of user-created motorized trails would not occur. Future development of the forested stands in the project area would be guided by natural processes except that wildfire control would still occur. Management actions would continue such as wildfire suppression, recreation site maintenance, invasive plant control, and special use administration (e.g. maintaining clearings along powerline right of way).

Alternative 2

Alternative 2 is proposed action that was scoped with the public with some modifications and refinements. It consists of 7,370 acres of tree treatments including commercial operations to thin overstocked stands and create small openings. Plantation thinning and ladder fuel reduction will account for 1,459 acres of the tree treatment. Fuels would be treated across 7,326 acres. See Figures 4 and 5 for location of these treatments. About 13 mmbf of sawlog timber will be produced by this alternative, requiring 5.3 miles of temporary road development. Total volume including biomass is about 35,300 CCF. Most harvest treatments will be followed with mowing and/or underburning to reduce natural fuels accumulations. About 44 miles of road will be closed or decommissioned (Figure 10). The footprint of this alternative is 43% of the forested acres. Forest Plan Amendments will be needed to allow underburning within Scenic Views corridors, commercial thinning within LOS stages of ponderosa pine that are below HRV, and thinning within deer thermal cover within MA-7.

Thinning to an average of 40 sq. feet basal area is proposed in the Scenic Views allocation and the Newberry National Volcanic Monument. The intent of thinning to a lower basal area in these areas is to increase the amount of time that stands are resilient to bark beetles, and to create conditions that could be maintained with fire over time. In General Forest allocation, thinning is proposed to an average basal area of 60 sq. feet.

For a description of the activities listed in Table 4, refer to page 31.

Table 4: Activities Proposed with Alternative 2

Activity	Acres*
Tree Treatments	
Thinning to 40 ft. avg. BA	2,020
Thinning to 60 ft. avg. BA	3,305
Ponderosa pine Restoration	559
Opening for deer cover (5 openings, 4-5 ac each)	22
Aspen enhancement	5
Plantation thin	542
Ladder fuel reduction	917
Total	**7,370**
Fuels Treatment	
Handpile/burn (around Lava River Cave)	5
Mow	294
Mow + underburn	7,027
Total	**7,326**

Transportation System	
Temporary road development	5.3 miles
Road closure	38.6 miles
Road decommissioning	5.4 miles

*Acres are approximate and do not account for such things as retention patches and areas to protect. Actual acres treated will be fewer.

The following table summarizes tree and fuels activities to show where they occur in combination or alone.

Table 5: Summary of Activities, Alternative 2

Activity	Acres
Tree treatments with fuels treatment	7,291
Tree treatments with no fuels treatment	79
Fuels treatments with no tree treatment	35
Total Footprint	**7,405**

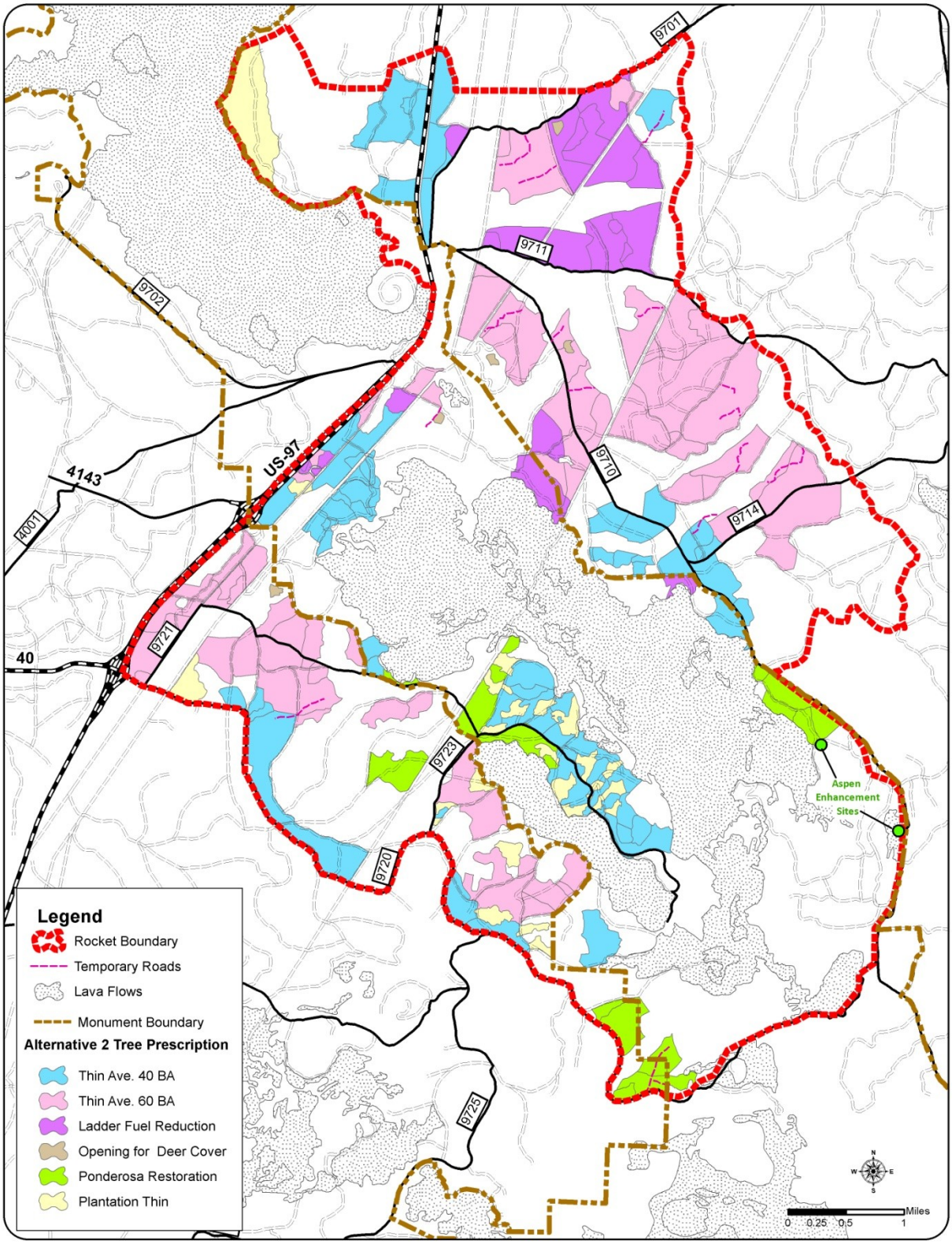


Figure 4: Alternative 2 proposed tree treatments and temporary road locations.

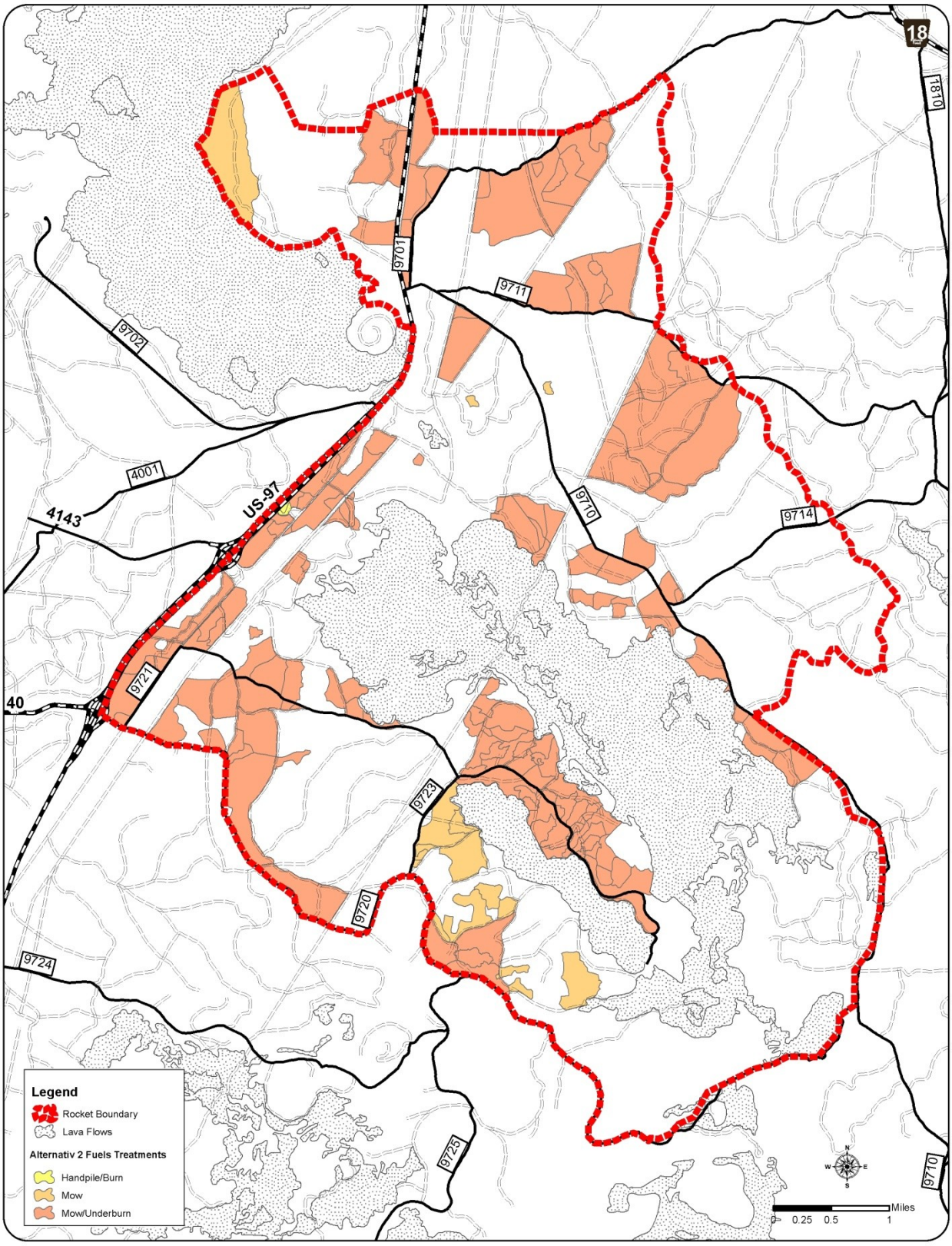


Figure 5: Alternative 2 proposed fuel treatments.

Alternative 3

A total of 5,676 acres would receive treatment under Alternative 3 (Tables 6 and 7). About 3,304 acres involve commercial harvest and 2,336 acres of plantation thinning and ladder fuel reduction. Fuels would be treated on 3,983 acres. See Figures 6 and 7 for location of these activities. This alternative would produce about 6.8 mmbf sawlog timber, requiring 2.8 miles of temporary road development. Total volume including biomass will be about 18,200 CCF. About 44 miles of road closure and decommissioning are also included (Figure 10). The footprint of this alternative is about 35% of the forested acres in the project area.

Alternative 3 addresses several key issues by: dropping treatment in the Old Growth Management Areas (OGMAs), dropping treatment in historic goshawk post-fledging areas (PFAs), increasing openings, and limiting harvest within the Monument to only small trees such as ladder fuel reduction or plantation thinning. Additionally, this alternative reduces underburning in the Scenic Views allocations so the amendment to scenery standards applies to much fewer acres. It also does not require an amendment to the Eastside Screens for thinning within LOS stands because the commercial thinning is dropped, but ladder fuel reduction and underburning are still proposed in those stands.

Table 6: Activities proposed with Alternative 3.

Activity	Acres*
Tree Treatment	
Thinning to 40 ft. avg. BA	---
Thinning to 60 ft. avg. BA	947
Thinning to mixed range of BA (40 to 80)	2,168
Ponderosa pine Restoration	144
Thinning for dwarf mistletoe reduction	7
Opening for deer cover	18
Opening for dwarf mistletoe control	20
Aspen enhancement	5
Plantation thin	648
Ladder fuel reduction	1,688
Total	**5,645**
Fuels Treatment	
Handpile/Burn (around Lava River Cave)	5
Mow	2,308
Mow + underburn	1,670
Total	**3,983**
Transportation System	
Temporary road development	2.8 miles
Road closure	38.6 miles
Road decommissioning	5.4 miles

*Acres are approximate and do not account for such things as retention patches and areas to protect. Actual acres treated will be fewer.

The following table summarizes where activities would occur in combination or alone.

Table 7: Summary of activities, Alternative 3.

Activity	Acres
Tree treatments with fuels treatment	3,952
Tree treatments with no fuels treatment	1,693
Fuels treatments with no tree treatment	31
Total Footprint	**5,676**

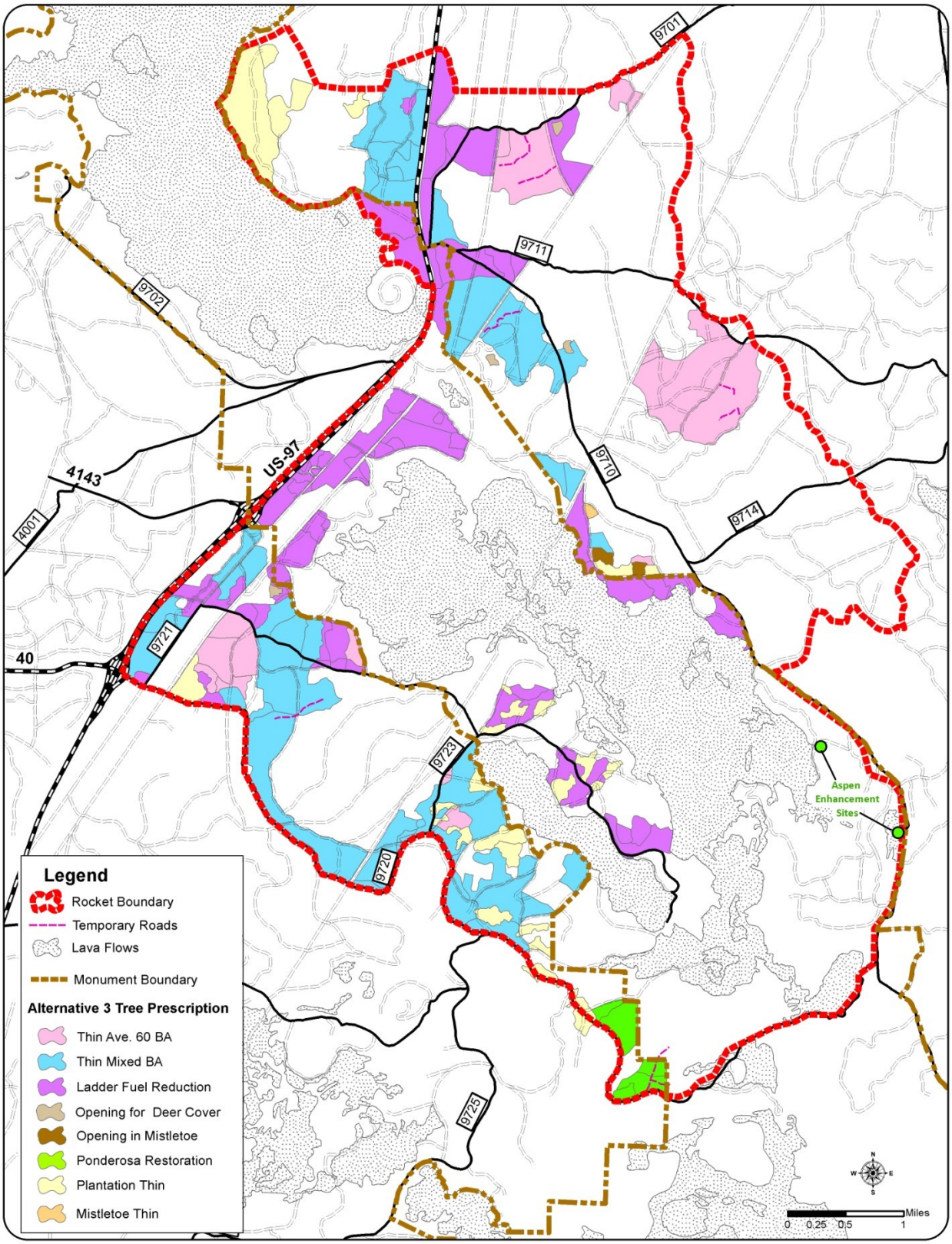


Figure 6: Alternative 3 proposed tree treatments and temporary road locations.

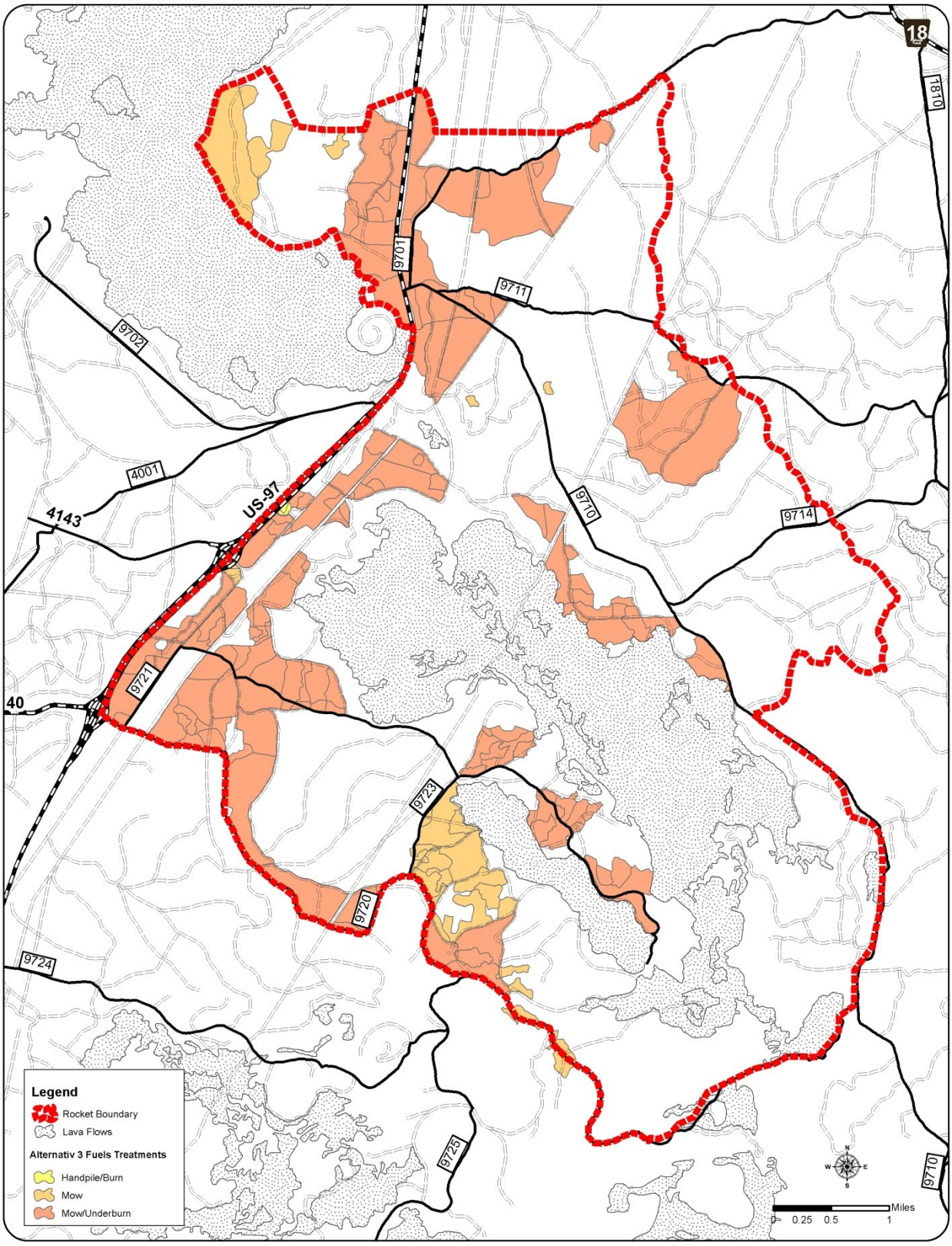


Figure 7: Alternative 3 proposed fuels treatments.

Alternative 4

This alternative was developed to address some of the key issues. It incorporates more stands for thinning (about 1,674 acres above Alternative 2). These stands are in need of thinning because of the risk of beetle infestation or existing levels of mistletoe. This alternative increases the economic impact of the project, producing about 16 mmbf sawlog timber, and would require about 5.8 miles of temporary road development. Total volume, including biomass would be 43,000 CCF. The footprint of this alternative is about 61% of the forested acres in the project area. About 44 miles of road closure and decommissioning are included (see Figure 10).

Alternative 4 would require the same Forest Plan Amendments as Alternative 2 (Scenic Views to allow underburning and commercial thinning within ponderosa pine LOS stages that are below HRV). These amendments are described in detail on page 34.

Table 8: Activities Proposed Under Alternative 4

Activity	Acres*
Tree Treatment	
Thinning to 40 ft. avg. BA	---
Thinning to 60 ft. avg. BA	2,435
Thinning to mixed range of BA (40 to 80)	4,441
Thinning for dwarf mistletoe reduction	324
Ponderosa pine restoration	638
Opening for deer cover	37
Opening for dwarf mistletoe	24
Aspen enhancement	5
Plantation thin	884
Ladder fuel reduction	1,152
Total	**9,940**
Fuels Treatment	
Mow	1,118
Mow + underburn	6,748
Handpile/burn (around Lava River Cave)	5
Total	**7,871**
Temporary road development	5.8 miles
Road closure	38.6 miles
Road decommission	5.4 miles

*Acres are approximate and do not account for such things as retention patches and areas to protect. Actual acres treated will be fewer.

Table 9: Summary of Activities, Alternative 4

Activity	Acres
Tree treatments with fuels treatment	7,840
Tree treatments with no fuels treatment	2,100
Fuels treatments with no tree treatment	31
Total Footprint	**9,971**

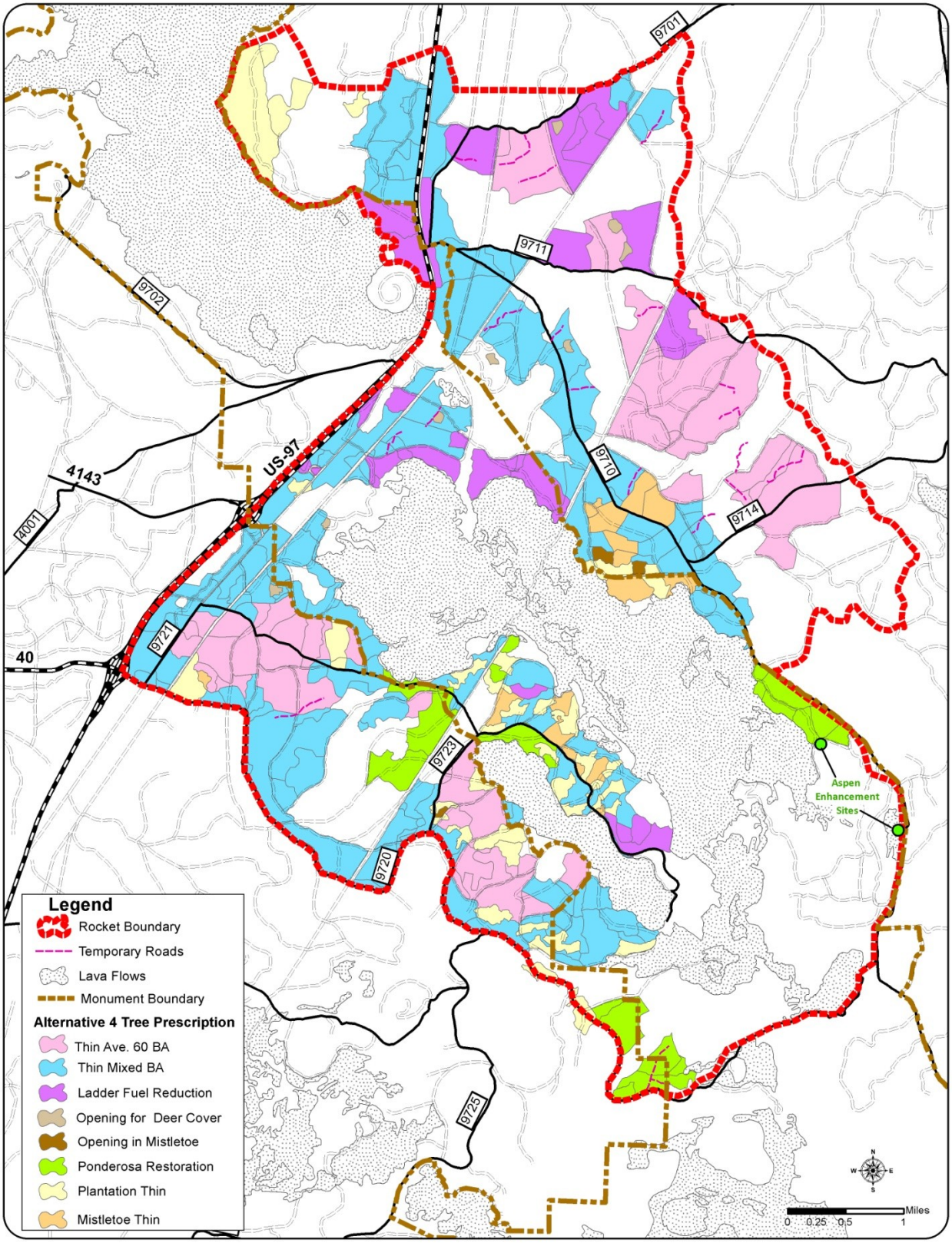


Figure 8: Alternative 4 proposed tree treatments and temporary road locations.

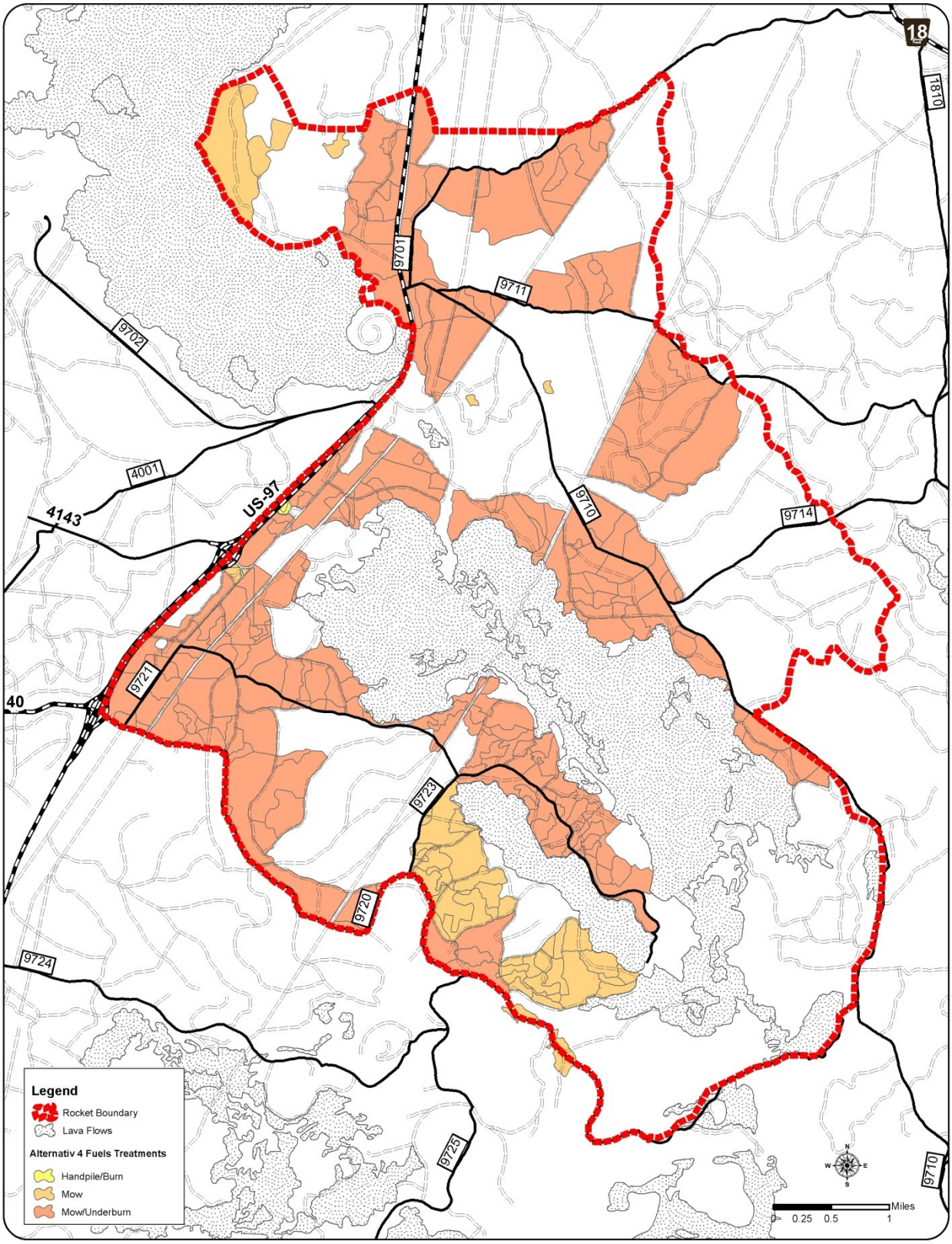


Figure 9: Alternative 4 proposed fuel treatments.

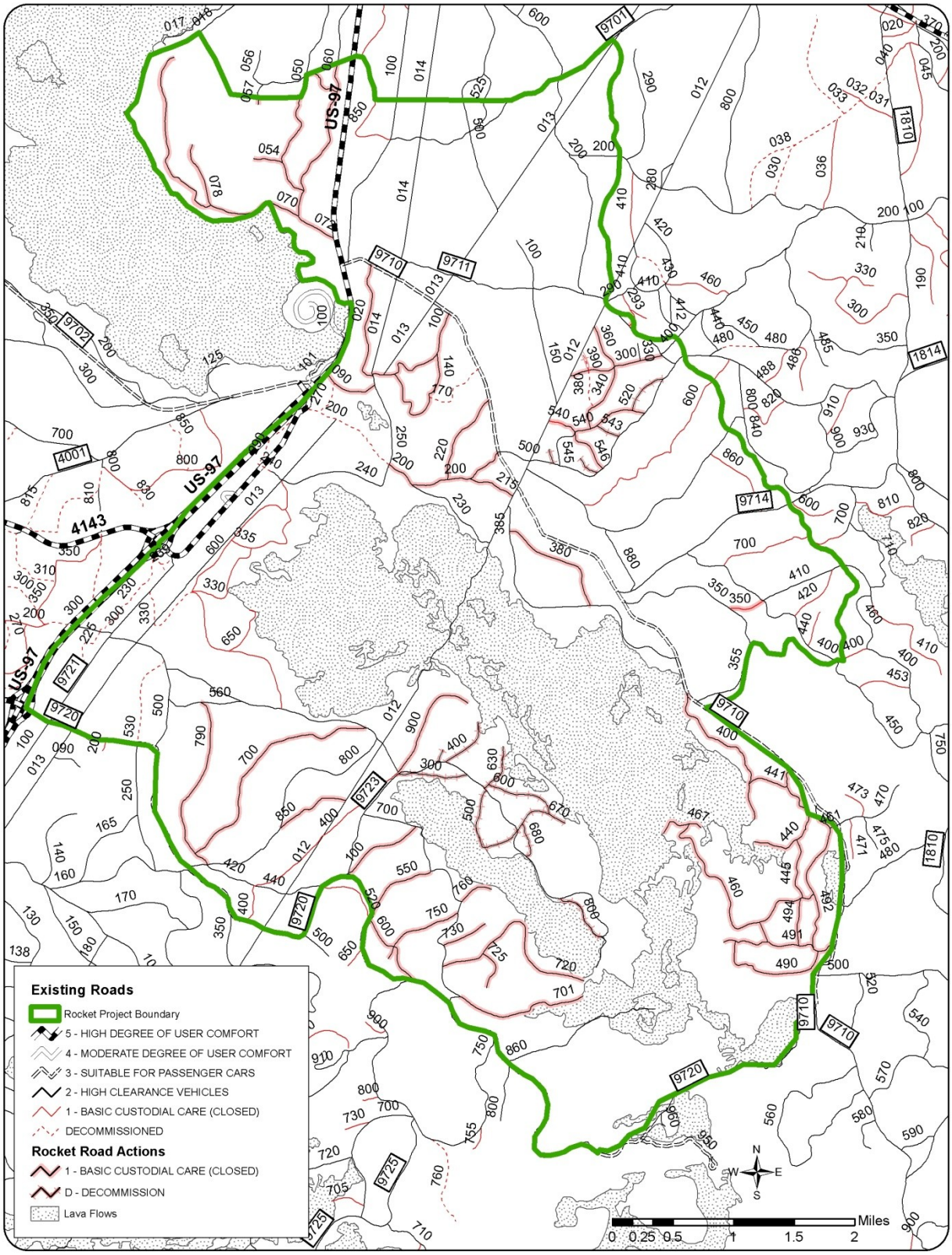


Figure 10: Transportation system showing proposed road closures common to all action alternatives.

Description of Activities Common to All Action Alternatives

Tree Treatments

Commercial Harvest Operations: These two paragraphs describe how operations will occur. Commercial harvest, including thinning and creation of openings (see below) would be conducted using ground based equipment to fall and transport trees to landings. Cutting would be limited to trees less than 21 inches dbh[1] and would generally be done with a mechanical tracked harvester. Whole tree yarding would occur. Felled trees would be transported to landings where they would be delimbed, bucked into lengths, decked and loaded onto trucks. Landings would be needed at a rate of one acre per ten to fifteen acres of harvest.

Wherever possible, existing landings and skid trails would be used to minimize soil disturbance and other soil impacts. Skid trails would be located approximately 100 feet apart. Fellers, feller-bunchers, and processors would be allowed to travel cross-country and not be restricted to designated trails. These types of equipment would cut and bunch felled trees for pickup and removal by skidders and forwarders which would be restricted to designated skid trails. A harvester/forwarder is an optional harvest system that could be utilized in place of a shear/skidder system.

Thinning: Thinning is conducted to reduce tree density, primarily to maintain or improve tree growth, maintain or enhance forest health, and control species composition. Thinning also reduces the continuity of crowns to reduce the chances of initiation and continuity of crown fires. Thinning will generally be from below, varying spacing to ensure the best, most dominant trees with the least amount of dwarf mistletoe are retained. Ponderosa pine will generally be favored for retention over lodgepole pine or true fir. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. Exceptions would be where 1) ponderosa pine are overtopped by lodgepole pine or true fir, or 2) where the largest diameter trees in the upper most canopy levels are not the healthiest, most vigorous trees. In these cases the smaller ponderosa pine or the smaller, healthier trees will be retained. Where removal of trees from the lower crown class will not reduce stocking to desired levels, trees from the dominant and codominant crown classes will be removed to favor the best trees of those same crown classes.

Post-treatment desired stocking levels proposed with this project are expressed in terms of square feet of basal area (BA) per acre and are considered average post-treatment conditions within a given treatment area. Varying the treatment based on management area objectives, this project proposes thinning to three desired stocking levels: 40 BA (Alternative 2), 60 BA (Alternatives 2, 3, and 4); and a mixture of stocking levels ranging from 40 to 80 (Alternatives 3 and 4). With the mixed BA thin, residual stocking would vary depending on size of dominant and codominant trees. Where these trees are less than 16 inches dbh, desired stocking would be 40-60 BA and where these trees are 16 inches dbh and larger, desired stocking would be 60-80 BA.

Smaller material (generally < 7” dbh) will be felled by hand and will be utilized as market conditions allow, lopped and scattered, or piled and burned (see “slash treatment” below).

Ponderosa Pine Restoration Treatment: Lodgepole pine and true fir growing in areas historically dominated by ponderosa pine would be cut and removed. Trees to be cut would include all lodgepole pine 7-20.9” dbh and all true fir 7-20.9” dbh either with less than 50% live crown ratio or growing within or touching the dripline of desirable ponderosa pine of any size. Treatment of lodgepole pine or true fir less than 7” dbh would depend on ponderosa pine stocking, proposed use of prescribed fire, and management area objectives. Treatment would vary from cutting all trees in this size class to retaining some to meet desired stocking levels. If removing lodgepole pine or true fir in this size class reduces stocking below minimum levels, ponderosa pine would be planted to at least minimum stocking levels in areas 3 acres or larger. In addition to lodgepole pine and true fir, ponderosa pine would be cut and removed if of poor vigor,

[1] The Eastside Screens prohibits including trees greater than 21” in timber sales. However, during harvest of timber, there may be an occasional tree over 21” diameter that is required to be felled and removed for operational needs such as landings, temporary roads, and skid trails. These instances are reviewed by the Line Officer.

mistletoe infected, or excess to desired stocking (40-80 sq. ft. of basal area per acre). Dead lodgepole pine, standing and down, in excess to wildlife standards and guidelines will be removed. Removal of cut trees would be as described for commercial thinning.

Thinning to Reduce Dwarf Mistletoe (Sanitation Harvest): To reduce the incidence of dwarf mistletoe in previously thinned second growth ponderosa pine stands of commercial size, thinning will focus on the cutting and removal of trees less than 21" dbh moderately to heavily infected with dwarf mistletoe. All heavily infected ponderosa pine (DMR[2] 5 or 6) would be cut and removed, regardless of residual basal area. Cutting and removal of moderately infected ponderosa pine (DMR 3 or 4) would vary depending on residual basal area. Trees with DMR 3 or 4 would be cut where residual basal area would be at least 40 or 20 square feet, respectively. Ponderosa pine with little (DMR 1 or 2) to no mistletoe infection would be retained, regardless of basal area. Removal activities would be similar to those described for commercial harvest operations.

Openings to Create Deer Cover and Openings in Dwarf Mistletoe-Infected Stands: Small openings of 3 to 12 acres will be created in second growth ponderosa pine stands by removing all trees below 21" dbh, followed by mowing and/or underburning. The openings would then be planted with ponderosa pine seedlings to regenerate new cover stands. A connected action with the reforestation will be gopher control through baiting. Additionally, seedlings will have protective tubing placed around them. Another connected action is intended to prevent the new seedlings from becoming infected with mistletoe: Within openings, mistletoe-infected ponderosa pine ≥ 21" dbh would be made into snags by topping or girdling; and outside openings, mistletoe-infected ponderosa pine within 40 feet of the opening edge would be cut and removed if < 21" dbh, or made into snags if ≥ 21" dbh.

Plantation Thinning: Existing plantations would be thinned either by hand using chainsaws or small fellers or feller-bunchers to reduce stocking levels to between 90 and 170 trees per acre. Trees to be cut would be predominately less than 10 inches dbh. If market conditions permit, felled trees would be removed and utilized for firewood, biomass, chips or other products. Removal activities would be similar to those utilized for commercial sales. Resulting slash materials would either be grapple piled in the unit or on the landing and the piles burned. If market conditions preclude utilization, the felled trees would be grapple piled and burned.

Ladder Fuel Reduction: Ladder fuel reduction is proposed in nearly all Rocket treatment units. It involves cutting, usually by hand, understory trees in the lower most canopy layer of a stand to reduce potential for fire to move into the crowns of trees in the middle to upper canopy layer trees. Small diameter trees, generally less than 4 to 6 inches dbh, with potential to carry fire into the crowns of ponderosa pine in the middle to upper canopy levels would be cut. If market conditions preclude utilization, resulting slash would be treated by lopping and scattering or piling and burning.

Slash Treatment: Slash removal methods for a specific unit depends on the amount of residual fuel, other proposed treatments, harvest method, harvest machinery used, and other factors.

Trees with commercial value (usually greater than about 7" dbh) will be whole-tree yarded, with limbs and tops attached to the landings, thereby reducing the amount of slash piling within units. The preferred method of slash disposal is biomass utilization, which is highly dependent on biomass markets. Tops and limbs will be utilized as biomass as market conditions allow, otherwise they will be burned at landings. For the purposes of analysis, it is assumed that the slash will not be utilized.

Lop and Scatter: In general, the slash in the ladder fuel reduction units, any units that have been thinned prior to the Rocket treatments, and are planned to be underburned will be lop and scattered. In these units the amount of slash produced is minimal enough that leaving it on the forest floor will not result in a dramatic increase in fuel loading. Lopping consists of cutting the limbs off of thinned trees, rearranging the fuel bed to 15" or less off the ground. Lopped and scattered slash will be further dispersed during mowing and the material will be consumed during the underburning.

[2] DMR = Dwarf Mistletoe Rating from Hawksworth and Wiens (1996). See p. 134 for a description of the rating.

Machine and Hand Pile: In areas where there is too much material to lop and scatter, the slash will be piled by hand and/or machine. The piles will then be burned in the fall or winter. In general, slash piles need to cure for a summer season before the fuels are dry enough to consume well during pile burning. The decision whether to machine or hand pile is based on the amount of material, the size of the unit, tree spacing, soil concerns, slope, and other considerations. In most units, areas that have not been thinned before, the slash will be piled with a grapple piler or dozer. In small isolated units, on steeper slopes and in units with less slash, the material will likely be hand piled.

Aspen Enhancement: Conifer stocking would be reduced in two small areas (1 and 4 acres) within the NNVM that have aspen growing beneath an overstory of lodgepole and ponderosa pine. All lodgepole, the dominant conifer species, would be removed. Generally only poor vigor ponderosa pine would be removed. Removal activities would be similar to those utilized for commercial harvest. Resulting slash material would be hand piled or lopped and scattered.

Natural Fuels Treatments

Mowing: Thinning influences fire behavior measurements such as crowning index and torching index by increasing tree spacing and reducing ladder fuels. However, it does not reduce surface fuels (such as needle cast) or shrub densities, two key drivers of fire behavior. Mowing does not reduce surface fuels; rather it alters the fuel model by rearranging fuels. After a mow treatment, the fuel model changes from a brush fuel model to a grass or timber understory fuel model and the potential flame length from a surface fire is reduced. The mowing treatments will be done with a deck mower and/or a masticator. Targeted shrub species are bitterbrush and manzanita. The amount of mowing/mastication needed is based on post-harvest shrub coverage and will vary widely between units. In units with a large amount of lava rock or tight tree spacing it is more difficult for machinery to maneuver and the mow coverage will be less.

Prescribed Fire Underburn: Low intensity underburning is proposed to both reduce fuels and to reintroduce a natural disturbance process to the landscape. Prescribed fire decreases potential flame length by killing shrubs and consuming surface fuels and it reduces crown fire potential by raising the canopy base height by consuming ladder fuels such as small diameter trees and scorching the lower limbs of live trees. Prescribed burning is an imprecise tool and prescribed fire without a prior thinning and/or mowing is not desirable when understory trees are sufficiently dense that attempts to kill them with fire would run a high risk of also killing the overstory trees. In the Rocket action alternatives, prescribed burning is coupled with a ladder fuel reduction thinning and a mechanical mow/mastication treatment. A monitoring element is described for underburning on page 47.

The amount of ladder fuel reduction thinning and mowing/mastication needed to successfully underburn will vary widely between units. In units with minimal shrub coverage and ladder fuels, mowing/mastication and ladder fuel reduction thinning treatments may not occur prior to burning or only selected areas adjacent to prescribed burn containment lines will be treated to prevent control problems during burn implementation. In units with abundant ladder fuels and thicker shrub densities, mowing and ladder fuel reduction thinning would occur across the entire unit to prevent undesirable levels of scorch and overstory tree mortality during prescribed burning.

Mowing can be used as a surrogate for prescribed fire. However, mowing alone does not reintroduce the natural process of fire, it requires more frequent maintenance to keep fire hazard low, and it does not reduce potential fire behavior to the same degree that prescribed burning does.

Prescribed fire will either be performed through hand ignitions, aerial ignitions or a combination of both. Hand ignitions are typically done with a handheld or ATV/UTV mounted drip torch. Hand ignitions are a preferred method of ignitions in smaller units and when more precise control over ignitions is desired. For instance, in the Rocket project area hand ignitions will likely be used near Lava River Cave and directly adjacent to highway 97.

Aerial ignitions are an effective and economical implementation method when larger areas are available for prescribed burning. The primary advantage is the ability to burn more acres in shorter time frames with

fewer personnel. Usually a helicopter mounted plastic sphere dispenser (PSD) or helitorch are used to ignite fuels. In the Rocket area, PSD would likely be the aerial method of choice given the fuel type. Helitorches are more appropriate for denser canopies and in prescribed burns where the objective is to burn the crowns. PSDs are more effective at producing a surface fire.

Aerial ignition is rarely used without concurrent hand ignitions. For example, hand ignitions are normally used around the perimeter of a burn unit, whereas the interior of the burn unit would be ignited with an aerial platform.

More than one entry may be needed to meet the initial desired condition. Where there are high fuel loadings, initial fire entries often include jackpot burning, or burning larger woody material during the wet season to reduce fire intensity and mortality. A typical underburn would follow the jackpot burning. Another multiple entry burn might include first burning during higher relative humidity to decrease fire intensity. The second entry would occur during lower relative humidity to help consume more fine fuels and remove ladder fuels. Multiple entry burns often take several years to complete, due to weather and scheduling.

Fireline Construction: Prescribed burn units use roads as perimeters as much as possible; however, fire lines may be necessary to keep fire from spreading outside of unit boundaries. Firelines would be either hand-constructed to be approximately 20” in width or machine-constructed using a skid-steerer that creates a line approximately 5 feet in width. A plow attached to a tractor or ATV is another method used to build prescribed burn control lines. Firelines would be rehabilitated following underburning activities by pulling displaced surface material back over them, including soil, rocks, and woody material; soil berms would be scattered back across the firelines.

Transportation System Management

Temporary Road Development: Temporary roads are used to access further reaches of timber sale units to extract timber more efficiently and reduce ground based impacts from skidding long distances without the use of a road system. Temporary roads are built to low specification, just enough to get equipment into landings and are closed or obliterated at the end of the timber sale activity. These roads would be built on relatively flat ground and would be constructed to the lowest possible standard capable of supporting log haul in order to minimize ground disturbance. Where possible, they are built on top of previously established skid trails to minimize additional soil compaction associated with the use of heavy equipment. Temp roads are shown in Figures 4, 6, and 8 with associated harvest units.

Road maintenance / Roadside Hazard Trees: The following road work would be required to facilitate haul and to comply with the current Road Management Objectives:

- 119 miles of pre-haul maintenance including roadside brushing, spot surface, restore drainage, blade and shape roadway, fell danger trees, and clean lead-outs.
- Highway Safety Act road 9710 is one of two primary routes that support this project. It is recommended that to safely support this project 9710 will need a higher degree of maintenance due to damage from recent storm events. This work will consist of re-establishing of the road template, drainage and resurfacing. Due to the damage along this road, it should be resurfaced to a compacted depth of 6” (inches) of dense graded crushed aggregate.
- Up to 14 miles of roads in Maintenance Level 1 (administratively closed) will be re-opened for use in this project, and then re-closed after project activities are complete.

Road Closures and Decommissioning: All action alternatives include about 38.6 miles of road closure and 5.4 miles of road decommissioning (see Figure 10). These roads may be needed for the current project; therefore, closure would occur after activities are complete. Following project activities, roads would be closed through a combination of methods. The Forest Plan states “Roads will be closed through the most economical method that is effective in meeting the management objectives for the area. These include seasonal administrative closures, sign restrictions, barriers, gates, and road obliteration. The preferred method of closing roads will be by obscuring the road entrance to discourage vehicle access.” (TS-8).

Other Connected Actions

User-created OHV Trail Restoration

Approximately 35 miles of user-created OHV trails, primarily single track from motorcycle and mountain bikes have been created over time throughout the project area, including within the Monument. Concentrated ground disturbance is occurring where play areas are starting to develop. OHVs are not allowed in the Monument (M-71, NNVM Plan page 46). In addition, motorized use off of designated roads and trails does not comply with the Travel Management Rule. This restoration is considered a connected action because our thinning and underburning work in the area will create more open conditions which may lead to more illegal off-road activity. To deter that kind of use, restore the land to a productive condition, and further compliance with Monument standards and guidelines, user-created trails will be obliterated and signage may be installed in certain locations.

Forest Plan Amendments

Site-specific Forest Plan amendments are required for implementing the Rocket project. Proposals for thinning and burning create short-term impacts that are noticeable to the public. Conditions have changed since the Forest Plan was finalized in 1990 because stands have grown denser and fuels have accumulated. Best available science related to fuels reduction and underburning has been developed since that time as well. The 1990 Forest Plan did not take into account the need for active management within the scenic view corridors that expanded beyond limitations of the standards and guidelines.

Amendment #1: Applicable to Alternatives 2, 3, and 4

Management Area 9 Standard: M9-8 (LRMP 4-123), dealing with Timber/Ponderosa Pine – Foregrounds, 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 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.* This direction is also applicable within the Monument in areas managed for retention and partial retention foreground (see Figure 57).

Although activity fuels would be treated as soon as possible, especially along travel corridors, the use of prescribed fire will create visible impacts (e.g. blackened, scorched vegetation and tree trunks, slash and slash piles) for approximately five years, which exceeds the amount of time management actions can be visible within retention and partial retention allocations. The use of prescribed fire is an integral part of meeting hazardous fuels objectives, restoring resilience into stands. The decision to authorize this project would amend this standard to allow visible effects of fuels reduction for approximately five years. US 97 is designated for retention; FRs 9710 and 9720 are designated for partial retention. The Units that Amendment #1 applies to are listed in Table 10.

Amendment #2: Applies to Alternatives 2, 3, and 4

Management Area 9 Standard: 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 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*. This direction also applies within the Monument in areas managed for retention and partial retention (see Figure 57)[3].

[3] Scenery Management System (SMS) standards and guidelines are an updated version of the Visual Quality System (VMS) standards and guidelines and these are applied to areas of the project that are both within and outside the boundaries of Newberry National Volcanic Monument.

Areas along US Highway 97 and the Old Dalles-California Highway are designated as Retention Foreground and Forest Roads 9710, 9711, 9720, 9721, and 9723 are designated as Partial Retention Foreground. It will not be possible to comply with M9-90 and effectively meet project objectives for resilience and fuels reduction. The use of prescribed fire is an integral part of meeting hazardous fuels objectives, restoring resilience into stands, and addressing the goals for restoration described in the Newberry National Volcanic Monument Management Plan. US 97, FR 9710 and FR 9720 are also identified as critical transportation corridors in the CWPP relative to the need for safe ingress and egress for both the public and firefighters during wildfire events. Limiting the scope and intensity of treatments along those routes reduces their effectiveness in providing safe ingress/egress. Mowing only would not meet project objectives as well because it does not treat the fine fuels. In the scenic view allocation, it would break up the large burn units resulting in more difficult and expensive implementation. These areas would remain at increased fire hazard without a more comprehensive and intensive system of treatments, including prescribed fire. It is necessary to amend the 5 acre limitation for fuels treatments to meet stand and fire management objectives. The proposed amendment would allow prescribed fire to occur within the Scenic Views allocation (retention and partial retention foreground areas) in blocks larger than five acres.

Table 10: The units and number of acres proposed for underburning treatment within foreground areas (retention and partial retention) of Scenic Views MA are listed by alternative:

Alternative	Units	Total Unit Acres
2	11, 22.1, 22.4, 22.5, 22.6, 23.1, 36, 37, 41.1, 41.2, 42, 45, 48, 96.1, 96.2, 96.3, 97, 98, 99, 100, 209, 210, 213.1, 247, 275, 277.1, 277.2, 277.3, 278, 307.1, 307.2, 338, 801.1, 803, 804.1, 807.2, 812.1, 812.2, 812.5, 818, 821.3, 836, 842.1, 842.2, 876.1, 976.2, 900	1,509
3	96.2, 96.3, 99, 100, 275	77
4	11, 41.1, 42, 45, 48, 49.1, 49.2, 96.3, 97, 98, 99, 129.1, 129.2, 210, 213.1, 275, 277.1, 277.2, 307.1, 307.2, 803, 812.1, 812.2, 812.5, 821.1, 836, 842.1, 842.2, 976.1, 976.2, 922, 923, 924, 941, 943, 944, 945, 946, 949, 958, 959, 960, 969, 972, 978, 980, 982, 992, 995	1,374

To maintain scorching below 30% of the crown, treatments would be based on the following:

- If stand density is too dense to underburn without substantial mortality, stand densities will be reduced by thinning with follow-up slash piling and burning of the piles.
- If shrubs are present in sufficient densities to cause undesirable scorch during underburn implementation and stand density is low, the unit may be mowed prior to prescribed burning. Some tree mortality could occur.
- If stand density is low and no shrubs are present, the area would be assessed to determine if treatment is needed.
- To achieve underburning objectives, follow-up fuels treatments may be necessary.

Ecologically, the reintroduction of fire is consistent with the restoration concept of more frequent low intensity fire on the landscape. Historically, fire played a bigger role in influencing forest succession. Interfering with one disturbance agent (fire) has increased the influence of other disturbance agents (insect and disease) (Gara 2000).

Amendment #3: Applies to Alternatives 2, 3, and 4

Analysis with lidar data provided evidence of the existence of stands that have enough large trees to qualify as Late and Old Structure (LOS) under the Eastside Screens, where the only definition for LOS is “where

large trees are common" (see Forested Vegetation section for more information on the Historic Range of Variability analysis). Treatment within these stands outside of the NNVM is the subject of this amendment, which will be the third amendment proposed with the Rocket project EA.

Eastside Screens standards and guidelines Appendix B 6 (d) Scenario A states "*If either one or both late and old structural stages falls BELOW HRV in a particular biophysical environment within a watershed, then there should be NO NET LOSS from that biophysical environment. Do not allow timber harvest activities to occur within LOS stages that are BELOW HRV*."

Alternatives 2, 3 and 4 of the Rocket project propose thinning of commercial size trees within the ponderosa pine late-open structural stage, mixed conifer late-closed stage, and mixed conifer late-open stage, which are all currently below HRV. A description of these vegetation classifications can be found on page 119. Treatments are proposed in areas where the development of large trees is currently impeded, or existing large trees are at risk from fire or insects and disease. The objective of these treatments would be to improve conditions for the development and/or maintenance of large trees, thus retaining or enhancing LOS acreage in the long-term. Action alternatives would need to employ a commercial timber sale or similar tool to accomplish objectives. Therefore, a site-specific amendment to Appendix B 6 (d) under Scenario A is needed to allow timber harvest in LOS stages that are currently below HRV.

This amendment applies only to timber harvest within ponderosa pine late-open, mixed conifer late-closed, and mixed conifer late-open outside of the NNVM. Currently there are 678 acres in the ponderosa pine and 74 acres in the mixed conifer biophysical environments within the Rocket project area. Table 11 displays the number of acres of timber harvest proposed within LOS by alternative. The total number of acres the amendment applies to is 62 under Alternative 2, 1 acre Alternative 3, and 78 acres Alternative 4. There would be no net loss of LOS, but what is currently multi-stratum could become single-stratum. All treated areas would remain in an LOS condition because all trees > 21" would be retained. The amendment does not apply to harvest in the ponderosa pine late closed structural stage because the Eastside Screens allow harvest in stages that are within or above HRV.

Units included in this amendment are displayed in Appendix B. Most are within the ponderosa pine biophysical environment.

Table 11: Timber harvest within large tree structural stages by alternative.

LOS Stage and HRV	Existing Proportion in HRV Analysis Area	Existing Acres of LOS in Rocket Project Area	Alt. 2 acres timber harvest	Alt. 3 acres timber harvest	Alt. 4 acres timber harvest
Ponderosa Pine Biophysical Environment					
Late Closed 0-7%	9% (6,056 acres) (above HRV – not subject to amendment)	574	232	11	372
Late Open 25-59%	4% (2,576 acres) (below HRV)	104	***32***	***0***	***42***
Mixed Conifer Wet Biophysical Environment					
Late Closed 12-23%	2% (583 acres) (below HRV)	27	***1***	***0***	***2***
Late Open 4-10%	3% (951 acres) (below HRV)	47	***29***	***1***	***34***

Amendment #4: Applies to Alternatives 2, 3, and 4

Within Management Area 7, the general theme and objective provides that "*Vegetation will be managed to provide optimum habitat considering the inherent productivity of the land. Herbaceous vegetation will be managed to provide a vigorous forage base with a variety of forage species available. Forage conditions*

may be improved where conditions are poor. Foraging areas will be created where forage is lacking, maintained when in proper balance, or reduced when overabundant and more foraging areas are needed. Long-term tree or shrub cover to moderate cold weather conditions is equally important. Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder being in hiding areas. Some stand conditions may satisfy both kinds of cover."

Across MA-7 thermal covers is present on 12%, which is below the objective of 30%. Although not a standard and guideline, the objective cannot be met in the project area while still meeting the purpose and need. The amendment would provide that in the Rocket project area, the objective of 40% cover (with approximately three-quarters of that thermal cover) will be provided, and cover and forage areas will be located for optimum use by big game, considering project level circumstances (e.g. roads, Highway 97 underpasses, areas showing high-use by deer); however, thinning within thermal cover in MA-7 will be allowed which will further reduce the proportion of thermal cover within the entire MA-7 area.

When considering the "inherent productivity of the land" maintaining thermal cover at 30% across the MA-7 is not sustainable, particularly within the Rocket project area where low-productivity sites dominate. During design of the proposed action, the ID Team designed the alternatives to retain existing thermal and hiding cover in an arrangement that addresses the management area's objective while also thinning in areas that need it and are not as critical for providing thermal cover. The effects to thermal cover in MA-7 and deer are discussed in the effects analysis section. The following Table 12 displays how many acres this amendment would apply to by alternative.

Table 12: Thermal cover treated within MA-7 by alternative.

MA-7	No Action	Alt. 2	Alt. 3	Alt 4
Thermal Cover Treated	0	362 acres	307 acres	378 acres
Thermal Cover Retained	1,223 acres	861 acres (29% of MA-7)	916 acres (31% of MA-7)	845 acres (29% of MA-7)

Resource Protection Measures

Resource Protection Measures (also referred to as project design) are listed here to describe project design considerations and best management practices that will reduce or eliminate unwanted effects and ensure project activities are implemented to comply with Forest Plan standards and guidelines.

The sources of these measures include but are not limited to: Forest Plan goals, objectives, or standards & guidelines; Project Design Criteria from the Programmatic BA; Best Management Practices; conservation strategies; and Invasive Plant Prevention Practices.

Resource Protection Measure	Units
Lava River Cave Area – for Protection and Maintenance of Cave Resources and Recreation and Scenic Values	
Operations of Lava River Cave shall have priority over harvest and fuels operations in the vicinity from May 1 through September 30. Consider visitor safety, smoke, harvest activities, and traffic when planning implementation. Implement activities in LRC units from October 1 through April 30. Activities in May and September would occur on Tuesdays and Wednesdays only. Activities proposed outside these date to be coordinated with Monument management.	96.1, 96.2, 96.3, 97, 98, 99, 100, 101, 278, 833, 836
Post educational information at Lava River Cave (and consider Lava Butte) to explain when, where and why treatments are occurring. Consider using before and after example photos to help the public understand the short term nature of the first order effects of the treatment and	96.1, 96.2, 96.3, 97, 98, 99, 100, 101, 278, 833, 836

Resource Protection Measure	Units
the longer term goals of the project. Whenever possible, provide information on treatment locations and timing on forest websites. Consider Monument photo point monitoring requirements when planning Lava Butte photos.	
Protect chokecherry communities in mowing and underburning units that are located to the south of and adjacent to the Lava River Cave exit and along FS Road 9703 and protect developed recreation site signs along 9703.	96.1, 96.2, 96.3,97, 98, 99, 100, 101, 278, 714, 809.1, 809.2, 832, 833, 834, 836
Consider blue marking on frontage road.	
To retain screening between Lava River Cave and Highway 97, limit treatments on 2 acres of Unit 97 to falling ladder fuels and treating the resulting slash by handpiling and burning. No mowing or underburning should be allowed in this area.	97
Remove or top all hazard trees (as defined by Forest Service Hazard Tree Guide) within 1 ½ tree lengths of the perimeter of Lava River Cave built facilities.	96.1, 96.2, 96.3, 97, 98, 99, 100, 101, 278, 833, 836
To Preserve Scenic Quality in Visual Corridors / Scenic View Management Areas	
Locate landings, skid trails, slash piles or staging areas using existing openings and skid trails and minimize bole damage to remaining vegetation along scenic travel corridors and access to developed recreation sites (Highway 97, Forest Roads 9703, 9710, 9711, 9720, 9721, and 9723). Flush cut stumps (6 inches or less with angle cut away from line of sight) in immediate Foreground areas (0-300 feet).	117, 152.2, 220, 277.1, 277.2, 277.3, 367.1, 367.2, 447, 715, 830.1, 831.1, 831.2, 831.5, 840.1, 840.2, 905, 906, 907, 908, 960, 973
Design underburning activities to minimize short-term visual effects by maintaining crown scorch at less than 30 percent and minimize bole scorch up to 10 feet in height.	All NNVM Units
Minimize amount of leave-tree markings and black out tagging units with vertical orange paint on both sides of trees along scenic travel corridors and access to developed recreation sites after sale closes.	All NNVM Units
One year (for retention foreground) and two years (in partial retention foreground) after the work has been completed, clean-up activities along Highway 97, Forest Roads 9703, 9710, 9711, 9720, 9721, and 9723 both within and outside the Newberry National Volcanic Monument boundaries including landings, skid trails, slash piles or staging and removal of flagging and unit boundary tags and other markings will not be highly visible to the casual Forest visitor (Forest Plan Amendment).	129.1, 129.2, 876.1, 876.2, 922, 958, 959, 960, 982, 22.1, 22.4, 22.5, 22.6, 23.1, 218, 801.1, 807.2, 11, 209, 210, 213.1, 275, 307.1, 307.2, 804.1, 818, 821.1, 941, 943, 944, 945, 946, 949, 992, 812.1, 812.2, 812.5, 995, 900, 45, 48, 49.1, 49.2, 245, 277.1, 277.3, 803, 842.1, 842.2, 969, 972, 978, 36, 37, 41.1, 41.2, 42, 247, 338, 352, 885, 911, 914, 923, 924, 925, 980, 981, 987, 988
Coordinate with USFS special use administrator regarding (1) the timing of sale marking along utility corridors to identify utility hazards and hazard trees to be considered for timber sale inclusion; and (2) timing of pre-work meetings to ensure utility safety measures are addressed during implementation.	21,22,23,24,867,843,864,875,817,245,48,246,361,814,238,96,809, 811,837,810,234,876,

Resource Protection Measure	Units
	20,123,828
Where meeting standards and guides for maintaining vegetation 200 feet (LRMP) or 150' (NNVM) from caves and drainages, avoid making cave entrances obvious to the public	96, 97, 98, 99, 100, 101, 278, 833, 836
To reduce potential for direct fire-related mortality, bark beetle induced mortality, and fire damage which could result in long-term growth loss, conduct burns in a manner that will result in 1) retention of at least 40 percent live crown ratio on dominant and codominant trees, with crown scorch generally less than 50 percent, and 2) minimal cambium scorching of lodgepole pine. Measures will include: 1) initiating burns outside the time of bud elongation (generally between mid-May to early June depending on weather conditions), 2) initiating burns when weather and fuel moisture conditions are favorable for meeting fuel reduction objectives and minimizing damage, and 3) utilizing lighting techniques expected to meet fuel reduction objectives while minimizing damage to residual trees. To minimize cambium scorching of lodgepole pine, lighting techniques to include avoiding direct ignition under lodgepole pine.	All units with prescribed underburning.
To prevent introduction and spread of invasive plants	
Clean all equipment before entering National Forest System lands. Remove mud, dirt, and plant parts from project equipment before moving it into the project area.	All units
The district botanist or her designee will inspect all fill material for the presence of weeds prior to use on the project.	Any source
Avoid locating landings or skid trails where there is an existing weed site.	22, 96, 97, 98, 99, 100, 152, 210, 220, 275, 277, 447, 807, 801, 802, 831, 832, 834, 840
All existing weed sites within activity units will be treated prior to project initiation in the manner determined by the Invasive Plants FEIS and ROD.	22, 96, 97, 98, 99, 100, 152, 210, 220, 275, 277, 447, 807, 801, 802, 831, 832, 834, 840
Soil Resource Protection	
<u>Mechanical Harvest Operations:</u> • Restrict operations to winter only if feasible, except in Winter Range • Minimize as much as possible the extent of the skidding network • Retain as leave patches dense stands on rougher terrain i.e. rocky or sloped) <u>Non-merchantable, post-harvest treatments:</u> • For young stand management, avoid post-harvest mechanical operations, conduct by hand as is practicable or combine with fuels treatment • Limit equipment travel and utilize either small light-weight machines or ones with long boom reach, designate and maximize distance between primary travel routes <u>Fuels Treatments</u> • For mechanical activities use either small light-weight machines or prohibit heavy equipment from operating off of existing primary skid trails. • Maintain effective ground cover and organics, retain >50% of litter/duff wherever it exists	Extent of detrimental soil conditions is high
Sensitive Soil units: 22, 45, 51, 85, 125, 242, 246, 248.1, 313.1, 347.4, 325.1, 356, 801.1, 801.2, 821.3, 842.1, 856, 865	
<u>All mechanical activities</u> • Avoidance – defer mechanical activities on slopes > 30%, retain as untreated patches. <u>Prescribed Fire Treatments</u> • Minimize upslope pre-heating when underburning to minimize litter and duff consumption	Sensitive soils (steep slopes ≥30%)
<u>Mechanical harvest operations:</u>	Sensitive soils –frost

Resource Protection Measure	Units
• Restrict operations to winter only if feasible • Minimize as much as possible the extent of the skidding network Non-merchantable, post-harvest treatments • For young stand management, avoid post-harvest mechanical operations, conduct by hand as is practicable or combine with fuels treatment • Limit equipment travel and utilize either small light-weight machines or ones with a boom reach, designate and maximize distance between primary travel routes. Prescribed Fire treatments • Leave as much biomass as is feasible to meet the minimum of fuel objectives • In frost pockets retain as much of the litter and duff layers as possible by only burning in concentrations or around the drip lines of trees, treat only the heaviest of slash concentrations • Retain as much existing large CWD as is practical where it exists • If piling slash, prohibit mechanical operations off of primary skid trails, ensure that all piles are located on the skid trails	pockets and lower or mid slopes of cinder cones (slopes < 30%)
Mechanical Harvest operations • Too rocky to subsoil and restore, avoid new landings and temporary roads as is feasible.	Very rocky soils
Many BMPs are employed during operations to protect resources. They generally follow those defined in the guide, "National Best Management Practices for Water Quality Management on National Forest System Lands" (USDA 2012). Local variations to these have evolved over the last several decades to adapt to refined techniques, methods, and products. Listed below are BMPs most commonly practices to minimize detrimental soil impacts that are applicable to the activities being proposed in the Rocket project area: • Convey to all equipment operators the need to limit ground disturbance as much as is feasible. Avoid traveling over undisturbed ground unless necessary. • Avoid repetitive passes by heavy equipment except over designated primary skidding routes (i.e., roads or skid trails). Restrict travel of heavy equipment off designated primary skid routes to two passes or fewer. • Limit, as is feasible, heavy equipment, particularly tracked machinery from pivoting or unnecessary side-hill travel on slopes greater than 15 percent. Travel should mostly be down the fall-line and perpendicular to the contour of the slope. • Minimize travel of heavy equipment on slopes greater than 15 percent late in the season when soils are extremely dry and susceptible to excessive soil displacement. • Suspend operations during wet periods when soil moisture is high and heavy equipment tracks sink deep (i.e., half the width of the track) below the soil surface with one or two pass, particularly during spring thaw or after heavy rains. • Skidding, forwarding, or haul operations should avoid using the bottom of dry swales or draws as primary travel routes (i.e., temporary roads, landings, or skid trails). • Operations on sensitive soils or where the extent of existing detrimental soil impacts is high should be conducted over frozen ground as is feasible, or when the snowpack is at a depth sufficient enough to protect mineral soil. Travel of heavy equipment off of designated primary routes on sensitive soils should be avoided as much as is feasible. All attempts should be made to avoid new landings and skid trails in previously managed stands on sensitive soils. • For ground-based cutting and skidding operations, re-use existing log landings and primary skid trails whenever feasible, or roads identified to be decommissioned. Locations of new landings, primary skid trails, and temporary roads must be approved by the Forest Service prior to use. • For whole-tree harvest systems, primary skid trails will be spaced at least 100 to 150 feet	All Units unless more restrictive measures already prescribed for specific units.

Resource Protection Measure	Units
apart, except at convergence zones around landings or where terrain limitations dictate otherwise. • For cut-to-length harvest systems, spacing of primary forwarder trails should be at least 65 feet, except where terrain limitations dictate otherwise. To the extent possible, slash mats should be deposited over primary forwarder trails during cutting operations. • Restrict grapple skidders to designated areas only (i.e., roads, landings, primary skid trails) and on slopes 30 percent or less. • The location of temporary roads will be approved by the Forest Service prior to construction. Temporary roads shall be located on terrain where minimal width can be maintained, and where the least amount of cut-and-fill construction is needed. • Avoid locating temporary roads on sensitive soils, and prohibit them from being routed down through the bottoms of swales, draws, abandoned channels, or dry natural drainageways. • Landings and temporary roads shall be constructed using drainage control structures. Erosion and sediment control measures should be placed to prevent accelerated erosion and off-site transport of sediment to a water source as is needed. • Subsoil or decompact all temporary roads to a depth of at least 16 to 24 inches after use. Outslope any segments requiring a cut into the hillslope. • Piling of post-activity fuels should be limited, as is feasible, to existing hardened surfaces (i.e., roads, landings, skid trails). Restrict travel of heavy equipment off designated primary skid routes to two passes or fewer. On sensitive soils, prohibit machine travel off of primary skid trails altogether. • Locate machine constructed slash piles on existing hardened surfaces (i.e., roads, landings, skid trails) as much as possible. • Minimize the amount of large diameter CWD that is incorporated into slash piles, particularly those that are relatively sound or “buckskin” (i.e., decay classes 1 through 3, particularly pieces that are gray and without bark). Except where there are heavy concentrations of residual dead and downed wood, retain as much residual large CWD as possible (where it exists). In previously harvested areas, refrain from incorporating existing CWD in slash piles as much as is feasible. • Underburning activities should be conducted so that at least 40 percent of the duff and litter layer across an activity area is retained. Target underburning when relative humidity and fuel moistures are favorable for litter and duff retention so that as much of the effective ground cover as possible is maintained. Litter and duff layers should have enough moisture to detect by hand, and not be too brittle. • Sites where the organic layers are thin, such as frost pockets or heavily disturbed areas where effective ground cover is less than 50 percent aerially, conduct underburning in a manner that retains at least 50 percent of the duff and litter layer *depth*. • Retain a portion of live understory (where it exists). To facilitate an increase after fire in the production and turnover of the litter, fine roots, and soil biota. A proportion of the underburn should be non-lethal so that a mosaic of the understory is retained. • Minimize the consumption of sound, large diameter CWD during prescribed underburns. Where CWD is close to or in contact with the ground attempt to minimize the duration and intensity that it burns to lessen the effects to soils. • Restore as much machine-constructed fire lines as possible by redistributing displaced topsoil and unburned woody debris over the disturbed surface.	
To Minimize Impacts to Wildlife and to Preserve Wildlife Habitat Components	
Areas of quality hiding cover will be retained across the project area in untreated patches to	All units

Resource Protection Measure	Units
total approximately 10% of treatment acres.	
Retain trees of high value to wildlife on site, except where a hazard. Examples include snapped-out tops, trees with cavities, true fir with conks that would indicate a future hollow log, non-lodgepole trees with multiple tops, and trees with very large limbs.	All units
Retain ponderosa pine trees less than 21" dbh with old tree characteristics (from Van Pelt 2008) except where they are either: 1) ladder fuels which pose a threat to larger diameter trees or 2) dwarf mistletoe infected and contribute to infection potential of desired understory trees. Ponderosa pine old tree characteristics include all of the following: 1) orange bark with plates generally more than three times wider than the darker fissures that separate them, 2) rounded crown, and 3) below the main crown, few if any dead branches present and knots not noticeable.	All units
Green Tree Replacements (GTRs): a minimum of 2.5 live trees per acre greater than or equal to 21 inches will be retained either as live trees or in the event they are mistletoe infected as newly created snags. Where fewer than 2.5 live trees greater than or equal to 21 inches dbh will remain following harvest or snag creation, trees 19 to 20.9 or largest size class available will be retained as needed to a density of 2.5 trees per acre.	22.3, 123.2, 308.2, 308.4, 354, 451.2, 451.3, 716, 811.3, 839.2, 903
Where units occur within connectivity corridors, thinning will be modified in the following units, to retain adequate canopy cover (i.e. rather than 40 sq. ft. basal area, a minimum of 60 or 80 sq. ft. basal area will be retained.	
Retain at least 25 percent of existing shrub cover across units after prescribed burning operations.	All burning units
Place a minimum 300-foot no treatment buffer around guzzlers, which are located adjacent to the treatment units.	936, 937
Implementation of prescribed underburning and mowing is subject to standard and guide M7-26 which limits those activities to 2.0-2.5% of the forest-wide MA-7 acreage annually. Rocket implementation opportunity within MA-7 will therefore be determined during annual Forest-wide MA-7 assessment.	20-23, 96-102, 106, 109, 110, 117, 123, 125, 126, 129, 152, 218, 220, 229-231, 234, 238, 278, 325, 367, 446, 451, 800-802, 807-811, 814, 815, 823-841, 876, 877, 902, 903
Within MA-7 and adjacent to wildlife undercrossings and jumpoff areas, commercial harvest, precommercial thinning, mechanical shrub treatments, and prescribed burning operations are preferred to occur between April 1 and November 31. Consult wildlife biologist for operating in winter range outside these dates.	20-23, 96-102, 106, 109, 110, 117, 123, 125, 126, 129, 152, 218, 220, 229-231, 234, 238, 278, 325, 367, 446, 451, 800-802, 807-811, 814, 815, 823-841, 876, 877, 902, 903
Conduct underburning in northern goshawk post-fledging areas (PFAs) between September 1 and March 1 and in coordination with a Deschutes NF wildlife biologist. 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.	North: 22.5, 22.6, 23.1, 23.4, 802.3, 807.1, 807.2, 941, 946, 948, 949, 992 South: 244.1, 244.2, 817 (and any other units if nests are located)
Report raptors encountered before or during management activities (including layout, implementation, and post-sale activities) to a Deschutes NF wildlife biologist. A "no-treatment"	All units

<table>
<tr><th>Resource Protection Measure</th><th>Units</th></tr>
<tr><td>buffer may also be placed around the nest in consultation with a Deschutes NF biologist.</td><td></td></tr>
<tr><td>Protect raptor nests from disturbance according to the table below. Disturbance activities include temp road construction, small tree thinning, timber harvest, grapple piling, mowing, prescribed slash burning, and underburning operations.
Cooper’s hawk April 15-August 31 (WL-19)
Sharp-shinned April 15-August 31 (WL-19)
Northern goshawk March 1-August 31 (WL-3)
Red-tailed hawk March 1-August 31 (WL-3)
Osprey April 1-August 31 (WL-3)
Golden Eagle February 1 – July 31 (M3-15)
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.</td><td>None currently identified</td></tr>
<tr><td>Retain existing snags (≥ 10” dbh) except where snags are felled for hazard trees along roads, log landings, or for occupational safety. Felled snags will be retained to provide down wood.</td><td>All units except: 33, 36, 37, 61.3, 65, 247, 335, 338, 366, 705, 707, 812.1, 812.2, 812.3, 812.4, 812.5, 817, 863, 864, 867, 868, 881, 882, 887, 995, 996</td></tr>
<tr><td>Avoid larger (≥ 10” dbh) snags by locating skid trails and landings away from them where possible.</td><td>All units</td></tr>
<tr><td>Current direction on minimum snag levels per plant association group:
• Ponderosa pine: 4 snags/acre (3/acre ≥ 10” dbh; 1/ac ≥ 20” dbh)
• Mixed conifer: 4 snags/acre (3/acre ≥ 10” dbh; 1/ac ≥ 20” dbh)
• Lodgepole pine: 6 snags/acre ≥ 10” dbh</td><td>All units except deer openings where a minimum of 2.5 trees >= 21” per acre will be retained</td></tr>
<tr><td>In ponderosa pine restoration units, down wood may be removed to facilitate meeting stand prescriptions (operational feasibility) except in identified units where high density patches of down wood is retained for marten habitat.</td><td>33, 65, 247, 37, 335, 366, 812.1, 812.2, 812.3, 812.4, 812.5, 887, 995, 996</td></tr>
<tr><td>Where possible, retain cull material greater than or equal to 9 inches in diameter rather than moving it to landings.</td><td>All units</td></tr>
<tr><td>The following are down wood requirements from the Eastside Screens:
<table>
<tr><th>Vegetative Series</th><th>Pieces per Acre</th><th>Diameter Small End</th><th>Piece Length</th><th>Total Lineal Length</th></tr>
<tr><td>PP</td><td>3-6</td><td>12”</td><td>>6 feet</td><td>20-40 feet</td></tr>
<tr><td>MC</td><td>15-20</td><td>12”</td><td>>6 feet</td><td>100-140 feet</td></tr>
<tr><td>LP</td><td>15-20</td><td>8”</td><td>>8 feet</td><td>120-160 feet</td></tr>
</table>
Post-sale monitoring will determine the extent to which measures are necessary for down wood retention.
Options for meeting down wood requirements (where available) include:
• Retain down wood ≥ 8” in lodgepole pine and ≥ 12” in all other PAGs. If sufficient size classes are not present, then the largest available down logs would be substituted. Only activity-created slash below these maximum diameters would be piled and utilized or disposed.
• Do not include material > 9” in grapple and hand piles for all plant associations.
• If snag and down wood diameters do not meet objectives within a unit, retain largest</td><td>Underburning and piling units</td></tr>
</table>

Resource Protection Measure	Units
material available. • Ensure that consumption will not exceed three inches total (.5 inches per side) in featured log sizes. • Down wood may be manipulated (shifted, clumped, grouped, drive over, etc.) only as necessary to meet unit objectives. • Conduct pile burning during conditions that eliminate or minimize fire creep.	
Where identified, high quality snags would be protected by a variety of methods (e.g. no direct ignition, lining, spot mop-up, etc.)	All underburning units
Conduct prescribed fire activities during optimal conditions that prevent smoke from entering Lava River Cave, and other identified caves. Preferred months are May and October.	96.1, 96.2, 96.3, 97, 98, 99, 101, 278, 833, 836
Avoid timber harvest, vegetation removal, underburning, and mowing on rock outcrops in identified units	
Trees will not be removed except for safety in a 200 foot (NNVM Units) or 150 foot (LRMP Units) radius around cave entrances and in feeder drainages with slopes of less than 30 degrees. There will be no ground-disturbing activities on slopes steeper than 30 degrees adjacent to cave entrances.	LRC: 96.2, 97, 98, 99, 100, 278, 325.4, 347.4 and 836 and any other caves or infeeder drainages discovered in the units during project implementation
Trees should not be felled across fissures or caves and avoid the use of mechanized equipment in any fissures or caves encountered.	all units
To Protect Cultural Resources	
Eligible sites to be protected during operations through a variety of heritage resource protection methods including but not limited to avoidance, operating over frozen ground, limiting equipment turning or maneuvering.	The Heritage Resources Specialist Report identifies affected units and site type.
Sites to be avoided will be flagged prior to project unit layout and areas to protect will be provided to the contracting representative.	
In the event that previously unknown sites or artifacts are found during project implementation, they will be flagged and operations in the area avoided until an archaeologist is consulted.	All units
To Protect Range Resources	
Protect the range study plot – Condition and Trend Transect #5. Site will be flagged by range program and excluded from any treatment. Township 20 South, Range 11 East, SE ¼ Section 2.	Unit 816

Monitoring

Objective: Monitor implementation of prescribed underburns to determine if resource protection measures have been met (EA page 39) and determine if fire-related mortality has reduced stocking to less than minimum stocking.

Methods/Parameters for initial post-burn monitoring:

1. Identify where live crown objectives have not been met (from Resource Protection Measures):

NNVM Burn Units	Crown scorch <30%; Bole Scorch <10 feet
All Rocket Burn Units	Crown scorch <50%; Live crown ratio <40%

2. Determine if fire related mortality has reduced stocking to less than minimum stocking if either of these criteria has been met:
   a) A clump of trees, 3 acres or more in size, exceeds threshold for probable mortality based on crown scorch (crown scorch varies depending on average tree DBH)
   b) Combined area equaling or exceeding 10% of the unit has trees with high probability of mortality based on crown scorch

Follow-up to monitoring:

1. Where live crown objectives are not being met, determine additional mitigations or changes in silvicultural prescriptions necessary to achieve resource objectives (responsibility of fuels and silviculture)
2. Where excess fire-related mortality has occurred, monitor units for up to two years following burn to determine is adequate stocking exists or if a reforestation plan should be developed (responsibility of silviculture)

Post Sale Projects

Money may be collected from the timber sales to complete certain projects such as required reforestation or enhancement and restoration projects in the vicinity of the timber sales. Required mitigation measures have the highest priority for funding, but may be funded by other means such as appropriated funds to insure that requirements are accomplished.

This list is intended to serve as an overall guide for the project area. As timber sales are defined, specific priorities may be adjusted to meet the needs for each sale area. Projects not covered in this EA would require documentation through a separate NEPA process unless not subject to NEPA.

Table 13: Potential Post-Sale Projects Listed

Sale Area Improvement Project	Covered in this EA
Ponderosa pine planting in created openings – required reforestation	Yes
Gopher and /or big game animal damage control in reforested openings – required reforestation	Yes
Precommercial thinning	Yes
Weed survey and control	No
Subsoiling	Yes
Unauthorized OHV trail restoration	Yes

Road closures	Yes
Snag creation in and around openings	Yes
Signing of Monument	No

Alternatives Not Considered in Detail

Non-commercial thinning only: Fire alone will not reduce crown density, and fire cannot be utilized in many places unless the crowns are opened up more. Without removing commercial size trees, stands that need thinning would stay close to or above the UMZ. Non-commercial work is included in the project where appropriate, but the purpose and need for density reduction, improving health and growth of residual trees, and providing forest products could not be met without thinning commercial size trees.

Treat all stands that need it: The IDT considered an alternative that would enter even more stands than Alternative 4 with commercial harvest, mowing, and burning. This was not analyzed in detail because it would not be possible to be consistent with hiding and thermal cover standards and guidelines for deer. Improving deer habitat conditions is a component of the purpose and need, so all action alternatives were designed to be consistent with the standards and guidelines.

No openings for deer habitat: Some scoping respondents are opposed to the proposal to create small openings for generating deer cover. Conversely, the Oregon Dept. of Fish and Wildlife supported the proposal and suggested that we create more openings across the project area. Improving deer habitat conditions, including hiding cover is part of the purpose and need for the project. Therefore, the IDT did not analyze an alternative without created openings. However, the alternatives do vary the amount and size of openings and it is analyzed as a key issue (see page 11). The no action alternative provides a "no openings" option.

Prescribe burn through peninsula portion of Monument without mechanical pre-treatment: The existing condition within the "peninsula" portion of the project area (reference a map) makes prescribed burning without pre-treatment infeasible. Prescribed burning in the peninsula under dense stand conditions and with an abundance of ladder fuels would likely result in a large amount of overstory mortality. The goals and objectives of the Monument would not be met because the restoration clock would be set back, likely to a stand initiation phase. Because the forest is not currently in a natural state due to past harvesting and fire suppression, to introduce fire without pre-treatment would not approximate natural fire. The IDT did not analyze an alternative that burns in the peninsula without pre-treatment, but Alternative 3 addresses concerns with mechanical harvest in the Monument by only including those stands that could successfully be prescribed burned without a mechanical harvest first.

Non-mechanical treatment in aspen stands: Within two small aspen stands totaling about 5 acres, the proposal is to remove conifers with mechanical harvest. A suggested alternative was to prescribe burn the aspen rather than remove conifers. Due to the small size of the units and the small size of the aspen trees, removing the conifers mechanically is a more economically viable alternative to prescribed burning. Managing for aspen with fire is more appropriate when used on a bigger scale and when aspen has a more prominent presence on the landscape. Also, because of the small size of the existing aspen, prescribed fire could result in near total mortality. Although this could result in a high amount of suckering and encourage a healthy future aspen stand, the desire here is to not restart the stand, but keep the existing aspen trees maturing while encouraging more sprouting to occur. Prescribed fire could also result in mortality of lodgepole pine in the area which could negatively affect the scenic quality.

Comparison of the Alternatives Considered in Detail

Table 14: Summary of activities proposed under each alternative

Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Tree Treatments	acres	acres	acres	acres
Thinning to 40 ft. avg. BA	0	2,020	---	---
Thinning to 60 ft. avg. BA	0	3,305	947	2,435
Thinning to mixed range of BA (40-80 ft)	0	---	2,168	4,441
Ponderosa pine restoration	0	559	144	638
Opening for deer cover	0	22	18	37
Opening in dwarf mistletoe	0	---	20	24
Thinning for dwarf mistletoe*	0	---	7	324
Aspen enhancement	0	5	5	5
Plantation thin	0	542	648	884
Ladder fuel reduction	0	917	1,688	1,152
Total	**0**	**7,370**	**5,645**	**9,940**
Fuels Treatments				
Handpile/burn (around LRC)	0	5	5	5
Mow	0	294	2,308	1,118
Mow + underburn	0	7,027	1,670	6,748
Total	**0**	**7,326**	**3,983**	**7,871**
	miles	miles	miles	miles
Transportation System				
Temporary road development	0	5.3	2.8	5.8
Road closures	0	38.6	38.6	38.6
Road decommissioning	0	5.4	5.4	5.4

The following tables provide summary information on the measures used to determine how well the alternatives meet the purpose and need for action (Table 15) and the measures used to determine how each alternative addresses key issues (Table 16).

Table 15: Summary of how each alternative addresses the elements of the purpose and need.

Purpose and need element	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Improve resilience to fire and lessen risk of large scale loss of forest				
Wildfire hazard rating Acres rated as low moderate high extreme	 2,188 8,809 6,316 117	 8,805 4,728 3,853 92	 5,589 7,324 4,426 77	 8,820 5,653 2,945 68
Percent of forested acres with low wildfire hazard rating	13%	50%	32%	50%
Amount of condition class 2 treated	0 acres	7,049	5,580	9,541
Improve resilience to insects and disease; improve health and growth of trees; and lessen risk of large scale loss of forest				
Hazard: forest condition; Risk: beetle presence, abundance, and distribution.	Forest conditions favorable for large-scale beetle outbreak: homogenous and high density of tree size associated with bark beetle disturbance	Forest conditions less favorable for large-scale beetle outbreak: increased heterogeneity with smaller patches of high density; tree vigor improved or maintained increasing survivability.	Less improvement of conditions than Alt. 2. Improvement of shorter duration than Alt. 2	More improvement of conditions than Alt. 2. Improvement of shorter duration than Alt. 2.
Percent of project area at higher risk of loss to insects and disease (above UMZ)	69% of project area at higher risk of loss to insects and disease (above UMZ). Dense forest conditions dominate project area.	44% of project area at higher risk of loss to insects and disease (above UMZ) 25% increase in resilient area	53% of project area at higher risk of loss to insects and disease (above UMZ) 16% increase in resilient area	36% of project area at higher risk of loss to insects and disease (above UMZ) 33% increase in resilient area
Percent of NNVM within project area at higher risk of loss to insects and disease (above UMZ)	71% of NNVM at higher risk 0% increase in resilience	51% NNVM at higher risk 20% increase in resilient area	69% NNVM at higher risk 2% increase in resilient area	43% NNVM at higher risk 28% increase in resilient area
Move structural stages closer to the historic range of variability				
Improve condition and trends within HRV	No change in ponderosa pine early successional stage. Mid-open stands on trajectory towards LOS but subject to beetle	22 acres (<1%) increase in ponderosa pine early successional stage. 6% of mid-closed stands on landscape thinned and put on	38 acres (< 1%) increase in ponderosa early successional stage. 4% mid-closed stands thinned and put on trajectory	61 acres (< 1%) increase in ponderosa early successional stage. 9% mid-closed stands on landscape thinned and put

	risk.	trajectory towards LOS.	towards LOS.	on trajectory towards LOS.
Maintain stands with large tree structure	0 acres of LOS thinned to reduce risk	295 acres LOS thinned to reduce risk	11 acres LOS thinned to reduce risk	435 acres LOS thinned to reduce risk
Improve deer habitat conditions, including arrangement of forage, cover, and thermal habitat				
Openings created for developing deer cover	0 openings created	5 openings Total 22 acres	6 openings Total 38 acres	11 openings Total 61 acres
Reduce disturbance and fragmentation by reducing open road density	No change in open road density 2.5 mi/sq. mi in watershed	38.6 miles of road closed 5.4 miles decommissioned 2.22 mi/sq. mi in watershed	38.6 miles of road closed 5.4 miles decommissioned 2.22 mi/sq. mi in watershed	38.6 miles of road closed 5.4 miles decommissioned 2.22 mi/sq. mi in watershed
Reduce disturbance by addressing unauthorized motorized use	No change	35 miles of user-created OHV trails restored	35 miles of user-created OHV trails restored	35 miles of user-created OHV trails restored
Contribute forest products				
Total volume of timber and other wood products produced	0	35,300 ccf	18,200 ccf	43,000 ccf
Sawlog volume produced	0	13 mmbf	7 mmbf	16 mmbf
Forest sector jobs created or maintained	0	256	136	320

Table 16: Summary of how each alternative addresses the key issues.

Key Issue	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Tree stocking following thinning				
Average BA of 40 ft.^{2}	0 acres	2,020 acres	0 acres	0 acres
Average BA of 60 ft. ^{2}	0 acres	3,305 acres	947 acres	2,435 acres
Mixed Average of BA 40-80 ft. ^{2}	0 acres	0 acres	2,168 acres	4,441 acres
Ratio of treated to untreated stands in project area				
Percent of forested area treated	0%	42%	33%	57%
Percent of forested area remaining in dense forest condition	69%	44%	53%	36%
Commercial harvest within Newberry National Volcanic Monument				
Amount of mechanical thinning in NNVM	0 acres	957 acres	5 acres	1,298 acres

Key Issue	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Percent of NNVM in dense forest conditions	71%	reduced to 51%	slightly reduced to 69%	reduced to 43%
Treatment within two Old Growth Management Areas				
Amount of OGMA thinned	0	55 acres	0	211 acres
Percent of OGMAs remaining in dense forest	89% above UMZ	68% remains above UMZ	89% remains above UMZ	38% remains above UMZ
Treatment within Goshawk PFAs and Reproductive Habitat				
Acres and percent of PFA treated	0	536 27%	0 0%	741 38%
Acres and percent of project-level reproductive habitat treated	0	4,796 45%	3,686 34%	6,442 60%
Created Openings				
Number of openings	0	5	6	11
Size range of openings	N/A	4-5 acres	4-12 acres	4-12 acres
Total of openings	0 acres	22 acres	38 acres	61 acres

Environmental Impacts of the Alternatives

Introduction

This section of the EA describes the components of the human environment that may be impacted by project activities described previously. Effects discussions follow CEQ guidance for scope by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. Measures to mitigate or reduce potential adverse effects caused by the implementation of any of the actions proposed are listed in the section Resource Protection Measures. These measures are an integral component of the action alternatives, and conclusions made about the environmental consequences are made with these measures in mind.

Project Record

The interdisciplinary team (IDT) includes Forest specialists for each discipline. Specialists on the IDT prepared technical reports to address the environmental consequences of the Rocket project. All reports are maintained in the project file, located at the Bend/Ft. Rock Ranger District office in Bend, Oregon. In some cases, this environmental assessment provides a summary of the report and may only reference technical data upon which conclusions were based. Specialist reports are incorporated by reference into this environmental assessment (40 CFR 1502.41).

Best Available Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of the environmental assessment. Referenced material is a consideration of the best available science.

Cumulative Effects Analysis

The following section on environmental consequences includes discussion of cumulative effects. Where there is an overlapping zone of influence, or an additive effect, this information is disclosed. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. Most of these actions and natural events are displayed in Table 17. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. This approach is consistent with Forest Service NEPA regulations at 36 CFR 220.4(f).

The following table lists the groups of actions that have contributed to the existing conditions within the project area and surrounding landscape. Effects analysis considers these past actions as contributing to the current conditions.

Table 17: Past actions and events that have contributed to the current conditions in the project area.

	Timing	Description	Residual Effects
Roads	20th century	Road system developed. 130.5 miles open roads; 12 miles closed (maintenance level 1).	Current transportation system provides administrative and public access. Open road density contributes to wildlife disturbance effects.
Highway 97 Widened	2009 - Present	Highway expanded to four lanes, separated by a median. Fences installed to funnel big game to undercrossings.	Remaining rehab of openings and temp roads to be completed. Two undercrossings on boundary of project area.
Historic Industrial Timber Operations	1920s-1930s	Logging by Shevlin-Hixon and Brooks-Scanlon companies, primarily clearcutting.	Existing stand structure, trees about 80 years old, lack of large trees.
Large Wildfires	1911 - Present	Sugarpine Butte Fire (1911) - 700 acres Sugar Fire (1995) - 50 acres Green Mtn. Fire (1995) – 223 acres 18 Road Fire (2003)– 3800 total acres	Changes in stand structure, reflected in existing condition. Some areas have been salvaged and reforested.
Wildfire Suppression	1986 - 2009	67 fire starts; all suppressed at less than 5 acres except Sugar Fire.	Generally no visible effects remain.
Livestock Grazing	1930s to 1990	The Coyote Allotment is vacant with no permittee and no use by livestock. Official Forest Service grazing records document that livestock grazing in the project area occurred as early as the 1930s.	Range allotment became inactive in 1990. All fencing within the Rocket Project area has recently been removed. Allotment will be administratively closed. No remaining visible effects on vegetation.
Vegetation Management / Fuels Reduction Projects			
Past Thinning	1979s to 2010s	Approximately 9,200 acres of the Rocket area have been thinned in the past, sometimes more than once.	Thinning and other harvest has contributed to the current vegetative structure in the area and is reflected in the current condition assessment for forested vegetation and fuels.
Reforestation	1970s – 2010s	Planting of seedlings has occurred on approximately 1,000 acres.	Contributes to current vegetative structure and hiding cover.
Recent Thinning and Fuels Reduction			
Oz Project	2008	OSU study on stand structure development; units thinned and group selection cut; shrubs mowed.	A portion of the Oz study units are within Rocket project area. Six openings of 11 acres were created on the landscape as well as snag creation. Burning is still to occur.
Kipuka Timber Sale (Ponderosa Pine Restoration EA)	DN 1996	Project intended to move 400 acres within Monument towards open park-like stands of ponderosa pine.	Recently harvested units in project area contribute to existing structure. These units are planned to be underburned.
South Bend HFRA	Decision Notice 2008	Adjacent to project area. Fuels reduction including thinning, mowing, and burning.	Changes in forest density and fire risk within vicinity of project. Thinning and mowing are complete. Underburning may overlap in

	Timing	Description	Residual Effects
			time with Rocket implementation timeframe.
Fuzzy EA		Adjacent to and within project area. Fuels reduction including thinning, mowing and burning.	Changes in forest density and fire risk within and adjacent to the project area. There is 419 acres of Fuzzy underburning in the Rocket planning area that has not been completed.
Sunriver HFRA	Decision Notice 2008	Adjacent to project area. Fuels reduction including thinning, mowing, and burning.	Changes in forest density and fire risk within vicinity of project. Thinning and piling will be completed in 2014. Underburning will likely overlap in time with Rocket implementation timeframe.
Lava Cast EA and Lava Cast CE	Decision Notice and Decision Memo	Adjacent to project area to south. Thinning, mowing, and burning.	Changes in forest density and fire risk within vicinity of project. Thinning and mowing are complete. Underburning is planned.

The following table lists the actions that are currently ongoing or are reasonably foreseeable. The temporal and spatial scale of analysis is variable depending upon the resource concern being evaluated; therefore this list is used as a reference. Where the Rocket project would result in an incremental effect when added to any of these projects or activities, it is noted in the cumulative effects analysis for that resource.

Table 18: Ongoing or reasonably foreseeable future actions that may cause cumulative effects with the Rocket project.

Project Name / Activity	Status/Timing	General Description of Activities
Miscellaneous / Special Uses		
BPA Powerline Maintenance	Existing/Ongoing	125 foot wide clearing, for approximately 6 miles across project area (approximately 91 acres). Maintenance activities include hazard tree falling, mowing, and weed control.
Gas Transmission Northwest Maintenance	Existing/Ongoing	100 foot wide clearing, for approximately 6 miles across project area (approximately 73 acres). Maintenance activities include hazard tree falling, mowing, and weed control.
New Midstate Electric Powerline Installation	Planning	Midstate electric has proposed installation of a new powerline that would run from LaPine area to Sunriver area. The proposed line does not cross the Rocket project area. The line would run parallel to the gas transmission line within the same watershed.
Recreation		
Developed Recreation Sites: Lava River Cave; Lava Cast Forest; Lava Lands Visitor's Center	Existing/Ongoing	Day use sites, recently expanded parking lot at Lava River Cave which averages 60,000 visitors a year. Seasonal.
Hiker/Horse Trails	N/A	No trails within project area
OHV Trails	Ongoing	No designated trails within project area. Illegal use is occurring off roads and trails.

Project Name / Activity	Status/Timing	General Description of Activities
Lava River Visitor Center to Sunriver Paved Path	Construction 2013 or 2014	Six mile paved path from LLVC to Sunriver intended for walking and biking. Outside project area, but nearby and within same watershed.
Roads		
Road Maintenance	Ongoing	Grading, ditching, brushing out, and hazard tree removal.
Big Game Fence Maintenance	Ongoing	Fence along Highway 97 to prevent wildlife from crossing highway.
Road Closures	Planning	Identified in previous NEPA projects within the same watershed. Contributes to reduction in road density.
Travel Management Rule	Ongoing	Across project area and Forest. Motorized travel in Central Oregon restricted to designated roads and trails only; no cross-country OHV travel is allowed.
Vegetation Management		
West Bend Vegetation Management	Planning Objection Period 08/2013	Does not overlap project area. Thinning, mowing, underburning proposed within same watershed. Implementation to begin in 2014 including about 14,500 acres of commercial thinning.
Invasive Plant Treatment	Ongoing	Herbicide spraying along Highway 97 under new forest-wide EIS. All other sites in project area are hand-pulled.
Oz Project	Ongoing	As part of the OSU study, forty acres of Oz unit #6 is scheduled to be underburned in Spring of 2014.

Fuels, Fire Behavior, and Air Quality

Introduction

Over the last century, increased human interaction within the land, including fire exclusion, grazing, and logging has altered the Deschutes National Forest landscape. As a result, there has been a notable increase in insect outbreaks, fuel loading, human caused fires and other disturbances. In response to the change in disturbance dynamics, forest managers are focusing on making our forests more resilient to disturbances. This section of the EA references the Fuels and Air Quality Specialist Report and focuses on the effects that the thinning, mowing and prescribed burning described in the action alternatives will have on the project area's resilience to fire and how effective the proposed treatments will be at lessening the risk of a wildfire that results in a large scale loss of forest. This section also addresses the effects of the alternatives on air quality due to prescribed burning. The other components of the purpose and need are addressed in other sections of this environmental assessment, particularly Forested Vegetation. A comparison of cost and time required to complete the fuels treatments is located in the Economic Analysis section.

Fuel Treatments and Project Design Considerations

The vegetation treatments proposed in the Rocket planning area are intended to build resiliency to both fire and disease. The treatments described for the action alternatives (pages 30-31) follow the principles outlined in the following Table 19. See page 4 for a definition of resilience as it relates to this project's purpose and need.

Implementing fuels treatments across the entire project area would maximize the project goals of building resilient forest stands. However, besides being expensive and time consuming, this would conflict with visual quality and wildlife goals and objectives. When designing treatments, consideration was put into how fire would travel across the landscape and there was an attempt to maximize treatment effectiveness by strategically placing treatment areas.

Table 19: Principles of fire resistance for dry forests (adapted from Agee, 2002 and Hessburg and Agee, 2003). Agee and 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).

Fuel Treatments within the Newberry National Volcanic Monument

The Newberry National Volcanic Monument (NNVM) comprises of 10,331 acres of the project area, and meeting the goals of NNVM plan was an important consideration when designing the proposed treatments. The goals of the NNVM plan include sustaining or restoring ecosystems and ensuring ecosystem resiliency within the Monument while providing natural ecological succession of vegetation to the maximum extent practical.

The goal of fuels treatments in the NNVM is to allow natural processes to play out to the largest extent possible. In its current condition, with a relatively dense overstory and a dense shrub understory, letting fire

play its natural role in much of the area would result in an undesirable loss of the overstory due to the high fire hazard. Given the NNVM's close proximity to the town of Bend, the major transportation corridor that passes through it (Highway 97), the presence of high use recreation areas such as Lava River Cave and Lavacast Forest, and many other public safety and resource issues, it would be very difficult for fire managers to use a strategy in the monument that allows fire to burn naturally.

Through a combination of thinning, mowing and prescribed burning the fire hazard will be lessened. This will both decrease the risk of "resetting" the current stands and it will allow fire managers to manage fires in the monument on a larger scale.

Treatments near Lava River Cave

When designing treatments near the cave, consideration was put into preserving the cave's microclimate and maintaining a visual screen between the parking lot and highway 97. The primary goals of the treatments is to improve firefighter and public safety. There are three firefighter and public safety objectives for fuels treatments near Lava River Cave:

1. Provide safe egress out of the cave area in the event of a wildfire.

2. Increase the success rate of firefighters directly attacking a fire near the cave area by decreasing potential fire intensities.

3. Decrease potential fire intensities to a level that, if necessary, people and vehicles could safely remain in the parking lot during a wildfire incident.

Treatments along Critical Transportation Routes

Community Wildfire Protection Plans identify critical transportation routes by definition. In this project area, Highway 97 and Forest Service roads 9703, 9710, 9711 and 9720 were identified as critical transportation routes. Highway 97 is an important route for commerce coming in and out of the Bend area, as part of treatment design there is a focus to maximize treatments along the highway corridor. Considerable work has been done with other planning projects along the corridor. The treatments proposed in Rocket would complement and reinforce these other fuel treatments.

Forest Service Roads 9703, 9720 and 9711 are heavily used by recreationists and other forest users: 9703 is the main access road to Lava River Cave, 9720 provides access to Lava Cast Forest, and 9710 and 9711 provide access from the east side of the district to Highway 97. The primary intent of treatments along these roads is to provide safe ingress and egress for both the public and firefighters. These treatments are not "wall to wall" and are balanced with a wildlife objective of maintaining thermal and hiding cover for deer and scenic views objectives.

It is unlikely that these treatments alone would stop a rapidly moving wildfire displaying extreme fire behavior. However, the treatments along the roads will provide a place for firefighters to attempt to stop a wildfire through control actions such as backfiring and they will help provide safe ingress and egress.

To meet desired conditions in the Rocket planning area, multiple entries of mowing and/or prescribed burning may be required. For example, in a unit that exhibits high fuel loading, a single entry of burning may not sufficiently reduce fuels. In this case, a second entry within a year or two of the first may be required to meet desired conditions.

Seasonality of Prescribed Burning

Although it is generally desired that the effects of prescribed burning mimic those of natural fires, prescribed underburning typically takes place during the cooler and wetter spring or fall months. Because they are implemented under wetter and cooler conditions, prescribed burns in the spring and fall typically consume less fuel than would occur during summer wildfire conditions (Table 20). Until heavy fuels are reduced to historical levels, out of season burns that consume less fuel are preferred for reintroducing fire without causing severe effects. In addition to a desire to burn under more benign weather conditions, there is usually

a lack of a prescribed burn workforce during the historical fire season because firefighting personnel are being used on wildfires. A literature review on the ecological effects of prescribed fire season found that the effect of prescribed burning season appeared to be relatively minor for many of the species that have been studied (Knapp, Estes, & Skinner 2009).

Table 20: Percentage Reduction in 3+" Down Wood, summer wildfire conditions vs. spring/fall prescribed burn conditions

Fuel Type	Summer Wildfire	Spring or Fall Underburn
3+ inch Sound	18.3%	6.7%
3+ inch Rotten	34.3%	15.5%

Created with FOFEM, cover type, SAF 237-Interior Ponderosa Pine
Fuel Type = Natural
Summer Wildfire percentage calculated with Season = summer and moisture scenario = very dry
Prescribed burn season percentage calculated with season = spring and moisture scenario = moderate (a run with season = fall, produced exact same results as season = spring)

Management Direction

Management activities on the Deschutes National Forest are directed by the Deschutes Land and Resource Management Plan, referred to in the document as the Forest Plan. Fire and fuels management are guided by direction in the Forest Plan and by direction in the National Fire Plan and associated documents. The Rocket planning area lies partially within the NVNM, and there is specific guidance within the NVNM plan that influenced project design. Specific Forest Plan and NVNM plan direction and a description of the major national direction guiding this project is found in Appendix A of the Fuels and Air Quality Specialist Report.

Analysis Methods

The effects analysis for fuels is geographically bounded by the Rocket project boundary. Only fire and fuels reduction activities that occurred within the project area during the last fifteen years were considered in the cumulative effects analysis. District experience and field reviews have shown that vegetation management activities such as thinning followed by mowing and prescribed fire have the beneficial effects of reducing fire intensity and fire behavior for an average of 15 years, perhaps longer depending on location and treatment intensity.

Fire history and Occurrence: FireFamily Plus was used to compile climatology and weather information for use in FlamMap. Fire history information from FireFamily Plus was used in conjunction with Deschutes National Forest fire history GIS databases to complete the fire history analysis.

Fire Behavior Predictions: FlamMap v5.0 (Finney et al., 2006) is a fire modeling program that runs on GIS-generated data and generates fire behavior data comparable across landscapes for a given set of weather and fuel moisture data inputs. FlamMap was used to predict potential fire behavior using existing fuel conditions as well as post treatment conditions for each alternative. ArcFuels (Ager et al., 2011) was utilized to modify stand and fuel conditions in order to reflect changes that occurred during activities identified in the action alternative(s), as well as build the landscapes with necessary data inputs for each of the alternatives. The data landscape inputs necessary for FlamMap v5.0 include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class.

Fire Weather Analysis: Fire Family Plus 4.1 is a windows program that combines fire climatology and occurrence analysis. This program has an extensive data filter system that allows users to evaluate and develop fire danger percentile ratings, generate fire history data and perform queries on weather stations and associated weather conditions using climatology. Historical weather and fire occurrence data was extracted by using KCFAST, a data warehouse supported by FAMWEB the Fire and Aviation Management Web Applications Team. The Lava Butte Remote Automated Weather Station (RAWS 352618), located on top of Lava Butte on the west side of the project area, was selected to best represent weather and fuel conditions for the project area. The weather analysis was used to find parameters that would best represent the conditions

similar to the days that fires such as the Skeleton fire and 18 Road fire made big runs. Details on wind and moisture parameters can be found in the Fire, Fuels, and Air Quality Specialist Report, Appendix C.

Assumptions used in Analysis

Alternative development and environmental effects are based on the following assumptions:

- Lightning is and will continue to be a source of potential ignitions; it is assumed that the probability of future fire occurrence within the project area is 100%. Wildland fire will not be eradicated in these ecosystems. A successful strategy will be built upon designing a vegetative environment, including species and structural characteristics that will produce desired, safely manageable fire behavior in the event of an unplanned ignition. There are no ecosystems that are completely "fire safe." Certain combinations of ignition, fuel moisture in the live and dead vegetation, wind, and relative humidity can combine under extreme circumstances to threaten any vegetated ecosystem.
- This analysis is done at a landscape level and the purpose of the analysis is to compare the effects of the alternative **relative** to one another. No conclusions in this report are relevant at the stand level and the intent of the analysis is limited to providing a basis for alternative comparison.
- An increase in average tree diameter of the stand reduces fire severity. Larger trees have thicker bark and are more resistant to flame scorch from surface fuels. The more acres thinned from below, the greater the average diameter of remaining trees. Treatment of natural surface fuels will also reduce fire severity.
- Public and firefighter safety is the top priority in fuels and fire management. Treatments in the forest will focus on creating a safe working environment for fire suppression forces. Ground suppression forces can operate safely adjacent to flames that are 4 feet in length and less. Extreme fire behavior, including crown fire, rapid surface spread and long range spotting, create an unsafe environment for the public and firefighters.
- The Rocket Planning Area is valued for a variety of reasons, including wildlife habitat, unique vegetative communities and visual quality. Any management done in the name of hazardous fuels reduction in that zone must also consider these other objectives.
- Weather conditions at the 97th percentile for FlamMap analysis are defined as the combination of temperature, relative humidity, and wind speed on a summer day that is warmer, drier, and windier than 97% of all other recorded summer days. Under 97th percentile conditions, there will be about 3 days on average that are hotter, drier, and windier than those 97th percentile conditions.
- "Fire season" is defined as the period between May 15 and September 30, during which most fires and acres burn. For the analysis in this document, the effects of treatments are assumed to cover 100% of the treatment area. There is currently no way to spatially analyze untreated areas within treatment units (i.e. it is not possible to capture the analysis of the effect of leaving 10 or 20% of mowing units unmowed). Leaving certain areas of units untreated would likely reduce the effectiveness of hazard fuel reduction indicated in the analysis, but to what extent is unknown.
- Any analysis completed using the FlamMap model adopts all limitations and assumptions of the model itself, see (Finney, Brittain, & Seli, 2006).
- The fire behavior modeling assumes that the full complement of fuels treatments (thinning, mowing and burning) is completed simultaneously and instantaneously. In reality, it may take two or more years after thinning treatments have begun before prescribed burning begins. For example, if the thinning on the Rocket project starts in 2014, the first prescribed burning may not occur until 2016 or 2017. Once the full set of treatments is completed, the hazard rating shown in the analysis would be accurate.

- Tree mortality and other related resource damage from potential wildfire is not predicted by any of the models used in this analysis. It is assumed from best available science that fuels treatments reduce fire severity and crown scorch (Pollet & Omi, 1999); (Ritchie, Skinner, & Hamilton, 2007). It is assumed from best available science that larger diameter and taller trees generally survive greater levels of fire damage ((Harrington, 1993); (Regelbrugge & Conrad, 1993); (Stephens & Finney, 2002); (Thies, Westlind, & Loewen, 2005). It is also assumed from best available science that fire damage to the crown and bole influences a tree's probability of surviving fire, and that either crown scorch, consumption or a combination of the two are important to mortality of ponderosa pine trees (Saveland & Neuenschwander, 1990); (Stephens & Finney, 2002) (Wallin, Kolb, Skov, & Wagner, 2003) (McHugh & Kolb, 2003) (McHugh, Kolb, & Wilson, 2003). Ground fire severity is also assumed to be linked with post-fire mortality (Swezy & Agee, 1991) (McHugh & Kolb, 2003), as well as beetles that may be attracted to fire-damaged trees (McCullough, Werner, & Neumann, 1998) (Parker, Clancy, & Mathiasen, 2006).

Indicators and Measurements: A primary purpose of the Rocket project is to improve resiliency. For this analysis it is assumed that a typical fire in a resilient ponderosa pine forest would be low intensity and would result in low severity effects to the overstory. This analysis uses two measurements to indicate how the alternatives affect the resiliency of the vegetation within the Rocket planning area. A third measurement is used to indicate the effects of the alternatives on air quality.

Resilience to Fire is measured by:

- Acres treated of Fire Regime Condition Class Two and Three; and
- Acres of forested project area rated as low for wildfire hazard.

Air Quality is measured by:

- Production of Particulate Matter PM 10 and PM 2.5.

Description of Measure One: Acres of Fire Regime Condition Class Two treated with mowing and/or prescribed burning.

Fire regime condition class (FRCC) is a classification of the amount of departure from the natural fire regime (Hardy, Schmidt, Manakis, & Samson, 2001)(Hann and Bunnell 2001) (Schmidt, Menakis, Hardy, Hann, & Bunnell, 2002). Fire regimes are identified based on the average number of years between fires combined with the amount of the dominant over story vegetation replaced by fire. By using FRCC as an indicator of resilience, it is assumed that a resilient forest will have characteristics similar to ponderosa pine forests prior to the turn of the century when frequent low-intensity surface fires were the norm and high-intensity stand-replacing fires in ponderosa pine forest were rare.

A fire regime is a generalized classification of the role fire would play across a landscape in the absence of modern human intervention but including the possible influence of aboriginal fire use – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (Agee 1993; Brown 1995; Brown & Smith 2000). A condition class is a classification that measures the degree of departure from natural or historic fire regime (Hann and Bunnell 2001). Each fire regime has three coarse-scale condition classes: low (Condition Class 1); moderate (CC 2) and high (CC 3). The fire regime and condition class concept was designed to be used at the landscape scale, not at the stand level, and is a measure of ecological trends, not a fire hazard metric. Descriptions of fire regimes and condition classes are included in Appendix E of this EA.

The Rocket planning area does not have any vegetation that the FRCC analysis classified as condition class 3. All of the vegetation is currently classified as 1 or 2 and it is assumed that vegetation in condition class 2 is in need of restoration.

The FRCC analysis used in this report is based upon landscape level data that was produced in 2006. Although the analysis is from 2006, little management has been done in the project area and no large fires have burned in the area since then. The purpose of the FRCC analysis is not to provide a specific stand level analysis of the effects of the alternatives but rather a coarse analysis of how much area in need of restoration

(condition class 2 and 3) each alternative treats, relative to one another. It does not measure the change that occurs with each alternative and there is no presumption that treating a FRCC 2 or 3 classified area will result in FRCC 1.

Description of Measure 2: Acres of project area rated as low for fire hazard

To measure the effects that the treatments will have on fire behavior, fire hazard is used as an indicator. 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: *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, 2012).

This analysis assumes that a resilient ponderosa pine forest will be rated as low for fire hazard and will not support widespread crown fire and surface fire behavior will be of relatively low intensity.

Fire hazard is a combination of potential flame length and crown fire activity. To rate wildfire hazard, the matrix in Table 21 was used. This table was based on the matrix table used in the ArcFuels user guide (Vaillant, Ager, Anderson, & Miller, 2012). To receive a low rating, the predicted flame lengths need to be less than four feet and crown fire activity should be surface or passive (torching). See Fuels and Air Quality Specialist Report Appendix C for data input used.

Table 21: Fire hazard rating matrix

Crown Fire Activity	Flame Length (feet)			
	<4	4-8	8-11	>11
Surface Fire	Low	Moderate	Moderate	High
Passive	Low	Moderate	High	Extreme
Active Crown	Extreme	Extreme	Extreme	Extreme

Description of Measure 3: Production of Particulate Matter PM 10 and PM 2.5

Smoke deteriorates air quality and causes a range of negative health effects depending on the quantity, concentration and duration of emissions. The action alternatives involve pile burning and underburning and the production of particulate matter is measured to determine the effects of the alternatives on air quality.

Smoke can potentially impact human health through the inhalation of small airborne particles, known as "particulate matter" (PM) (Core & Peterson, 2001). PM with an aerodynamic diameter less than 10 microns and a diameter less than 2.5 microns (known as PM10 and PM2.5) are "criteria pollutants" as defined in the Federal Clean Air Act.

Biomass utilization is the preferred method of slash disposal. However, the amount of biomass utilization depends upon numerous factors that are unknown at the writing of this report, such as biomass markets, contract types, and specific harvest methods. For the purpose of the air quality analysis, it is assumed that none of the slash generated during thinning treatments is utilized and that it is all burned in slash piles

Resiliency to Fire

Existing Condition

The important ecological role of fire in central Oregon ponderosa pine forests is widely recognized (Hessburg & Agee, 2003). The majority of the Rocket project area (85%) is composed of vegetation characterized by Fire Regime I (see Table 22). Before the start of active fire suppression in the early 1900s, ponderosa pine forests (typified by Fire Regime I) experienced low-intensity surface fires every 4-24 years and open stands of large, long-lived, fire-resistant ponderosa pine were typical (Arno 1996) (Bork 1984). The intensive logging done by the Shevlin-Hixon and Brooks-Scanlon lumber companies during the 1930s

and 1940s changed the landscape of the Rocket area by leaving few residual large trees and very few small stands of larger, older ponderosa pine. In addition, the absence of fire over the last 100 years has led to the development of shrubs and dense thickets of regeneration in the understory. The project area is now dominated by relatively young (70-80 year old) relatively dense ponderosa pine stands. Most of the forested portion of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (see Table 25).

Table 22: Rocket planning area fire regimes (PAGs from Volland 1985)

Fire Regime	Description	PAG	Acres	% of Forested
I	0-35 year return, low	Ponderosa Pine	15,429	85%
III	35-100+ year return	Mixed Conifer	1,980	11%
IV	35-100+ year return	Lodgepole Pine	706	4%
Non-Forested	Non-forested areas	Lava, Rock and Cinder	4,567	

Natural and human-caused fire starts are a common occurrence in the Rocket project area. There were 67 detected fire starts in the planning area between 1980 and 2009 (Table 23). About 60% of these starts were lightning caused, 24% were human caused and 16% of the starts were of unknown origin. On average there are approximately 2.2 starts per year in the project area.

Table 23: Fire Starts in Rocket Planning Area – Retrieved from Fire and Aviation Layer, 1980-2009

FIRE CAUSE	STARTS	PERCENTAGE
Lightning	40	59.7
Equipment Use	2	3.0
Smoking	2	3.0
Campfire	7	10.4
Debris Burning	1	1.5
Railroad	0	0
Arson	4	6.0
Children	0	0
Miscellaneous/Unknown	11	16.4
TOTAL	67	100

A few large fires (greater than 100 acres) have burned portions of the Rocket Planning area. These fires are displayed in Table 24. A large fire of note that did not burn within the project area is the Skeleton Fire. In 1996, the Skeleton fire burned 22,000 acres and 19 homes and 15 outbuildings (Figure 11, Figure 12). The Skeleton Fire occurred 5 miles northeast of the project area in fuel models similar to those found in Rocket. The Woodside Ranch Fire of 2007 was similar (Figure 12). Most large fires in this part of the Deschutes National Forest occur when there is a combination of high winds, low humidities (less than 15%) and a slash or brush component in the fuel profile. Most fires in the ponderosa pine forest types are “one burning” period fires and they spread to north, east and south, not towards the west (McCauley 1993). The large number of fire starts, the current fuel loading, and the recent history of large fires near the project area provide evidence that the project area could experience a large fire resulting in large scale mortality to the overstory.

Table 24: Fires within Rocket Planning Area

Fire Name	Year	Total Acres	Project Area Acres
Sugarpine Butte	1911	700	557
Green Mountain	1995	223	217
18 Road	2003	3,800	198
Sugar	1995	33	33

Figure 11: 1996 Skeleton Fire, photo taken from Cabin Butte

Figure 12: August 1st, 2007 Woodside Ranch Fire, photo taken approximately 25 minutes after initial report. Fire would grow to five hundred acres within three hours before being stopped through burnout operations in the 1996 Skeleton Fire scar.

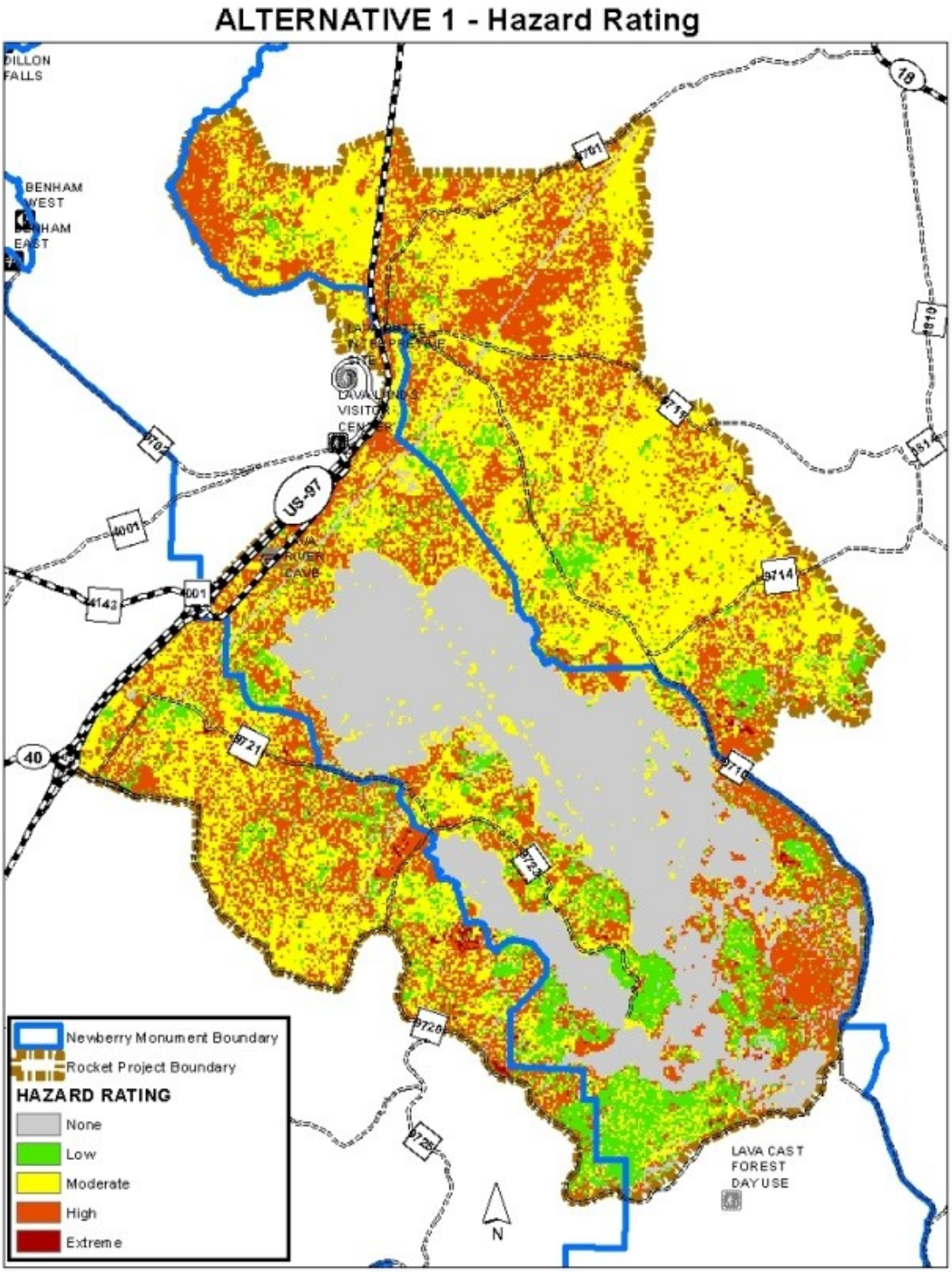


Figure 13: Current condition and Alternative 1 Hazard Rating. Colors correspond to Table 25 displaying 15,242 acres (87% of forested acres) at moderate, high, or extreme fire hazard.

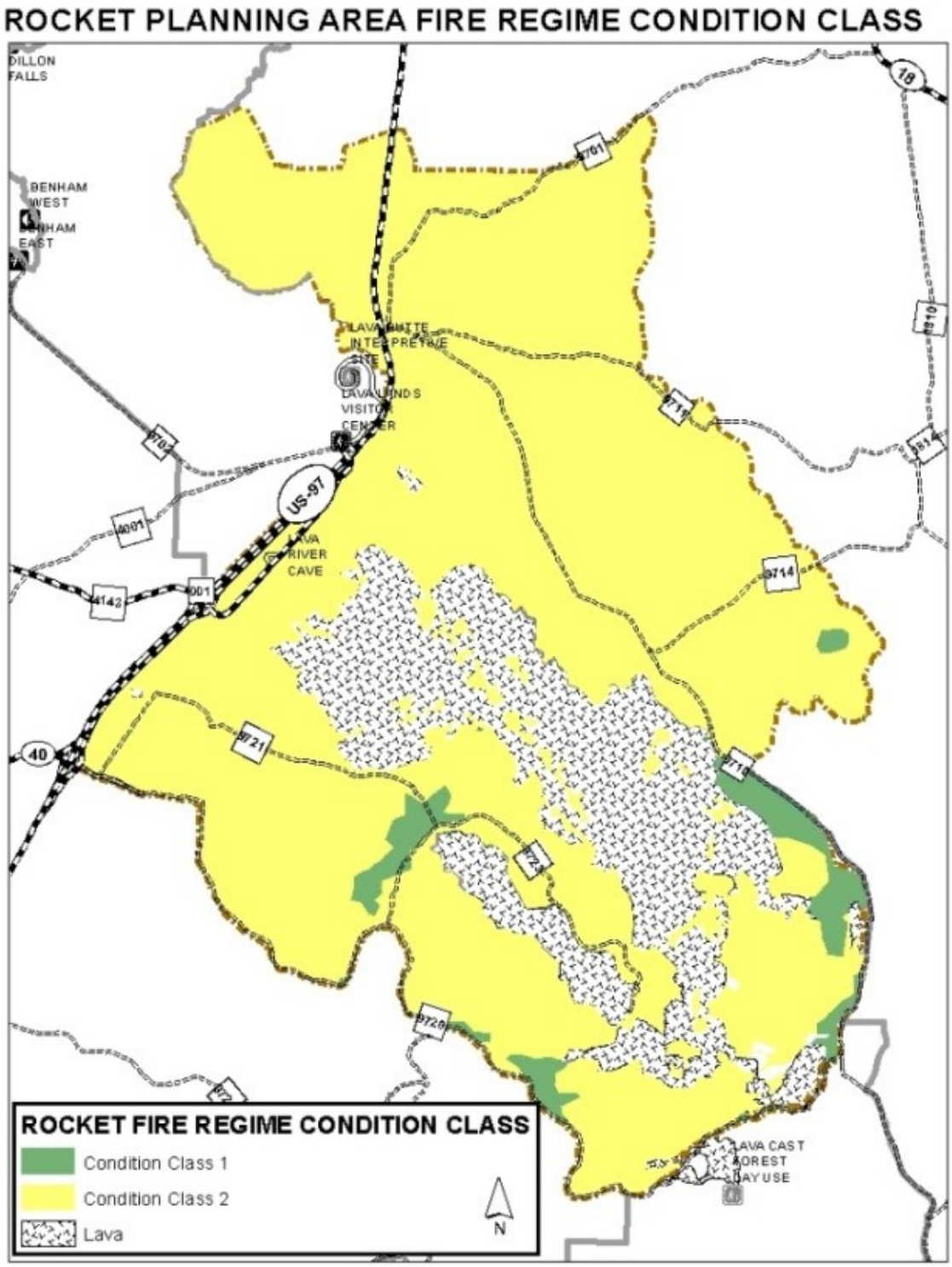


Figure 14: Existing Condition Fire Regime Condition Class. Most of project area is in a Condition Class 2, moderately departed from historic regimes.

Fire Resilient Forest – Desired Condition

In the context of fire and fuels management, the desired condition is a fire resilient forest (Figure 15 and Figure 16). For this project, resiliency is defined as the capability of a forested area to survive a disturbance event, specifically wildfire and insect attack, relatively intact and without large scale tree mortality. There are two measurements being used to determine how the proposed action meets this goal.

Fire Regime Condition Class

To meet this goal it is desired that the FRCC of the entire project area be in a condition class of one where there is a natural or historical range of variability (HRV) of vegetation characteristics. There are two parts of FRCC to consider, vegetation condition and fire frequency. As shown under the existing condition, 85% of the Rocket 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 (i.e. every 200+ years). Fire history studies in nearby pine stands show that the area experienced low-intensity surface fires every 4-24 years and open stands of large, long-lived, fire-resistant ponderosa pine were typical (Arno, 1996; Bork, 1984) prior to the 1900s. To move more of the area towards this condition, the area should be prescribed burned or wildfire should burn on the landscape on a similar interval. Much of the area is composed of single aged black bark stands, open stands of large, long-lived fire resistant ponderosa pine are only found in scattered patches throughout the project area. It is desired to maintain the existing patches of large ponderosa pines and set the stage for the current black bark stands to develop into larger trees through thinning and prescribed fire.

Figure 15: Example of a fire-resilient ponderosa pine stand. Picture is from the west side of the Bend/Ft. Rock Ranger District.

Fire Hazard

To meet the resiliency goal, the surface fuels in the project area would be maintained at a level that would only support flame lengths of 4' or less and the crown bulk density, crown base height of the forest stands would be at a level that crown fire would not be supported under 97th percentile weather conditions. This condition would make direct attack possible by fire suppression personnel and would decrease crown fire potential.

Surface Fire Hazard

Bitterbrush and manzanita dominate the understory in many of the Rocket stands. To decrease the surface fire hazard, the proposed mowing is intended to remove the brush so that the potential fire behavior could be represented by a fuel model 9. The underburning is intended to decrease the fine fuel loading so that fuel loading would be best represented by a fuel model 8. Currently, much of the project area is best represented by a fuel model 5 or 6.

Crown Fire Hazard

To address crown fire hazard treatments that affect torching and crowning potential are proposed in the Rocket planning area. Crown fire hazard is influenced by foliar moisture content, windspeed, crown bulk density and crown base height. Foliar moisture is dependent upon season, trees species, and tree health …variables that cannot be manipulated by forest management. Wind speed cannot be modified either. However, thinning can influence the "effective windspeed" by decreasing the sheltering effect that trees have on wind speeds.

Crown bulk density is the most important variable in determining a stand's susceptibility to active crown fires (Scott, 1998). Crown bulk density can be decreased through overstory thinning and, to a lesser degree, understory removal. One purpose of the overstory thinning proposed in the Rocket planning area is to reduce crown fire hazard by decreasing crown bulk density.

Crown base height is important in determining the potential for crown fire initiation. The understory treatments proposed in this project are designed to raise the crown base height by removing ladder fuels such as small diameter trees and brush. The proposed mowing and underburning further decreases the potential for crown fire initiation by lowering the potential flame lengths.

The entire project area cannot be treated to meet the above goals. However, the landscape within the project area should display a mosaic of strategically placed areas which are managed to reduce fire hazard.

Figure 16: This picture shows drastically different results from wildfire in stands untreated (left side of picture) and treated (right). The stand on the left was untreated prior to a wildfire that resulted in 90% mortality. The stand on the right had been precommercial thinned, mowed and underburned; the resulting low intensity wildfire caused little to no mortality in the over story.

Desired Condition within NNVM

The desired future conditions for NNVM are described in pages 8-11 of the NVNM Plan. The NVNM Plan identifies the need to allow natural ecological processes, including fire, to operate at the maximum extent practical. While the desired condition within the NNVM is for fire to play a key role in ecological processes within the Monument, fire suppression is also used where needed to protect Monument resources and values (NNVM, p. 8). To allow fire to operate at the maximum extent possible, the vegetation conditions in NNVM need to be maintained at a level that supports low intensity fire similar to what would historically occur in ponderosa pine forests on the Deschutes National Forest.

Desired Condition in Management Area 7, Deer Habitat

The desired future condition in this management area is to maintain a landscape that is resilient to fire while at the same time meeting the management area goal of providing optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities. To meet this desired condition, prescribed burning would be implemented on a scale and timeframe that does not bring the landscape below desired bitterbrush and cover thresholds. Per Forest Plan Standard and Guideline M7-26, in this management area, burning prescriptions will provide for the reestablishment of bitterbrush within 20 years and approximately 2.0-2.5% of the management area could be burned each year. To not exceed the 2-2.5% limit, any prescribed burning in the Rocket planning area will be balanced with prescribed burning in other planning areas within management area 7.

Desired Condition in Management Area 8, General Forest

The desired future condition in this allocation is a landscape that is resilient to fire while at the same time meeting the allocation goal to emphasize timber production while providing forage production, visual quality, wildlife habitat and recreational opportunities for public use and enjoyment.

Desired Condition in Management Area 9, Scenic Views

The desired future condition in this allocation is to maintain a landscape that is resilient to fire while meeting the management area goal of providing Forest visitors with high quality scenery that represents the natural character of Central Oregon. The desired condition for ponderosa pine is to achieve and maintain visual diversity through variations 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 variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand.

Environmental Consequences – Resilience to Fire

Alternative 1 - Direct and Indirect Effects

Under alternative 1, no action, the resiliency to fire will continue to decrease. There are currently no planned treatments in the project area. However, nearby treatments in the Lavacast, Fuzzy, South Bend HFRA and Sunriver HFRA projects may aid in preventing a fire from a entering the Rocket planning area.

It can be expected that the FRCC rating of two seen over most of the area will remain at a two or rise to a three as fire continues to be excluded and vegetation continues to depart from historic conditions.

Table 25 displays the fire hazard rating by acres currently and after treatment for the three action alternatives. If no treatments are done, the fire hazard will become elevated over time as tree and shrub densities increase, and surface fuels continue to accumulate. This will increase the potential for a large scale loss of the overstory if a wildfire were to occur in the project area.

Table 25: Hazard Rating Acres by Alternative

	FIRE HAZARD RATING							
ALTERNATIVE	Low		Moderate		High		Extreme	
	acres	%forested	acres	%forested	acres	%forested	acres	%forested
1 (No Action)	2,188	13%	8,809	50%	6,316	36%	117	<1%
2	8,805	50%	4,728	27%	3,853	22%	92	< 1%
3	5,589	32%	7,324	42%	4,426	25%	77	< 1%
4	8,820	50%	5,653	32%	2,945	17%	68	<1%

The critical transportation corridors and WUI areas will continue to be at risk, and this risk will increase as fuels accumulate and stand densities climb.

No treatments will occur within NNVM and consequently it will continue to be difficult for fire managers to allow wildfire to operate at the maximum extent possible. Under most circumstances, due to high fuel loads and the proximity to critical transportation corridors and high use recreation areas, most fire starts are aggressively suppressed. Because of the firefighter and public safety concerns, this strategy would likely continue. Nearby fires in similar vegetation types such as the 18 Fire and the Skeleton Fire provide evidence that any fires that escape initial attack in the project area would likely result in large scale mortality to the overstory.

Without treatments in deer habitat, a wildfire could result in a large scale loss of thermal and hiding cover. Detailed discussion of deer habitat occurs later in the Wildlife section of this EA.

Alternative 2 – Direct and Indirect Effects

Under Alternative 2, there would be 7,049 acres of FRCC 2 in the project area treated with thinning, mowing, and/or prescribed burning. An analysis using Flammap shows that after fuels treatments are complete, 8,805 acres will be at a low fire hazard rating (Table 25, Figure 18). This alternative treats a large percentage of the Fire Regime I ponderosa pine stands in the project area and it includes a large number of treatments along critical transportation corridors and in the WUI around Lava River Cave.

Alternatives 2 and 4 have a similar amount of mowing and prescribed burning planned. Of the action alternatives, these two would best meet the goal of increasing resiliency to fire. However, the prescribed burn units in Alternative 2 are generally smaller in size and more spread out across the entire project area than Alternative 4. This creates a slightly more "mosaic" landscape of fuels treatments. The tradeoff is that the prescribed burn units are smaller and use roads as control lines less frequently than in Alternative 4. Consequently, more time and money will likely be required to implement a similar amount of prescribed burning in Alternative 2 than in Alternative 4. Table 179 shows a comparison of cost and time to conduct prescribed burning. Fewer burn units in Alternative 2 extend "road to road" and consequently more fireline construction would occur than under Alternative 4.

Table 26: Total Treatment Acres and amount of Rx Burning in CC 1 and CC2

	Condition Class 1		Condition Class 2	
Alternative	RX Burn Acres	Total Acres	RX Burn Acres	Total Acres
1	0	0	0	0
2	172	179	6,678	7,049
3	9	83	1,657	5,580
4	182	301	6,548	9,541

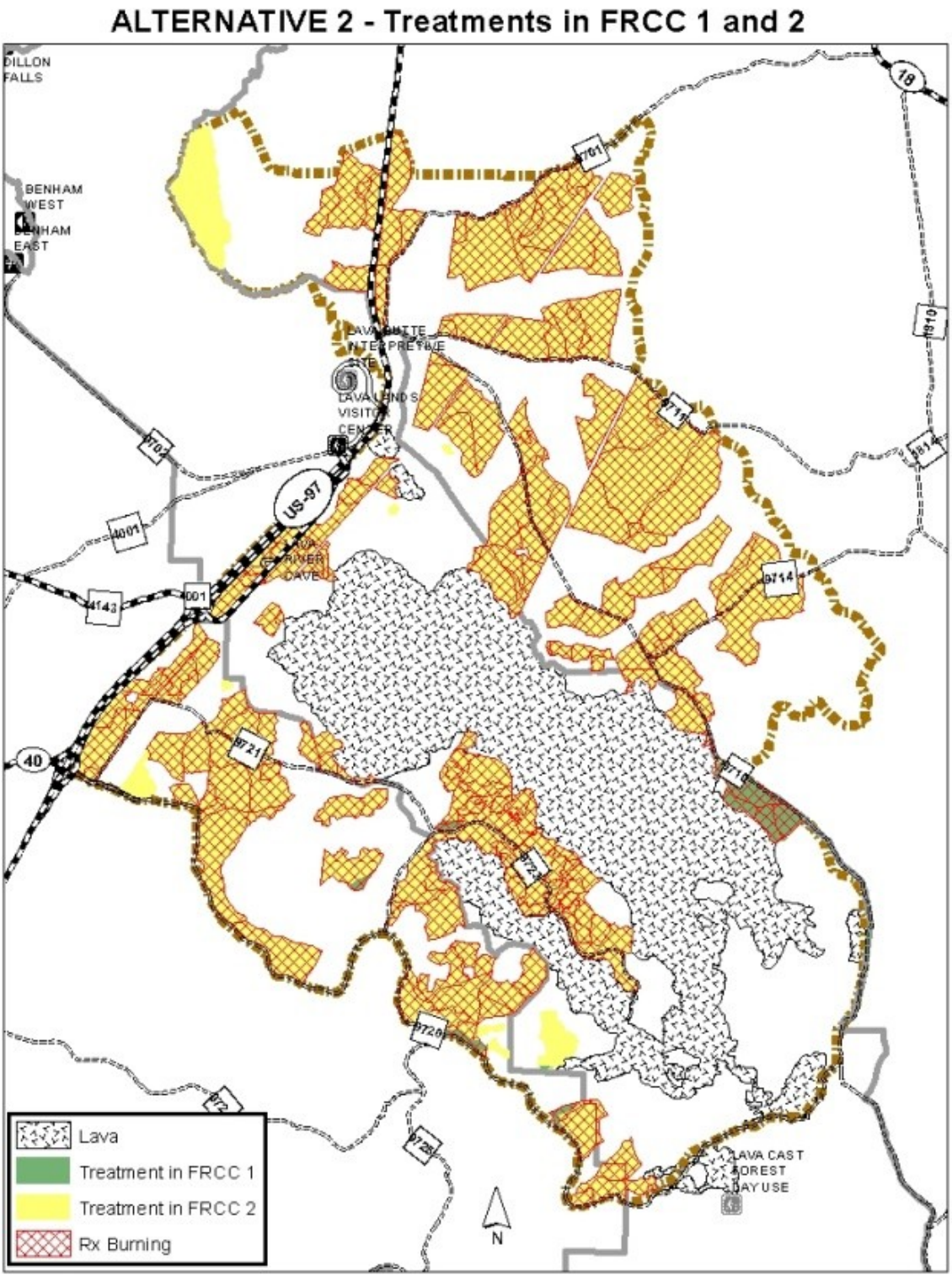


Figure 17: Alternative 2 treatments in FRCC 1 and 2.

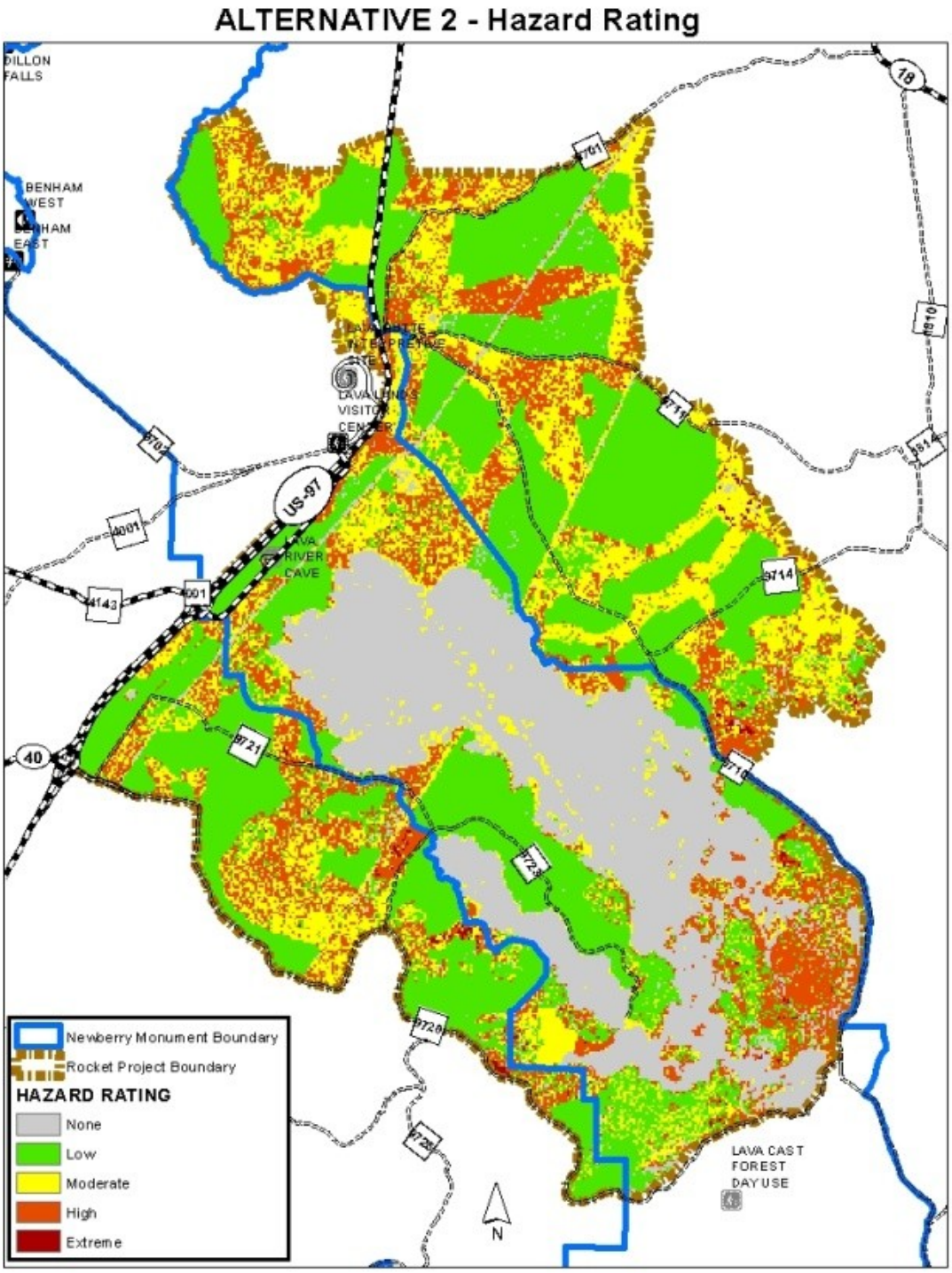


Figure 18: Alternative 2 Hazard Rating displaying the fire hazard rating of moderate, high or extreme reduced to 8,763 forested acres and hazard rating of low increased to 8,805 acres (Table 25).

Under Alternative 2, fewer fuels treatments are planned in NNVM than in Alternative 4. This is displayed in Table 27.

Table 27: Fuels treatment acres in NNVM

Alt.	Mow Only	Mow/Burn	Pile/Burn	Total Fuel Acres
1	0	0	0	0
2	5	1,408	5	1,418
3	306	799	5	1,111
4	277	2,090	5	2,372

Alternative 3 - Direct and Indirect Effects

Alternative 3 proposes 3,983 acres of fuels treatments in the project area and it treats 5,580 acres of FRCC 2 classified acres in the project area with thinning and/or fuels treatments (Table 26). An analysis using Flammap shows that after fuels treatments are complete, 5,589 acres will be at a low fire hazard rating (Table 25 and Figure 20). Alternative 3 was designed to address concerns about burning in scenic view allocations. There are considerably fewer acres of fuels treatments in Alternative 3 than in the other action alternatives. Because all of the critical transportation corridors and Lava River Cave are within the scenic views allocation, no prescribed burning is proposed near those areas. However, there is a considerable amount of thinning and mowing in these areas. Alternative 3 treats the fewest number of acres in the NNVM with fuels treatments and proposes the least amount of prescribed burning. Of the action alternatives, this alternative would do the least to meet the purpose of increasing resiliency to fire.

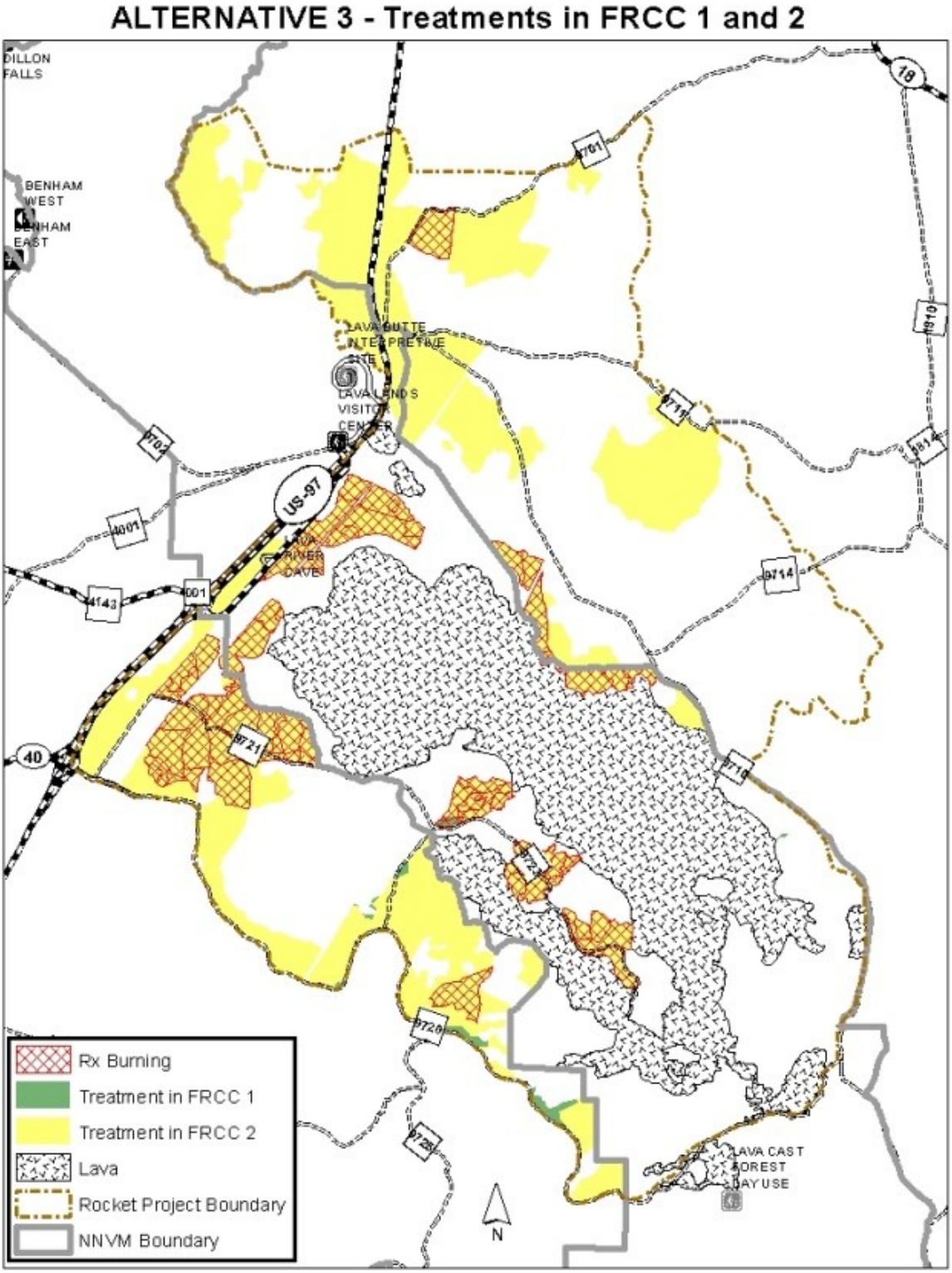


Figure 19: Treatment of FRCC 1 and 2 under Alternative 3.

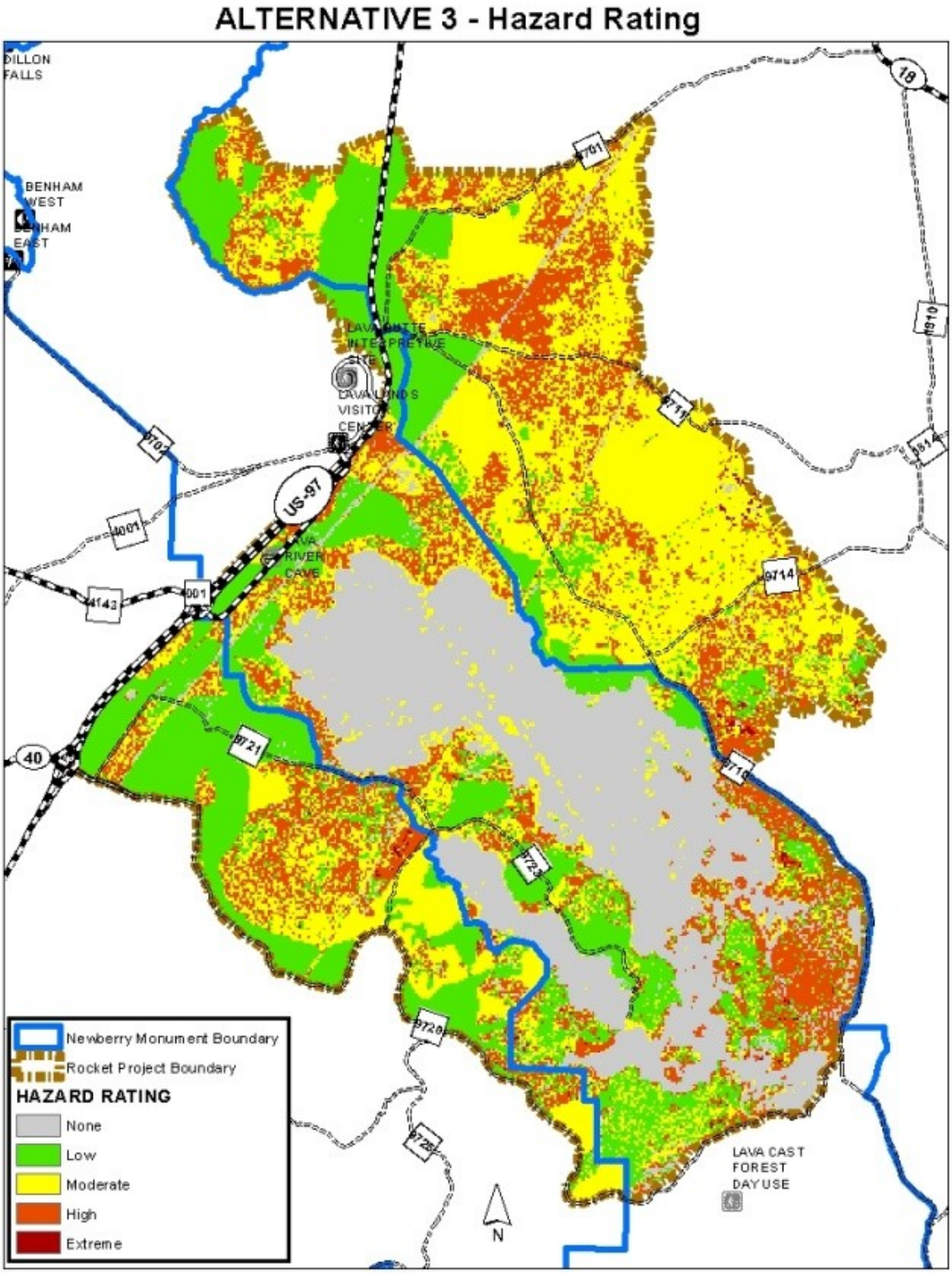


Figure 20: Alternative 3 fire hazard rating map displaying fire hazard rating of moderate, high, or extreme reduced to 11,827 acres. Fire hazard rating of low increased to 5,589 acres (Table 25).

Alternative 4 – Direct and Indirect Effects

Alternative 4 does 7,871 acres of fuels treatments in the project area and it treats 9,541 acres of FRCC2 classified acres in the project area with thinning and/or fuels treatments (Table 26 and Figure 21). An analysis using FlamMap shows that after fuels treatments are complete, 8,820 acres will be at a low fire hazard rating (Table 25). Alternative 4 does 2,372 acres of fuels treatments in NNVM, the most of all the action alternatives (Table 27). Alternative 4 prescribed burn treatments were designed to maximize efficiency while at the same time take into consideration wildlife and scenic view objectives. In general, the burn blocks are larger and utilize roads as control lines whenever possible. The larger burn blocks allow for the option of aerial ignition, which is more cost effective on a larger scale.

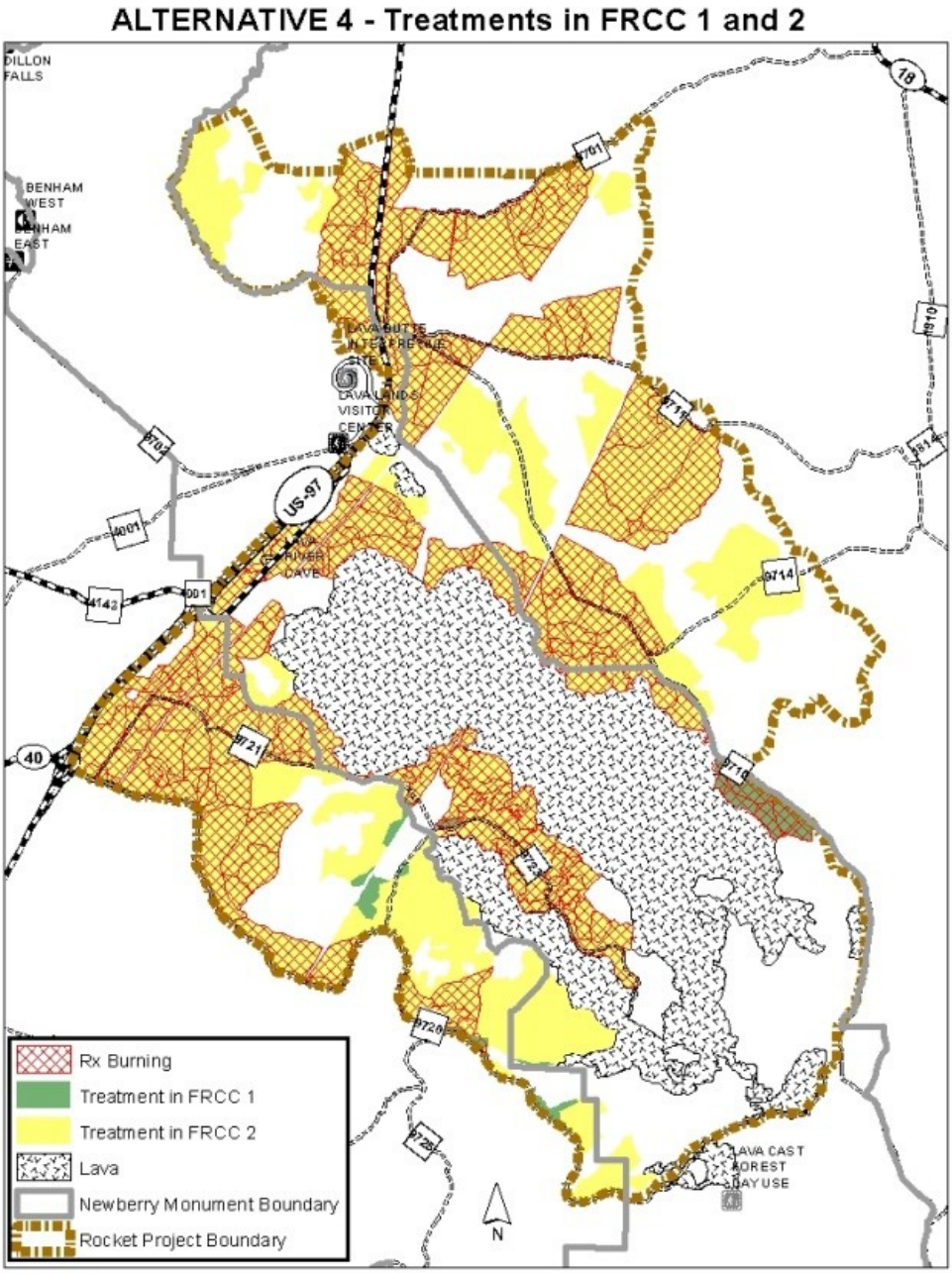


Figure 21: Treatments by FRCC, Alternative 4.

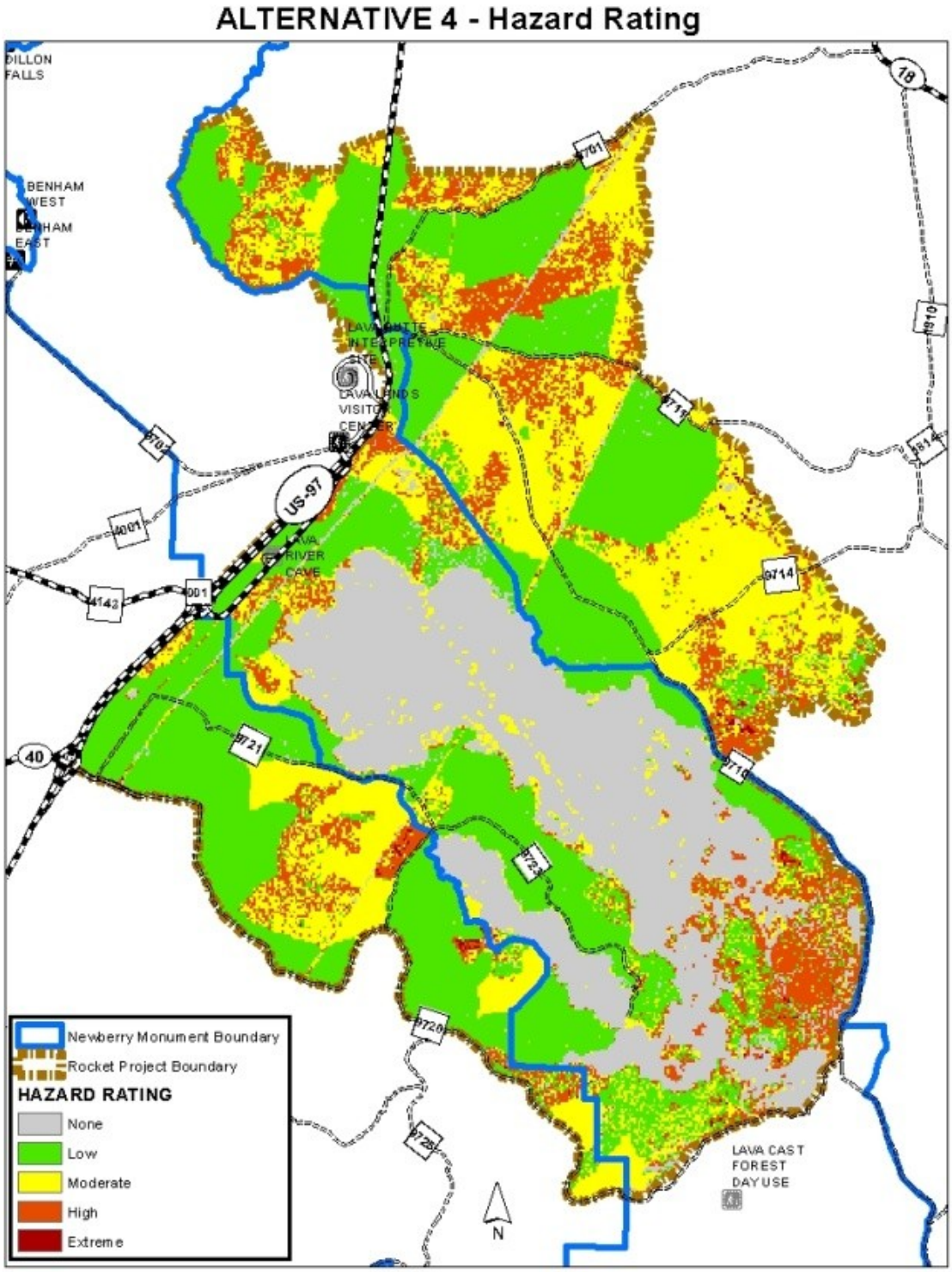


Figure 22: Alternative 4 fire hazard rating map displaying fire hazard rating of moderate, high, or extreme reduced to 8,666 acres. Fire hazard rating of low increased to 8,820 acres (Table 25).

Cumulative Effects – All Alternatives

The cumulative effects analysis is spatially bounded by the adjacent project boundaries of Sunriver HFRA, Lavacast EA, Lavacast CE, and South Bend HFRA and temporally bounded at fifteen years. Vegetation management activities such as thinning followed by mowing and prescribed fire tend to show beneficial effects of reducing fire intensity and fire behavior for an average of 15 years. The past accomplishments and ongoing fuels treatments in these projects are anticipated to have a net positive landscape level effect on resiliency to fire by decreasing fire hazard and treating FRCC 2 and 3 rated areas. In addition, the treatments done in these projects in combination with the treatments done in Rocket would reduce risk to firefighters and the public and provide more strategic options for fire managers to manage wildfire on a larger scale.

The Rocket project boundary overlaps some other project areas. The amount of treatment completed and planned under these projects is displayed in Table 28 and Figure 23.

Table 28: Planned and completed fuels treatments within the Rocket Project Boundary

		Thinning		Mowing		Underburning	
NEPA Project Name	Total Acres	Completed	Available	Completed	Available	Completed	Available
Fuzzy	732	289	0	407	0	208	419
South Bend	51	0	33	41	10	0	0
NNVM Old Growth Ponderosa Pine Demo Project	190	20	95	0	0	95	95
TOTAL	**973**	**309**	**128**	**448**	**10**	**303**	**514**

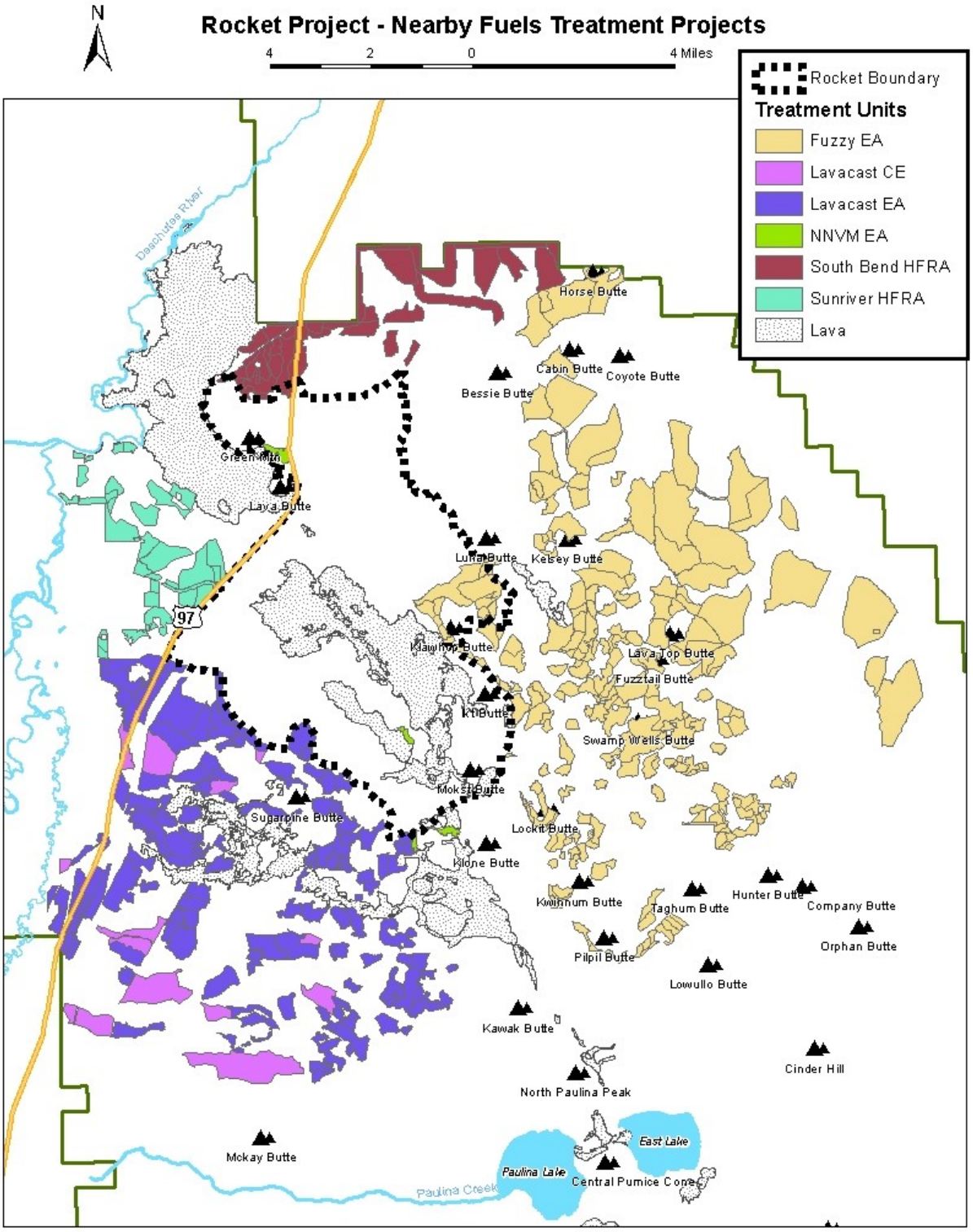


Figure 23: Ongoing and completed fuels treatment projects adjacent to the Rocket project area.

Fuels implementation costs and timeline were considered in the design of project alternatives. The following table displays the estimated cost and time required to complete the underburning in the Rocket project area. This is displayed separately for the other activities because the amount of underburning accomplished is highly dependent on burn unit design, a factor that was considered in alternative development. For example, a thousand acre burn unit surrounded by existing roads and lit by a helicopter would require an equal amount or less time and money to implement than a hundred acre hand ignition burn surrounded by hand or machine line. Roads are a more effective control line, hand and machine line is a less effective holding line, generally meaning that more ignition time will need to be spent during implementation to ensure that fire does not cross the hand line, hand lines are more labor intensive to patrol, and more time and money is required to build hand or machine line. See the Fuels and Air Quality Specialist Report for specifics on how this table was built.

Table 29: Prescribed burn completion time and money for action alternatives

Alt.	Acres of underburning	Machine line (feet)	Estimated ignition days	Years to complete	Underburn Rx cost	Cost per acre
2	7,032	140,000	53	6-9	$905,800	$129
3	1,675	33,000	18	2-3	$250,500	$150
4	6,753	37,700	29	3-7	$660,600	$98

Air Quality

Environmental Consequences

Direct and Indirect Effects Common to all Alternatives

A primary purpose of this project is to improve resiliency during disturbance events, such as fire. To meet this goal fire needs to be reintroduced into some areas that have not burned in over a hundred years. The preferred method to do this is through prescribed fire. Because of a relatively high population density, one of the greatest challenges prescribed burn implementers face in the Bend area is smoke management.

Bend is classified as a smoke sensitive receptor area (SSRA). SSRAs are areas designated by the Oregon State Board of Forestry, in consultation with the Department of Environmental Quality, for the highest level of protection under the Oregon smoke management plan. As an SSRA, there are tight restrictions on the amount of prescribed fire smoke that can impact the city of Bend. To prevent prescribed fire smoke from impacting Bend, prescribed fire implementers have limited atmospheric conditions to burn under and, consequently, limited burning opportunities.

Prescribed burning is proposed in all of the action alternatives and the estimated amount of particulate matter produced during pile burning and underburning is disclosed in Table 30. These emissions will be distributed over several years during the implementation phase of the project. When building the table it was assumed that in all thinning units, the material will be piled and burned. This table shows the maximum amount of emissions for underburning and pile burning. Mastication, biomass utilization, and other slash treatment options were not considered in this analysis; however, during implementation, other methods of slash removal will likely be used and the actual emissions will likely be less than shown in the table.

Table 30: Particulate matter emissions by alternative for pile burning and underburning

ALTERNATIVE	UNDERBURNING		PILE BURNING		TOTAL	
	PM 2.5 (tons)	PM 10 (tons)	PM 2.5 (tons)	PM10 (tons)	PM 2.5 (tons)	PM10 (tons)
2	704	827	1,581	1,869	2,285	2,696
3	168	197	1,210	1,430	1,598	1,627
4	676	793	2,271	2,684	2,947	3,477

There are two general methods for managing the effects of fire smoke on air quality:

1. Use techniques that reduce emissions produced for a given area treated; and
2. Redistribute the emissions through meteorological scheduling and by sharing the airshed.

To reduce emissions prescribed burn implementers can reduce the amount of fuel in the unit. In Rocket, this is being done through techniques such as whole tree yarding and disposing of slash through pile burning and biomass utilization. Another way to reduce emissions is to reduce the amount of fuels available to burn by implementing under cooler and wetter conditions, such as in the spring and fall when most prescribed burning occurs.

Controlling particulate matter production is only part of the equation when managing smoke. Smoke can also be redistributed. The primary method for doing this is to burn during good atmospheric dispersion conditions.

The primary concern when burning in the Rocket project area is impacting visibility on Highway 97 and populated areas on the south side of Bend. The Rocket project area lies east of the highway and winds during prescribed burn season generally have a westerly component to them. This helps push smoke away from the highway and populated areas. However, prior prescribed burning near Highway 97 resulted in some smoke settling on the highway during the evening when the air cooled and the atmosphere became more stable.

There are several methods to minimize and mitigate the smoke effects on the highway. These include:

- Completing ignitions early in the day to give smoke a chance to disperse before cool, stable nighttime air sets in.
- Alerting motorists of the potential for low visibility through road signs.
- Mop up shortly after ignitions.
- Burn smaller units: hand ignition of smaller burn blocks along the highway is proposed for much of the project area.

Prescribed burning under any of the action alternatives would be conducted in compliance with the National Air Quality Standards under the Oregon Smoke Management Plan. However, Alternatives 2 and 4 have more burning proposed near the highway and consequently some smoke will likely impact this critical transportation corridor during implementation.

Given the high incidence of human and lightning caused fire starts within the Rocket planning area, the relatively recent occurrence of large fires such as the Skeleton Fire and the18 Fire near the Rocket planning area, and the predominance of vegetation that historically burned every 4-24 years, there is a strong probability that a large fire will impact the Rocket planning area. The effects of large wildfire smoke would likely be magnitudes greater than prescribed burn smoke because both particulate matter emissions per acre is greater (see Table 31) and, more importantly, few of the smoke mitigation techniques available to prescribed burn implementers described above are available during a wildfire event.

Another consideration is that prescribed fire smoke is spread out over time. For example, the PM2.5 produced in the Skeleton Fire (estimated 3,135 tons) and 18 Fire (estimated 389 tons) occurred over a short 2-3 day period. Whereas the 3,477 tons estimated to be produced under alternative 4 would be spread out over 3-7 years and the burning would be done under conditions that would minimize impacts to populated areas.

Table 31: Particulate Matter Emissions, Rx Burn vs. Wildfire

FIRE TYPE	PM 2.5 (lbs./acre)	PM 10 (lbs./acre)
Spring Prescribed Fire	200	235
Summer Wildfire	285	336

Forested Vegetation & Silviculture

Introduction

This section of the EA will document analysis of how well each alternative meets the purpose and need, focusing on how well each alternative will:

- Improve resilience to insect and disease, specifically bark beetles and dwarf mistletoe; and
- Move structural stages on the landscape closer to the historic range of variability (HRV).

In addition, the following key issues are addressed (defined pp. 14-16):

- Tree stocking after thinning (Issue 1),
- Ratio of treated to untreated within Newberry National Volcanic Monument and project area (Issues 2 and 7),
- Openings created for developing deer cover (Issue 3), and
- Treatments in Old Growth Management Areas (Issue 4).

Refer to the Silviculture Specialist Report for details on the regulatory framework and management area standards and guidelines that apply to the Rocket project. Key concepts from the Eastside Screens are included here:

Historic Range of Variability (HRV): Proposed timber sales and its associated watershed are to be characterized for patterns of stand structure by biophysical environment. This characterization is to be compared to the HRV, which should be developed for large landscapes across which forest types, environmental settings, and disturbance regimes (fire and insects/disease) are relatively uniform. It should be based on conditions in the pre-settlement era.

Late and Old Structural Stages (*LOS*): The Screens define seven structural stages for use in characterizing the landscapes. According to the screens, these structural stages are not necessarily associated with age or to seral (species composition) development. Main elements of the structural stage definitions include: number of cohorts present, canopy continuity, number of canopy layers (strata), and size of trees. Even though structural stages are not necessarily associated with stand age, the Eastside Screens interim wildlife standard uses the collective term "late and old structural stages" (LOS) when referring to the following Eastside Screens structural stages: 1) multi-strata with large trees and 2) single-strata with large trees. According to Eastside screens definitions, "large trees are common" in these structural stages. The Screens do not, however, define the terms "large" or "common". Region 6 interim old growth definitions (Hopkins et al. 1993) have been used to define these terms, with the old growth minimum diameter of 21 inches considered "large" and the old growth minimum trees per acre of 13 considered "common". The term "stands where large trees are common" has been used interchangeably with the term "LOS." When discussing existing LOS in the Rocket project area, this EA is referring to stands where the large tree component of LOS is present.

No net loss of LOS and retention of large trees: The interim wildlife standard provides direction for timber sale activities where late and old structural stages are found to be below HRV. This direction includes no net loss of late and old structure (LOS), no timber harvest within LOS, retention of live trees greater than or equal to 21 inches dbh, moving vegetative structure towards LOS, and maintaining open, park-like stand conditions where this occurred historically. In 2003, guidance was issued that reaffirmed the Eastside Screen objective of increasing the number of large trees and LOS stands on the landscape (USDA Forest Service 2003).

Connectivity: The interim wildlife standard provides direction for maintaining or enhancing the current level of connectivity between LOS stands and between Forest Plan Old Growth management areas. Harvesting is permitted in connectivity corridors if canopy closures are maintained within the top one-third of site potential.

Reference Conditions

Ponderosa Pine Late and Old Structural (LOS) Stages

Three reference conditions are used in this analysis to compare how well each alternative promotes ponderosa pine late and old structural stages. Two of the references describe historic conditions in old growth ponderosa pine stands. Munger (1917) describes historic old growth conditions based on observations in the early 1900s. Youngblood et al. (2004) describes historic old growth conditions based on a retrospective study of current conditions. The third reference describes conditions associated with old growth forest conditions, though not necessarily "historic" conditions. It is the Region 6 interim old growth definition for ponderosa pine which is based on ecological data from a number of east-side Region 6 forests (Hopkins et al. 1993).

Munger (1917) gives an indication of the average number of trees per acre and the distribution of diameter classes in representative stands in various parts of the state of Oregon. The site conditions associated with the stand located near LaPine may be most representative of the conditions present within the area of the Rocket project area. Table 32 displays tree densities by size measured in the LaPine stand. Munger (1917) notes "yellow-pine forests are so irregular in density that figures for the average stand per acre or per quarter section are apt to be misleading. Though the volume of timber may be very high on an area of an acre or so, there are usually openings in the forest, groups of young growth, glades, or barren spots, which reduce the average per acre volume of any large tract."

Table 32: Tree densities by size class in early 1900s ponderosa pine stand near LaPine (from Munger 1917).

Size Class (Diameter at Breast Height)	Number of Ponderosa Pine per acre
2 to 10 inches	2.04
12 to 14 inches	0.60
16 to 20 inches	1.32
22 inches and larger	9.95
Total	13.91

Youngblood et al. (2004) describe the historic (pre-1900) stand structure present in pumice-dominated eastside old-growth ponderosa pine forests (Table 33). This eastside reference condition is based on three study areas, with Pringle Butte Study Area being the closest geographically to the Rocket project area (9 miles west). Youngblood et al. (2004) made a generalization that trees alive and in the upper canopy at the beginning of the study were present in 1900 and represent "old growth" trees. The Rocket project is within the range of ponderosa pine sampled by Youngblood et al. (2004).

Table 33: Ponderosa pine eastside old-growth reference condition (from Youngblood et al. 2004).

Location	Upper Canopy Live Tree Density		Upper Canopy Live Tree Size	
	Trees/Hectare	Trees/Acre[1]	DBH (cm)	DBH (inches)[1]
Metolius Study Area	34 - 94	14 - 38	12.0 – 133.1	4.7 – 52.4
Pringle Butte Study Area	35 - 79	14 - 32	16.0 – 121.9	6.3 – 48.0
Blacks Mountain Study Area	15 - 73	6 – 30	29.5 – 129.8	11.6 – 51.1
Reference Condition	50 ± 3.5	20 ± 1.4	60.0 ± 1.55	23.6 ± 0.61

[1] English equivalents of the reported metric measurements using the following conversions:
(Trees/Hectare) * (0.405) = Tree/Acre (Centimeters) * (0.394) = Inches

The Region 6 interim ponderosa pine old growth definition (Hopkins et al. 1993) applies to climax ponderosa pine forests located east of the Cascades in Oregon and Washington. The definition presents attribute values indicative of climatic climax stands developing with fire suppression. According to the Region 6 definition, old growth ponderosa stands have dominant trees at least 150 years in age and greater than 21 inches dbh. Dominant trees number at least 13 trees per acre and typically range from 18 to 40 trees per acre. Gap size is described as being at least one-half acre in size.

Stand Density

Stand density measures how thickly trees grow (Davis and Johnson 1987). Stand density is a quantitative measure of stocking expressed either absolutely or relative to some standard condition (Helms 1998). Trees per acre and basal area per acre are measures of absolute density. Basal area and trees per acre, when considered alone, do not express the degree of crowding (competition) existing within a stand (Curtis 2010). Relative density, however, does describe the "degree of crowding" within a stand (Ernst and Knapp 1985). It is the ratio of the measured absolute density of a given stand to some reference level specific to that forest type (Ernst and Knapp 1985). When the evaluation of two stands results in the same relative stand density, they can be thought of as being at the same degree of crowding, even though they may differ in age, stand size, or species composition (Ernst and Knapp 1985). Stand density index (Reineke 1933) is a measure of relative density.

The following stand density reference conditions (management zones) are used in this analysis to evaluate susceptibility to bark beetle attack (Purpose and Need) and adequacy of stocking (NFMA):
1) the upper management zone, 2) the lower management zone, and 3) the minimum stocking level.

Upper and Lower Management Zones

The upper and lower management zones are based on concepts described by Cochran et al. (1994) for use in estimating density limits. Upper density limits or upper management zones (UMZs) often are determined by establishing the relative density level at which a suppressed class of trees begins to develop. For ponderosa pine, mortality due to mountain pine beetle is not confined to intermediate and suppressed trees. Empirical stocking level curves for ponderosa pine suggest that tree mortality due to mountain pine beetle remains at a low level until a critical stand density is reached. Upper management zones for ponderosa pine can be established at those stand densities above which mortality from mountain pine beetle can become serious. The lower density limits of management zones (LMZs) often are set at 67 percent of the UMZ. This lower limit or zone maintains enough stocking to capture a significant portion of the site resources in tree growth.

The upper management zone reference condition is used in this analysis to identify stands whose density makes them susceptible to mountain pine beetle attacks. How long stands remain above the upper management zone before mountain pine beetles attack and tree mortality becomes serious is extremely variable. Classifying a stand as susceptible to bark beetle attack does not mean bark beetles will surely attack. It only means attacks are very likely to occur (USDA Forest Service 1996). This likelihood of attack is a function of beetle presence, abundance and distribution.

Minimum Stocking Level

The minimum stocking level is the stocking needed to carry out the least intensive silviculture strategies used in the construction of the managed yield tables for the 1990 Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1994). Silvicultural prescriptions, which must meet requirements of NFMA, are to identify minimum stocking level for all stands where regeneration harvests are applied (Deschutes LRMP S&G TM-6). The minimum stocking level is also a reference point below which a thinning treatment would be heavy enough to begin the regeneration process. Instead of being considered an intermediate cutting method, a treatment with this heavy of a cutting should be considered a regeneration harvest (USDA Forest Service 2004b) with the associated requirement to adequately restock the site with trees. Use of the minimum stocking level as a reference below which restocking is required is consistent with Oregon's Forest Protection reforestation rule which requires reforestation any time after-harvest stocking drops below a minimum standard (Logan 2002). In some cases, timber harvest without restocking

may be considered adequate restocking (USDA Forest Service 2006a). An example would be not restocking after timber harvest to create greater structural or age-class diversity in a uniformly forested landscape (USDA Forest Service 2006a). The determination to not restock would need to occur with a project-level decision after comparing the existing vegetation condition to the objectives and desired vegetation conditions (USDA Forest Service 2006a).

Procedure Used to Determine Upper and Lower Management Zones and Minimum Stocking Level

Upper management zones were determined using the procedure described by Booser and White (undated) for calculating maximum stand density indexes. This procedure adapts for use on stands in the Deschutes National Forest the method described by Cochran et al. (1994) for setting upper management zones. Upper management zones (Table 34) appropriate for site conditions found in the Rocket Project Area were determined using plant association measures of growth basal area and site index (Simpson 2007). These measures of site productivity were used in the procedure described by Booser and White (undated).

Lower management zones were set at 67 percent of the upper management zone. The minimum stocking level is based on the level identified for ponderosa pine stands managed on the Deschutes National Forest (36.5 SDI) using the uneven-aged harvesting method (USDA Forest Service 1994).

Table 34: Stand density reference conditions and measures of site productivity.

Plant Association (Simpson 2007)	Site Productivity (Simpson 2007)		Reference Conditions Stand Density Index[3] (SDI)		
	GBA[1]	Site Index[2]	Upper (UMZ)	Lower (LMZ)	Minimum
Low site productivity ponderosa pine					
Ponderosa pine/bitterbrush/fescue	105	77	105	70	40
Ponderosa pine/manzanita	120	84	130	90	40
Low site productivity reference condition			**130**	**90**	**40**
High site productivity ponderosa pine					
White fir-grand fir/common princes pine (ABCO-ABGR/CHUM)	182	91	200	135	40
White fir-grand fir/greenleaf manzanita	137	87	154	103	40
High site productivity reference condition			**200**	**130**	**40**

[1]**Growth Basal Area (GBA)**: An index of stand stockability. It is the basal area per acre at which dominant trees grow in diameter at the rate of 1 inch per 10 years at age 100 (Hall 1984).

[2]**Site Index**: a species-specific measure of forest productivity expressed in terms of the average height of trees at a given age. Table value is for ponderosa pine at age 100.

[3]**Stand Density Index**: relative density expressing relationship of number of trees to stand quadratic mean diameter.

Relationship between LOS and Management Zone Reference Conditions, Tree Diameters, and Stand Basal Area

One of the key issues identified from public comments pertains to the Alternative 2 thinning treatment that would reduce basal area to 40 square feet per acre. Some expressed concerns this was too low and suggested adopting a range of basal areas such as 60, 80 or 100. Table 35 displays how for a given basal area, trees per acre decrease with increasing tree diameters. As an example, assume all trees in given area have a diameter of 14 inches. Thinning to 60 basal area would retain 56 trees per acre. This density of trees would be above the LOS reference condition, and the associated stand density index (SDI) would be within the upper and lower management zones. Assume instead, for illustration purposes only, all trees are 28 inches. Thinning to 60 basal area would retain only 14 trees per acre. This density of trees would be at the low end of the LOS reference condition, and the SDI would be more than that associated with minimum stocking but less than the lower management zone. Assume further these 14 trees per acre grow 4 inches in diameter. The basal area of 14 trees per acre, 32 inches in diameter would be 80 square feet. With the same number of trees per

acre, but larger diameter trees, the associated SDI increases sufficiently to be within the lower and upper management zones.

Table 35: Trees per acre (TPA) associated with a range of basal areas (BA) and diameters (DBH) and the associated relationships to management zones and historic large tree density.

DBH (Inches)	20 BA (Sq. Ft.)	40 BA (Sq. Ft.)	60 BA (Sq. Ft.)	80 BA (Sq. Ft.)	100 BA (Sq. Ft.)	120 BA (Sq. Ft.)
8	57	115	172	229	286	344
10	37	73	110	147	183	220
12	25	51	76	102	127	153
14	19	37	56	75	94	112
16	14	29	43	57	72	86
18	11	23	34	45	57	68
20	9	18	28	37	46	55
22	8	15	23	30	38	45
24	6	13	19	25	32	38
26	5	11	16	22	27	33
28	5	9	14	19	23	28
30	4	8	12	16	20	24
32	4	7	11	14	18	21
34	3	6	10	13	16	19
36	3	6	8	11	14	17
38	3	5	8	10	13	15
40	2	5	7	9	11	14

Management Zones	Shading	Historic Large Tree Density
<40 SDI/Acre (Less than minimally stocked)		**Bold solid black line** outlines historic conditions, assumed to be 13 TPA (Munger 1917 and Hopkins et al. 1993) to 40TPA (Youngblood et.al. 2004).
>=40 and <90 SDI/Acre (More than minimum stocking, but less than LMZ for low site.)		
>=90 and <130 SDI/Acre (Within LMZ and UMZ for low site. Less than UMZ for high site.)		
>=130 and <200 SDI/Acre (Above UMZ for low site. Within LMZ and UMZ for high site.)		
>200 SDI/Acre (Above UMZ for both low and high site productivity)		

Diameter Growth

For this analysis, the concepts of growth basal area (Hall 1987) were used to approximate diameter growth of trees. A diameter growth rate of 1.5 inches per decade can be predicted for stands stocked at 67% of growth basal area (Hall 1987). Using plant association GBAs, basal area reference condition at which the diameter growth rate would be 1.5 inches was determined (Table 36).

Table 36: Diameter growth reference condition expressed in terms of basal area.

Plant Association (Simpson 2007)	Growth Basal Area (Simpson 2007)	Basal Area (Ft^2/Acre) Reference Condition for 1.5 inches diameter growth per decade[1]
Low site productivity ponderosa pine		
Ponderosa pine/bitterbrush/fescue	105	70
Ponderosa pine/manzanita	120	80
Low site productivity reference condition	**110**	**74**
High site productivity ponderosa pine		
White fir-grand fir/common princes pine (ABCO-ABGR/CHUM)	182	122
White fir-grand fir/greenleaf manzanita	137	92
High site productivity reference condition	**160**	**107**

[1]Basal Area for 1.5 inches diameter growth per decade = (Growth Basal Area)*(.67)

Analysis Methods

To analyze the effects leaving 40 basal area (Alternative 2) compared to a mix of basal areas that would vary depending on tree size (Alternatives 3 and 4), the relationship displayed in Table 35 was used to estimate the average number of post-thin trees per acre. Assumptions were made as to what the range of average diameters would be following thinning.

To analyze how thinning and other harvest treatments would affect dense-forest (Key Issue), improve resilience to bark beetles (Purpose and Need), and move structural stages closer to the HRV (Purpose and Need), a Deschutes National Forest data set was used that has classified vegetation information into a number of metrics (USDA Forest Service 2013a). This data set was constructed using data collected in 2009 and 2010 using Lidar[4] technology. Stand density index (SDI) values from this data set were used to describe the existing proportion of dense forest in the Rocket project area. For each action alternative, assumptions were made as to how SDI would change. Structure classifications from this data set, which describe five diameter classes and two canopy cover classes, were used to compare how alternatives would move Rocket's associated watershed closer to HRV. These structure classifications differ in a number of ways from those described in the Eastside Screens, but both classification methods use the same definition for classifying conditions where "large trees are common". Similar to the density analysis, assumptions were made as to how these structure classes would change with proposed treatments. Use of an assumed post-treatment condition will show average large-scale patch changes, but is too coarse a method to show the fine-scale patch diversity that will likely remain following treatment.

Key Issue: Tree Stocking Level Following Thinning

Alternative 2 proposes to thin to 40 ft^2 of basal area (BA) per acre within all management areas, with the largest number of treatment acres within Scenic Views and NNVM (Table 37). Some public comments expressed concern this basal area is too low, not typical or "natural" for this age of ponderosa pine, does not enhance old growth characteristics in OGMAs, and that goals and objectives for Scenic Views and NNVM

[4] Lidar is a technology which uses laser reflecting back to the Lidar apparatus to identify the distance from the source. This was used from an airplane to produce very precise accurate and high-resolution images of the surface of the earth and vegetation. Tree height, tree density (trees per acre), and canopy cover are measures directly derived from Lidar data. Tree diameter is indirectly derived, using regression equations whose variables include potential natural vegetation group and tree height. Classifications are for 30 meter square grid pixels.

may not be met. Thinning to this basal area would increase the length of time until stand stocking reaches the upper management zone (UMZ). Alternatives 3 and 4 address this issue by prescribing a range of basal areas (40 to 80 ft^2 of basal area per acre) to be retained (Table 37), with the lower basal areas being retained where trees are smaller in diameter and the higher basal areas being retained where trees are larger.

Alternative 2. Use of the 40 BA thinning treatment is proposed within the following management areas whose goals and objectives include a management emphasis of providing for large, old growth ponderosa pine: NNVM, Old Growth, and Scenic Views (Table 37). Within these management areas there is an emphasis on "natural ecological succession" (NNVM), "naturally evolved old growth forest ecosystems" (Old Growth), and "scenery that represents the natural character of Central Oregon" (Scenic Views). Timber production is not a focus, but is allowed to move towards or maintain large, old ponderosa pine. Approximately 90 percent of the acres proposed for the 40 BA thinning are within these management areas. In some cases, units with this treatment extend into deer habitat and general forest, accounting for the remaining 10 percent of acres.

Alternative 3 and 4. Instead of the 40 BA thinning treatment, the 40 to 80 BA thinning treatment is proposed within NNVM, Old Growth, and Scenic Views (Table 37), the management areas which have an emphasis of providing for large, old growth ponderosa pine. Additionally, within these management areas the 40 to 80 BA thinning treatment is proposed in place of the 60 BA thinning treatment (Table 37).

Table 37: Thinning treatments (40, 60, and Mix) by alternative and management area.

Management Areas	Alternative 2			Alternative 3			Alternative 4		
	40 BA	60 BA	40-80 BA	40 BA	60 BA	40-80 BA	40 BA	60 BA	40-80 BA
Deer Habitat	12	564	0	0	277	101	0	434	193
General Forest	146	1,958	0	0	659	708	0	1,953	545
NNVM, Lava Butte Zone	307	66	0	0	0	4	0	0	615
NNVM, Transition Zone	583	1	0	0	1	0	0	0	683
NNVM Subtotal	*890*	*67*			*1*	*4*	*0*	*0*	*1,298*
Old Growth	44	11	0	0	0	0	0	0	211
Scenic Views, Retention Foreground	319	210	0	0	0	477	0	0	691
Scenic Views, Partial Retention Foreground	569	350	0	0	10	650	0	48	1,215
Scenic Views, Retention Middleground	40	145	0	0	0	227	0	0	288
Scenic View Subtotal	*928*	*705*	*0*	*0*	*10*	*1,354*	*0*	*48*	*2,194*
TOTAL	**2,020**	**3,3058**	**0**	**0**	**947**	**2,168**	**0**	**2,435**	**4,441**

Measures

Measure 1: *(Historic Stocking)* Average post-thin trees per acre (expressed as a range) and relationship to the average historic stocking of large trees (expressed as a range).

Measure 2: *(NFMA)* Post-thin stocking level relative to upper and lower management zones.

Measure 3: *(NFMA and Beetle Risk)* Years to reach the lower management zone (LMZ) and/or the UMZ.

Methods/Assumptions

Relationship between basal area and tree diameter displayed in Table 35 was used to estimate average number of trees per acre that would remain after thinning. Estimates assume post-thin quadratic mean diameters[5] would range from 13 to 20 inches dbh, with diameters most commonly being between 13 and 16 inches. Assumption is based on monitoring information from similar treatments in similar stand conditions and professional experience. Using assumed post-thin quadratic mean diameters, diameter growth after thinning was predicted using GBA as described by Hall (1987). This method allows for a simple comparison of the relative change in diameter growth at different stocking levels independent of other variables, such as live crown ratio and mistletoe infection, that could mask or confound the change. Projections assume no mortality, another way to isolate and predict relative change in diameter growth associated with thinning treatments. Growth projections were made in 10-year increments for at least 30 years or until stocking reached the upper management zone.

Existing Condition

Most units proposed for thinning have been previously thinned and can be characterized as dense stands of ponderosa pine with trees ranging in size from 5 to 20.9 inches dbh, most of which are 70 to 90 years old. Larger, older trees are uncommon, occurring as scattered individual trees or scattered groups of trees. Stocking in previously thinned stands ranges from 100 to 200 trees per acre, and in stands with no prior thinning, stocking can range from 250 to 1,100 trees per acre. Existing stocking levels are well above the 13 to 40 trees per acre associated with LOS reference conditions (Hopkins et al. 1993, Munger 1917, and Youngblood et al. 2004). Stocking also exceeds upper management zones, making the trees susceptible to mountain pine beetle attack.

Direct and Indirect Effects—Alternative 1

No treatments to reduce tree stocking levels would occur with this alternative and the existing condition would not change in the short term. Stocking would remain well above historic reference conditions and bark beetle attacks would continue to be likely to occur.

Direct and Indirect Effects—Alternative 2

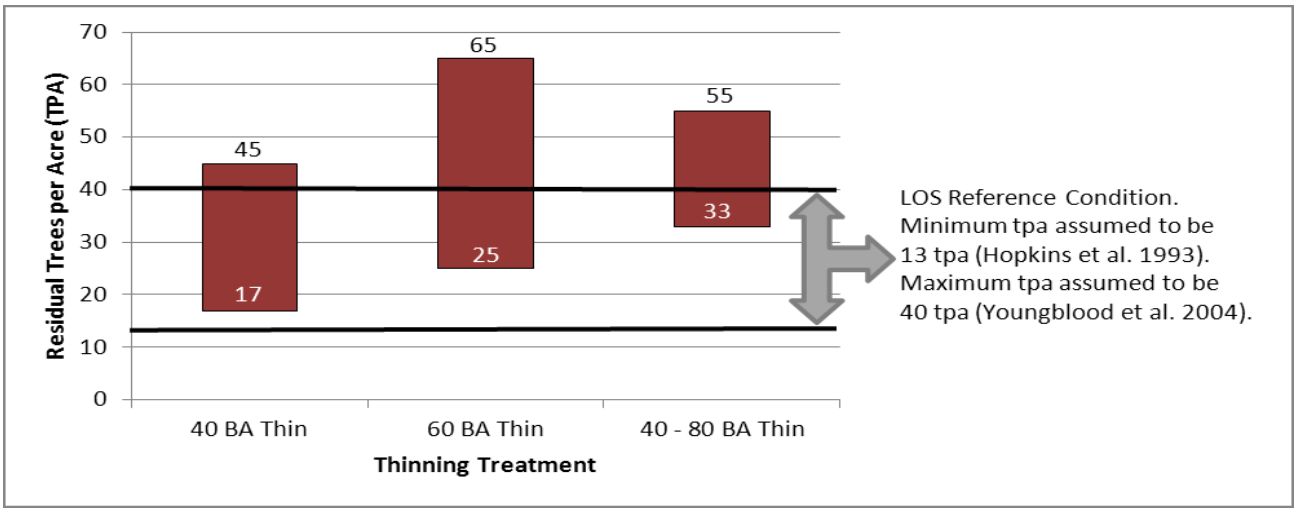
Alternative 2 would thin 2,020 acres to an average of 40 sq. ft. basal area. The number of trees per acre retained with the 40 BA thinning treatment would be approximately the same as LOS reference conditions (Figure 24). Lowest stocking would be found where residual trees are larger in diameter and highest stocking would be found where smaller trees are more common (see Table 35 for this relationship). While stocking would be similar to reference conditions, trees would be smaller in diameter and younger in age than that associated with reference conditions. It will be 20 to 30 years before large trees (greater than 21 inches dbh, minimum reference condition) are common (13 trees per acre, minimum reference condition). It will be 60 to 80 years before most residual trees are 150 years, the age associated with “old” ponderosa pine trees (Hopkins et al. 1993). During the early portion of this time of growth and maturation, low tree stocking would favor rapid diameter growth, understory establishment and growth, and resiliency to bark beetle attack. This low stocking, however, would provide little buffer against future disturbance events.

Cumulative Effects – Alternative 2

The scale of analysis for post-treatment stocking is at the individual stand level. No other projects are occurring or are expected to occur within the treated stands that would affect stocking levels. Therefore, there would be no cumulative effects on post-treatment stocking.

[5] Quadratic Mean Diameter (QMD): The diameter corresponding to a group of trees mean basal area (Helms 1998)

Figure 24: Residual trees per acre with 40, 60, and 40-80 BA Thin treatments compared to historic conditions.



Average of 40 Basal Area Thin

Rapid diameter growth. At the low stocking levels associated with the 40 BA Thin, diameter growth would be relatively rapid for the next 30 years, with 10-year diameter growth rates ranging from 1.7 to 2.4 inches on the lower productivity sites and 1.9 to 3.0 inches on the higher productivity sites (see Figures 2 and 3 in Silviculture Report for a graphic representation). Diameter growth would be most rapid in the 10 years following thinning and would slow through time as trees increase in diameter and more fully occupy the site. By 30 years, most trees will exceed the minimum LOS reference condition size, an exception being post-thin 14-inch trees growing on lower productivity sites.

Long time period for understory establishment and growth. At this low tree density, site resources such as water would be available for the establishment and growth of understory vegetation, including grasses, shrubs, and tree regeneration. On the lower productivity sites, it would take 10 to 20 years for tree stocking to reach the lower management zone, the stocking at which a significant portion of the site resources would be captured in tree growth and would be less available for growth of understory vegetation (Table 38). This time period would be longer on the higher productivity sites, taking 30 to 45 years for tree stocking to reach the lower management zone (Table 38). On these higher productivity sites, a dense, tall shrub understory could develop if thinning is not followed by periodic fire or mechanical shrub treatments.

Long time period of resiliency to bark beetle attack. Following thinning on the lower productivity sites, there would be a 30 – 45 year time period during which stocking would remain below the upper management zone, the level above which mortality from mountain pine beetle can become serious (Table 38). This time period would be even longer on the higher productivity sites, with stocking remaining below the upper management zone for 50 to 80 years (Table 38). Low stocking during this time would limit tree mortality from mountain pine beetles to low levels and minimize the need for reducing stocking using mechanical harvest.

Small buffer against future disturbance events. During the 60 to 80 year time period needed for trees to mature to the age associated with "old" ponderosa pine, the low density associated with the 40 BA thin would not provide much of a buffer for absorbing future mortality that will likely occur due to disturbances such as wind damage, lightning and fire. During the latter half of this time period, which would coincide with when most trees exceed 21 inches dbh, tree mortality from beetles could increase on the lower productivity sites, as stocking increases above the upper management zone. On the higher productivity sites, tree mortality from beetles would be expected to remain at low levels throughout this time period as stocking would remain below the upper management zone.

Table 38: Post-thin stocking relative to upper and lower management zones with 40, 60, and mixed (40 – 80) basal area per acre thinning treatments.

Measure	Thinning Treatment		
	40 Basal Area	60 Basal Area	40 - 80 Basal Area
Lower productivity ponderosa pine sites:			
Post-thin relation to lower (LMZ) upper (UMZ) management zones	Below LMZ; but more than minimum.	Between LMZ and UMZ.	Varies by diameter. At <14" dbh, below LMZ. At >=14" dbh, between LMZ and UMZ.
Years before thinned stand reaches LMZ	10 – 20 years	N/A	0 – 10 years
Years before thinned stand reaches UMZ	30 – 45 years	10 – 25 years	5 – 20 years
Higher productivity ponderosa pine sites:			
Post-thin relation to lower (LMZ) upper (UMZ) management zones	Below LMZ; but more than minimum.	Below LMZ; but more than minimum.	Varies by diameter. At <15" dbh, below LMZ. At >=15" dbh, between LMZ and UMZ.
Years before thinned stand reaches LMZ	20 – 40 years	10 – 15 years	5 – 20 years
Years before thinned stand reaches UMZ	50 – 80 years	40 – 50 years	30 – 40 years

Direct and Indirect Effects—Alternative 3 and 4

The number of trees per acre retained with the 40 to 80 BA (Mixed BA) thinning treatment would be at the high end of LOS reference conditions where residual trees are larger, and would exceed LOS reference conditions where smaller trees are more common (Figure 24). The mixed BA thin, which would vary leave basal area based on tree diameter, would retain a relatively small range of trees per acre and would leave more of the larger diameter trees when compared to the 40 BA thin. As with the 40 BA thin, trees retained would be smaller in diameter and younger in age than that associated with reference conditions. It will be 30 to 40 years before trees greater than 21 inches dbh are common. It will be 60 to 80 years before most residual trees reach the age associated with "old" ponderosa pine trees. Post-thin stocking levels would have variable effects on diameter growth, understory establishment and growth, and resiliency to bark beetle attack. Higher stocking associated with the mixed BA thin could provide a buffer against disturbances and provide future management options.

40 to 80 BA Thin (Mixed BA Thin)

Variable diameter growth. Ten-year diameter growth rates would be most rapid where post-thin diameters average less than 18 inches dbh. Stocking would be similar to the 60 BA thin resulting in similar diameter growth rates. On lower productivity sites, 10-year diameter growth would be 1.4 to 1.8 inches for the next 20 years. On higher productivity sites, diameter growth would be more rapid for a longer period of time, ranging from 1.5 to 2.3 inches for the next 30 years.

Where post-thin average diameters average 18 to 20 inches, higher stocking would result in slower diameter growth rates than either the 40 BA thin or the 60 BA thin. On lower productivity sites, diameter growth would only be 1.2 to 1.4 inches for the next 20 years. On higher productivity sites, diameter growth would be more rapid for a longer period of time, ranging from 1.4 to 1.9 inches for the next 30 years.

By 30 to 40 years, most trees will exceed the minimum LOS reference condition size, an exception being post-thin 14-inch trees growing on lower productivity sites. Figures 5 and 6 of the Silviculture Specialist's Report demonstrate these concepts.

Variable understory establishment and growth. Much of the area treated with the mixed BA thin would remain at or above the lower management zone (Table 38). Only in areas dominated by trees less than 14 to 15 inches dbh would stocking be less than the lower management zone. On lower productivity sites, it could take up to 10 years for these areas to grow to the lower management zone. On higher productivity sites it could take 5 to 20 years. With these varying levels of tree stocking, understory establishment and growth would be variable. Understory establishment and growth would be most rapid in areas stocked less than the lower management zone, areas where trees are not fully utilizing site resources. Where trees are more fully utilizing site resources, establishment and growth of understory would be reduced, but not eliminated.

Variable resiliency to bark beetle attack. On lower productivity sites, stocking following thinning would remain below the upper management zone for 5 to 20 years and for 30 to 40 years on higher productivity sites (Table 38). Stocking would most quickly exceed the upper management zone, the level above which mortality from mountain pine beetle can become serious, in those areas where diameters average 18 inches dbh and larger. In areas with larger trees, predicted 10-year rates of diameter growth less than 1.5 inches is another indicator of susceptibility to bark beetle attack.

Buffer and future management options. Densities associated with the 40 to 80 BA thin provide a buffer, at least in the short term, against disturbance events. After 20 years of growth and maturation, but before LOS size and age conditions are achieved, there would be an opportunity on lower productivity sites to again reduce stocking below the upper management zone and move stocking to levels associated with LOS conditions. Resistance gained at that time to bark beetle attack could persist until trees are closer to the age associated with "old" ponderosa pine. Conversely, after 20 years there would be the opportunity to allow stocking to remain above the upper management zone and allow natural disturbance events to reduce densities, albeit in a less controlled manner than the prior option. On higher productivity sites, there may be less opportunity under current management direction for future planned reductions in density. Stocking increase above the upper management zone would coincide with the time when most trees exceed 21 inches dbh, the minimum size associated with LOS conditions.

Cumulative Effects – Alternatives 3 and 4

The scale of analysis for post-treatment stocking is at the individual stand level. No other projects are occurring or are expected to occur within the treated stands that would affect stocking levels. Therefore, there would be no cumulative effects on post-treatment stocking from either Alternative 3 or 4.

Consistency with Management Direction

Appropriateness of stocking levels (NFMA). Use of the 40 BA, 60 BA, and Mixed BA thinning treatments would maintain tree densities at appropriate levels for meeting management area goals and objectives. Use of the 40 BA thinning treatment is proposed primarily in management areas whose emphasis is on providing for large, old growth ponderosa pine; maximizing wood fiber is not an objective. The relatively long period of resilience to bark beetles and reduced need for future mechanical entries associated with the 40 BA thin would be a benefit within these areas, which include NNVM, Old Growth Management Areas, and Scenic Views.

Within NNVM, use of either thinning treatment would protect existing large, old trees (NNVM S&G M-8) and would leave stands in a condition where it would be possible for stands to maintained and perpetuated solely with prescribed fire (NNVM S&G M-15). Higher densities associated with the 40-80 BA thin could allow insects to play an earlier and pronounced role in ecosystem function (NNVM S&G M-12).

Within Old Growth Management Areas, either thinning treatment would reduce beetle risk which would serve to perpetuate existing old growth characteristics and enhance development of old growth characteristics where they are currently lacking (LRMP S&G M15-4). Higher densities associated with the 40-80 BA thin could allow insects to play a reduced, yet ongoing role in stand development, leading to patches of forest with abundant standing dead and eventually downed dead trees, conditions for which old growth forests are to be managed.

Within Scenic View Allocations, either thinning treatment would reduce beetle risk (LRMP S&G M9-5) and would leave the largest diameter trees with the healthiest crowns (LRMP S&G M9-6). The 40-80 BA thin may better meet the desired visual condition of having areas with numerous, large diameter trees (LRMP S&G M9-4) and may better provide a mix of heavier and lighter stand densities (LRMP S&G M9-9).

Key Issues: Ratio of Treated (less dense) to Untreated (more dense) Stands within the NNVM and the Project Area

The proposed action would treat about 7,405 acres, or 34% of the project area (43% of forested area). Some commenters are concerned that the scale of the proposed treatment would not meet long-term needs for dense forests, snags, and dead wood. Scoping comments also expressed the importance of finding an "optimal" mix of treated and untreated areas and suggested that we consider a variety of combinations such as 60/40, 50/50, and 20/80. Conversely, some commenters felt that there are ways to increase economic impact and feasibility of the project, such as including all stands in need of thinning in the project. Alternatives address this issue by varying the acres of thinning treatment. Alternative 3 would treat fewer acres, while Alternative 4 would treat more (see Figure 3 and Table 14).

Measure

The measure for this issue is the proportion of the project's forested area and the proportion of area within NNVM stocked above the upper management zone. This stocking level is considered to be "dense" forest as it is at this density where mortality from bark beetles can become serious.

Methods and Assumptions

Existing density classification. Tree density was classified into the five SDI classes displayed in Table 35. These classes correspond to the upper and lower management zones for ponderosa pine growing on high and low site productivities and the minimum stocking level (Table 34). To classify existing tree density into these five classes, this analysis uses a Deschutes National Forest data set that has classified vegetation information into a number of metrics, including diameter and number of tree per acre (USDA Forest Service 2013a). This data set was constructed using data collected in 2009 and 2010 using Lidar technology.

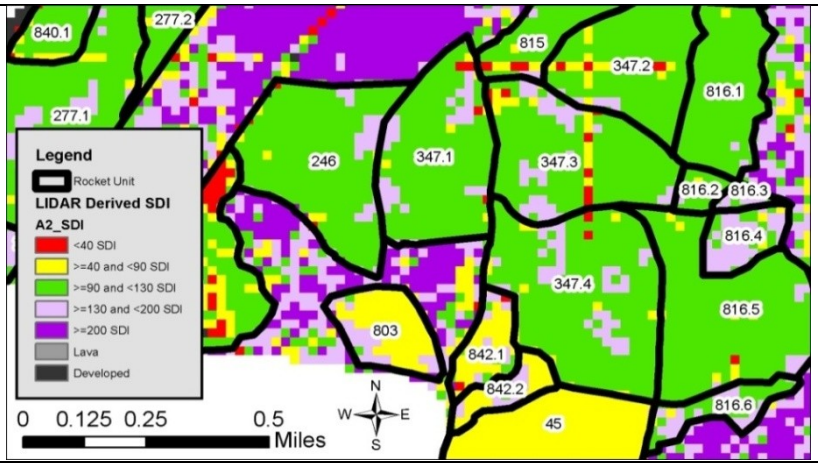
Post-treatment density classification. For each action alternative, existing SDI classifications were changed to reflect predicted tree density following proposed treatments. Treatments assumed to reduce density to less than 40 SDI were those creating openings and enhancing aspen. Thinning treatments were assumed to reduce density to a variety of SDI classes depending on treatment and existing tree diameters. In general, the 40 BA thin was assumed to reduce density to between 40 and 90 SDI and the 60 and Mixed BA thins were assumed to reduce density to between 90 and 130 SDI. Fuels treatments, specifically ladder fuels reduction and underburning, were assumed to not reduce density enough to result in a change in SDI class.

Accuracy of post-treatment density classification. Post-thinning density classes are based on assumed average conditions. While predicted broad-scale average landscape conditions will be relatively accurate, the use of average conditions will not identify the fine-scale patch diversity that will remain following thinning. Post-thin projections likely over-estimate acres of the average density class and under-estimate acres of density classes on either side of the average class. Projected reductions of the highest SDI class (>200 SDI) will be the most accurate, as thinning will move densities into one of the lower density classes. Projected increases of the lowest SDI class (<40 SDI), associated with the creation of openings and enhancing aspen, will also be accurate.

An example of the likely over-estimation of the average density class and the corresponding under-estimation of density classes on either side of the average can be seen in Figure 25and Figure 26, respectively. Figure 25 displays predicted post-thin density classes within a group of units in the southern portion of the Rocket project area that would be thinned to 60 BA. Predictions portray relatively uniform conditions, with relatively little fine-scale patch diversity. In contrast, Figure 26 displays a different group of units also located in the southern portion of the Rocket project area that were thinned to 60 BA just prior to

the acquisition of the data set used for this analysis. The existing post-thin condition in these units shows more fine-scale diversity, with density classes on either side of the average condition (90 – 130 SDI) being present. Figure 27, a recent aerial image, provides an actual picture of what the density classes look like within these recently thinned units.

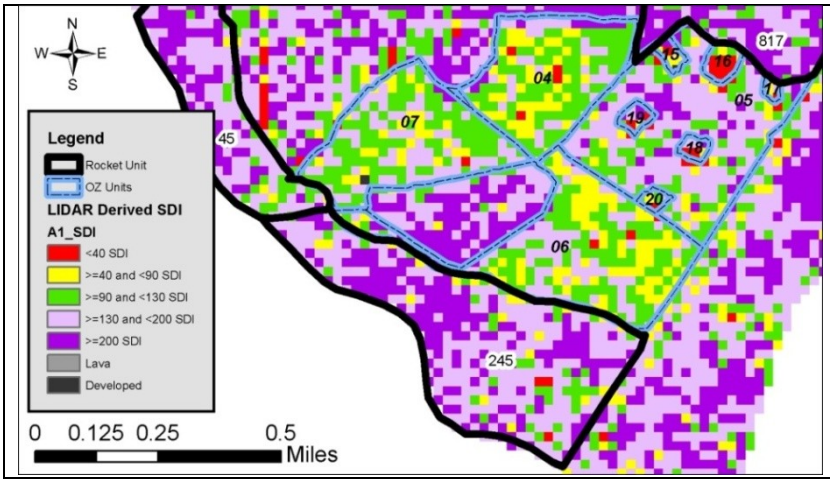
Figure 25: Predicted stand density index (SDI) classes in Rocket Alternative 2 units thinned to 60 BA.



Units proposed for thinning to 60 BA: 246, 347.1 through 347.4, and 816.1 through 816.6.
Post-thin Assumptions:
60 BA thin reduces density to between 90 and 130 SDI except:
- Where existing densities <90 SDI, density class remains unchanged.
- Where existing average tree size is >=20"dbh, density is only reduced to between 130 and 200 SDI.

Accuracy: Predictions likely overstate uniformity of post-thin conditions.

Figure 26: Existing stand density index (SDI) classes in units (OZ) recently thinned to 60 BA.

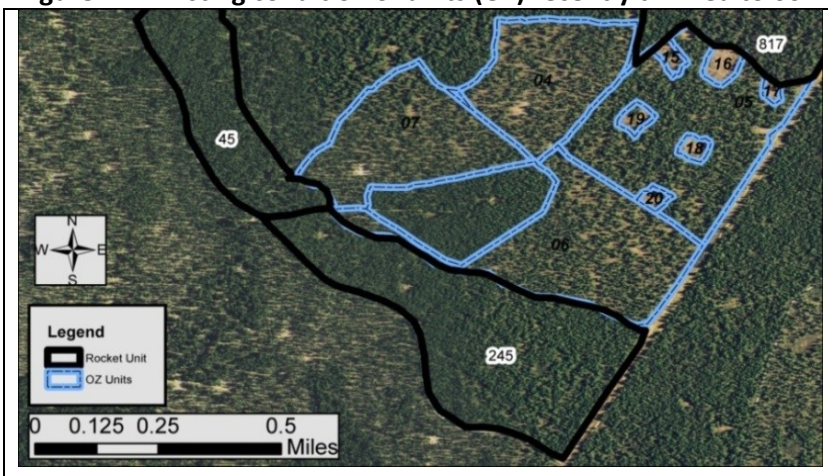


Units thinned to 60 BA just prior to acquisition of analysis data set: OZ units 06 and 07.

Units show variation above (>=130 and <200 SDI) and below (>=40 and <90 SDI) the average density class (>=90 and <130 SDI) predicted to be present with the 60 BA thin.

Classification of existing condition: Displays fine-scale spatial diversity likely to be present following proposed thinning.

Figure 27: Existing condition of units (OZ) recently thinned to 60 BA as portrayed by 2012 NAIP imagery.



Units thinned to 60 BA prior to date of NAIP imagery:
OZ units 06 and 07.

Image provides a picture of what the density classes look like as viewed from above.

Existing Condition and Trend

Dense forest condition. Approximately 69 percent of the Rocket project area and 71 percent of NNVM is densely forested, with tree densities exceeding 130 SDI (Figure 28 and Figure 29, respectively, Alternative 1). The densest patches of forest exceed 200 SDI and are scattered throughout the project area (Figure 30).

SDI values of 200 and more exceed upper management zones for low and high productivity ponderosa pine sites. SDI values of 130 and more also exceed the upper management zone for low productivity ponderosa pine sites, which dominate the Rocket project area, one exception being the southeastern part of the project area, specifically the portion of NNVM located south of the lava flow (Figure 30). In this area, site productivity is high and only SDI values of 200 and more exceed the upper management zone. Areas exceeding the upper management zones identify areas where mortality from mountain pine beetle could become serious.

Open forest condition. Open forest, areas with less than 40 SDI, make up 4 percent of the forested landscape (Figure 28, Alternative 1). This condition is found in areas that are reforesting, such as recent burns, and in areas being maintained as open forest, such as the buried gas line that extends north and south through the project area.

Density condition trend. The current trend is towards increasing stand densities as trees grow in diameter. Table 35 displays this relationship, showing as relatively similar number of trees per acre increase in diameter, total stand density index increases with movement upward through the different management zones.

Figure 28: Rocket Forested Area - Proportion in five stand density index (SDI) classes by alternative.

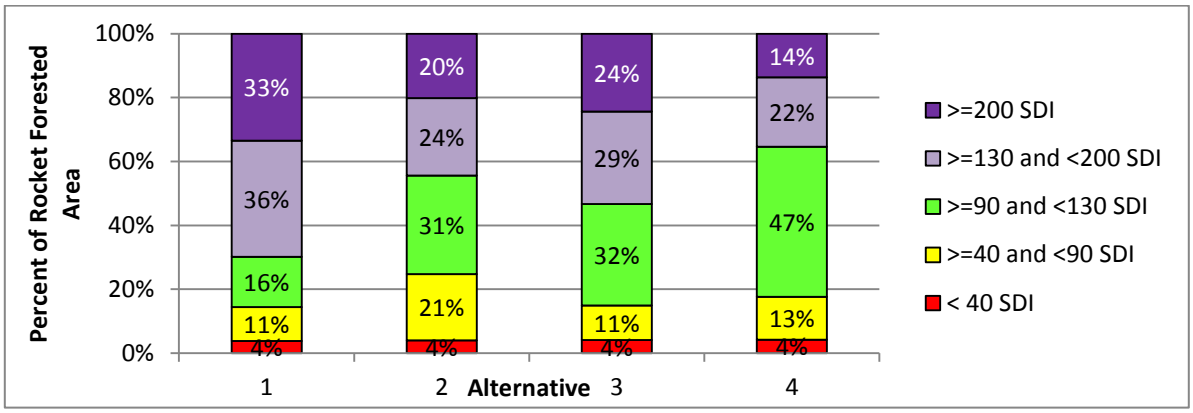
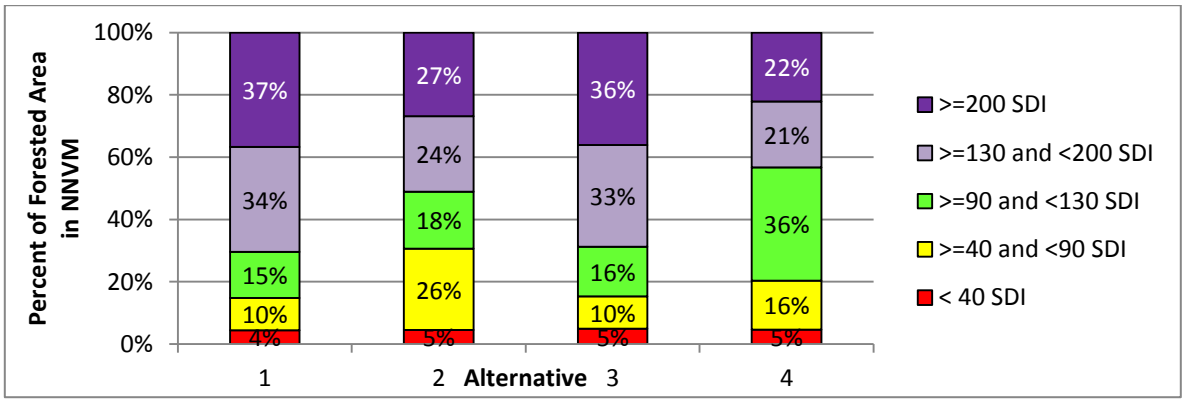


Figure 29: Rocket NNVM Forested Area - Proportion in five stand density index (SDI) classes by alternative.



Direct and Indirect Effects—Alternative 1

No treatments to reduce tree density would occur with this alternative and barring stand replacement disturbances, the existing condition would not change in the short term. Dense forest conditions would continue to dominate the landscape (Figure 30) with the densest forest condition present on 33 percent of the project area (Figure 28) and 37 percent of the area within NNVM (Figure 29).

Direct and Indirect Effects—Alternative 2

Dense forest conditions would be reduced to 44 percent of the project area, with 20 percent in the densest forest condition (Figure 28). Within NNVM, dense forest would be reduced to 51 percent, with 27 percent in the densest condition (Figure 29). Variable-sized patches of the densest forest would continue to be scattered throughout the project area (Figure 31). This alternative, with its 40 BA thinning treatment, would more than double the amount of low density forest (>=40 and <90 SDI) within the project area and within NNVM. This would be the greatest increase of the three action alternatives (Figure 28 and Figure 29). Open forest conditions would be increased by treatments creating openings and enhancing aspen. Created openings are discernible on the landscape (Figure 31) however the increase in open forest conditions is too small in the context of the project area to increase the proportion of this density class (Figure 28). Within NNVM, a smaller scale of analysis, this density class would increase by one percent (Figure 29).

Direct and Indirect Effects—Alternative 3

In the project area, dense forest conditions would be reduced to 53 percent, with 24 percent in the densest forest condition (Figure 28). Within NNVM, limited use of mechanical harvest would result in dense forest changing little from the existing condition (Figure 29). Variable-sized patches of the densest forest condition would continue to be scattered throughout the project area and, by alternative design, would remain within

Old Growth areas and areas classified as LOS (Figure 32). As with the other action alternatives, creating openings and enhancing aspen would increase the amount of open forest, but the increase is too small in the context of the project area to change the existing proportion of this density class (Figure 28). Unique to this alternative, no openings would be created within NNVM (Figure 32). Open forest within NNVM would increase by less than one percent due to aspen enhancement, but shows as increasing by one percent (Figure 29) due to the rounding of proportions to whole numbers that total 100 percent.

Direct and Indirect Effects—Alternative 4

In the project area, dense forest conditions would be reduced to 36 percent of the project area, with 14 percent in the densest forest (Figure 28). Within NNVM, dense forest would be reduced to 43 percent, with 22 percent in the densest forest (Figure 29). Reductions at the project scale and within NNVM would be the largest of the four alternatives. This alternative would retain variable-sized patches of the densest forest, but these patches would not be as well distributed as with the other alternatives. The southwestern portion of the project area would have very few patches of the densest forest condition (Figure 33). This alternative would create the most openings, but even this amount would be too small in the context of the project area to increase the proportion of this density class (Figure 28).

Cumulative Effects – Alternatives 2, 3, and 4

None of the actions listed as a reasonably foreseeable future project would combine with the Rocket treatments to change the proportion of density classes predicted for each alternative because density classes were analyzed within the Rocket project area only, and no other density reduction activities are proposed to take place in that area. Alternative 2 would treat about 10% and Alternative 4 would treat about 13% of the ponderosa pine within the NNVM. The Record of Decision for the NNVM Plan calls for 3,700 acres or 37% of the ponderosa pine to be restored (NNVM ROD p. 10). Limited thinning and burning activity has occurred in the NNVM since the time the Plan was written. The NNVM Old Growth Ponderosa Pine Restoration EA (1996) has been implemented on 95 acres. Other projects include South Bend HFRA and the Fuzzy EA. Implementation of Rocket Alternative 4 will make progress in meeting the goals of the Monument legislation and plan, but when combined with past projects the amount of thinning and/or burning is still be shy of meeting the 3,700 acres of ponderosa pine restoration.

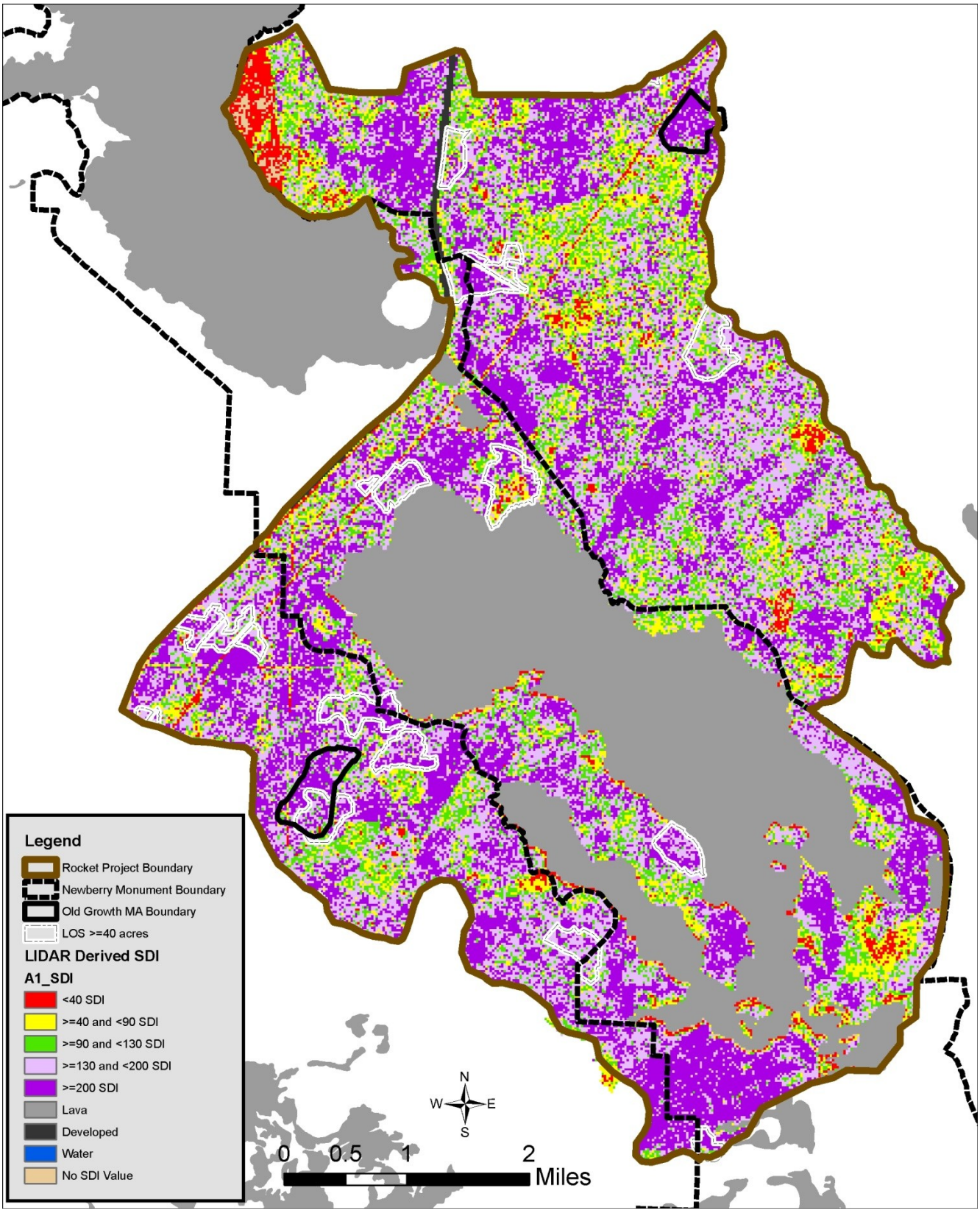


Figure 30. Alternative 1 (Existing Condition) – Map of five stand density index (SDI) classes.

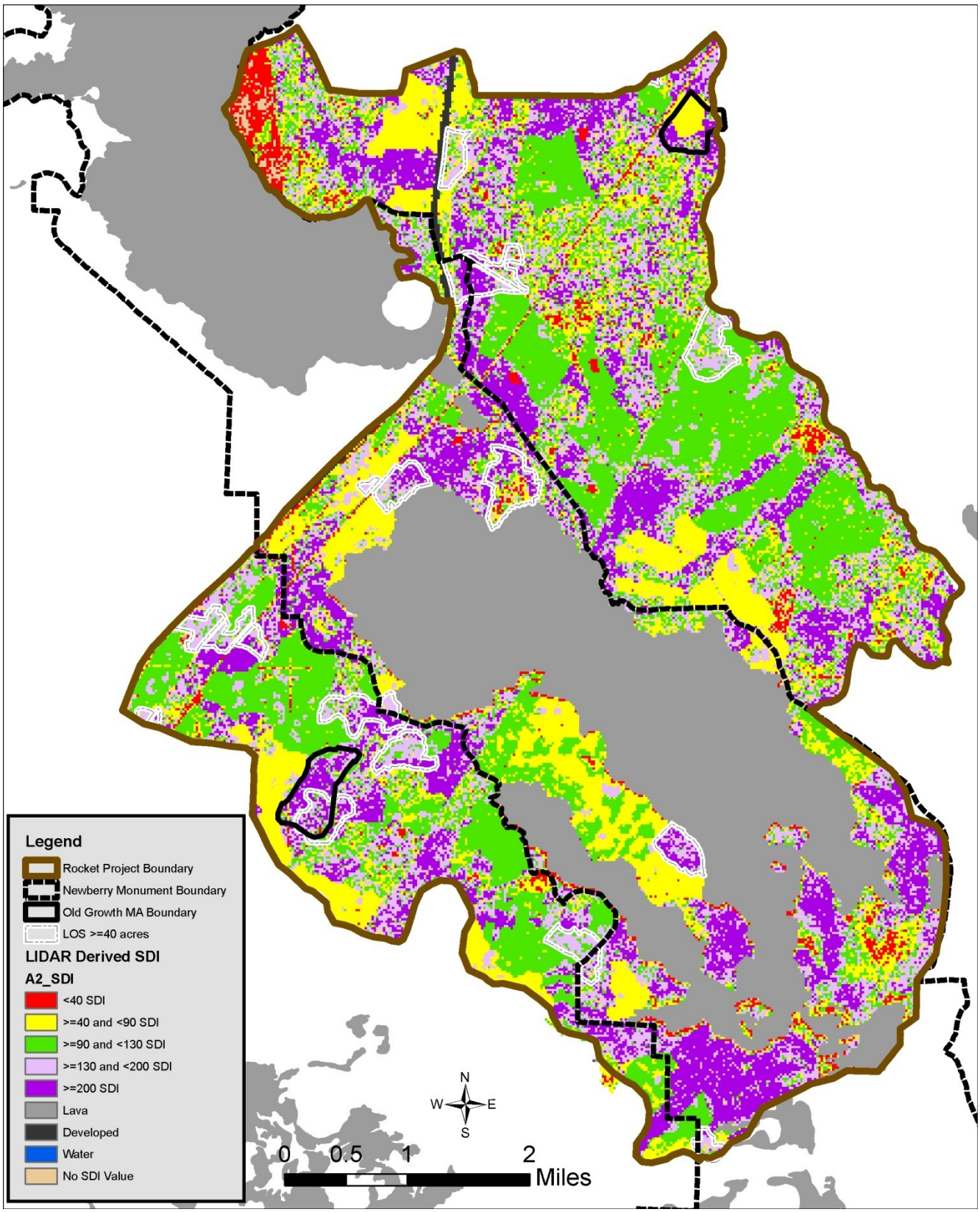


Figure 31. Alternative 2 - Map of five stand density index (SDI) classes after cutting treatments.

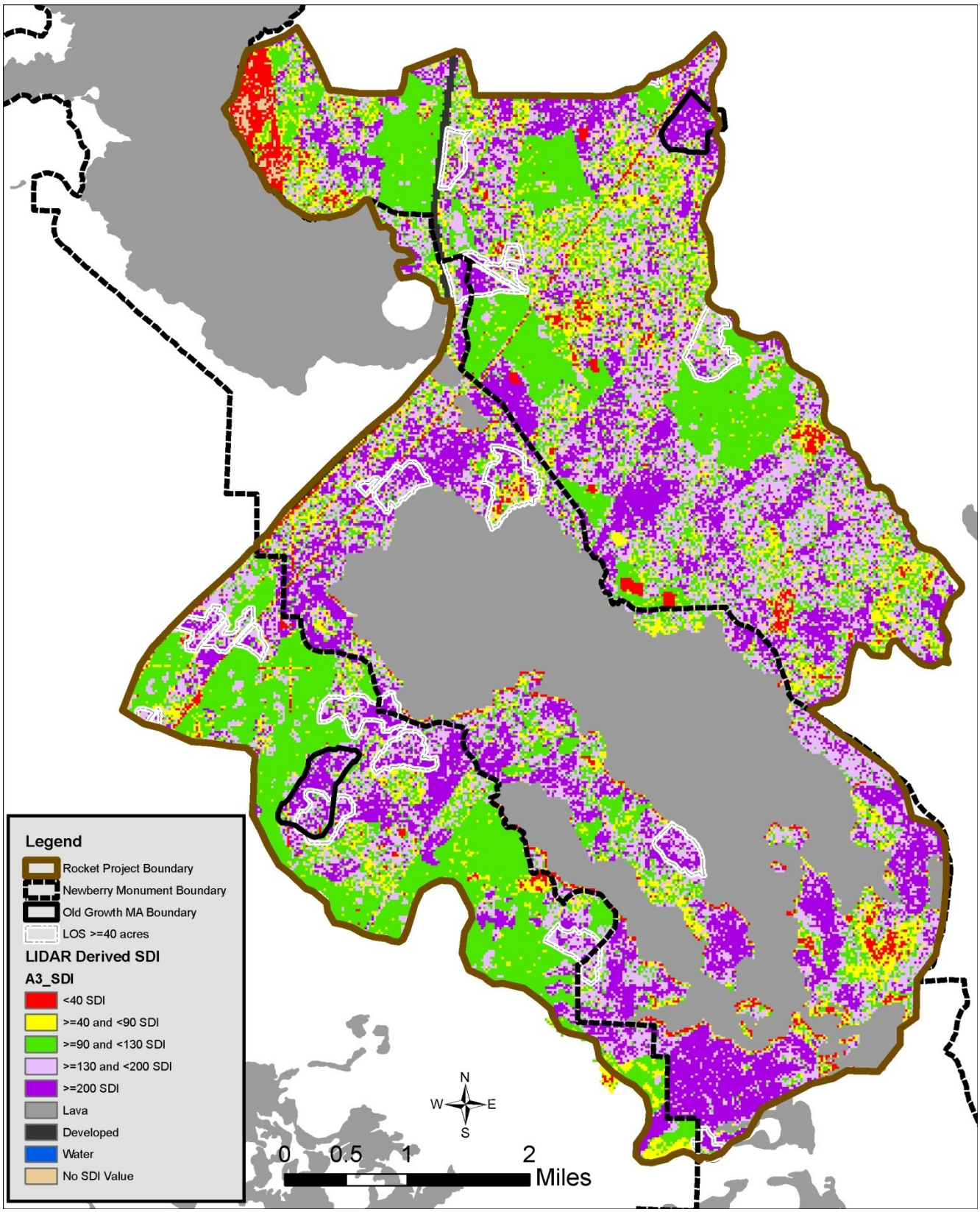


Figure 32. Alternative 3 - Map of five stand density index (SDI) classes after cutting treatments.

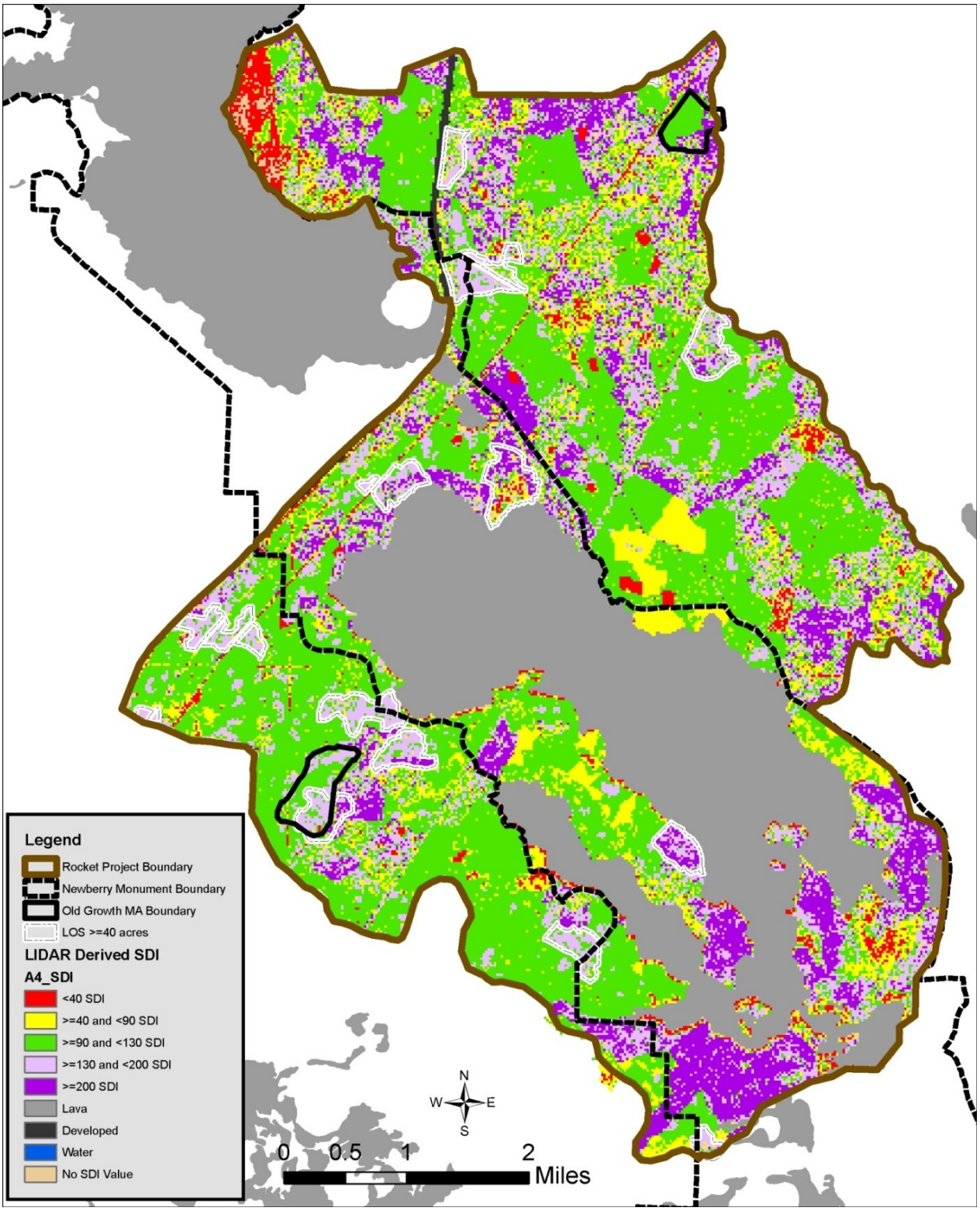


Figure 33. Alternative 4 - Map of five stand density index (SDI) classes after cutting treatments.

Key Issue: Treatment within Old Growth Management Areas (OGMAs)

The proposed action (Alternative 2) includes thinning within portions of two OGMAs where they have previously been thinned and are in need of thinning again. One of the comments pertaining to OGMAs received during scoping suggested thinning to reduce beetle risk should not be a goal unless old growth characteristics are at risk. Alternatives address this issue by varying the acres of treatment within the OGMAs (Table 39). Alternative 3 drops all treatment within OGMAs, while Alternative 4 increases the amount of treatment.

The following analysis addresses forest health conditions within the OGMAs. This key issue is also addressed later in the wildlife section to address how treatments may impact wildlife species in the OGMAs (see page 213).

Table 39: Rocket north and south Old Growth Management Areas (OGMAs) and Alternative 2 and 4 treatments.

Rocket OGMAs Location and Treatment Unit	Alternative 2			Alternative 4		
	Treatment	Acres	% of OGMA	Treatment	Acres	% of OGMA
North (98 Acres)						
808	40 BA Thin/Mow/Burn	44	45%	Mix BA Thin	44	45%
878	---	---	---	Mix BA Thin	13	13%
Subtotal		44	45%		57	58%
South(155 Acres)						
816.6	60 BA Thin/Mow/Burn	11	7%	Mix BA Thin/Mow/Burn	11	7%
910	---	---		Mix BA Thin/Mow/Burn	93	60%
965	---	---		Mix BA Thin/Mow/Burn	50	32%
Subtotal		11	7%		153	99%
TOTAL (253 Acres)		55	22%		211	83%

Measure

Proportion of OGMAs stocked at or above the upper management zone (130 SDI).

Existing Condition

Much of the north OGMA has been thinned, most recently in 1971. It can be characterized as single-story, immature ponderosa pine. Large trees are not common enough for any of this OGMA to be classified as LOS (Figure 30). Only small portions of the south OGMA have been thinned, with most recent thinning dating from 1987 and 1999. Thinned areas are single-story, immature ponderosa pine. Outside thinned areas, this OGMA is multi-story ponderosa pine. A portion has enough large diameter trees to be classified as LOS (Figure 30). Tree density is high in both OGMAs, with 89 percent of the combined area at or exceeding 130 SDI (Figure 34), the upper management zone.

Direct and Indirect Effects—Alternative 1 and 3

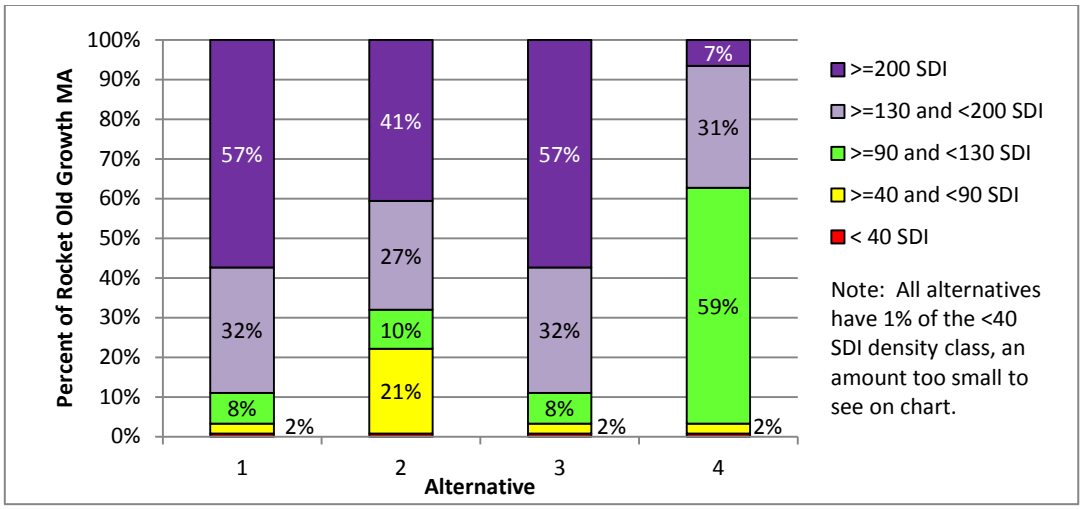
No treatments to reduce tree stocking would occur with these alternatives and the existing condition would not change in the short term. Most of the areas in OGMAs would remain stocked above the upper management zone, a stocking level that is too high to provide resiliency against bark beetle attack and too high to ensure large tree structure will be maintained or develop. At endemic levels, individual or small groups of trees could be killed annually. If an outbreak of mountain pine beetle occurs, however, up to half the trees and up to 67 percent of the current basal area, mostly in the largest trees, could have expected mortality (Barrett 1979). In discussing the results of a 35-year study on ponderosa pine response to thinning

and understory removal, Cochran and Barrett 1999) state "the reduction of growth rates of even the largest trees with increasing stand densities indicates that unmanaged stands that escape thinning through fire or other disturbances will progress very slowly toward mid- or late seral conditions."

Direct and Indirect Effects—Alternatives 2 and 4

Thinning treatments proposed with Alternatives 2 and 3 would reduce the proportion of the OGMAs exceeding the upper management zone (130 SDI) from 89 percent to 68 and 38 percent, respectively (Figure 34). While Alternative 4 would thin more acres inside OGMAs, use of the mixed BA thinning treatment would retain more of the existing larger diameter trees compared to that retained with the 40 BA thinning treatment in Alternative 2 (see Key Issue re: Tree Stocking After Thinning). By reducing tree density, both thinning treatments would maintain or improve tree diameter growth rates and reduce the risk of bark beetle outbreak, improving the potential to maintain existing large tree structure and develop additional large tree structure.

Figure 34: Rocket Old Growth Management Allocations (MA) outside NNVM - Proportions of five stand density index (SDI) classes by alternative.



Cumulative Effects – Alternatives 2 and 4

None of the actions within the cumulative effects analysis area would combine with the Rocket treatments to further change the stocking levels within the OGMAs because none of them involve tree treatments within the OGMAs.

Consistency with OGMA Management Direction

Retention of dense stand conditions with Alternatives 1 and 3 would contribute towards meeting an OGMA objective of providing abundant standing and downed dead trees. This, however, could be at the expense of another OGMA objective of providing large trees. Thinning proposed with Alternatives 2 and 4 would enhance old growth characteristics by increasing the potential for live, large tree structure to develop in 20 to 40 years. Either thinning treatment would reduce beetle risk, serving to perpetuate existing old growth characteristics and enhance development of old growth characteristics where they are currently lacking (LRMP S&G M15-4). Higher densities associated with the 40-80 BA thin could allow insects to play a reduced, yet ongoing role in stand development, leading to patches of forest with abundant standing dead and eventually downed dead trees, conditions for which old growth forests are to be managed.

Key Issue: Openings Created for Developing Deer Cover and Reducing Mistletoe

Introduction

Alternative 2 proposes to create five openings[6] ranging in size from 4 to 5 acres (Table 40) to improve hiding cover in the Deer Habitat land allocation and in the NNVM Lava Butte Zone, whose management objectives include providing some habitat for deer migration. To insure adequate and uniform regeneration and meet management and legal requirements, the openings would be replanted to ponderosa pine following harvest. Some members of the public are opposed to this approach. Conversely, ODFW is supportive of the proposal and would prefer to see openings created in more than just the Deer Habitat land allocation. Rather than planting, some members of the public suggest relying on natural regeneration to reforest the openings. Some members of the public oppose creating openings greater than 1.5 acres, stating larger openings would not mimic natural openings which they believe would generally be about 0.5 to 1.5 acres in size.

The following analysis addresses the forest health and silvicultural considerations pertinent to created openings. This key issue is also discussed in the wildlife section to address how openings impact or benefit wildlife, including mule deer (see page 206).

Alternatives address this issue by varying where openings are created, the number created, and the size of openings created. Alternative 3 proposes to create 6 openings ranging in size from 4 to 12 acres (Table 40). It drops the proposal to create one opening within NNVM and proposes to create two additional larger openings within the General Forest allocation. In addition to developing deer cover, these added treatment areas would regenerate ponderosa pine stands heavily infected with dwarf mistletoe. Alternative 4 proposes to create 11 openings ranging in size from 3 to 12 acres (Table 40). Compared to Alternative 2, it increases the number of openings within NNVM from one to two. Compared to Alternative 3, it increases the number of openings within the deer habitat, general forest and scenic view allocations.

Table 40: Alternative summary of created openings, including number, size, and management allocation.

Management Allocation	Alternative 2			Alternative 3			Alternative 4		
	Number of Opening	Size Range (Acres)	Total Acres	Number of Opening	Size Range (Acres)	Total Acres	Number of Opening	Size Range (Acres)	Total Acres
Deer Habitat	3	4 - 5	14	3	4 - 5	14	5	4 - 7	26
General Forest	0	---	0	2	8 - 12	20	2.5	4 - 12	22
NNVM, Lava Butte Zone	1	---	4	0	---	0	2	3 - 4	7
Scenic Views, Partial Retention Foreground	1	---	4	1	---	4	1.5	4	6
TOTAL	**5**	**4 - 5**	**22**	**6**	**4 - 12**	**38**	**11**	**3 - 12**	**61**

Ponderosa pine natural regeneration. There is not reasonable assurance natural regeneration would adequately restock openings within five years of harvest (S&G TM-49 and TM-50). Support of this can be observed in the Rocket project area within openings similar to those proposed. Two to three years following harvest, there is no indication natural regeneration is adequately restocking the openings, which following harvest were mowed and planted. Barrett (1979) reports seedling establishment by natural regeneration in the ponderosa pine type east of the Cascade Range is highly unpredictable. Factors that need to coincide for successful natural regeneration include having heavy seed crops, favorable weather during the growing

[6] **Opening.** Defined by the Deschutes LRMP as an area without trees. According to the LRMP, openings created by harvest activities will no longer be considered openings when trees reach four and one-half feet tall (S&G TM-59). Created openings can be the result of clearcutting, which is an even-aged regeneration method in which essentially all trees are cut, producing a fully exposed microclimate for the development of a new age class of trees (Helms 1998).

season, low competition, and exposed mineral seedbeds (Habeck 1992). The average interval between heavy ponderosa pine cone crops is every 4 to 5 years and optimum seed viability is produced by trees 60 to 160 years old (Habeck 1992). Majority of ponderosa pine surrounding proposed openings are 75 to 85 years old, the lower end of the age range at which optimum seed viability is produced.

Opening size. The Deschutes Collaborative Forest Project Steering Committee (2012) recommends the creation of openings at a "range of sizes" in second growth ponderosa pine. Openings are recommended to create early seral conditions and to reduce extent and severity of dwarf mistletoe infection. An additional recommendation is to utilize best available science regarding estimates of historic range of successional class distributions, including the size of each class at the landscape, project and stand scale.

Prior to Euro-American settlement, natural patterns of dry forest structure and composition favored low- or mixed-severity fires (Hessburg et al 2005). Even in low-severity fire regimes, intense fires could sometimes occur, possibly due to longer than normal fire-return intervals that allowed litter and understory fuels to build up, or due to very unusual fire weather, such as strong north winds (Agee 1993). These intense fires would have been one of the natural disturbances that created openings within the historic ponderosa pine forest.

From the scientific literature, it is difficult to determine appropriate patch size reference conditions for openings created by disturbance events in historic ponderosa pine forests. Reported patch sizes are as small as 0.025 – 0.35 hectares[7] (Agee 1998) and as large as several hundred hectares[8] (Agee 1993). Openings of the size proposed with the Rocket project (4 to 12 acres) may be too large to be represented in studies evaluating spatial pattern at the smaller, forest stand scale (Larson and Churchill 2012) and too small to be considered in studies evaluating spatial pattern at the larger, forest landscape scale (Hessburg et al 1999 and Lehmkuhl et al 1994).

Larson and Churchill (2012) report on live tree spatial patterns in fire-frequent forests of western North America. They "exhaustively searched the peer reviewed literature" addressing the smaller, forest stand scale. Pacific Northwest studies reporting spatial reference conditions used plots one hectare[9] or less in size, which are smaller than openings proposed with the Rocket project. Larson and Churchill (2012) state the spatial structure of fire-frequent forests visited by low and moderate severity fires is a mosaic of three elements: openings, widely-spaced single trees, and tree clumps. Of these, they state openings are the most poorly quantified for the following reasons: 1) openings are not explicitly considered, and 2) openings are difficult to delineate.

Hessburg et al (1999) assessed vegetation patterns at the larger, forest landscape scale, reporting on historical and current forest and range landscapes in the interior Columbia River basin. In this assessment, vegetation patches were delineated to a minimum size of 4 hectares[10], which is larger than all but the largest opening proposed with the Rocket project (12 acres). For the landscape surrounding the Rocket project (Southern Cascades ecological reporting unit), the mean historic[11] patch size is 171.5 hectares[12] for the structural stage in which post-disturbance regeneration is occurring (stand initiation). This mean patch size, however, is reported for a landscape which includes a variety of cover types, including lodgepole pine. Mean patch size specific to the ponderosa pine cover type is not reported.

Lehmkuhl et al (1994) also reported on the historical and current conditions forest landscapes in the interior Columbia River basin. Their source of vegetation data was the same as that used by Hessburg et al (1999) however they reported on fewer subwatersheds. In contrast to Hessburg et al (1999), mean patch size for a given landscape is reported by overstory cover type. For the landscape surrounding the Rocket project (Deschutes River basin), the mean historic[13] patch size is 36.8 hectares[14] in the ponderosa pine cover type for

[7] 0.06 to 0.86 acres
[8] Assuming "several" is more than 200 hectares and less than 1000 hectares, this would be between 490 to 2,470 acres.
[9] 2.471 acres
[10] 10 acres
[11] Photos used to delineate historic conditions date from 1943 to 1959 (Hessburg et al 1999)
[12] 424 acres
[13] Photos used to delineate historic conditions date from 1943 to 1959 (Lehmkuhl et al 1994)

the structural stage equivalent to one in which post-disturbance regeneration has occurred (seedling-sapling-pole).

Existing Condition

Proposed openings are located within a landscape dominated by dense (25 percent or more crown canopy cover) stands of ponderosa pine that range in size from 5 to 20.9 inches dbh and are 70 to 90 years old. Within these stands, larger diameter (greater than or equal to 21 inch dbh) older trees (greater than 150 years old) are uncommon, occurring as scattered individual trees or scattered groups of trees. Plantations dating from 1970 to 1985 are scattered throughout the project area. These plantations, approximately 30 to 40 years old, provide some age class diversity within the landscape and provide deer hiding cover patches of varying sizes.

All areas where openings would be created have been previously thinned and consequently are primarily single story. Spatial distribution of trees varies by unit, with the most open stand conditions in units with an objective of mistletoe reduction. Shrub canopy cover, specifically greenleaf manzanita, is high within these more open units. Stocking of trees 21 inches dbh and larger varies by unit. Highest stocking is found in the three openings proposed between Highway 97 and the lava flow: Units 716, 811.3, and 839.2. Two of the three units are located within NNVM. Remaining units have few if any of these larger diameter trees.

Environmental Consequences

Direct and Indirect Effects—Alternative 1

Development of new hiding cover patches will be dependent on disturbance events, such as fire and beetle outbreaks, creating conditions suitable for the development of a new age class of ponderosa pine. The location of these openings would not necessarily be optimal when considering deer movement patterns. Natural regeneration of these openings to ponderosa pine would be unpredictable, being dependent on adequate number of trees surviving the disturbance event and having heavy seed crops and favorable weather during the growing seasons shortly following the disturbance event. It is predictable, however, that shrubs would be successful naturally regenerating within these openings. Ten to twenty years after the disturbance event, shrubs would be dense and tall enough to provide deer hiding cover. While shrubs could provide hiding cover, shrubs would not achieve a height tall enough to provide deer thermal cover.

Direct and Indirect Effects—Alternatives 2, 3, and 4

Removal of all ponderosa pine less than 21 inches dbh will remove essentially all trees within the boundary of the treatment units. This removal of trees and the subsequent reduction of shrub canopy cover by mowing and or burning will create conditions suitable for the development of a new age class of ponderosa pine. The location of these openings is based on the need to promote the use of the highway undercrossings and to improve conditions in the deer winter range. Planting would assure a sufficient number of trees become established to provide future hiding cover for deer. Ten to twenty years after planting, trees will have grown to a height of at least six feet and openings would begin to provide deer hiding cover (Deppmeier 2006). These patches could continue to provide hiding cover for at least an additional 10 to 30 years, as evidenced by older plantations within the project area. After 30 to 40 years, trees within these patches will be approaching or have achieved a height of at least 30 feet, the recommended height for thermal cover. Alternative 4 provides the most openings, and Alternative 2 the least. Refer to the Silviculture Specialist's Report for details on each of the proposed openings.

Cumulative Effects – Alternatives 2, 3, and 4

In the ponderosa pine biophysical environment (65,626 acres) of the Rocket HRV analysis area (113,359 acres), openings have been created by Oz (a past project) and are proposed with West Bend (an ongoing project). The Oz project created 13 openings totaling 34 acres, ranging in size from 1 to 4 acres. Six of the

[14] 91 acres

openings, totaling 11 acres, are located within the Rocket project area. The West Bend project would create 44 additional openings in the HRV analysis area, with openings totaling 204 acres and ranging in size from 0.4 to 14 acres.

Openings proposed with Rocket in combination with these other projects total between 260 acres (Alternative 2) to 299 acres (Alternative 4). This range of acreage is less than one percent (0.40 – 0.46%) of the ponderosa pine biophysical environment. The combined increase in early seral structure will be too small to change the proportion of early seral structure within the HRV analysis area (refer to HRV section which begins on page 108), which is currently below HRV (see Figure 41).

Consistency with Management Direction

Creation of openings outside NNVM. Within deer habitat, created opening will allow for the regeneration of new cover stands, which is one of the appropriate uses of timber harvest in this management area (M7-3). Within scenic views, created openings will provide a desired visual component (M9-4), introducing visual diversity into a landscape where it is lacking (M9-5). Within general forest, while uneven-aged management is the preferred silviculture system (M8-7), level of dwarf mistletoe infection precludes its use where created openings are proposed. Use of even-aged regeneration harvest as proposed follows a management strategy described for general forest, multi-storied, single-species stands with moderate to heavy dwarf mistletoe infection (Deschutes LRMP, Page 4-39, Table 4-29).

Creation of openings within NNVM. Created openings will result in patches of regeneration being scattered within a landscape dominated by single-story immature ponderosa pine, providing some diversity within the forest. In describing conditions that result in "historic" fire-based ponderosa pine old growth, the NNVM management plan states while the characteristic open and "park like" stand conditions is common over the landscape, the ponderosa pine forests do not lack diversity. Unburned islands of regeneration are scattered over the landscape and mid- and late-successional stages are evident (NNVM Management Plan p. 24). Within the NNVM Lava Butte Zone, openings will provide some deer hiding cover within a landscape in which fire will be reintroduced and the development of historic, fire-based ponderosa pine old growth will be fostered (NNVM S&G LZ-1). Openings will enhance wildlife habitat (NNVM S&G M-8) and will provide for habitat diversity (NNVM S&G M-10). While the use of natural regeneration is preferred over planting within NNVM, planting will be done with species that are ecologically adapted to the site (NNVM S&G M-11). Use of the even-aged regeneration method will meet the resource objective of improving deer hiding cover (NNVM S&G M-17).

Opening Size. Sizes of all proposed openings are consistent with the Deschutes LRMP standard and guidelines for openings (Table 41). The largest openings, 8 and 12 acres in size, would be located within the General Forest management area and would be less than half the 40 acre size limit described in the LRMP. These largest openings are proposed to both improve hiding cover and reduce mistletoe infection. Smaller openings 4 to 5 acres in size would be a suitable size for providing visual screening for deer. The smallest opening, 3 acres in size, would be slightly smaller than the size described in the LRMP as suitable for providing visual screening.

Table 41. Deschutes LRMP Standards and Guidelines pertaining to created opening size.

Opening Size	Deschutes LRMP Standard and Guidelines
0.25 to 5 Acres	Created opening size range in ponderosa pine foreground partial retention (M9-10).
0.5 Acres	Minimum clump size for providing visual screening in denser black bark stands (WL-59).
0.5 to 2 Acres	Usual group size where the silvicultural system being used is uneven-aged management with group selection (TM-16).
4 – 5 Acres	Suitable clump size for providing visual screening for deer in more open black bark pine stands (WL-59).
6 – 7 Acres	Maximum group size, found in rare cases, where the silvicultural system being used is uneven-aged management with group selection (TM-16).

Opening Size	Deschutes LRMP Standard and Guidelines
6 Acres or larger	Suitable stand size for deer hiding cover if average height is 6 feet and stand has not been thinned in 15 years (WL-54).
40 Acres	Maximum opening size using even-aged silviculture in ponderosa pine (TM-58)

Culmination of Mean Annual Increment (CMAI). Tree growth within stands planned for regeneration harvest has generally reached culmination of mean annual increment, which is defined as the age required to achieve volume production equivalent to at least 95 percent of CMAI (USDA FS 2006). Managed yield tables developed for the Deschutes National Forest ponderosa pine working group (USDA FS 1990) indicate within the Fort Rock strata, 95 percent of CMAI occurs between the age of 55 and 75 years. Stands proposed for regeneration harvest are 70 to 90 years old and diameter growth is slowing.

Assurance of adequate restocking following final regeneration harvest. With the proposal to plant trees, control gopher populations within openings, and minimize shrub competition around planted seedlings, there is reasonable assurance of adequate restocking following final regeneration harvests. This can be observed in the Rocket project area within openings similar to those being proposed that have been successfully regenerated.

Historic Range of Variability and Late and Old Structure

Introduction

Purpose and need. An identified purpose and need for this project is to move the proportion of structural stages on the landscape closer to the historic range of variability (HRV). Past thinning has placed some mid-seral stands on a trajectory towards becoming late and old structure (LOS). This trajectory, however, can be adversely affected by slowing diameter growth rates, mortality from beetles, and high intensity and/or stand-replacing wildfires. The purpose of this project is to maintain or accelerate that trajectory in previously thinned stands, start it for those not previously thinned, and for some stands, hasten the process by reducing stand densities to LOS stocking levels. Another purpose and need is to improve deer habitat, specifically hiding cover, since much of the project area is black-bark ponderosa pine which provides little hiding cover for deer.

Treatments to meet purpose and need. All action alternatives propose thinning treatments to move towards historic conditions for LOS, and propose creating openings (followed by planting) to promote new patches of deer hiding cover. Alternative 2 proposes the most extensive use of 40 BA thinning, which would reduce tree densities to approximately LOS stocking levels (see "Key Issue: Tree stocking after thinning"). Thinning and creating openings would be accomplished primarily through timber sale contracts or similar contracts that include removal of commercial timber. A portion of acres proposed for thinning are within areas classified as LOS, with timber harvest acres in LOS varying by alternative (see Table 11). Alternative 3 treats the fewest acres of LOS through timber sales, foregoing much of the thinning in these areas to retain existing dense forest conditions. Alternative 4 not only treats the most acres of LOS, but treats the most acres through timber sales. LOS areas proposed for treatments are primarily in the ponderosa pine biophysical environment, except for a small amount in the mixed conifer wet biophysical environment (see Appendix A of the Silviculture Specialist's Report). No alternative would create openings in areas classified as LOS (Silviculture Report Appendix A).

Forest Plan Amendment. The Eastside Screens Interim wildlife standard states timber harvest activities are not to be allowed within "LOS stages that are below HRV". This project proposes a site-specific amendment to allow timber harvest in LOS stages that are currently below HRV (see pages 36 and 125). The amendment would not, however, change Eastside Screen direction to retain live trees greater than or equal to 21 inches dbh.

Spatial Scale of Analysis

Figure 35 displays the Rocket HRV analysis area, its two associated watersheds, and past and ongoing projects located within these watersheds. The HRV analysis area totals 113,350 acres. The majority of the Rocket project is within the North Unit Diversion Dam – Deschutes River watershed. The southern portion of the project extends slightly into the Lower Little Deschutes River watershed and is entirely within the Sugar Pine Butte – Little Deschutes River subwatershed. The HRV analysis area includes those portions of the Deschutes River watershed and the Little Deschutes River subwatershed under federal management, including all allocations and 25,660 acres of the Newberry Monument. The HRV analysis area excludes the following: 1) land in the city limits of Bend, 2) other private lands, and 3) land owned by the state of Oregon, all of which is lava-covered. The HRV analysis area encompasses all or portions of past projects (Lava Cast, South Bend HFRA, and Sunriver HFR) and much of an ongoing project (West Bend).

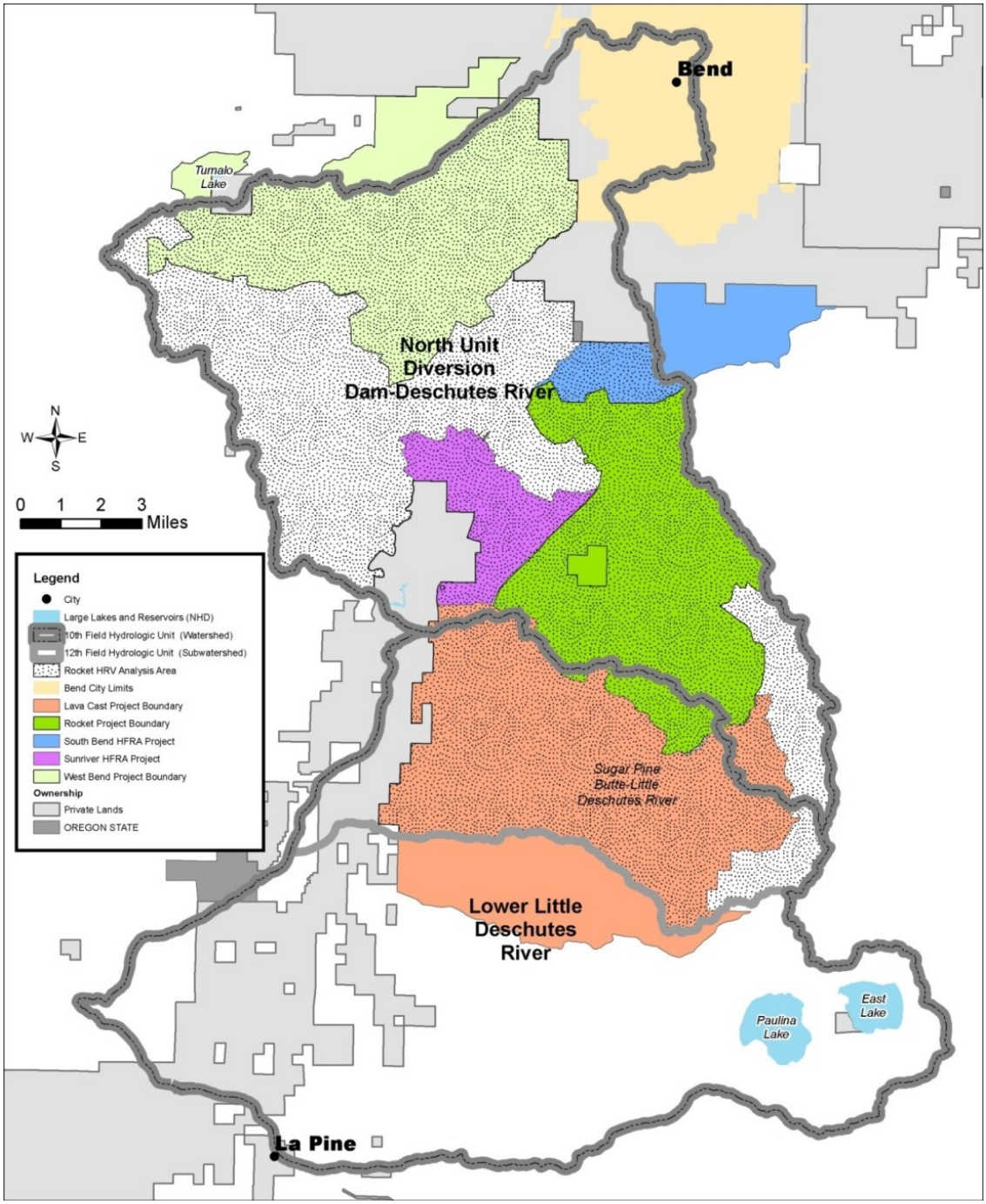


Figure 35. Map showing Rocket HRV analysis boundary and its relation to watershed boundaries and projects.

Methods

Biophysical Environments. The Eastside Screens interim ecosystem standard directs a proposed timber sale and its associated watershed be characterized for patterns of stand structure by biophysical environment. To facilitate assessing cumulative effects, biophysical environments used in this analysis are the same as

those used in the West Bend project and are based on a recent, raster-based data set[15] of potential vegetation subzones that makes use of plant associations described for the eastside of the Cascade Mountain Range in Oregon (Simpson 2007). The biophysical environments combine a number of the vegetation subzones, with the grouping informed by a historic timberland type map and a polygon-based map[16] of plant association groups which combine plant associations described by Volland (1985).

1) **Historic timberland type map (**Figure 36**).** Historic timberland types mapped in the 1930s (Harrington 2003) show vegetation conditions relatively close to the time when fire began to be excluded from the landscape. This mapping shows much of the HRV analysis area dominated by ponderosa pine. Other tree species such as lodgepole pine or white fir, if present, would have been less than 20 percent of the standing volume (Harrington 2003b). Lodgepole pine is the next most common vegetation type, present in the southeast and northwest portions of the analysis area.

2) **Vegetation classifications based on potential vegetation (**Figure 37and Figure 38). The following two vegetation classifications are based on potential vegetation that would occupy a site in the absence disturbance, including fire. Maps created using these classifications show varying potential in the analysis area for mixed conifer to occur more extensively than it did historically when fire was a common disturbance agent.

   a) **Plant association groups (Figure 37).** Displays Central Oregon pumice zone plant associations (Volland 1985) combined into PAGs by their climax species, site potential, and temperature and moisture similarities. Similar to the historic timberland type map, the dry ponderosa pine PAG dominates the central portion of the analysis area and lodgepole pine dominates the southeastern portion of the analysis area (Figure 37). In contrast to historic mapping, this mapping shows potential wet mixed conifer vegetation in the northwest portion of the analysis area and dry mixed conifer vegetation in the southeast.

   b) **Biophysical environments with underlying vegetation subzones (Figure 38)**. Displays biophysical environments for the HRV analysis area and some of the underlying vegetation subzones (See Appendix C of Silviculture Report for complete list of vegetation subzones grouped into biophysical environments). The vegetation subzone data set (USDA Forest Service 2013a) is based on plant associations described for the eastside of the Cascades Mountain Range in Oregon (Simpson 2007). Similar to PAGs, vegetation subzones also group plant associations together by site productivity and disturbance regimes.

      - **Ponderosa Pine Biophysical Environment:** The one ponderosa pine biophysical environment used in this analysis combines ponderosa pine vegetation subzones[17] and the mixed conifer dry subzone from this data set. In the central portion of the analysis area, this grouping closely approximates the historic extent of ponderosa pine (Figure 36) and the PAGs based on Volland's plant associations (Figure 37) and likely had similar fire regimes historically. In the Rocket area, ponderosa pine is the dominant species, with lodgepole pine occasionally found as individual, scattered trees or in groups. This biophysical environment totals 65,626 acres of the HRV analysis area.

      - **Mixed Conifer Wet Biophysical Environment:** In the southeast portion of the Rocket area, the mixed conifer wet biophysical environment (Figure 38) is more extensive than the combined area shown as either mixed conifer dry or wet PAGs (Figure 37). Differing thresholds for classifying vegetation based on species composition, moisture gradients and temperature gradients contribute

[15] A Deschutes National Forest raster-based map data set (USDA Forest Service 2013a) generated from satellite data and imputed field data.
[16] A Deschutes National Forest polygon based map data set (USDA Forest Service 2012) generated from interpretation of aerial photos with some field validation.
[17] Vegetation Subzones include: (1) xeric, dry, and moist ponderosa pine and (2) ponderosa pine with lodgepole pine.

to the difference between the two potential vegetation classifications. This biophysical environment totals 27,569 acres of the HRV analysis area.

Differing thresholds used to identify vegetation series (i.e. ponderosa pine, mixed conifer, and lodgepole pine) has contributed to a more extensive mapping of mixed conifer potential vegetation compared to the mapping of PAGs based on Volland (1985). For an area to be classified into the white fir (mixed conifer) series using Volland (1985), the described threshold is at least 5 percent white fir canopy cover in both the overstory and understory layers. While Simpson (2007) identifies a threshold of 10 percent in any canopy layer, a lower threshold of 1 percent canopy cover in any layer was used in developing the vegetation subzone data set (Simpson 2013, personal communication). This lower threshold was used to account for past disturbances (such as fires or past harvest) that may have reduced the occurrence of white fir/grand fir.

Differing thresholds for classifying moisture regimes also contributes to a more extensive mapping of mixed conifer wet potential vegetation. The vegetation subzone data set using Simpson's plant associations more finely delineates environmental gradients, including moisture and temperature. Within the Rocket area, a subzone in the mixed conifer wet biophysical environment includes the white fir/grand fir/princess pine plant association. This association is one of the drier plant associations within the biophysical environment and could be considered transitional from the mixed conifer dry subzone (which was grouped into the ponderosa pine biophysical environment) to the mixed conifer wet subzone. This association was included in a mixed conifer wet subzone to reflect the increase in productivity and stockability of ponderosa pine compared to the subzones associated with drier and warmer conditions. Within the Rocket area this plant association likely had more frequent fire historically than if the project area was dominated by sites with more moisture. In addition the lava flows in the area seem to attract more lightning than areas further from the lavas. These factors would have favored a higher percentage of ponderosa pine and a higher percentage of open large structure on the mixed conifer wet sites in Rocket than an average mixed conifer wet site as shown in the HRV Table 43.

Within the Rocket area, this biophysical environment can be dominated by ponderosa pine or a mixture of ponderosa pine and lodgepole pine. White/fir can be present as individual trees or in groups, and can become the dominant species on north facing aspects.

Stand Structure Classifications. To facilitate assessing cumulative effects, this analysis uses the same method as the West Bend project to classify stand structure. The West Bend method uses the five successional stage classifications used by LANDFIRE for determining Fire Regime Condition Class (Table 42). The LANDFIRE classifications include three broad references to stand age (early successional, mid-successional, and late-successional) and two broad references to canopy cover (open and closed). Implicit to the classification referencing age is tree size. Early successional stands are characterized as having seedling to sapling sized trees, late-successional stands as having large diameter trees, and mid-successional stands are characterized as having tree sizes in between those associated with early and late successional. The distinction between the open and closed successional stages is based on canopy cover and varies by potential vegetation group. Eastside Screens *structural stages* equivalent to the LANDFIRE *successional stages* are displayed in Table 42 on the following page.

Table 42. Cross-walk between three stand structure classification methods.

LANDFIRE Successional Stage	Viable Ecosystem Size	Eastside Screens Structural Stage
Early Successional	Grass/Forb/Shrub Seedling/Sapling (.1 – 4.9”dbh)	Stand Initiation
Mid-successional, closed	Poles (5.0 – 9.9” dbh) Small (10.0 – 14.9” dbh) Medium (15.0 – 19.9” dbh)	Stem Exclusion: Open Canopy Stem Exclusion: Closed Canopy Understory Reinitiation Multi-stratum, without large trees
Mid-successional, open		
Late-successional, closed	Large (20.0 – 30.0” dbh)	Late and Old Structural (LOS) Stages • Multi-stratum, with large trees • Single-stratum, with large trees
Late-successional, open		

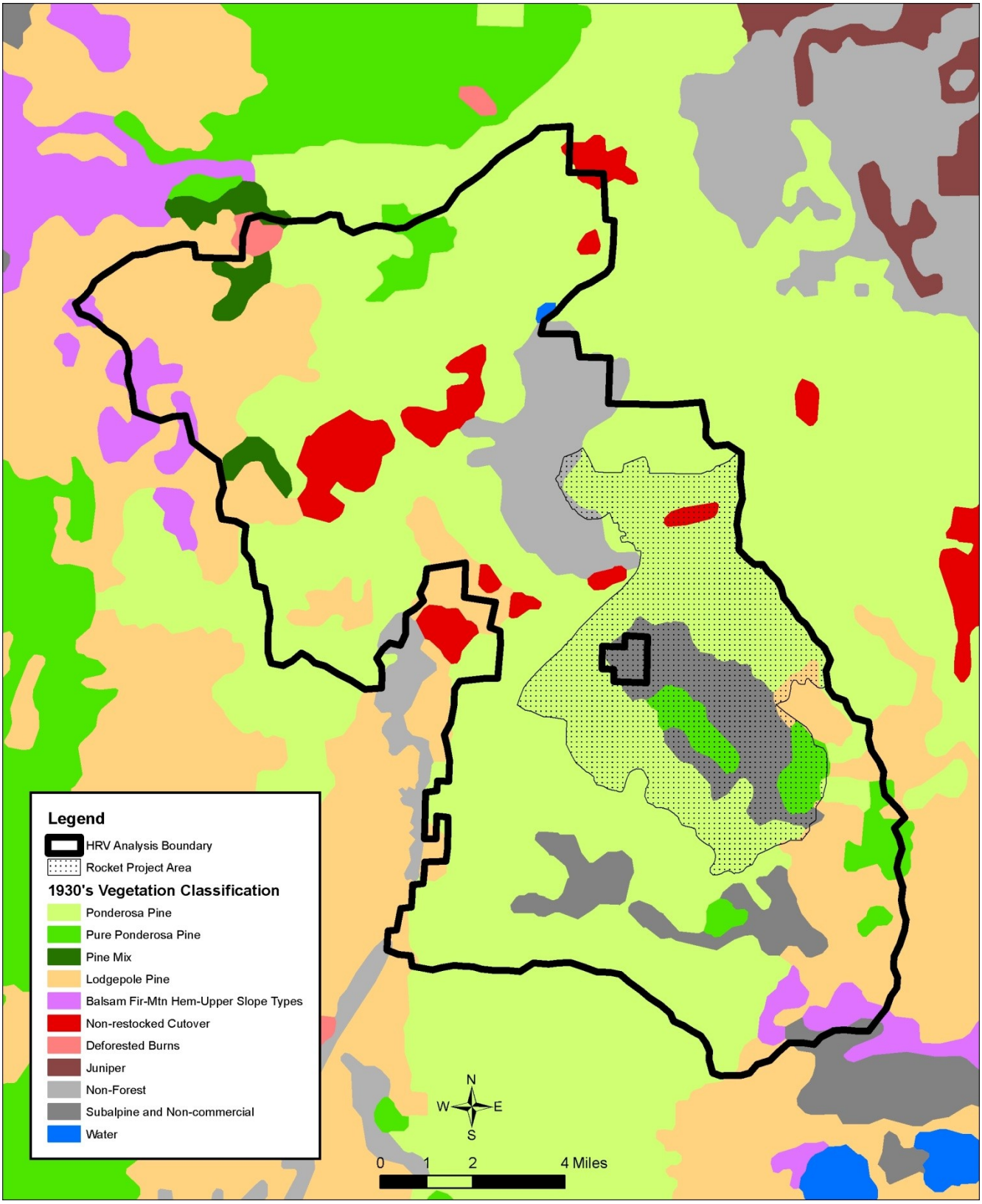


Figure 36: Rocket HRV analysis boundary and forest types mapped in 1930 (Harrington 2003).

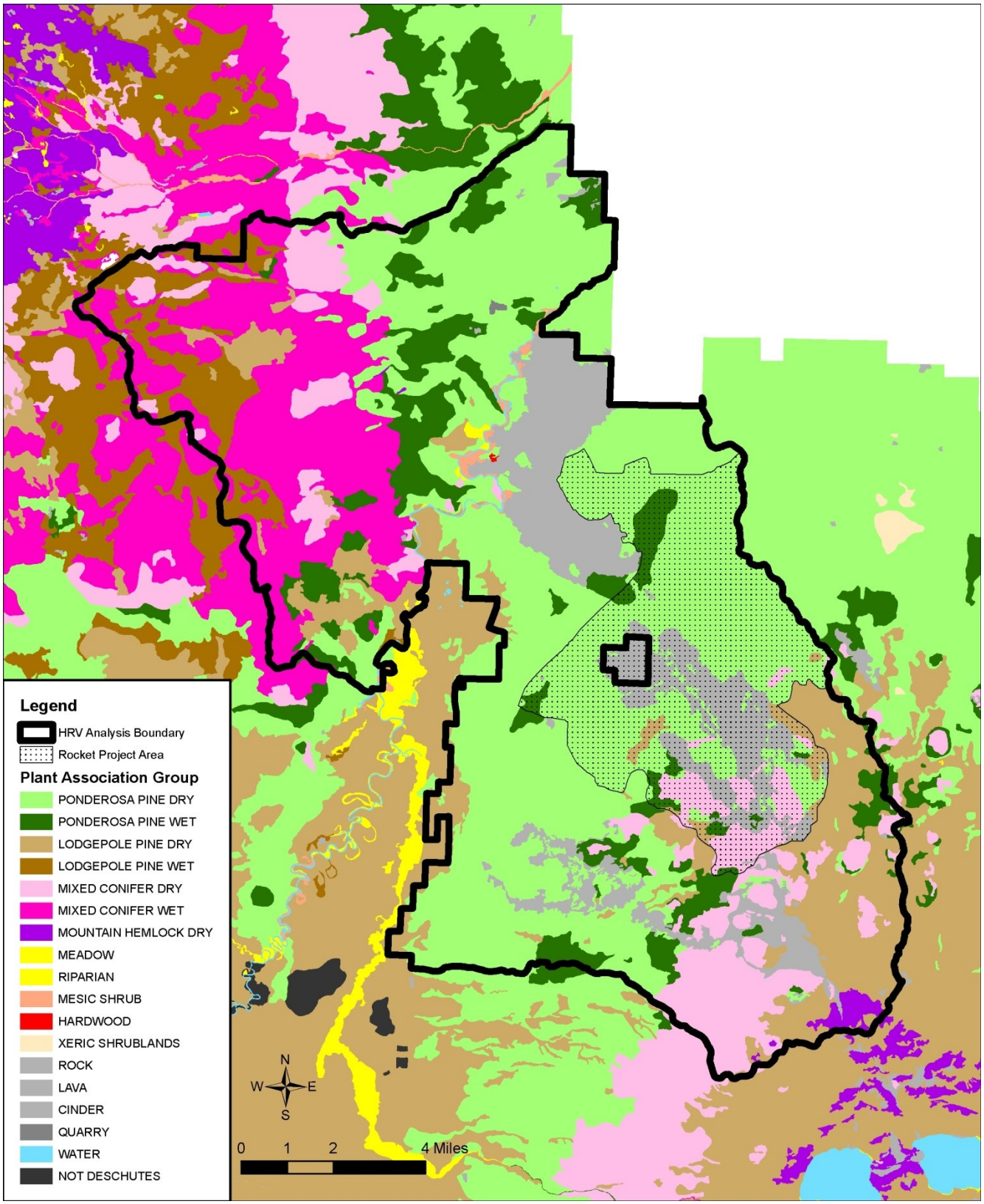


Figure 37: Rocket HRV analysis area and plant association group (Volland 1985).

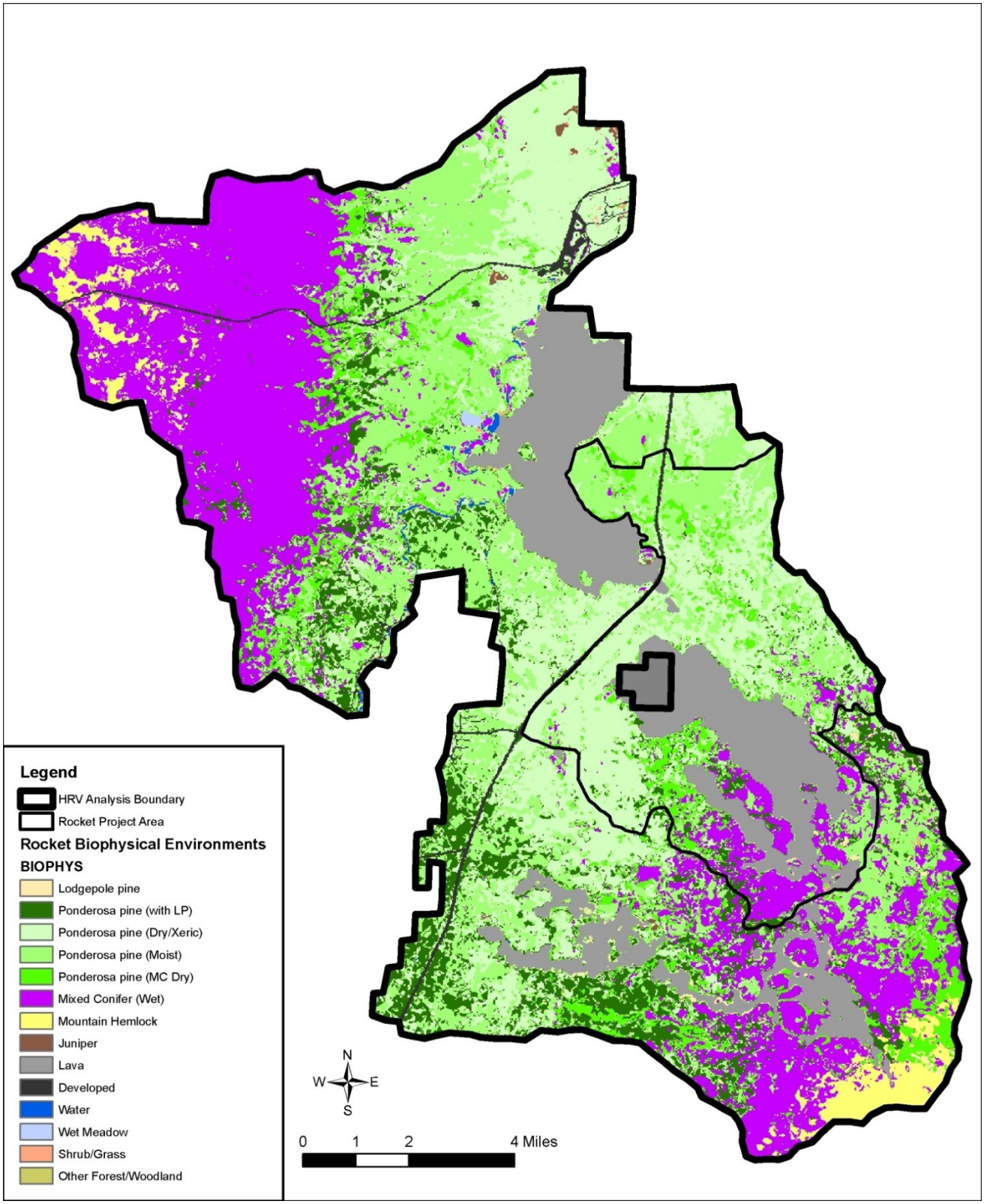


Figure 38: Rocket HRV analysis boundary and associated biophysical environments used in HRV analysis.

Existing structure classification. This analysis uses a Deschutes National Forest data set (USDA Forest Service 2013a) constructed from: 1) data collected in 2009 and 2010 using Lidar technology, and 2) Viable Ecosystems, a vegetation model used to classify Lidar derived data into size and open/closed canopy [18] classifications. The Viable size and cover classifications were grouped into the LANDFIRE successional stages (Table 42). The large viable size class was grouped into one of the LANDFIRE late-successional stages if 40 contiguous acres of the large size class were present. Where contiguous acres were less than 40 acres, this size class was grouped into one of the LANDFIRE mid-successional stages. The 40-acre size threshold is based on the lowest end of the typical size range for ponderosa pine old growth conditions (Hopkins et al. 1993).

Figure 39 shows a 2012 aerial image of the HRV analysis area and Figure 40 shows the analysis area classified into the five LANDFIRE successional stages. Patches of early successional stage are easily discernible on the aerial image as are some of the patches of mid-open successional stages.

Post-treatment structure classification. For each action alternative, existing structure classifications were changed to reflect predicted post-treatment structures. Treatments creating openings and enhancing aspen were assumed to create early successional structure. Thinning treatments were assumed to change canopy classification from closed to open with no change in the size classification. Fuels treatments, specifically ladder fuels reduction and underburning, were assumed to not reduce density enough to change existing classification.

Historic Range of Variability (HRV)

Two estimates of HRV (Table 43) are described for the West Bend Project (Powers 2013) and are used in this analysis to compare existing and projected successional stages to historic conditions. Biophysical environments are described on page 108. The Viable HRV, characterized by a Deschutes National Forest ecologist, describes the range of successional stages estimated to be historically present. The FLN HRV, characterized by the Fire Learning Network (FLN), describes one estimated historic condition, rather than a range.

Table 43: Historic Range of Variability

Successional Stage	Biophysical Environment			
	Ponderosa pine		Mixed Conifer Wet	
	Viable HRV	FLN HRV	Viable HRV	FLN HRV
Early Successional	10 – 45%	25%	5 – 36%	15%
Mid-successional, Closed	0 – 10%	5%	22 – 63%	40%
Mid-successional, Open	30 – 87%	25%	10 – 35%	15%
Late-successional, Closed	0 – 7%	5%	12 – 23%	20%
Late-successional, Open	25 – 59%	40%	4 – 10%	10%

For this analysis, successional stages within the mountain hemlock and lodgepole pine biophysical environments are not compared to the historic range of variability. Treatments proposed with the Rocket project would have no effect on these successional stages. None of the mountain hemlock biophysical environment is within the Rocket project area and while there are small patches of the lodgepole pine biophysical environment, no treatments are proposed in these areas with the Rocket project.

Measures

Measure 1: Within the HRV analysis area, proportion of structural stages compared to HRV.

[18] The break between open and closed is at 25 percent canopy cover in dry ponderosa pine, 40 percent in mixed ponderosa and lodgepole pine and dry mixed conifer, and 55 percent in wet mixed conifer.

Measure 2: Within the Rocket project area, proportion of each LOS area stocked at or above the UMZ.

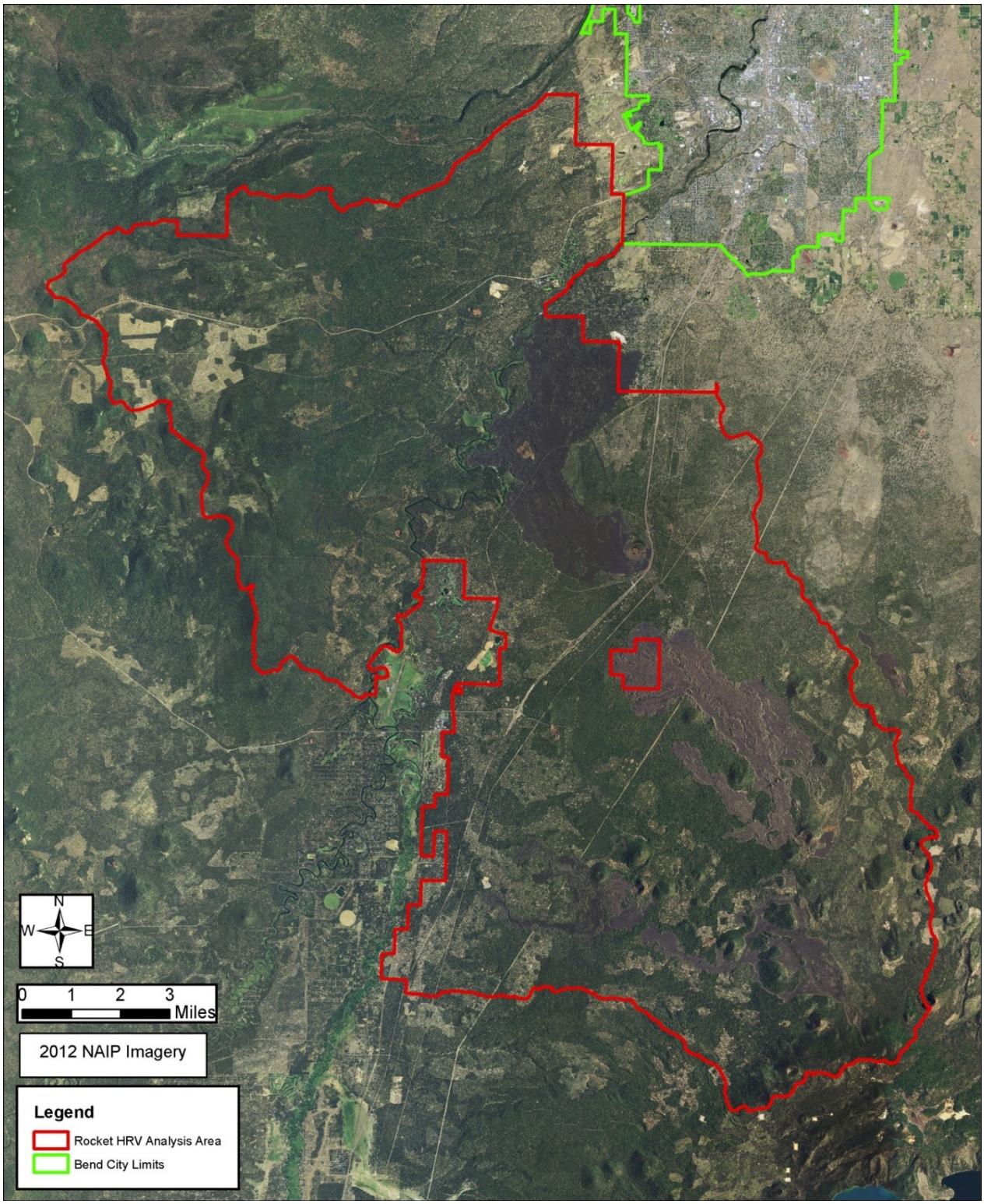


Figure 39: Existing condition of Rocket HRV analysis area as portrayed by 2012 NAIP imagery.

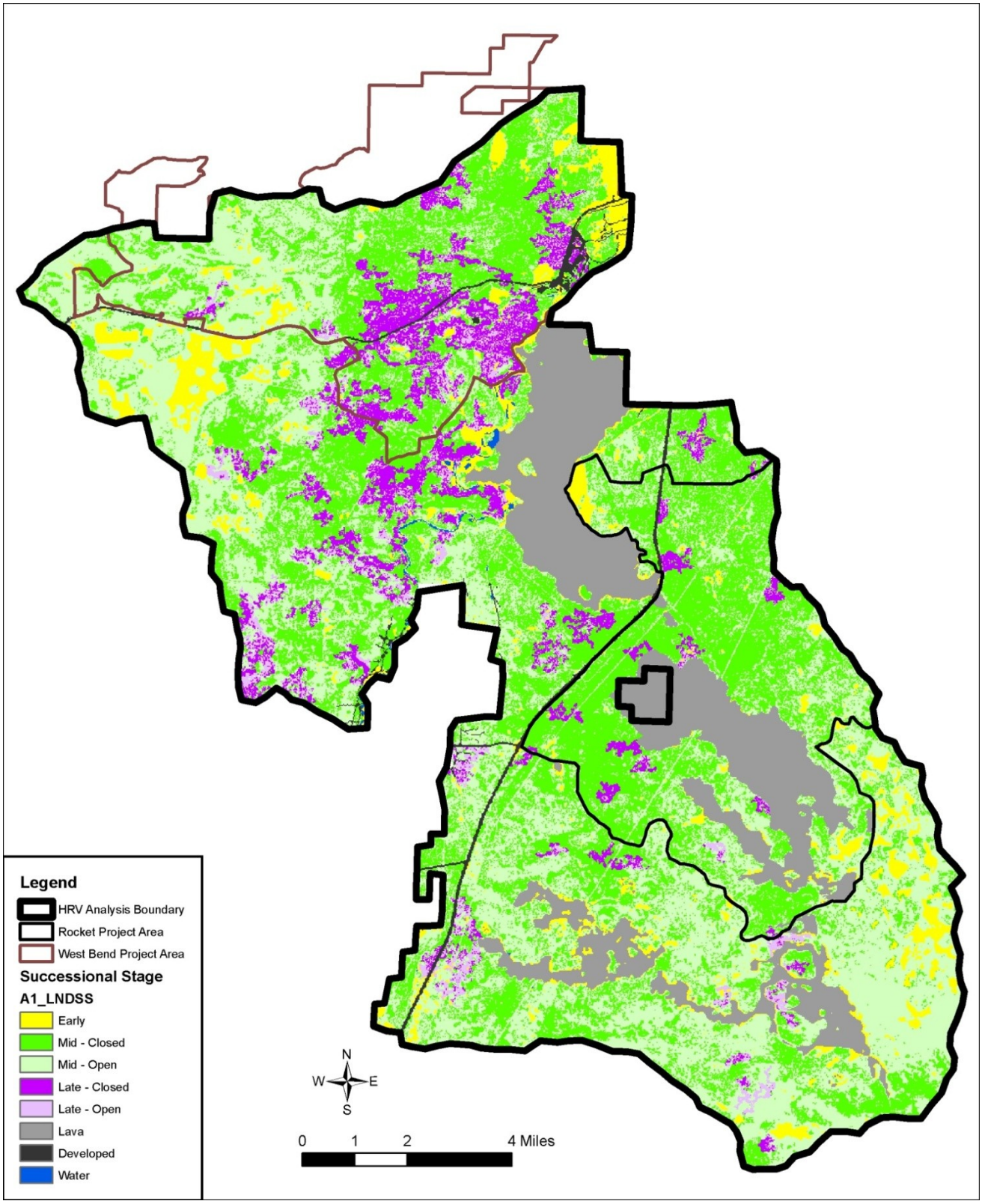


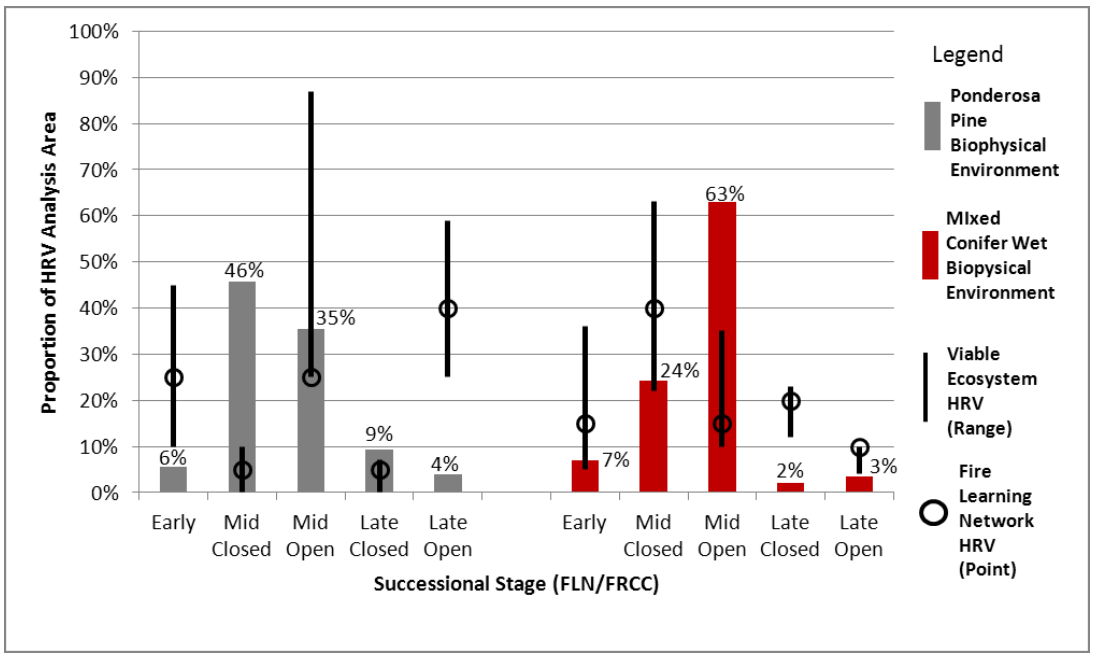
Figure 40: Successional stage condition associated with existing condition and Alternative 1.

Existing Condition

Condition and trends within HRV analysis area. Figure 41 compares the existing proportion of successional stages to HRV. Of the late successional stages, only ponderosa pine closed is above the HRV, and only slightly. Ponderosa pine open and both mixed conifer late successional stages are below HRV, as is the ponderosa pine early successional stage. The ponderosa pine mid-open successional stage is most likely to continue on a trajectory towards late successional conditions and is currently at a level that would be within the HRV of open late successional. In the short term, stand replacement wildfires pose the greatest risk to this successional stage and in the longer term, as densities increase, bark beetles could also pose a risk. The ponderosa pine mid-closed structure is substantially higher than what was present historically. In these dense stands, slowing diameter growth rates, mortality from bark beetles, and wildfires could slow or prevent development into LOS.

The mixed conifer mid-open successional stage is well above HRV, due to a combination of factors including species composition, mortality caused by bark beetles, and a relatively high canopy cover threshold (55 percent) for classification as closed canopy. Lodgepole pine dominates much of the area in the mixed conifer wet biophysical environment, as it did historically (Figure 36), and it has relatively small crown diameters compared to similarly sized ponderosa pine or white fir. Depending on existing species composition and future disturbance events, there could be multiple trajectories for these mid-open successional stages, but these trajectories will likely be away from mixed conifer wet, late successional conditions.

Figure 41: Existing proportion of successional stages in the ponderosa pine and mixed conifer biophysical environments compared to Historic Range of Variability (HRV).



Density within LOS areas in the Rocket project area. Many of the areas classified as LOS have tree densities favorable for bark beetle outbreaks. Densities exceed 130 SDI on 76 percent of the LOS acreage, and exceed 200 SDI on 37 percent of the acreage (Figure 42, Alternative 1). SDI values of 130 and more exceed the upper management zone for all LOS areas located outside of NNVM, and SDI values of 200 and more exceed the upper management zone for both LOS areas within NNVM (Figure 30).

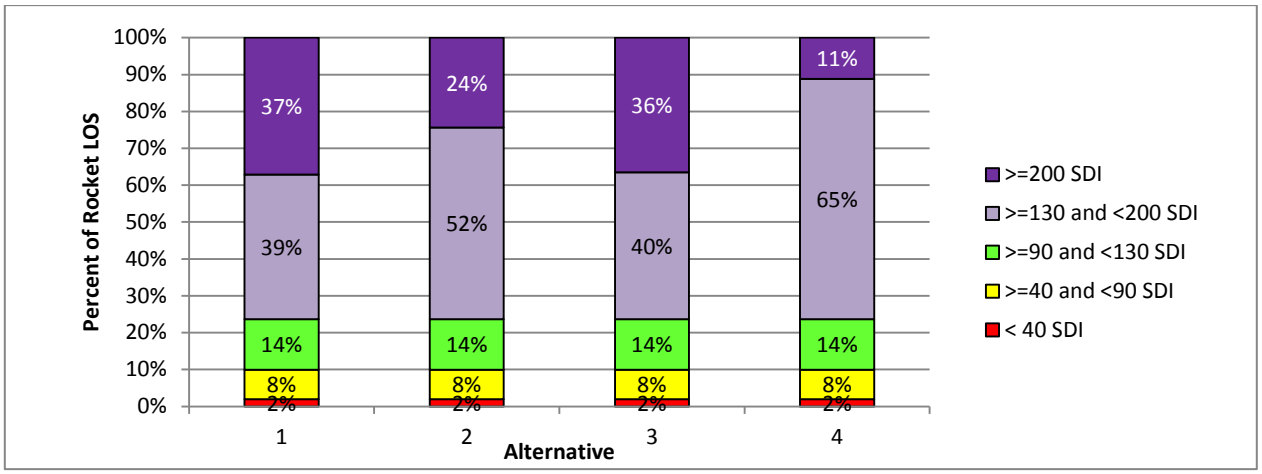
Environmental Consequences

Direct and Indirect Effects—Alternative 1

Condition and trends within HRV analysis area. The existing condition would not change in the short term. Early successional stages in the ponderosa pine biophysical environment would continue to be below HRV. The mid-open ponderosa pine successional stage would be most likely to continue on a trajectory towards late successional conditions. Until trees in this successional stage achieve diameters associated with late successional conditions, late-open conditions will continue to be less than what was present historically.

Density within LOS areas in the Rocket project area. Stand density within many of the areas classified as LOS would remain at levels vulnerable to bark beetle attacks. Areas exceeding the upper management zones identify where mortality from mountain pine beetle could become serious. If an outbreak of mountain pine beetle occurs, up to half the trees and up to 67 percent of the current basal area, mostly in the largest trees, could have expected mortality (Barrett 1979).

Figure 42: Rocket LOS areas - Proportion of five stand density classes (SDI) by alternative.



Direct, Indirect, and Cumulative Effects—Alternatives 2, 3, and 4

Figure 43 and Figure 44 (Alternative 2), Figure 46 and Figure 47 (Alternative 3), and Figure 49 and Figure 50 (Alternative 4) compare to HRV the successional stages associated with Rocket action alternatives separately and in combination with West Bend Alternative 3. Spatial arrangement of successional stages is shown in Figure 47, Figure 50, and Figure 53.

Conditions and trends within HRV analysis area. Alternatives 2, 3, and 4 would create between 22 to 61 acres of openings with the amount varying by alternative (see section of report addressing the key issue associated with openings). Openings would increase the amount of ponderosa pine early successional stage, but increases for all alternatives would be too small in the context of the HRV analysis area to cause the proportion of this successional stage to increase from the existing condition. Within the late open and late closed structural stages, the large tree component (trees > 21" dbh) is generally about 130 years old, which would be considered "mature" although some of the large trees could be younger or older.

Proposed thinning outside LOS would reduce the amount of ponderosa pine mid-closed successional stage by 4 to 9 percent, with the least decrease associated with Alternative 3 and the greatest decrease associated with Alternative 4. Even with these decreases, the proportion of ponderosa pine mid-closed successional stages would continue to be well above HRV. With the decreases in mid-closed, the proportion of mid-open successional stage would increase and would remain within HRV. In the context of the HRV analysis area, thinning in the mixed conifer successional stages would be too limited in scale to show a change from the existing condition.

Proposed thinning inside LOS would move late successional stages from closed canopy conditions to open canopy conditions on 11 to 435 acres with the least change associated with Alternative 3 and the largest change associated with Alternative 4. In the context of the HRV analysis area, changes associated with Alternatives 2, 3, and 4 would be too small to cause the proportion of late successional stages, either ponderosa pine or mixed conifer, to change from the existing condition.

Density within LOS areas in the Rocket project area. While the Forest Plan amendment would allow thinning to occur within existing LOS areas, the continuing direction to retain trees greater than or equal to 21 inches dbh would limit the extent to which densities could be reduced. Projections show the densest stand conditions being reduced to 11 to 36 percent (Figure 42), with the greatest decrease associated with Alternative 4 and the least decrease associated with Alternative 3. There would be little change, however, in the proportion of the LOS areas exceeding 130 SDI and bark beetles still could pose a risk. Thinning would however reduce ladder fuels and crown continuity, increasing resiliency to stand replacing wildfire.

Cumulative Effects – Alternatives 2, 3, and 4

Ponderosa pine biophysical environments. West Bend treatments in combination with Rocket treatments would further change the proportion of mid-closed and mid-open successional stages, however the proportions of each would remain above and within HRV, respectively. While there would be no change in the proportion of late successional stages with the Rocket treatments, in combination with West Bend there would be a three percent decrease in late closed, moving this successional stage from slightly above HRV to within the HRV. There would be a corresponding three percent increase in the amount of late open, with the changed proportion of this successional stage still well below HRV.

Mixed conifer wet biophysical environments. Rocket treatments would not change the existing proportion of successional stage in the mixed conifer wet biophysical environment, but changes would occur in all successional stages when considering the West Bend treatments. The early successional stage would increase by 5 percent and would remain within the HRV. A decrease in the mid-closed successional stage would change this condition from being within HRV to being slightly below HRV. The amount of mid-open would decrease by 2 percent and would still remain well above HRV. In late succession stages, closed canopy conditions would decrease and open canopy conditions would increase.

Consistency with Management Direction – Eastside Screens

Scenario A of the interim wildlife standard applies since one of the ponderosa pine LOS successional stages is below HRV and both mixed conifer LOS successional stages are below HRV.

No net loss of late and old structure (LOS). Rocket alternatives would change LOS canopy conditions from closed to open, but there would be no reduction in the total proportion of late successional stages.

No timber sale harvest activities within LOS stages below HRV. The proposed Forest Plan amendment addressing this direction would allow timber sale harvest activities within LOS.

Maintain all remnant late and old seral and/or live trees greater than or equal to 21 inches dbh. Proposed harvest treatments would retain all live trees greater than or equal to 21 inches dbh.

Manipulate vegetative structure to move it towards LOS. Harvest associated with Alternatives 2, 3, and 4 would move stands towards LOS. Thinning would favor retention of the best, most dominant trees, generally the trees best suited to quickly achieve diameters of at least 21 inches. Reduced stand density will maintain or accelerate tree diameter growth and will reduce conditions favorable for bark beetle outbreak. Accelerated diameter growth and reduced beetle hazard would maintain or accelerate the trajectory towards LOS.

Maintain open, park-like stand conditions where this occurred historically. Harvest associated with Alternatives 2, 3 and 4 would reduce the amount of ponderosa pine, mid-successional closed canopy structures, moving closer to open park-like conditions that occurred historically, and resulting in no net loss of LOS.

Figure 43: Alternative 2 successional stages in ponderosa pine compared to Historic Range of Variability (HRV).

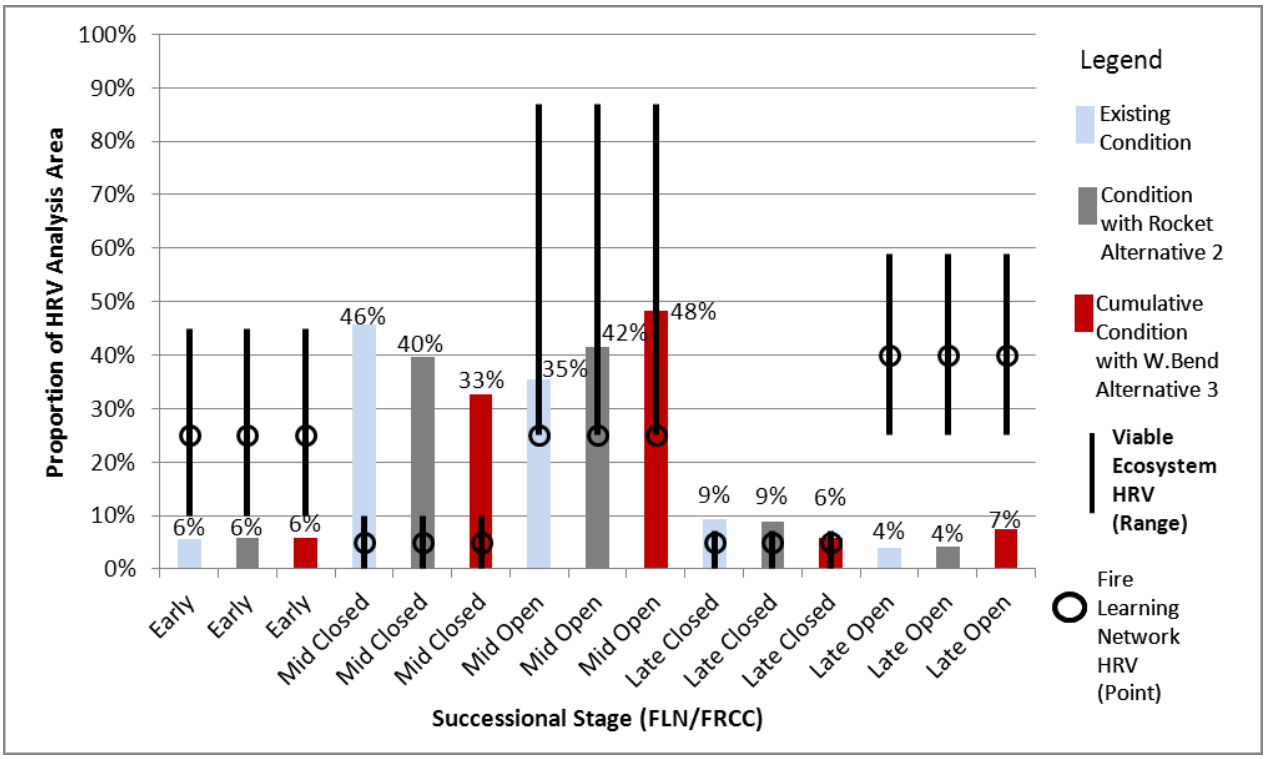
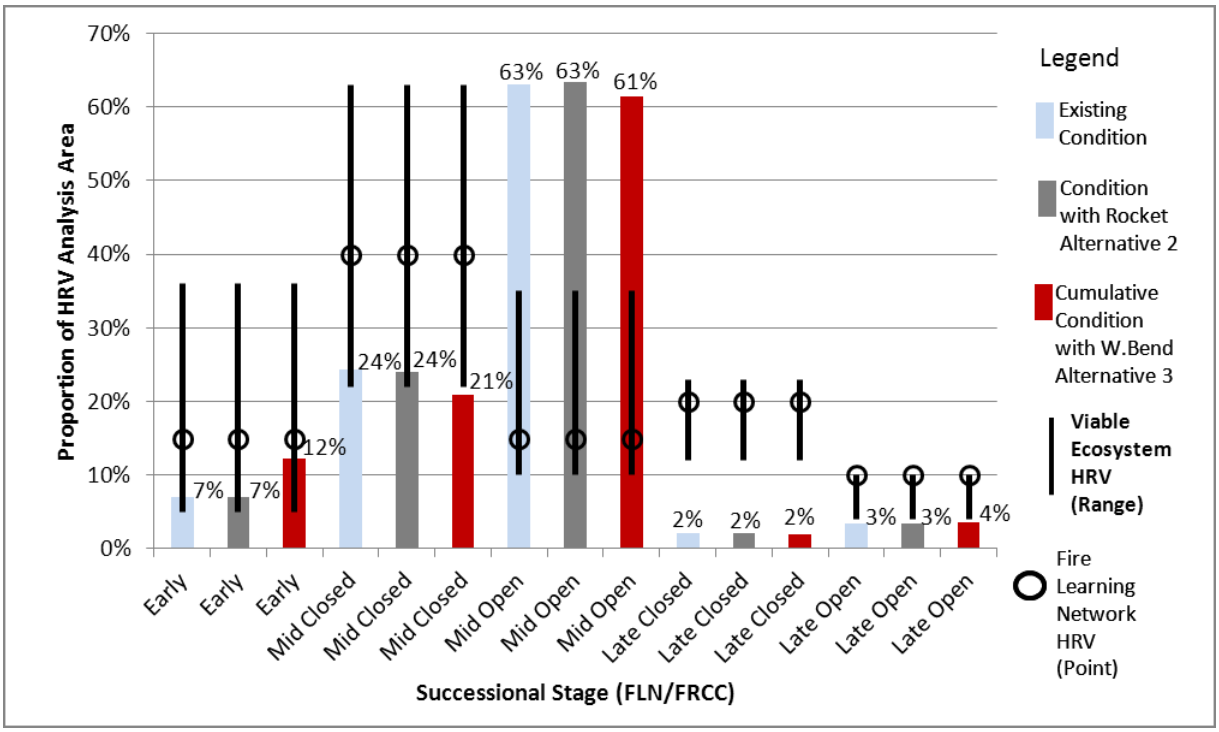


Figure 44: Alternative 2 successional stages in mixed conifer compared to Historic Range of Variability (HRV).



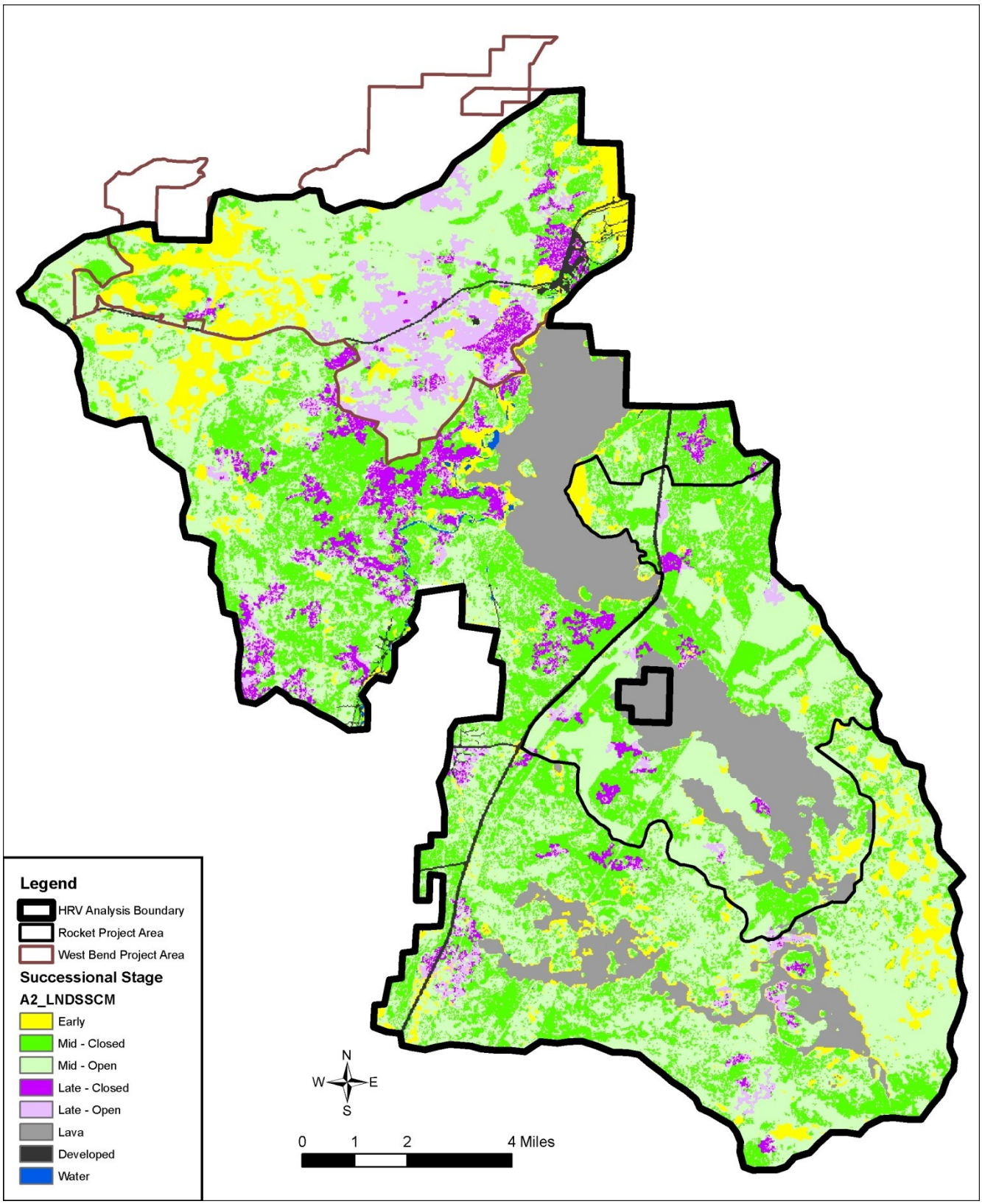


Figure 45: FRCC successional stages associated with Rocket Alternative 2 and West Bend Alternative 3.

Figure 46: Alternative 3 successional stages in ponderosa pine compared to Historic Range of Variability (HRV).

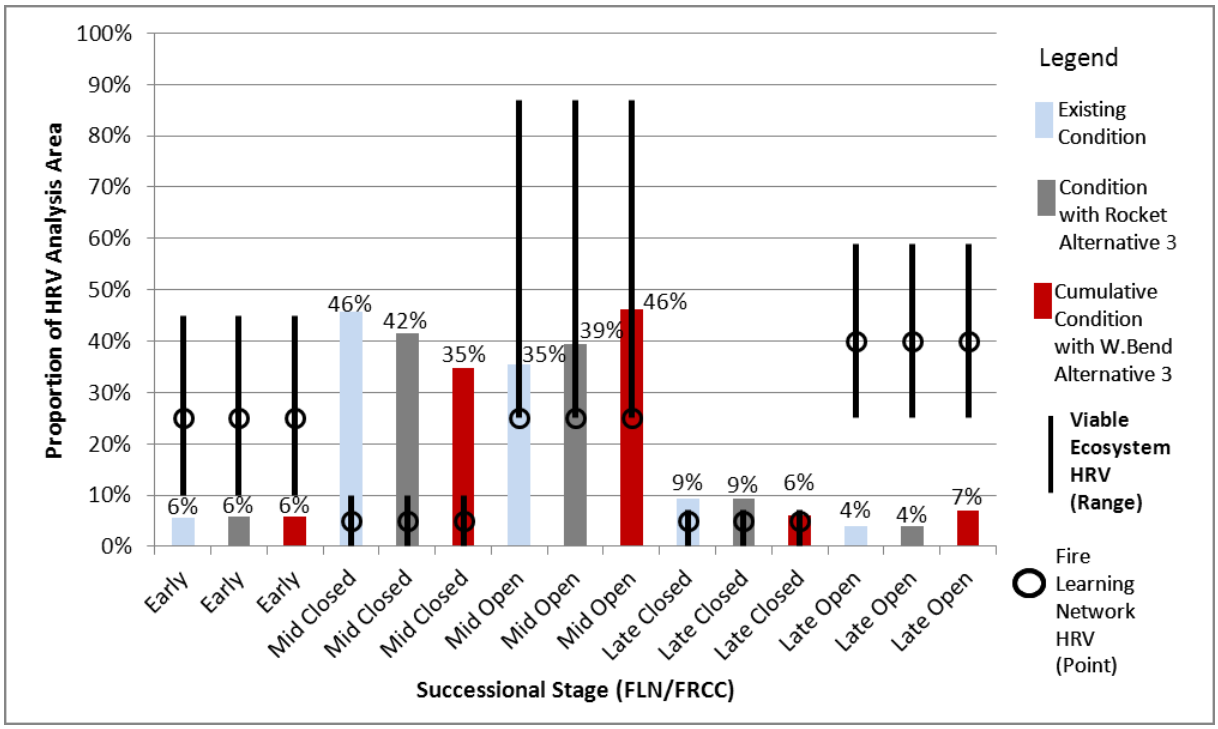
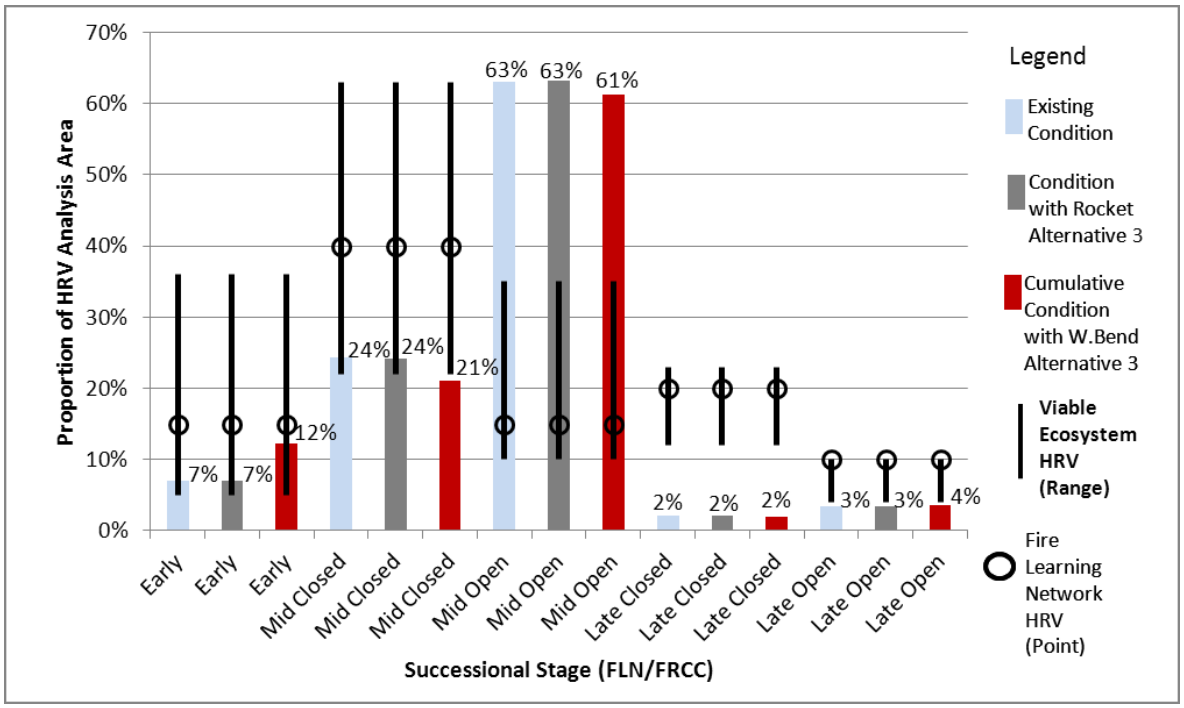


Figure 47. Alternative 3 successional stages in mixed conifer compared to Historic Range of Variability (HRV).



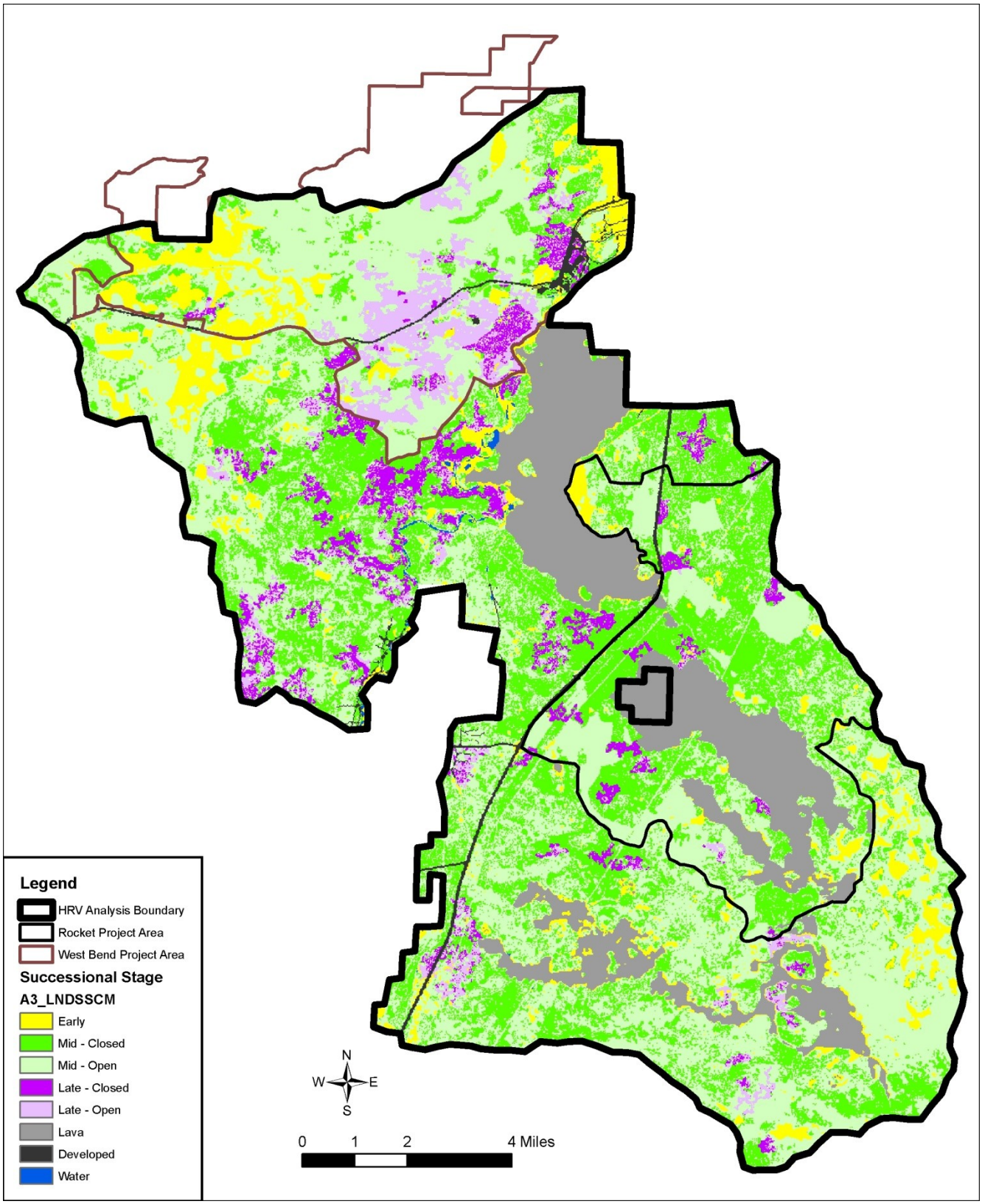


Figure 48: FRCC successional stages associated with Rocket Alternative 3 and West Bend Alternative 3.

Figure 49: Alternative 4 successional stages in ponderosa pine compared to Historic Range of Variability (HRV).

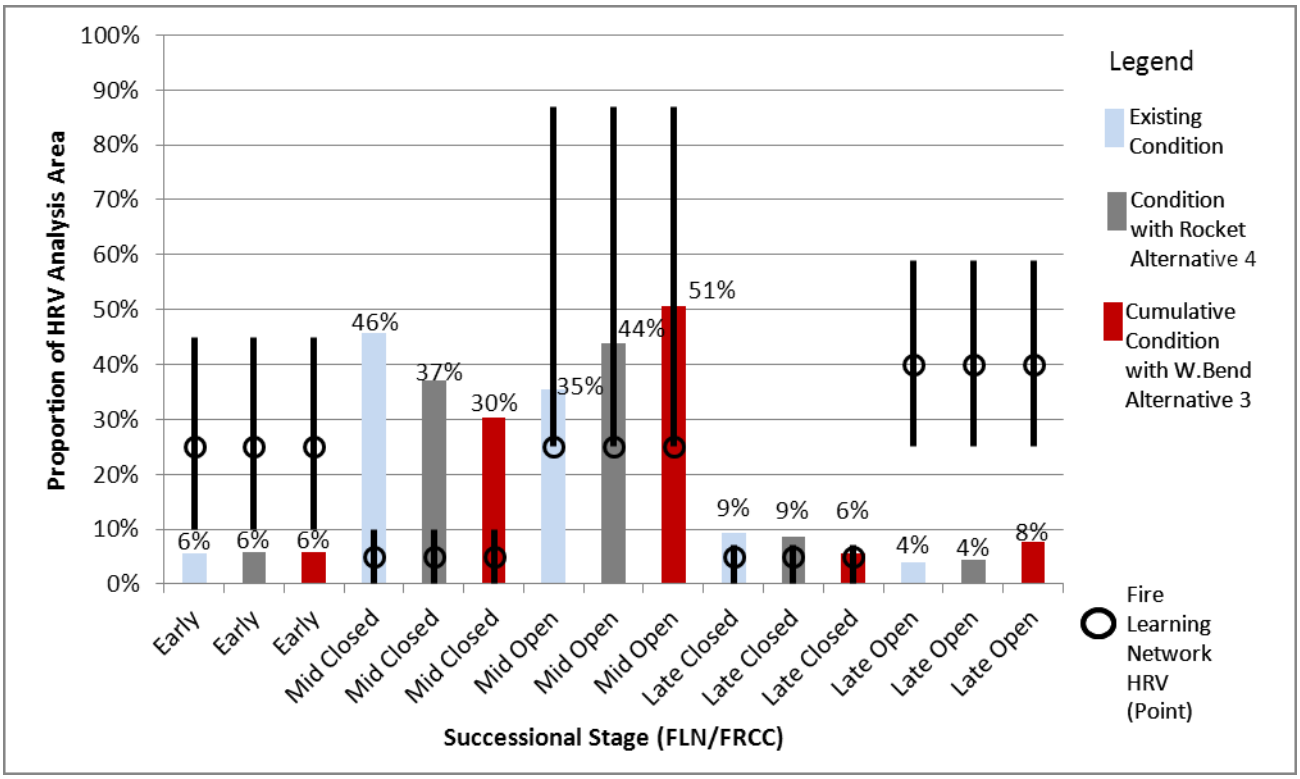
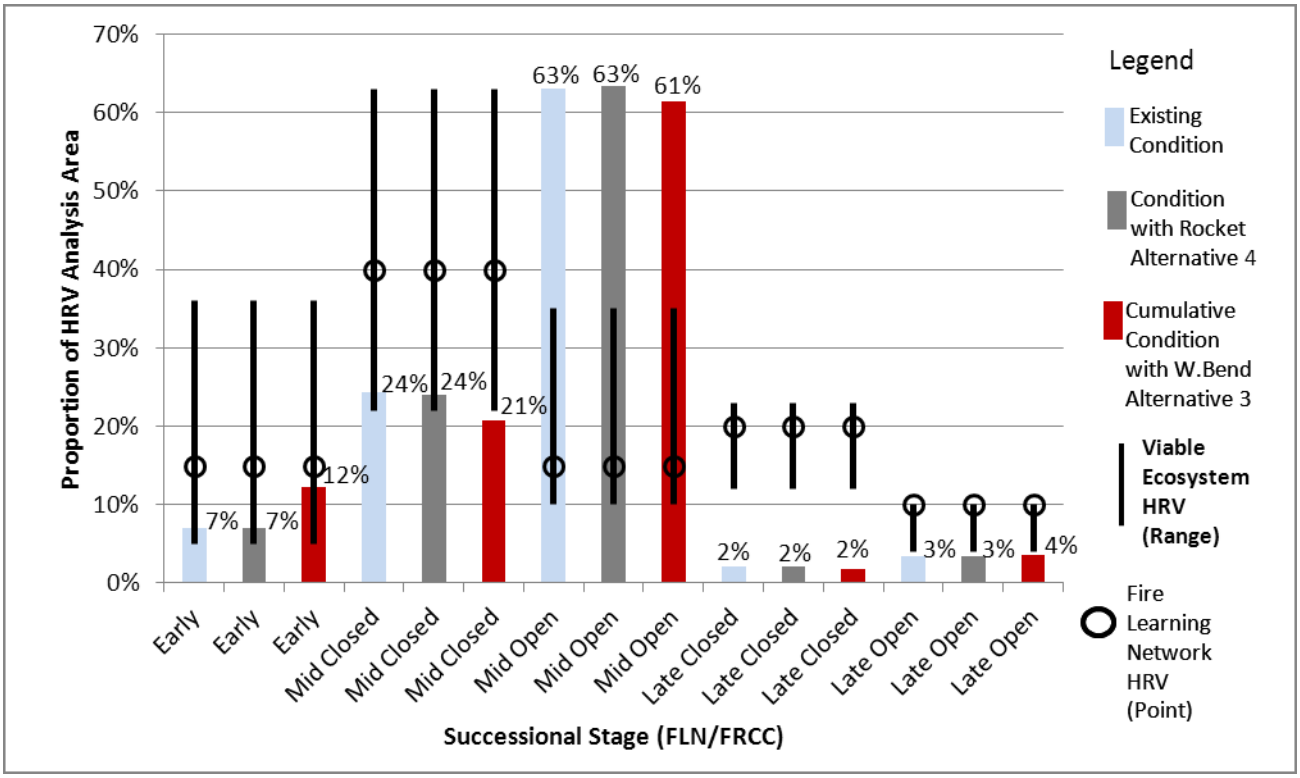


Figure 50: Alternative 4 successional stages in mixed conifer compared to Historic Range of Variability (HRV).



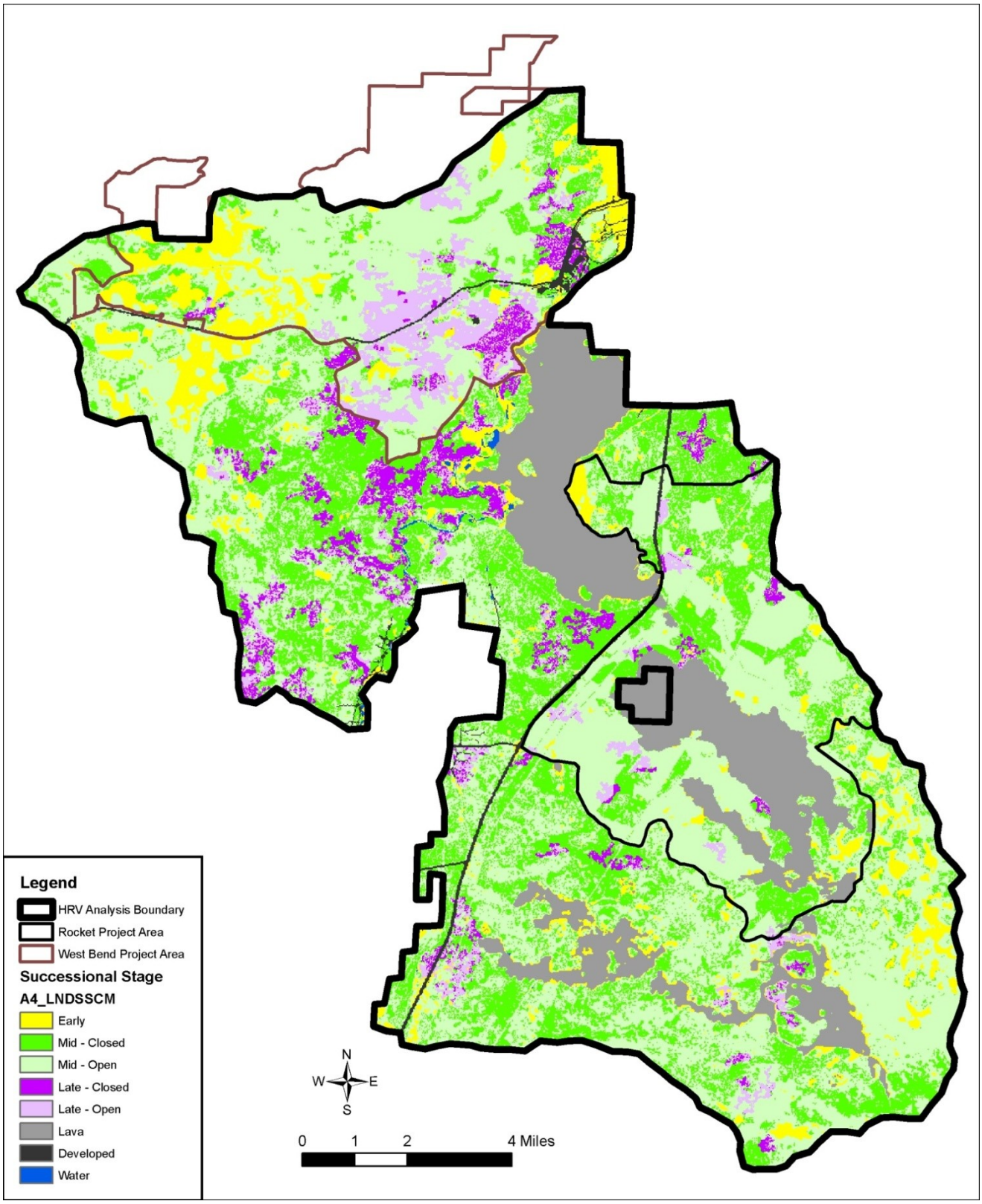


Figure 51: FRCC successional stages associated with Rocket Alternative 4 and West Bend Alternative 3.

Forest Plan Amendment – Harvest within LOS Stage Below HRV

As stated in the description of the alternatives (pp. 32-33), an amendment to the interim ecosystem standard under the Eastside Screens is required to fully implement any of the action alternatives. In accordance with FSM 1926.51, the following items describe non-significant amendments:

- Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;
- Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;
- Minor changes in standards and guidelines; and/or
- Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.

This amendment is a minor change to one standard and guide that will allow additional activities to contribute to achieving the management prescriptions. Within the project area, the total amount of commercial harvest that will occur within LOS stages that are below HRV is minor and is display in Table 11. The identified LOS is within stands that were proposed for thinning to promote the health and vigor and reduce fuels. No trees over 21" will be harvested. All acres will remain in an LOS category, but some acres move from the late-closed stage to the late-open stage. For example, under Alternative 4, 372 acres of ponderosa pine late-closed stage are thinned and move to late-open (Table 44). Other acres remain within the same LOS stage, but at a lower density. Thinning in these areas follows the Eastside Screens standard to encourage the development and maintenance of large diameter, disease-free, open-canopy structure. Thinning also moves the ponderosa pine LOS stages closer to the HRV and therefore contributes to the achievement of management prescriptions in the long term.

Table 44: Acres of large tree structural stages (LOS) in Rocket project area – existing condition and following each alternative. Total amount of LOS remains the same as existing condition for all alternatives.

	Existing	Under Alt. 2	Under Alt. 3	Under Alt. 4
Ponderosa Pine Late-Closed	574	342	563	202
Ponderosa Pine Late-Open	104	336	115	476
Total	**678**	**678**	**678**	**678**
Mixed Conifer Late-Closed	27	26	57	25
Mixed Conifer Late-Open	47	48	47	49
Total	**74**	**74**	**74**	**74**

Increased Resilience to Insects

Introduction

An identified purpose and need for this project is to improve vegetative resilience to disturbance agents, such as insects, and to lessen the risk that such disturbance events result in large scale loss of forest. This analysis focuses on how alternatives will affect resiliency to bark beetles, specifically mountain pine beetle, since the project area is dominated by second-growth ponderosa pine of an age susceptible to this beetle.

The Deschutes LRMP FEIS (USDA FS 1990) identified mountain pine beetle as posing a serious threat to young ponderosa pine stands throughout the Forest that had reached a susceptible condition, considered to be 60 to 80 years old and heavily stocked. When describing forest health in 50 years and beyond, the Deschutes LRMP describes the desired future condition as one in which "forest pest impacts", which would include bark beetles impacts, are present in the Forest, but act as desirable agents of a healthy functioning ecosystem. For this future condition, the LRMP describes resistance to devastating epidemics as being high and being maintained proactively with vigilance, planning and sound silvicultural techniques.

Bark Beetles as Disturbance Agents

Changes associated with bark beetle disturbance. Bark beetles can act as agents of change, affecting ecosystems directly and indirectly. These changes are summarized by Samman and Logan (2000).

> *Direct effects include individual tree death, changes in forest stand densities, changes in coarse woody debris, changes in forest floor litter, and changes in the amount of light reaching the forest floor. Indirect effects include timing, scale, and intensity of fire, changes in water quality and quantity, changes in wildlife use of the forest, changes in species composition, age, and size of remaining trees, and changes in commodity and/or amenity values.*

Stand conditions vulnerable to disturbance. Fettig (2012) states that starting with the earliest research studies, factors such as stand density, tree diameter, and host density have been identified as primary attributes associated with bark beetle infestations. The Deschutes LRMP FEIS (USDA FS 1990) describes how and under what conditions *Dendroctonus* beetles, specifically mountain pine beetle (*D. ponderosae*) and western pine beetle (*D. brevicomis LeConte*), act as disturbance agents in the forests of Central Oregon. These beetles can kill pines outright and do not require that host trees be moisture-stressed. The FEIS identifies stocking level as the single most important variable in determining the risk to bark beetle infestation. It indicates where stands are overstocked, tree mortality can be severe, but when trees are free to grow, bark beetle impacts are minimal. When describing bark beetle-tree interactions and forest health, Fettig et al. (2007) indicate as growing space diminishes, a tree's photosynthates are allocated to different uses in an order of priorities. They indicate that while the hierarchy is not absolute, photosynthates are allocated lastly to insect and disease resistance mechanisms. They summarize that production of insect resistance mechanisms may be compromised when growing space becomes limited by one or more factors.

Scale of disturbance. Level of tree mortality attributable to bark beetle attack can be limited to small spatial scales (e.g. single trees or groups of trees), but large areas can also be affected and high levels of mortality can occur when favorable stand and climatic conditions coincide (Fettig 2012). Endemic beetle populations have minimal effects on ponderosa pine stands, killing individual and occasionally small groups of trees (Sammon and Logan 2000). Historically, mortality from endemic populations provided the fuel needed for periodic, low-intensity fires that helped perpetuate uneven-aged ponderosa pine stands (Sammon and Logan 2000). Larger scale beetle outbreaks are often associated with more homogenous forest conditions, such as uniform stem densities (Fettig 2012). As described by Sartwell and Stevens (1975), outbreaks of mountain pine beetle in ponderosa pine rarely develop suddenly, evident first as scattered, small groups of killed trees. They describe the small groups enlarging over several years as successive beetle generations kill neighboring trees, sometimes to truly spectacular size. According to Sammon and Logan (2000), if populations build up to outbreak levels, 40 to 60 percent of the stand can be killed, depending on the age and size classes within the stand.

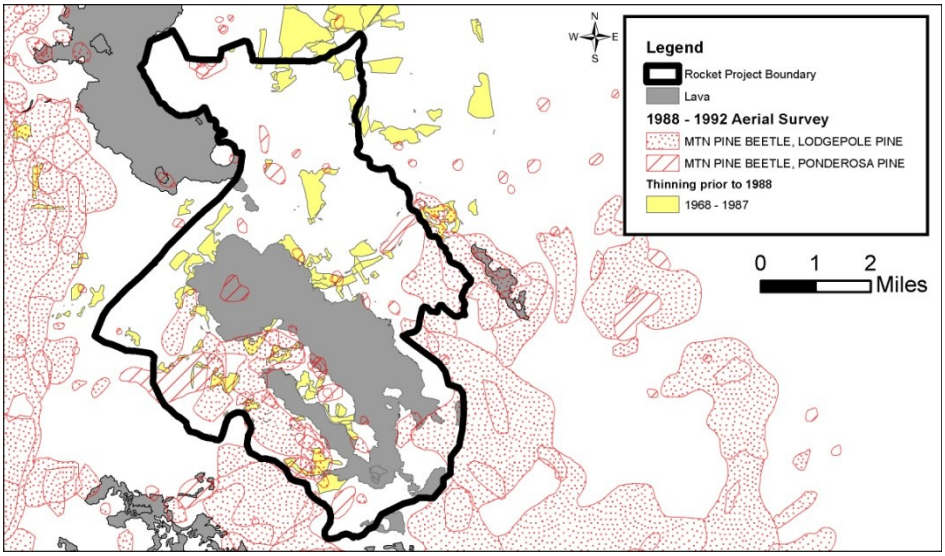
Disturbance Trends. Outbreaks of mountain pine beetle in the Pacific Northwest were becoming increasingly widespread by the early 1970's as second-growth ponderosa pine stands were beginning to attain a size and age susceptible to mountain pine beetle (Sartwell 1971). In the prior ten years, outbreaks had occurred on about 100,000 acres annually, predominately concentrated in the oldest second-growth stands (Sartwell 1971).

Znerold (1988) described the condition of second-growth ponderosa pine stands on the Deschutes National Forest in the late 1980's and the associated beetle activity. At the time, there were more than 130,000 acres

of second-growth, even-aged ponderosa pine. These 65-year old stands were over-stocked and displaying poor vigor, conditions considered highly favorable for a mountain pine beetle outbreak. Beetles were killing ponderosa pine in small groups scattered throughout the second-growth forest. Mountain pine beetle outbreaks that had recently occurred elsewhere demonstrated the potential for high levels of beetle-caused mortality. Znerold noted where stands were even-aged and over-stocked the beetle had often killed most of the merchantable-sized trees. He described 15-year results following a mountain pine beetle outbreak near Baker, Oregon that demonstrated beetle-caused mortality of more than 80 percent in unthinned, overly dense stands. The Deschutes LRMP FEIS (USDA FS 1990) also documented the mountain pine beetle attacks occurring in these second-growth ponderosa pine stands during this time and reported the Forest had initiated a thinning program to reduce stocking.

Going back 25 years in five-year increments, Figure 52 displays areas, mapped during annual aerial surveys, with lodgepole or ponderosa pine mortality caused by mountain pine beetle (USDA Forest Service 2013b). This figure also shows areas thinned within the Rocket project area, before and during the 25-year time period.

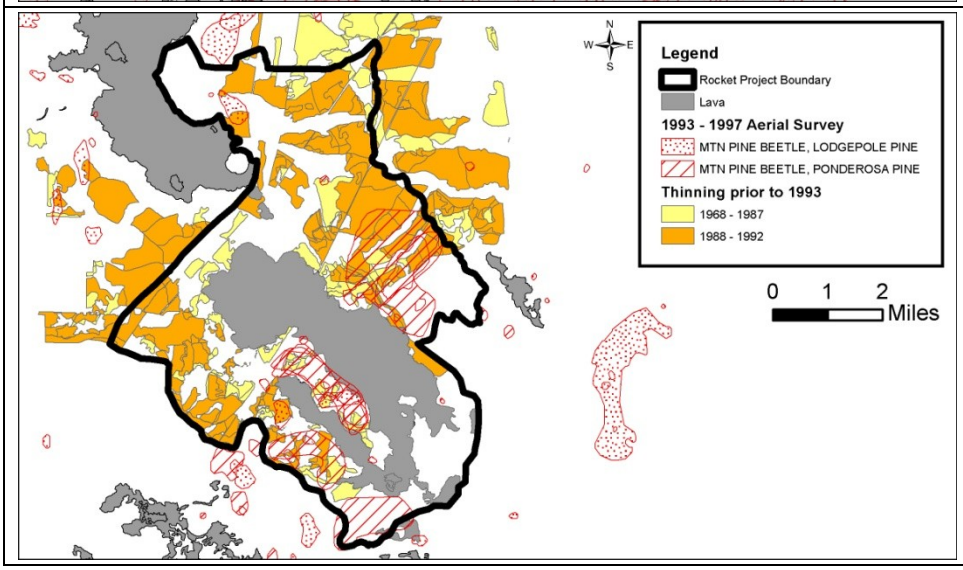
Figure 52: Twenty-five years, in 5-year increments, of mountain pine beetle activity and thinning treatments.



1987 – 1992

The outbreak of mountain pine beetle in lodgepole pine (LP) referred to in the LRMP FEIS ends during this time period. Beetle numbers remain high, but few suitable LP host trees remain.

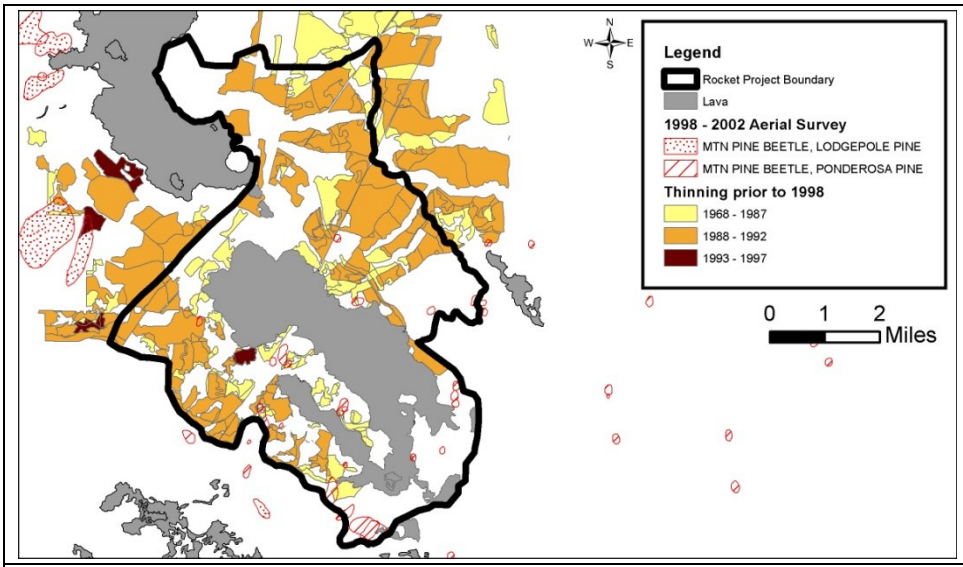
Scattered areas of ponderosa pine (PP) are being attacked by beetles. Patch sizes range from 10 – 625 acres, and mortality is low, ranging from 0.2 to 0.6 trees per acre.



1993 – 1997

Extensive thinning in the 5 years prior to this period part of the program referred to in LRMP FEIS. *(Note: Map does not show all thinning done outside of the Rocket project area).*

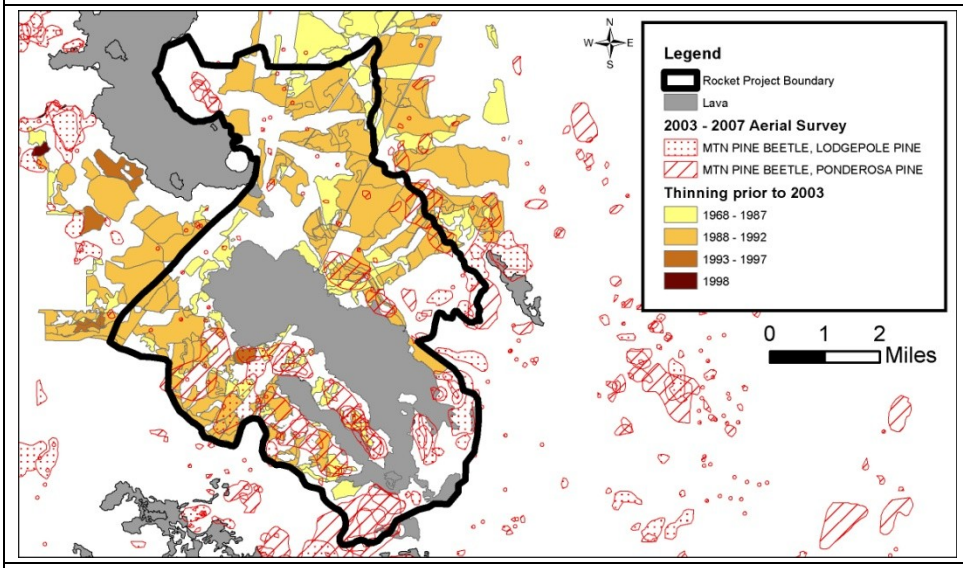
Within Rocket project area, large areas (400-1700 acres) of PP are being attacked by beetles, but tree mortality is low (0.25 to 1 tree per acre).



1998 – 2002

Little additional thinning done in the five years prior to this time period. *(Note: Map does not show all thinning done outside of the Rocket project area).*

Vulnerable stand conditions present, but low number of beetles present.

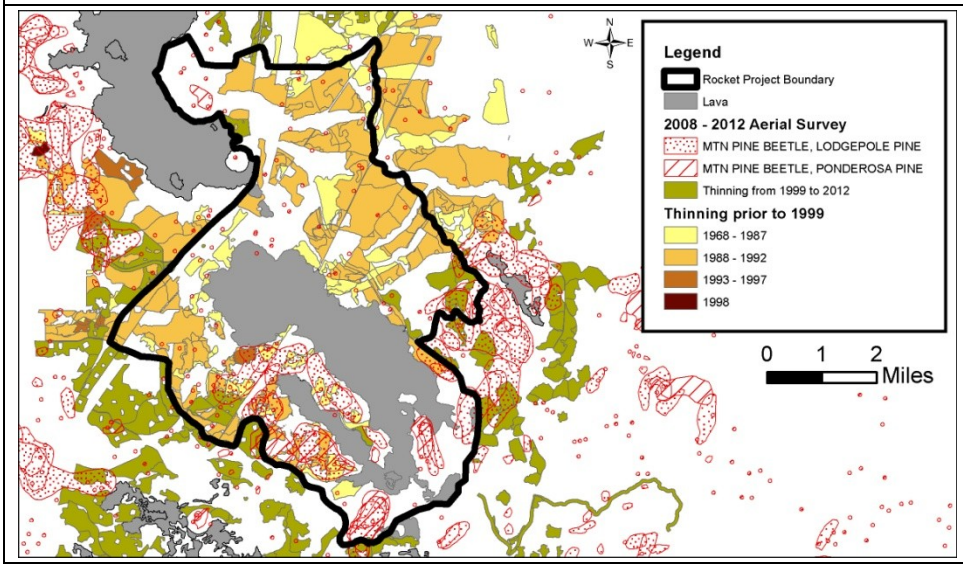


2003 – 2007

In the 5 prior years, no thinning in Rocket area.

PP mortality from beetles distributed throughout Rocket. Patch size ranges from 2 to 640 acres, and mortality is low, ranging from 0.5 to 5 trees per acre.

Larger patches being attacked are in unthinned areas and in areas with relatively high levels of dwarf mistletoe.



2008 - 2012

Suitable LP host trees become more available; more LP being killed by beetles. Patch size ranges from 2 to 840 acres, and mortality is 0.25 to 5 trees per acre.

PP mortality from beetles distributed throughout area. Patch size ranges from 2 to 280 acres, and mortality is 0.25 to 5 trees per acre.

Thinning to maintain or improve resilience to bark beetle disturbance. Fettig et al. (2007) reviewed tree and stand factors associated with bark beetle infestations and analyzed the effectiveness of vegetation management practices for mitigating the negative impacts of bark beetles on forest ecosystems. Their review drew from 498 scientific publications. Among the conclusions reported by Fettig et al. (2007) was the following regarding the effect of thinning on bark beetle susceptibility:

> *Factors involving tree density are consistently associated with the occurrence and severity of bark beetle infestations. ...thinning has long been advocated as a preventative measure to reduce the amount of bark beetle-caused tree mortality and its effectiveness for this purpose is supported by the scientific literature. Some studies of the efficacy of thinning have failed to detect significant differences among treatments, and others are limited to anecdotal evidence. However, to date there are no reports of significant increases in the amount of Dendroctonus spp. – caused tree mortality in response to thinning treatments.*

Thinning maintains or improves the vigor of residual trees, making more of a tree's photosynthates available for production of insect resistance mechanisms (Fettig et al. 2007). Thinning also changes the physical environment within stands, potentially increasing temperatures and wind speeds. Increased temperatures and wind speeds may accelerate the development of certain bark beetle species and force them to overwinter in stages that are more susceptible to freezing (Fettig et al. 2007). Lower stand densities could result in unstable layers of air and multi-directional movement of air. As described by Fettig et al. (2007), this type of air movement dilutes pheromone concentrations and could result in reductions in beetle aggregation. Fettig et al. (2007) indicate a significant number of pioneer beetles are required to overcome host defenses and a lack of beetle recruitment often results in unsuccessful attacks.

Reduced insect activity in thinned stands has been observed in a long-term study evaluating the effects of prescribed fire and thinning in central Oregon ponderosa pine forests. The study includes an area located in the southern portion of the Rocket project area. In reporting fifteen year results from the study, Busse et al. (2006) indicate tree mortality was absent in thinned plots, while insect-caused mortality was noted during the second-half of the study in unthinned stands (4 percent of unthinned trees).

Black (2005) reports findings seemingly contrary to Fettig et al. (2007) in a synthesis of reviewed research (sometimes referred to as the Xerces Report), stating there is mixed evidence of thinning being effective as a long-term solution to controlling bark beetles. Forest Service entomologists (USDA Forest Service 2006b) after reviewing the Black report concluded the report includes many examples of erroneous statements that are not even supported by the report's cited literature and while the report may be viewed as refuting hundreds of published papers on effectively managing forest insects and diseases, it does not.

Resilience to bark beetle disturbance following prescribed fire. The use of prescribed fire has the potential to increase beetle attacks within burn areas. As a general rule, if ponderosa pine trees retain at least 50 percent of the live crown present prior to the burn, mortality resulting from beetle attacks should be minimal (A. Eglitis, Zone Entomologist, 1999, personal communication). If less than this live crown is retained, particularly if less than 30 percent is retained, the survival of the tree is dependent on a number of factors, one of which is climatic conditions. (A. Eglitis, Zone Entomologist, 1999, personal communication).

Following prescribed fire, attacks by a variety of bark beetles can increase. Turpentine beetle (*D. valens LeConte*) attacks generally don't kill trees, but can make trees more susceptible to other insects. Increases in attacks by the pine engraver beetle (*Ips pini*), the western pine beetle, and the mountain pine beetle could occur. The pine engraver beetle can be the most significant mortality agent following an underburn. Beetle damage can continue up to 1 to 2 years. Increase in beetle activity would not be expected to expand into unburned stands. Within the burns, undamaged trees would generally not be susceptible to insect damage (A. Eglitis, Zone Entomologist, 1999, personal communication). If crown scorch on dominant and co-dominant trees is generally be less than 50 percent, increased beetle activity would be expected to cause minimal mortality.

Measure

Hazard and Risk Defined. Rating systems for bark beetles are intended to serve as general guides that aid in the identification of susceptible stands (Fettig et al. 2007). For forest stands, hazard relates to factors which affect the likelihood of bark beetle occurrence such as tree species composition, age-size structure, stand density and precipitation (Fettig et al. 2007). Risk is a function of insect presence, abundance and distribution as it relates to stand hazard or potential for tree mortality (Fettig et al. 2007).

Measure. The measure for this issue is the proportion of the project's forested area and the proportion of area within NNVM stocked above the upper management zone. This measure of stand density, a measure of hazard, identifies the stocking level above which mortality from bark beetles can become serious. Upper management zones are based on concepts described by Cochran et al. (1994).

This measure is the same as the one used to address the key issue pertaining to the ratio of treated to untreated forest. Figure 28 and Figure 29 display for each alternative the proportion of the project's forested area stocked at five stand density index (SDI) classes. SDI values of 200 and more exceed upper management zones for low and high productivity ponderosa pine sites. SDI values of 130 and more also exceed the upper management zone for low productivity ponderosa pine sites, which dominate the Rocket project area. See the section addressing this key issue for additional details and maps.

Existing Condition and Trends

Forest Conditions (Hazard). The Rocket project area is dominated by second-growth ponderosa pine that developed following the early railroad logging on what was then privately owned lands. While a portion of the area has been previously thinned, in the intervening years trees have increased in diameter and there has been a corresponding increase in stand density. Vegetation condition within the project area is relatively homogenous, creating forest conditions favorable for large scale beetle outbreaks. Stand densities at which mortality from beetles can become serious, SDI values of 130 and higher, are present on approximately 70 percent of the project area as well as in NNVM (Figure 28 and Figure 29). Areas of mid-successional stages have trees of a size and age associated with bark beetle disturbances and these areas dominate the project area and surrounding landscape, with approximately 80 to 90 percent in this condition (Figure 40 and Figure 41).

Beetle presence, abundance and distribution (Risk). Aerial surveys from the last 25 years, show bark beetles being present at low levels for the last 10 years throughout the project area, with distribution and abundance increasing from 15 years ago (Figure 52).

Trends. While past mortality associated with bark beetles has been relatively light within the project area, the past is not an indicator of what future mortality levels could be. As trees have grown in diameter, they have become increasingly more suitable habitat for bark beetles than they were in the past. Future conditions could be even more favorable for large scale outbreaks of bark beetles than in the past as the predicted decrease in precipitation associated with climate change interacts with the existing hazard and risk.

Environmental Consequences

Direct and Indirect Effects—Alternative 1

There would be no change from the existing conditions and trends, with vegetation conditions remaining relatively homogenous. Conditions favorable for bark beetles would continue to increase as trees grow in diameter. With increasing stand density, ability of trees to resist bark beetle attack would continue to decrease. Potential for beetle activity would be highest in stands, or portions of stands, where densities are above the upper management zone. Mortality from beetles would occur in periods of both normal and below normal precipitation, with extensive and accelerated tree mortality rates possible during periods of low precipitation.

Direct and Indirect Effects—Alternative 2, 3, and 4

Reduced stand density and improved tree vigor. Thinning treatments would reduce stand density, reducing a condition that consistently contributes to the likelihood of bark beetle occurrence. Vigor of trees would be maintained or improved, increasing the ability of trees to survive beetle attack. Depending on the alternative, the proportion stocked at or above 130 SDI would be reduced to 36 to 53 percent of the project area (Figure 28) and to 43 to 69 percent of NNVM (Figure 29). The least amount of this density condition would be retained with Alternative 4 and the greatest amount would be retained with Alternative 3.

Increased heterogeneity. All action alternatives would increase heterogeneity, reducing the present hazard and potential for large outbreaks of bark beetles. When considering density classes at the project-level, Alternative 2, with its use of the 40 BA thin, may create the most heterogeneity (Figure 31). When considering density classes at both the stand- and project-level, however, Alternative 4, with its use of the mix BA thin, may create the most heterogeneity (Figure 33). Alternative 4 would extensively reduce density, reducing the amount of large contiguous areas susceptible to bark beetles, but it would also retain a mixture of basal areas within thinning units which could maintain some of the desirable, low-level tree mortality associated with endemic bark beetle levels (see tree stocking after thinning key issue).

Beetles continue as disturbance agents. Scattered, incidental mortality from beetles would continue to occur in stands stocked below the upper management zone, primarily due to prescribed fire, stress induced by lightning strikes, or high levels of mistletoe infection. Mortality from beetles would occur in periods of both normal and below normal precipitation, with accelerated rates of tree mortality possible during periods of low precipitation. In areas stocked above the upper management zone, conditions would remain favorable for larger scale beetle outbreaks.

Prescribed fire mitigation. The mitigation measure to minimize crown scorch would be moderately effective in minimizing fire damage to dominant and codominant trees. Variable fuels and changing weather conditions could still cause high intensity burning within portions of burn areas, resulting in crown scorch in excess of 50 percent and in some cases complete killing of foliage. Areas where scorch exceeds stated limits would be monitored for mortality resulting directly from the fire or indirectly from bark beetle attack.

Cumulative Effects – Alternatives 2, 3, and 4

None of the actions contributing to cumulative effects would combine to change bark beetle effects.

Purpose and Need: Resilience to Dwarf Mistletoe

Introduction

A purpose and need for this project is to improve vegetative resilience to disturbance agents and to lessen the risk that disturbance events result in large scale loss of forest. This analysis focuses on how alternatives will affect resiliency to dwarf mistletoes, which are identified in the Deschutes LRMP FEIS (USDA FS 1990) as being widely distributed on the Forest, and as being one of the groups of pathogens most impacting the Forest. While widespread on the Forest and also within the Rocket project area, level of tree mortality attributable to dwarf mistletoes is usually limited to small spatial scales (e.g. single trees or groups of trees) rather than large spatial scale loss of forest, with mortality usually occurring incrementally over a long period of time.

Treatments proposed to reduce mistletoe. Thinning proposed with Alternative 2, 3, and 4 would retain ponderosa pine with the least amount of dwarf mistletoe, cutting and generally removing all ponderosa pine less than 21 inched dbh infected with high levels of dwarf mistletoe. Treatment and amount of treatment varies by alternative in some of the more heavily infected ponderosa pine stands (Table 45). Alternative 2 proposes to thin some of the stands, including some within NNVM, to 40 square feet of basal area. Responding to key issues, Alternative 3 proposes less thinning across the project area and less use of mechanical treatment within NNVM. Consequently, Alternative 3 proposes to forgo thinning in most of the heavily infected units, including all units in NNVM, and instead proposes to cut ladder fuels and follow that

treatment with mowing and burning. In several areas, Alternatives 3 and 4 propose to regenerate heavily infected stands, rather than thin as proposed with Alternative 2. Alternative 3 proposes to create 2 openings totaling 20 acres, and Alternative 4 proposes to create 3 openings totaling 24 acres. None of these openings would be within NNVM. In addition to openings, Alternative 4 proposes a treatment focused on the removal of moderately to heavily mistletoe-infected trees (sanitation cutting[19]), rather than a thinning treatment focused on reducing stand density to a specific target basal area.

Alternatives 2, 3, and 4 include a connected action to prevent mistletoe from spreading to ponderosa pine seedlings to be planted in all created openings, including openings created to promote new deer hiding cover. Within the openings, mistletoe-infected ponderosa pine greater than or equal to 21 inches dbh would be made into snags. Outside of the openings, mistletoe-infected trees within 40 feet of the opening edge would be cut and removed if less than 21 inches dbh, or made into snags if greater than or equal to 21 inches.

Table 45: Treatments proposed in ponderosa pine stands with higher levels of dwarf mistletoe by alternative.

Treatment	Alternative 2		Alternative 3		Alternative 4	
	Project	NNVM	Project	NNVM	Project	NNVM
Most effective in reducing mistletoe infection:						
40 BA Thin	119	87				
Mix BA Thin			4			
Sanitation, to remove mistletoe infection			7		170	154
Create openings to reduce mistletoe infection			20		24	
SUBTOTAL	**119**	**87**	**31**	**0**	**194**	**154**
Least effective in reducing mistletoe infection: Ladder Fuels Reduction		21	7	117		
TOTAL Acres in Mistletoe Infected Areas	**119**	**108**	**38**	**117**	**194**	**154**

Dwarf Mistletoes as Disturbance Agent

Effects associated with dwarf mistletoe. Dwarf mistletoe is a parasitic plant that affects the health, vigor, and growth of its host tree. Depending on management objectives and priorities, the effects of dwarf mistletoe are interpreted as positive, negative, or usually of mixed consequence (Geils et al. 2002). The Deschutes LRMP FEIS (USDA FS 1990) describes the effects of dwarf mistletoe.

> *The dwarf mistletoes are among the most damaging forest diseases in the Pacific Northwest. They damage their host by reducing growth, lowering wood quality and killing or predisposing it to attack from other pests. Most of the conifer species of the West are parasitized by dwarf mistletoes. Although losses from dwarf mistletoe are not as visible as those caused by insects, the cumulative losses of growth and mortality are considerable over the life of the Forest.*

Effects dwarf mistletoes have on host trees include: 1) reduced height and diameter growth, 2) increased mortality, 3) reduced seed production and reduced seed viability, 4) reduced wood strength and increased knot size, 5) increased susceptibility to attack by insects, particularly bark beetles, and 6) increased flammability (Hawksworth 1978). Extent to which mistletoe affects the host tree depends largely upon the age when the tree is initially infected. Trees that are older and larger when first infected initially experience little or no obvious effects whereas younger and smaller trees can experience significant reduction in height and diameter growth. Seedlings and saplings are severely damaged by infection with even a few mistletoe plants (Geils et al. 2002).

[19] As defined by Helms (1998), sanitation cutting is the removal of trees to improve stand health by stopping or reducing the actual or anticipated spread of insects and disease. It is considered an intermediate stand improvement treatment.

Effects dwarf mistletoes have on stands can vary. Heavy infection in a stand can adversely impact some wildlife species by decreasing cover, tree regeneration and growth, and cone/seed output (Bull et al. 1997). Other stand effects are described by Hawksworth and Wiens (1996).

> *By inducing formation of witches' brooms and causing topkill and mortality of host trees, dwarf mistletoes affect the species composition, vertical crown structure, and spacing of trees within infected stands. These direct effects, in turn, have numerous consequences on the physical structure and functioning of the ecosystem. For example, the brooms provide forage, nesting, and cover for birds and mammals, but also increase the likelihood of ground fires becoming crown fires. Canopy gaps caused by mistletoe–induced mortality increase within-stand diversity but also reduce the interior-forest area.*

The effects of mistletoe on the flammability of ponderosa pine stands are described by Koonce and Roth (1980).

> *Mistletoe may influence the frequency of fire by making stands more flammable. Mistletoe infected branches are often laden with resinous spindles and brooms which form fuel ladders leading to crowning fires. Fallen brooms persist in slash, increasing the amount of large, resinous, partially rotten, highly flammable material. In decadent stands, dwarf mistletoe increases the amount of dry, dead aerial fuel.*

Severity of dwarf mistletoe infection. Severity of mistletoe infection is measured with a 6-class rating system, in which a dwarf mistletoe rating of 1 (DMR 1) is the lowest level of infection and a rating of 6 (DMR 6) is the highest level of infection (Hawksworth and Wiens 1996). Effects dwarf mistletoes have on host trees increase as infection severity increases. As a rule, the threshold level for diameter growth reduction seems to be class 3, or when about one-half of the crown becomes infected (Hawksworth and Johnson 1989; and Geils et al 2002). Ponderosa pine with DMR 3 or less, have 2 percent or less reduction of diameter growth compared to a tree with no mistletoe infection (Hawksworth and Wiens 1996). At a DMR of 4, this reduction of diameter growth increases to 14 percent. At a DMR 5 or 6, reduction of diameter growth is even more, increasing to 27 to 50 percent, respectively. As severity of infection increases, reduction of ponderosa pine height growth can be as high 21 percent, and 10-year mortality rates within infected ponderosa pine stands can be up to 34 percent higher than those expected within stands not infected with dwarf mistletoe (Hawksworth and Wiens 1996).

Spread and intensification of dwarf mistletoe. Spread is the increase in the number of trees infected with dwarf mistletoe and it is primarily a function of the dispersal distance of the plant's seed. Maximum dispersal distance for dwarf mistletoe seeds is approximately 52 feet, but distances of 33 feet or less than are more common (Hawkworth and Wiens 1996). Dispersal beyond the maximum distance requires animal vectors.

Intensification is the increase in the number of mistletoe plants on infected trees. Within single-story stand structures, mistletoe has been found to intensify at a rate of approximately one dwarf mistletoe rating class every 14 to 18 years (Parmeter 1978 and Hawksworth and Johnson 1989). At this rate it would take approximately 40 to 55 years for infection levels to reach a mistletoe rating of three (DMR 3) and 70 to 90 years to reach a mistletoe rating of five (DMR 5). Sustained height growth of 10 or more inches a year is considered necessary for an infected tree to stay ahead and eventually outgrow the infection (Roth and Barrett 1985).

Multi-story stand structures are most vulnerable to the spread and intensification of dwarf mistletoe. In these conditions, the upper crowns of understory trees rarely remain free of increasing mistletoe populations, and reduction in tree growth with further increase in mistletoe infection is almost certain (Parmeter 1978). Rate of mistletoe intensification in an understory growing beneath an infected overstory has not been quantified in studies on mistletoe. It could be expected, however, within 30 to 60 feet of infected overstory, intensification of mistletoe in understory trees would be faster than rates observed in single-story stands.

Trends in dwarf mistletoe infection with fire suppression. The Deschutes LRMP FEIS (1990) describes the role low intensity fires has in controlling dwarf mistletoe and how the suppression of these fires has contributed to greatly increased dwarf mistletoe levels and associated damage. The FEIS also states fire

suppression has indirectly contributed to the spread of dwarf mistletoe by favoring more multi-aged (or multi-storied) stand conditions. Historically, low-intensity fires simplified canopy structure and reduced stem density which reduced the probability of mistletoe seed dispersal to susceptible understory hosts and lateral spread among host trees (Hessburg et.al. 1994). Historically, ponderosa pine stands had a modest amount of mistletoe, but mistletoe severity was continuously reduced under the influence of fire (Hessburg et.al. 1994).

Preventing dwarf mistletoe spread into regenerating openings. Where regeneration harvest is planned in areas infected with dwarf mistletoe, created openings should be no less than 20 acres in size to prevent mistletoe from spreading from infected trees along the edge to the newly regenerated stand (Hawksworth and Johnson 1989 and Geils et al. 2002). Leaving single trees or small clumps of residual infected trees throughout the openings should be avoided (Giels et al. 2002).

Existing Condition

Ponderosa pine dwarf mistletoe (*Arceuthobium campylopodum*) and lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) area present throughout the project area, with patches of infection varying in size and level of severity. Stand density throughout the project area, even in previously thinned stands, is high enough to favor the lateral spread of dwarf mistletoe. Proportion of mistletoe-infected trees is high enough in some areas, that removal of all infected trees, regardless of severity, would not leave a stand stocked above minimum stocking levels.

Direct and Indirect Effects––Alternative 1

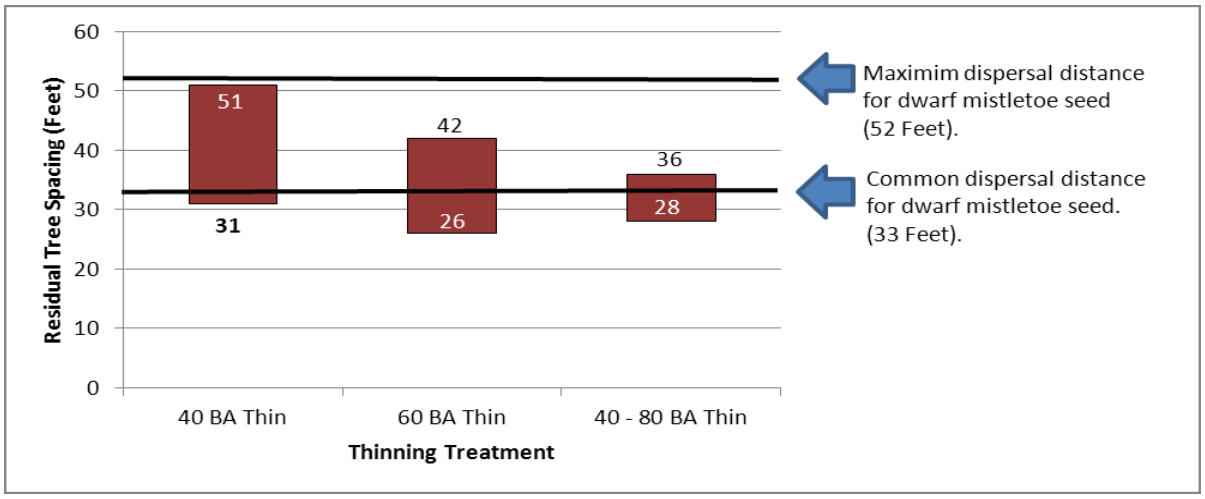
There would be no change in the existing condition. Dense stand conditions and multi-story stand structures will favor expansion and intensification of existing areas of dwarf mistletoe infection.

Direct and Indirect Effects––Alternatives 2, 3, and 4

All thinning treatments will reduce, but not eliminate, dwarf mistletoe from within treatment units, with all severity levels of mistletoe infection likely remaining. While trees with the least amount of dwarf mistletoe would be retained, trees with moderate amounts of mistletoe (DMR 3 and 4) may need to be retained to meet desired stocking levels. Trees greater than or equal to 21 inches dbh, regardless of mistletoe severity, would also remain both as scattered individuals and clumps of trees.

All thinning treatments will reduce stand density, increasing the distance between residual trees and correspondingly reducing the probability of dwarf mistletoe laterally spreading among residual trees. Probability of spread will vary, however, depending on residual stand density. Figure 24 compares the residual densities predicted to remain with the 40 BA, 60 BA, and 40 to 80 (Mixed) BA thinning treatments. Figure 53 displays the range of average tree spacing associated with these predicted post-thin residual tree densities. Of the three treatments, the 40 BA thinning treatment, which leaves the lowest residual tree density, would best reduce the potential for the lateral spread of dwarf mistletoe. Average spacing associated with this thinning treatment would generally exceed the common dispersal distance for dwarf mistletoe seed. Potential for lateral spread would be the highest with the mixed BA thinning treatment, which retains 80 square feet of basal area where trees are greater than 16 inches dbh. The average spacing associated with this thinning treatment would be approximately the same as the common dispersal distance for dwarf mistletoe seed.

Figure 53. Tree spacing with 40, 60, and 40-80 BA Thin compared to mistletoe seed dispersal distances.



Average residual tree spacing associated with the sanitation treatment, proposed most extensively with Alternative 4, would be within the ranges displayed in Figure 53. Tree spacing would be quite variable, with the closest spacing occurring where trees are not infected with dwarf mistletoe. Ladder fuels reduction, which would cut trees in the lower canopy, would simplify canopy structure but would not change the potential for lateral spread of dwarf mistletoe between trees in the middle and upper canopy levels.

Mowing and burning treatments would have little effect on stand dwarf mistletoe rating. According to Koonce and Roth (1980), scorch heights of 30 to 60 percent of the crown length are required to significantly reduce dwarf mistletoe infestations. They also state low intensity fires, appropriate for prescribed understory burning, are generally insufficient to sanitize the dominant trees, including old-growth, whose crowns are above the mean scorch height.

Cumulative Effects – Alternatives 2, 3, and 4

None of the reasonably foreseeable or future actions would affect the spread of dwarf mistletoe. There would therefore be no cumulative effects with the Rocket project on the spread of dwarf mistletoe.

Consistency with Management Direction

Within NNVM, use of the 40 BA thinning treatment and the sanitation treatment would protect existing large, old trees (NNVM S&G M-8) and would leave stands in a condition where it would be possible for stands to be maintained and perpetuated solely with prescribed fire (NNVM S&G M-15). Both treatments would retain ponderosa pine greater than or equal to 21 inches dbh, even if infected with dwarf mistletoe. Both treatments would prioritize heavily infected (DMR 5 or 6) ponderosa pine less than 21 inches dbh for removal. With reduced diameter growth rates and higher mortality rates than trees with lower levels of mistletoe infection, these trees would have the least potential for developing into large, old trees. These heavily infected trees could reduce potential for near-by trees to develop into large, old trees by utilizing site resources such as water and nutrients and serving as a source of mistletoe inoculum. The 40 BA thinning treatment would reduce tree density, moving stands closer to the open and "park-like" conditions with gaps characteristic of fire-based historic ponderosa pine old growth. Similarly, the sanitation treatment would also reduce tree density closer to that characteristic of fire-based old growth, with level of mistletoe infection guiding the spatial pattern of residual trees. Distribution of residual trees would be more variable than that associated with the 40 BA thinning, with gaps created or enlarged where ponderosa pine have little to no mistletoe infection. Gaps created or enlarged with both treatments would be characteristic of historic, fire-based ponderosa pine old growth which could have small gaps from one half acre up to several acres in size. Neither treatment would eliminate dwarf mistletoe within treatment units, allowing mistletoe to continue to play a role in ecosystem function (NNVM S&G M-12).

Wildlife: Introduction

Analysis Methods

Information on analysis methods applies to the analysis of Threatened, Endangered, and Proposed species analyzed in the Biological Evaluation as well as Management Indicator Species, Birds of Conservation Concern, and Landbird Focal Species. Species analyzed were those presumed to be present if the project area was within the range of the species and appropriate habitat components were available. The level of impact depended on the existing habitat conditions (i.e., limited habitat availability versus widespread habitat availability), the magnitude and intensity of the impacts of the proposed actions (i.e., will the proposed actions cause a loss, no change, or increase in habitat), the risk to the resources (sustainability and availability of the habitat), and the issues identified during the formulation of the alternatives (see pages 14-16).

Impact analysis for each species is primarily focused on short and long-term impacts to habitat. Noise disturbance from equipment and personnel and direct impacts to individuals (mortality, abandonment of offspring, and displacement) may occur to nesting/denning and foraging individuals. These impacts are anticipated to be limited to a small number of individuals annually for each species because a range of the species habitat would be treated (45 to 90% depending on the species) and not all of the project area would be treated during each year of implementation. Implementation of the tree treatments and mowing are anticipated to occur over a three to seven year period. Estimated acres burned under prescribed fire for the Rocket project range from 250 to 500 acres annually, but could be as high as 1,700 to 2,200 acres (the total amount that could be burned within the Paulina Winter Range Unit per year).

Management Indicator Species

Forestwide habitat assessments for each Management Indicator Species (MIS) identified in the Forest Plan were completed in 2012 (USFS 2012). These assessments were based on the amount of potentially suitable reproductive habitat that occurs across the Forest for most species, associated threats, and population trend data where available. Exceptions to this were hiding cover standards and guidelines used for mule deer summer and winter range and cave habitat for hibernation and maternity use for Townsend's big-eared bat. These MIS assessments used the best available science and guidance found in books, scientific journals, and scientific websites as well as NatureServe (2012). NatureServe and its network of natural heritage programs, including Oregon State Heritage Program, are the leading source for information about rare and endangered species and threatened ecosystems including population trend data. In addition, for those Management Indicator Species that are hunted or furbearing species (e.g., big game, waterfowl, American marten), Oregon Department of Fish and Wildlife provided (ODFW) 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 using Wildhab/Viable.

Three R6 Sensitive species that are analyzed are also MIS: Townsend's big-eared bat, white-headed woodpecker, and Lewis' woodpecker. The Rocket project analysis for these sensitive species references their MIS assessments.

The Rocket project analysis for Management Indicator Species incorporates these assessments by reference. A determination of positive, negative, or neutral trend towards viability on the Forest for each Management Indicator Species is made at the population level based on these forestwide assessments including habitat modeling. Consistency with the Forest Plan standards and guidelines for these species including impacts to snags, down wood and green tree replacements for the white-headed woodpecker and Lewis' woodpecker is included in the biological evaluation determination for each species.

Focal Landbirds

The national Forest Service Landbird Strategic Plan provides guidance for maintaining, restoring, and protecting habitats necessary to sustain healthy migratory and resident bird populations (USDA Forest Service 2000). On a regional level, individuals from multiple agencies and organizations with the Oregon-

Washington Chapter of Partners in Flight developed two publications for conserving landbirds in the Pacific Northwest: a *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) and *A Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington* (Altman and Holmes 2000). These documents outline conservation measures, goals and objectives, and habitat management recommendations for specific habitat types. The East-Slope Cascades Conservation Strategy covers the Forest which is within the Central Oregon subprovince. The white-headed woodpecker is a focal landbird species for large patches of old forest ponderosa pine with large snags. The Lewis' woodpecker is a focal landbird species for patches of burned old forest. Consistency with the conservation strategies in the East-Slope Cascades Conservation Strategy is included in the BE for those two species.

Birds of Conservation Concern and High Priority Shorebirds

Executive Order 13186 directs 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 Register 2001). The USFWS developed a list of Birds of Conservation Concern (BCC) to meet this goal (USDI Fish and Wildlife Service 2008). 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. 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. The 2008 list was derived from three conservation plans: Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004), the United States Shorebird Conservation Plan (USDI Fish and Wildlife Service 2004), and the North American Waterbird Conservation Plan (Kushlan et al. 2002). Conservation concerns include population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors. Bird Conservation Regions were developed based on similar geographic parameters and are the basic units for bird conservation efforts. The Rocket project area occurs in the Bird Conservation Region 9 (Great Basin).

The U.S. Shorebird Conservation Plan (USDI FWS 2004) identifies the conservation status of U.S. and Canadian shorebird populations.

Modeling Methodology

Habitat was modeled in the MIS forestwide assessments and is based on occurrence data, habitat descriptions found in scientific literature, various data sets, and professional experience. The Ochoco and Deschutes 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). The Viable 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 is a useful tool for cumulative impacts analysis of broad scale changes in vegetation at a subwatershed to Forestwide scale and subsequent changes in animal, insect, or plant communities.

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. No major vegetation projects have occurred in the Rocket project area since 2002. Existing conditions include past actions such as timber sales which used the Forest FACTS database.

For woodpecker species and the American marten, the snag components of habitat were determined using gradient nearest neighbor (GNN) data and the DecAID advisory tool in addition to Viable. Because of Forest Plan standards for cover and thermal cover requiring trees per acre and height, forest-wide deer and elk habitat was modeled using GNN data. Thermal and hiding cover data was refined with lidar dta and field verification for project-level planning and analysis. While modeling habitats or components generally match

conditions known to occur on the ground, modeling does not necessarily match a specific point. It gives conditions that may occur given the assumptions of the model. Since it is used identically for all alternatives, it provides a basis for comparison.

GIS Analysis

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

Gradient Nearest Neighbor (GNN) is a detailed mapping method of existing forest vegetation across all land ownerships in Oregon, Washington, and parts of California. It uses many variables on a gradient along with satellite imagery to assign data from known field plots to a 30 meter pixel ArcGIS grid with no data that have the same satellite imagery signature (i.e., it "looks" the same to the computer). Information on GNN is available at the project website: http://www.fsl.orst.edu/lemma/gnnpac.

DecAID

DecAID is a web-based synthesized dataset of the best available research on dead wood. DecAID does not provide information on all life needs of a given species (Mellen-McLean et al. 2012). It integrates current research/studies on wildlife use of dead wood (snags, logs, and down wood) in various habitat types. The use of DecAID is explained further in the marten and woodpecker section.

Cumulative Impacts

The impacts of past projects are included in the existing condition discussion under each subject heading and are not discussed as separate projects for most species. These past actions are either no longer having impacts that will overlap the impacts of the proposed action in time and space, or, if their impacts are ongoing, these impacts have been incorporated into the existing habitat conditions and it is not useful nor relevant to the decision-making process to analyze them separately. A list of past actions is included in Table 17.

Table 18 lists the ongoing or reasonably foreseeable actions in the cumulative impacts analysis area. Where the Rocket project will result in an incremental effect or impact when added to any of these projects or activities, it is discussed in the cumulative impacts analysis for that species or habitat. Short-term impacts are less than 20 to 30 years depending on the alternative while long-term impacts are generally greater than 20 to 30 years, unless otherwise noted in the species-specific discussions. This unit of time was used to assess long-term impacts because it is the amount of time that it takes until large trees >21 inches dbh are common in the project area after project implementation (Schroeder 2014). The cumulative impacts analysis area includes the project area boundary (approximately 22,682 acres), the North Unit Diversion Dam-Deschutes River watershed (64,226 acres), and the Sugar Pine Butte-Little Deschutes River subwatershed (28,573 acres) unless otherwise noted in species specific analyses. There are no planned actions within the Sugar Pine Butte-Little Deschutes River subwatershed; however, ongoing recreation contributes to minor disturbance. Only activities on National Forest system lands are analyzed under cumulative impacts.

Wildlife: Threatened, Endangered, Proposed, and Sensitive Species

A biological evaluation (BE) was prepared for the Rocket project to address the project's effects on candidate, threatened, or endangered species, and Region 6 Sensitive species. The BE is intended to ensure that all surface-disturbing activities and management actions are in compliance with the Endangered Species Act (ESA) of 1973, NFMA, NEPA, and the Forest Plan as amended. The BE is located in the project file.

The BE has considered the best available science such as forestwide species assessments, and/or reports, literature reviews, review citations, peer reviews, and science consistency reviews. The best available science coupled with District and Forest data, thorough field reconnaissance and project design features by the project wildlife biologist, and local knowledge of the area were used to determine species or habitat presence and impacts.

The following table summarizes effects determinations for species considered within the BE (Table 46). The Rocket Project area does not have any habitat for the threatened northern spotted owl. The Rocket Project area does not have denning or rendezvous habitat for the endangered gray wolf but does have dispersal habitat for this species. The Rocket Project area does not have denning habitat for the proposed wolverine but does have dispersal habitat for this species. The project area does have habitat for seven Sensitive species. The proposed actions would benefit some species while negatively impacting others. Some of the negative impacts are magnified by other past**,** present, and reasonably foreseeable future actions in the area.

Species listed below with a *No Effect* or *No Impact* determination either do not have the habitat for a particular species, or project activities do not have the potential to overlap the biological needs of an individual, or a combination of both. Only those species with potential habitat in the project area that would potentially be impacted by project activities are further analyzed.

Implementation of the Rocket action alternatives 2, 3, or 4 *May Impact* the following Sensitive species but would not lead to a trend towards federal listing: Townsend's big-eared bat, pallid bat, fringed myotis, Johnson's hairstreak, western bumblebee, white-headed woodpecker and Lewis' woodpecker. Long-term, implementation of any of the action alternatives would have a long-term beneficial impact to habitat for the Townsend's big-eared bat, pallid bat, fringed myotis, white-headed woodpecker, and Lewis' woodpecker.

Table 46: Effect/impact determinations for species considered under the BE for the Rocket Project Area.

Species	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Threatened, Endangered, and Proposed				
Gray wolf - Endangered	NE	NE	NE	NE
Northern spotted owl - Threatened	NE	NE	NE	NE
Northern spotted owl and 2012 designated critical habitat	NE	NE	NE	NE
North American wolverine - Proposed	NE	NE	NE	NE
Oregon spotted frog	NE	NE	NE	NE
Oregon spotted frog critical habitat	NE	NE	NE	NE
Candidate and Sensitive				
Northern bald eagle	NI	NI	NI	NI
American peregrine falcon	NI	NI	NI	NI
Lewis's woodpecker	**MIIH**	**MIBI**	**MIBI**	**MIBI**
White-headed woodpecker	**MIIH**	**MIBI**	**MIBI**	**MIBI**
Bufflehead	NI	NI	NI	NI
Harlequin duck	NI	NI	NI	NI
Tule white-fronted goose	NI	NI	NI	NI
American white pelican	NI	NI	NI	NI
Horned grebe	NI	NI	NI	NI

Species	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Tri-colored blackbird	NI	NI	NI	NI
Yellow rail	NI	NI	NI	NI
Northern waterthrush	NI	NI	NI	NI
Greater sage grouse - C	NI	NI	NI	NI
Townsend's big-eared bat	**NI**	**MIIH**	**MIIH**	**MIIH**
Pallid bat	**NI**	**MIIH**	**MIIH**	**MIIH**
Fringed myotis	**NI**	**MIIH**	**MIIH**	**MIIH**
Spotted bat	NI	NI	NI	NI
Pygmy rabbit	NI	NI	NI	NI
Pacific fisher - C	NI	NI	NI	NI
Columbia spotted frog	NI	NI	NI	NI
Crater Lake tightcoil	NI	NI	NI	NI
Evening fieldslug	NI	NI	NI	NI
Silver-bordered fritillary	NI	NI	NI	NI
Johnson's hairstreak	**NI**	**MIIH**	**MIIH**	**MIIH**
Western bumblebee	**NI**	**MIIH**	**MIIH**	**MIIH**
C = Candidate species; NE = No Effect; NI=No Impact; NLAA = May Impact, Not Likely To Adversely Affect; MIIH = May impact individuals or habitat, but would not likely contribute to a trend toward federal listing. MI/BI = May impact individuals due to disturbance; beneficial impact to habitat				

Threatened, Endangered, or Proposed Species

Table 47 includes those species that are federally listed or proposed. Those species that are in bold are analyzed further and contain habitat that occurs within or adjacent to the project areas and that the particular habitat and/or species may be negatively affected. Those species that are not in bold may or may not contain habitat within or adjacent to the project area, of which that habitat or species would not be impacted by the proposed projects.

Table 47: Federally endangered, threatened, and proposed species occurring or potentially occurring on the Forest and impacts from the proposed Rocket project.

Species	Status	Habitat Needs	Impacts	Rationale
Gray wolf (*Canus lupus)*	Federal Endangered, SH	Forest generalist	No effect	There currently is no established pack or breeding population on the Forest. No impact to dispersal habitat.
Northern spotted owl (*Strix occidentalis caurina*)	Federal Threatened, MIS, S3	Old growth mixed conifer forests with Douglas-fir & true firs	No effect	The proposed project area is located outside the Northwest Forest Plan and outside of the range of the northern spotted owl. The PDCs in the Programmatic BA do not apply.
Northern spotted owl critical			No effect	The proposed project area is outside the Northwest

habitat				Forest Plan and outside of any critical habitat.
North American Wolverine (*Gulo gulo luscus*)	Federal Proposed, Regional Forester Sensitive, MIS, S1	Mixed conifer high elevation forests; Alpine, Subalpine, Rock Talus, High Cirque Basins	No effect	No denning habitat in the project area. No impact to dispersal habitat.
Oregon spotted frog (*Rana pretiosa*)	Federal Proposed, Regional Forester Sensitive, S2	Found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover.	No effect	There is no water or wet meadow habitat within the project area.
Oregon spotted frog critical habitat			No effect	There is no water or wet meadow habitat within the project area.

***** Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest (December 2011). Oregon Sensitive Species determined from the **NatureServe** database for Oregon (2012), S1 = critically imperiled, S3 = vulnerable, SH = possibly extirpated.

Gray Wolf

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. In Minnesota and Wisconsin, wolves usually occur in areas with few roads, which increase human access and incompatible land uses (Thiel 1985, Mech et al. 1988, Mech 1989) but apparently can occupy semi-wild lands if ungulate prey are abundant and if not killed by humans (Mladenoff et al. 1997). A minimum of 10,000-13,000 square kilometers (with low road density) might be necessary to support a viable population; a single pack does not constitute a "minimum viable population" (USDI FWS 1987). Key wolf habitat components identified in the 1987 Wolf Recovery Plan (USDI FWS 1987) are: 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.

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. Overall, the Deschutes does not have a large elk population and has a declining deer population. Other than wilderness areas, the Forest has a relatively high road density due to past and ongoing timber management. The Forest also has a relatively high trail density, and a large human population that recreates year-round. In 2011, a radio collared lone wolf from Eastern Oregon was tracked via telemetry when it dispersed from its pack. It was determined the wolf passed through the Pine Mountain area on the eastern Fort Rock side of the District, which is approximately 15 miles east of the proposed project area, but then the wolf headed south/southwest to Crater Lake and into Northern California. In 2012, it was documented traveling back and forth across the California/Oregon southern border.

There are no records of an established individual or pack on the Forest nor is there a breeding population. The Rocket Project area does not contain habitat for denning or rendezvous sites. There is a very low probability that a gray wolf would disperse through the project area; however, treatments would not preclude movement through the project area. Since there is not a breeding population and the project alternatives would not affect dispersal habitat, there would be *No Effect* to gray wolves on the Forest under any of the Rocket project alternatives.

Northern Spotted Owl

The range of the northern spotted owl does not extend to the Deschutes River or east of the Deschutes River. The Rocket Project area is entirely east of the Deschutes River by one (1) mile at its most westerly point. Northern spotted owls generally require mature or old-growth coniferous forest with complex structure including multiple canopy layers, large green trees and snags, heavy canopy habitat, and coarse woody material on the forest floor. These types of forests usually contain the structures and characteristics required for nesting, roosting, foraging (NRF), and dispersal. Suitable habitat on the eastside of the Cascade Mountains is naturally confined to a narrow forested band below the high-elevation subalpine forests and above the low-elevation lodgepole/ponderosa pine forests (USDI 1992). Nesting, roosting, and foraging habitat for the northern spotted owl on the Forest includes stands of mixed conifer, ponderosa pine with white fir understories, and mountain hemlock with subalpine fir. Nest trees on the Deschutes have been predominantly large Douglas-fir trees.

Since the project area is not within or adjacent to suitable spotted owl habitat, there would be *No Effect* to the northern spotted owl or its habitat including NRF habitat or dispersal/connectivity habitat.

Northern Spotted Owl Critical Habitat

There is no designated critical habitat unit within 6 miles of the project area. Since this project does not occur within or adjacent to critical habitat, there would be *No Effect* to this habitat.

Wolverine

The wolverine is a Federal Proposed Species, a Region 6 Sensitive Species, and a Forest Plan 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 (Federal Register Vol. 78, No. 23). Final listing is anticipated for 2014.

The wolverine was thought to have been extirpated in Oregon by 1936 (Hiller 2011). At least one report of a wolverine was documented for each decade from the 1960s to the 1990s in Linn, Harney, Wheeler, and Grant counties, respectively (Hiller 2011). In 2011, a monitoring project detected three individual wolverines in the Wallow-Whitman National Forest in northeastern Oregon, an area with no prior documentation of wolverines (Magoun et al. 2013). During 2008, a wolverine (probably of Rocky Mountain origin) was confirmed in northern California, the first evidence in almost 90 years (Moriarty et al. 2009).

Wolverines appear to be extremely wide-ranging and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. 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 or clearcuts (Hornocker and Hash 1981).

Wolverines tend to be found in alpine or boreal coniferous (7,000 to 9,000 feet) forests where snow coverage remains well into the denning season (spring) with only slight variations in habitat use between summer and winter (Copeland et al. 2007; Aubry et al. 2007). This high elevation habitat is not available in the project area. 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. They may travel through and or forage infrequently at lower elevations on the district but utilize higher elevations for most of their needs.

A draft habitat assessment for the wolverine on the Forest was completed in 2012. Of the 1,656 acres of wolverine denning habitat modeled for the Forest no denning habitat was modeled for the Rocket Project area. A lack of habitat assumes a lack of presence. There is a very low probability that a wolverine would disperse through the project area; however, neither treatments nor staging areas would not preclude movement through the project area. Since there would be no impact to denning habitat and the project alternatives would not affect dispersal habitat, there would be *No Effect* to the wolverine on the Forest under any of the Rocket Project alternatives. The Rocket Project would not contribute to a trend towards federal listing for this species.

Oregon Spotted Frog

The Oregon spotted frog is the most aquatic native frog in the Pacific Northwest. It is almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover (Leonard et al. 1993, Corkran and Thoms 1996, McAllister and Leonard 1997, Pearl 1997, Pearl 1999). Oregon spotted frogs seem to prefer fairly large, warm marshes (approximate minimum size of 4 hectares (9 acres)) that can support a large enough population to persist depite high predation rates (Hayes 1994) and sporadic reproductive failures. Large concentrations of Oregon spotted frogs have been found in areas with the following characteristics: 1) the presence of good breeding and overwintering sites connected by year-round water; 2) reliable water levels that maintain depth throughout the period between oviposition and metamorphosis; and 3) the absence of introduced predators, especially warm-water game fish and bullfrogs (USFWS 2013).

There is no water or wet meadow habitat within the Rocket Project area; therefore, there would be *No Effect* to the Oregon spotted frog or its habitat.

Oregon Spotted Frog Critical Habitat

There is no designated spotted frog critical habitat within or adjacent to the project area; therefore, there would be *No Effect* to this habitat.

Region 6 Sensitive Species

Table 48 lists the Region 6 Sensitive Species and Federal Candidate Species. All of the species that are federally threatened or endangered are also considered regionally sensitive. These species have been addressed separately in the above section. Those species that are in bold are analyzed further and contain habitat within or adjacent to the project areas and that the particular habitat and/or species may be affected by project activities. For those species that are not in bold there may or may not be any habitat within or adjacent to the project area, but the habitat or species would not be impacted by the proposed project in either case.

Table 48: Region 6 Sensitive animal species and Federal Candidate species occurring or potentially occurring on the Forest and the impacts from the proposed project. Those species in bold receive further consideration and analysis.

Species	Status	Habitat Needs	Impact	Rationale
BIRDS				
Northern bald eagle (*Haliaeetus leucocephalus*)	Regional Forester Sensitive, MIS, BCC, S4B, S4N	Lakes, large rivers with nearby large diameter trees, usually ponderosa pine.	No impact	No habitat
American peregrine	Regional Forester	Riparian and cliff	No impact	No habitat

Species	Status	Habitat Needs	Impact	Rationale
falcon (*Falco peregrinus anatum*)	Sensitive, MIS, BCC, S2B	habitat.		
Lewis's woodpecker (*Melanerpes lewisi*)	**Regional Forester Sensitive, MIS, BCC, Landbird focal species (ES), S2, S3B**	**Large diameter snags in open ponderosa pine, burned forests.**	**May impact due to disturbance. Beneficial impact to habitat (all action alt.)**	**Existing habitat**
White-headed woodpecker (*Picoides albolarvatus*)	**Regional Forester Sensitive, MIS, S2, S3B**	**Large diameter snags in open ponderosa pine forests.**	**May impact due to disturbance. Beneficial impact to habitat (all action alt.)**	**Existing habitat**
Bufflehead (*Bucephala albeola*)	Regional Forester Sensitive, MIS, S2B, S5N	Snags associated with lakes	No impact	No habitat
Harlequin duck (*Histrionicus histrionicus*)	Regional Forester Sensitive, MIS, S2B, S3N	Rapid streams, large trees	No impact	No habitat
Tule white-fronted goose (*Anser albifrons elgasi*)	Regional Forester Sensitive, S2, S3N	Seasonal migrant (spring and fall), marshes and wetlands	No impact	No habitat
American white pelican (*Pelecanus erythrorhynchos*)	Regional Forester Sensitive, S2B	Freshwater lakes with islands available for breeding	No impact	No habitat
Horned grebe (*Podiceps auritus*)	Regional Forester Sensitive, MIS, S2B, S5N	Lakes	No impact	No habitat
Tricolored blackbird (*Agelaius tricolor*)	Regional Forester Sensitive, BCC, S2B	Lakeside, bullrush	No impact	No habitat
Yellow rail (*Coturnicops noveboracensis*)	Regional Forester Sensitive, BCC, S1B	Marsh	No impact	No habitat
Northern waterthrush (*Seiurus noveboracensis*)	Regional Forester Sensitive, S2B	Riparian habitat with dense willows along streambanks	No impact	No habitat
Greater sage grouse (*Centrocercus urophasianus phaeios*)	Federal Candidate, Regional Forester Sensitive, BCC, Landbird Focal Species (CP), S3	Sagebrush flats	No impact	No habitat
MAMMALS				
Townsend's big-eared bat	**Regional Forester Sensitive, MIS, S2**	**Caves, mines, bridges, rock**	**May impact but would not lead to**	**Cave winter habitat and**

Species	Status	Habitat Needs	Impact	Rationale
(*Corynorhinus townsendii*)		**crevices, ponderosa pine and juniper forests.**	**a trend towards Federal listing or contribute to a loss of viability on the Deschutes NF (all action alternatives).**	**foraging habitat**
Pallid bat (*Antrozous pallidus*)	**Regional Forester Sensitive, S2**	**Arid desert and grasslands with rock crevices, caves, old mines, trees, old buildings**	**May impact but would not lead to a trend towards Federal listing (all action alt.)**	**Cave winter habitat and foraging habitat**
Spotted bat (*Euderma maculatum*)	Regional Forester Sensitive, S2	Caves , cliffs, and rock crevices	No impact	This bat species has not been detected on the Forest. Very low potential of occurring in the project area.
Fringed myotis (Myotis thysanodes)	**Regional Forester Sensitive, S2**	**Caves, mines, rock crevices, in desert, grasslands and woodlands**	**May impact but would not lead to a trend towards Federal listing (all action alt.)**	**Roosting and foraging habitat**
Pygmy rabbit (*Brachylagus idahoensis*)	Regional Forester Sensitive, S2	Sagebrush flats	No impact	No habitat
Pacific Fisher (*Martes pennanti*)	Federal Candidate, Regional Forester Sensitive, MIS, S2	Mixed conifer, riparian, complex physical structure	No impact	No habitat
AMPHIBIANS				
Columbia spotted frog (*Rana luteiventris*)	Regional Forester Sensitive, S2, S3	Slow streams, marshes, ponds, lake edges	No impact	No habitat
INVERTEBRATES				
Crater Lake tightcoil (*Pristiloma arcticum crateris*)	Regional Forester Sensitive, S&M, S1	Perennial wet areas along streams.	No impact	No habitat
Evening field slug (*Deroceras hesperium*)	Regional Forester Sensitive, S&M, S1, S2	Perennially wet meadows in forested habitats	No impact	No habitat
Silver-bordered fritillary (*Boloria selene atrocostalis*)	Regional Forester Sensitive, S2	Wet meadows, bogs, and marshes that contain violets	No impact	No habitat

Species	Status	Habitat Needs	Impact	Rationale
		(host plant for caterpillar) and goldenrod (for adult feeding).		
Johnson's hairstreak (*Callophyrys johnsoni*)	**Regional Forester Sensitive, S2**	**Coniferous forests, especially old growth**	**May impact individuals or habitat but would not lead to a trend towards Federal listing (all action alt.)**	**Proposed treatments would reduce the amount of mistletoe infected trees in project area for larvae plus reduce the amount of host plants and food sources for the butterfly.**
Western bumblebee (*bombus occidentalis*)	**Regional Forester Sensitive, S2**	**Native wildflowers, rodent burrows for wintering.**	**May impact individuals or habitat but would not lead to a trend towards Federal listing (all action alt.)**	**Proposed treatments could cause direct mortality of bees, crush nesting and winter burrows and decrease the availability of flowering plants as a food source.**

***Federally listed and Regional Forester Sensitive S**pecies: Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest (December 2011)
Oregon Sensitive Species: **NatureServe** database for Oregon (2012): S1, critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, B = breeding, N = non-breeding, SH = possibly extirpated.
Landbird focal species: Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000)
Management Indicator Species: Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990)
Birds of Conservation Concern (BCC) U.S. Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) (2008)

Townsend's Big-eared Bat, Pallid Bat, and Fringed Myotis

Existing Condition

The Townsend's big-eared bat, pallid bat, and fringed myotis are dependent on caves, or cave-like structures (mines and buildings) rock crevices, rock faces/cliffs, tunnels, bridges, and for some, trees, as roost sites. Other habitat associations including foraging are coniferous forests, mixed mesophytic forests, forested lava flows, deserts, native prairies, perennial and intermittent riparian streams, cliffs, active agricultural areas, and

coastal areas (Gruver and Keinath 2006; Keinath 2004).

Within the Rocket Project area, three caves are known to exist. Most of these caves have not been surveyed. The largest and most well-known is Lava River Cave, which is one of the longest lava tubes in the state of Oregon, with a length of approximately one mile. Forest survey records from 1993-2011 show a hibernating population of 3-8 Townsend's big-eared bats during the winter. Hibernation by other species, including the pallid bat and fringed myotis, within this cave is not known as they often hibernate in cracks and crevices and are difficult to detect.

There are approximately 60,000 visitors to Lava River Cave annually. The cave is closed from October 1 to May 1 to reduce disturbance to hibernating bats. The current short chain link cyclone fence does not prevent illegal visitation, even though signs are posted. An unknown number of visitors enter the cave illegally during the winter season which likely results in disturbance to Townsend's big-eared bats and other bat species. During heavy winters, the entrance to Lava River Cave discourages visitation due to the formation of ice which makes the entry treacherous. This cave historically may have provided habitat for a large number of bats, prior to the use of the cave as a recreational site.

A recently identified threat to bats in the eastern and midwestern U.S. is white-nose syndrome (WNS), which has significantly reduced populations of five bat species in nine eastern states since 2006. This disease is associated or caused by a newly described, psychrophilic (cold-loving) fungus, *Pseudogymnoascus destructans* (Gargas et al. 2009). Termed "white-nose" due to the presence of this white fungus on their nose, it also may appear on their ears, forearms, and wing/tail membranes or may not be visible at all. Bats have been found exhibiting abnormal behavior (flying to different locations in the cave or flying outside the cave in search of food) or dying during hibernation, often in large numbers. Transmission is thought to be primarily bat-to-bat contact although other agents of transmission may occur. Bats may transmit WNS through contact at fall swarming (mating) cave sites as well as during hibernation.

There is a growing concern that WNS could eventually move west from bat to bat transmission or jump to new locations further west via spores, possibly carried by humans. Show caves including Lava River Cave are at heightened risk of transmission due to the large number of visitors that come from throughout the U.S., including WNS-affected states.

In addition to the caves, roosting habitat is potentially available in the lava flow and rock outcrops, the largest being the main lava flow within the Newberry National Volcanic Monument that occupies 5,248 acres. Other roosting habitat, including large trees and snags, occur in the project area, but are limited within the forested portion of the project area. An unknown number of large trees and snags do occur on the lava flow. Approximately 512 forested acres are considered LOS (late and old seral) habitat in the Rocket Project area which could provide roosting habitat.

Foraging habitat occurs across the forested portion of the project area (17,434 acres), with the quality of this habitat varying, depending upon stand conditions and densities.

Townsend's Big-Eared Bat

The following information is summarized from the Species Assessment for Townsend's big-eared bat for the Deschutes National Forest (USDA Forest Service 2012a).

Townsend's big-eared bats are a non-migratory species dependent on caves, or cave-like structures (mines and buildings) year-round. In the west, these natural and human made structures occur in a wide variety of habitat types and elevations from sea level to above 10,000 feet (Hayes et al. 2011, Siemers 2002, Szewczak et al. 1998). While mines in some areas of the western U.S. provide habitat, there are no mines that provide habitat for Townsend's on the Forest and few in Central Oregon. Townsend's big-eared bats will also use rock crevices, rock faces/cliffs, buildings, tunnels, bridges, and trees as roost sites. Old-growth redwood tree basal hollows created by fire were used as summer roost sites in central coastal California (Fellers and Pierson 2002) and northern coastal California (Gellman and Zielinksi 1996, Mazurek 2004).

Cave habitat associations for Townsend's big-eared bats in the west include coniferous forests, mixed

mesophytic forests, forested lava flows, deserts, native prairies, perennial and intermittent riparian streams, cliffs, active agricultural areas, and coastal areas (Western Bat Working Group 2005). In addition to cave or cave-like habitat, primary habitat components include suitable foraging habitat that provides insect prey and water sources for both drinking and foraging. Townsend's are foraging habitat generalists due to their successful foraging in a wide range of habitats where insects concentrate including riparian areas/intermittent streams, wetlands, lakes, forest/shrub edges, ridges, and forest canopy (Burford and Lacki 1998, Clark et al. 1993, Seidman and Zabel 2001). These bats can forage upwards of 5 miles from roosting sites (Gruver and Keinath 2006).

Pallid Bat

Pallid bats are found in arid deserts and grasslands, often near rocky outcrops, water, and less abundant in evergreen and mixed conifer woodlands. Pallid bats usually roost in rock crevices or buildings, and less often in caves, tree hollows, mines, etc. In Oregon, night roosts were in buildings, under rock overhangs, and under bridges; bats generally were faithful to particular night roosts both within and between years (Lewis 1994). Pallid bats prefer narrow crevices in caves as hibernation sites (Caire et al. 1989).

Fringed Myotis

The fringed myotis is found in a variety of habitats throughout its range, and seems to prefer forested or riparian areas. There are scattered records from waterholes in deserts, but these tend to be within flying distance of forested areas. Most records for this species occur west of the Cascade Mountains. Its nursery colonies are established in caves, mines, and buildings.

The fringed myotis, like many bat species, is very sensitive to disturbance at or modification of roosts and the surrounding environment. The most important roosts are maternity colonies and hibernacula (USDA 2004). Disturbance of roosts (i.e., caves, mines, cliffs, buildings, snags) can take the form of direct human contact or alteration of the roost environment. Roost destruction has been caused by anthropogenic activities including removal of large-diameter, cavity-forming trees suitable for roosting and modification of the forest structure around roost sites. Other important impacts include human activity in caves, closure of mines without consideration of bat access, and uninformed building and bridge modification (USDA 2004).

This species is more vulnerable to alteration of mature forest ecosystems than most bat species because: 1) it depends on old-growth conditions with abundant, large roosting snags; 2) it is a rare species; 3) it occurs in a restricted elevation zone; 4) it exhibits strong site fidelity; 5) it is sensitive to roost disturbance; 6) it has restrictive hibernation requirements; and 7) it has a low reproductive capacity (USDA 2004). Therefore, policies and logging practices that permit intensive logging of old growth and selective removal of dead and dying trees (e.g., Healthy Forest Initiative) are likely to be detrimental to the maintenance of a landscape suitable for the persistence of *M. thysanodes*. In addition to the reduction of old-growth forest and snag density, alteration of water flow or persistence can impact bat distributions. Changes in vegetation composition or structure can alter the abundance and diversity of their insect prey base. Management actions or disturbances that serve to homogenize the landscape at the scale of typical bat foraging areas can lead to a reduction in suitable habitat (USDA Forest Service 2004).

Table 49 lists the standards and guidelines applicable to caves and bats for the Rocket Project in the Forest Plan and the NNVM Management Plan.

Table 49: Standards and guidelines applicable to caves and bats for the Rocket project.

Source of Standard/Guideline	Text of Standard/Guideline
Forest Plan: CV-3 and Monument Plan: M-5	Until a significant cave list is completed, all caves will be protected as follows: • Trees will not be harvested in a 150 to 200 foot radius around cave entrances and infeeder drainages with slopes of less than 30 degrees. There will be no ground-disturbing activities on slopes steeper than 30 degrees adjacent to cave entrances.

Source of Standard/Guideline	Text of Standard/Guideline
	• Similar buffers will be maintained around direct drainages into caves. This includes sinkholes, cave collapse areas known to open into a cave's drainage system, and perennial, intermittent or ephemeral streams flowing into caves. • Clearcutting will be prohibited within 250 feet of the entrance to caves with significant populations of bats. A 150 to 200 foot wide forested corridor between the entrance of these caves and the nearest foraging area will be maintained. When the foraging area is a nearby stream, trees will not be harvested for 75 to 100 feet on either side.
Forest Plan: CV-4	A management plan will be developed for each significant cave. It will include an inventory and mapping of cave resources, research and monitoring programs, and when necessary, a cleanup or restoration program. Access will be determined by the capacity of caves to withstand the impacts of visitation and management prescriptions will be developed on a cave by cave basis.
Forest Plan: CV-5	Measures for the protection of caves will be incorporated into project plans for road construction, timber harvest, tree planting, and blasting near caves, and any activity which could change cave temperatures and drainage patterns.
Forest Plan: CV-6	The location of caves will be kept confidential when needed to protect major archeological sites, habitat for endangered wildlife, sensitive cave biota, and unique geological features.
Forest Plan: WL-70: Townsend's big-eared bats	Because most lava-tube caves have air movement that could be significantly influenced by their entrance environment, the character of existing forest vegetation will be maintained at these openings.

Direct and Indirect Impacts—Alternative 1

The selection of this alternative would result in no direct impacts to Townsend's big-eared bat, pallid bat or fringed myotis because no vegetation management actions would occur to reduce foraging and potential roosting habitat or to potentially disturb bats during their hibernation period (October through April). However, the impacts of this alternative would also continue to limit the amount of large tree and snag habitat available for roosting for the long-term. The blackbark pine stands would remain dense with high canopy closure, limited foraging habitat, and would grow increasingly susceptible to stand-replacement disturbances such as fire or insect and disease. This could result in the loss of foraging or roosting habitat within the short-term and with long-term implications.

Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013). Bat species within Central Oregon evolved with wildfires. Although wildfires can occur in almost any month in Central Oregon, particularly in drier years, the typical fire season is May through September or early October, with most fires occurring in late summer. Negative direct impacts to tree-roosting bats include injury or mortality from skin burns, gas and smoke inhalation, temporary loss of insect prey, and displacement from roost and foraging habitat. Wildfires that result in smoke accumulation inside cave hibernacula or maternity sites could cause injury or mortality or abandonment of young. Wildfires could affect foraging outside of cave entrances through burning of vegetation but it is unlikely that foraging habitat on a landscape scale would have been detrimental. Wildfires historically would not have affected hibernacula or maternity cave sites very often and unlikely would have had negative impacts on a large landscape scale. On a smaller stand-scale, a high intensity and/or stand-replacing fire that resulted in heavy smoke or substantially reduced vegetation outside cave entrances could negatively impact bats, especially for small populations. Historically, low-intensity, mixed severity or small high-intensity fires likely contributed to open understories and small openings that benefitted foraging habitat for bats.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Tree Treatments

Townsend's appear to avoid large clearcuts or regenerating stands in the early seral stages (Gruver and Keniath 2006). No large clearcuts are proposed under any of the action alternatives, but regenerating stands would occur. There would be 5 to 11 openings, depending on the alternative, that would be 3 to 12 acres in size. No trees over 21 inches dbh would be harvested. Only three of the proposed openings contain trees >21" dbh at 3-5 trees per acre. Trees this size or larger within and 30 feet outside these openings that contain mistletoe would be topped during logging operations for snag creation. This would be approximately 10-20 trees.

These areas would be burned and planted shortly after. Although these stands would be planted with ponderosa pine to decrease the amount of time to become forested, within the short-term, these stands would provide foraging habitat due to the bitterbrush that would come in from the increased sunlight. However, these acres may not provide foraging habitat when the stands reestablish into early seral stages of ponderosa pine, also within the short-term. This impact would be considered minor when considering these bats are foraging habitat generalists and the remaining acres within the project area can provide foraging habitat.

Other treatments within the ponderosa pine PAG should be beneficial to this bat species. Proposed treatments would provide diversity across the project area by opening up stands to provide for more shrub growth within the denser stands (for prey species) and providing for better maneuverability for the bats to forage. Tree growth would be accelerated towards LOS, thereby providing potential quality roosting habitat in the long-term.

To protect Lava River Cave and the other caves found within the project area, trees would not be harvested within 150 to 200 feet.

To protect potential roosting habitat within the lava flows and outcrops a resource protection measure is in place that would restrict logging on these flows and outcrops with shallow soils greater than 100 square feet, and require directional felling of trees away from this habitat.

Mowing

Mowing would have a short-term impact on bat foraging habitat due to the reduction in shrub cover, thereby reducing the insect prey base. Depending on the alternative, 55-77% of the project area would not be mowed. In areas that would be mowed, 10-30% of the shrub component would be retained. During mowing, the shrub height would be maintained at a sufficient height to potentially provide some habitat for bat prey insect species.

Prescribed fire

The use of prescribed fire during spring and late fall has increased as a management tool on the Forest over the past decade and will likely continue to increase on a larger scale in the future. For cave-dwelling bats such as Townsend's, burning any time from late October through April has the potential to disturb hibernating bats and cause extra arousals that are energetically costly for bats near the limit of their tolerances (Dickinson et al. 2009). Prescribed fires during later winter and spring may reduce bat insect prey during the critical period when bats are emerging from hibernation, are migrating, and when females are pregnant. Spring burning near maternity sites may cause females to abandon young. In areas with hibernacula and maternity sites, burning in early spring to avoid disturbing maternity colonies must be balanced against risk to hibernating bats (Dickenson et al. 2009).

Caves which have "chimney-impact" airflow may be at higher risk of drawing smoke inside the cave during nighttime inversions (when nighttime temperatures drop below the annual mean). Fire managers in Mammoth Cave National Park in Kentucky attempt to conduct fires on days warm enough to avoid smoke aspiration into hibernacula (i.e., when daytime temperatures are >50 F (>10 °C) (i.e., the average cave temperature). To protect Lava River Cave and the other caves found within the project area, prescribed burning operations would occur under weather conditions that would best prevent smoke from entering the caves. The preferred months to conduct prescribed fire at Lava River to protect hibernating bats would be

May through mid-October.

To protect potential roosting habitat within the lava flows and outcrops, underburning should not occur on these flows and outcrops with shallow soils greater than 100 square feet, plus it is preferred that prescribed burning adjacent to these outcroppings occur during the fall months when bats are more fit and able to survive potential disturbance associated with smoke.

Temporary Roads

Temporary roads could have a short-term impact to foraging habitat due to the reduction in shrub cover. Overall these impacts are expected to be limited because they are short-term and the roads would be rehabilitated. Table 50 summarizes the acres of potential bat roosting and foraging habitat removed by alternative from harvest and fuels activities and temporary road creation.

Table 50: Potential acres of bat foraging habitat impacted from tree and fuels treatments by alternative.

Habitat	Alternative 2	Alternative 3	Alternative 4
Acres of foraging habitat impacted (Percentage of Forested Area impacted)	Harvest - 6,453 acres (37%)	Harvest – 3,957 acres (23%)	Harvest – 8,788 acres (50%)
	Fuels - 7,321 acres (42%)	Fuels – 3,978 acres (23%)	Fuels – 7,866 acres (45%)
Acres of openings created	22	38	61
Miles of Temporary road development	5.3 (6 acres)	2.8 (3 acres)	5.8 (7 acres)

Alternative 4 would treat the largest acres of bat foraging habitat at 8,788 acres (50% of the forested project area) and treat the largest acres (7,866 acres) of shrub habitat for bat prey species (45% of the forested acres). It would also create the largest acreage of openings (61 acres) and temporary roads (5.8 miles or 7 acres).

Alternative 2 would treat 13% less acres of bat foraging habitat (6,453 acres) than Alternative 4 and treat a similar acreage of shrub habitat for bat prey species (7,321 acres or 42%). Approximately 22 acres of openings would be created (the least of all three alternatives) as well as 5.3 miles of temporary roads that would remove 6 acres of shrub habitat short-term.

Alternative 3 would treat the least amount of bat foraging habitat (3,957 acres or 23%) and shrub habitat for bat prey species (3,978 acres or 23% of the forested acres). Acres of created openings are greater than Alternative 2, at 38 acres, but less than the openings created in Alternative 4. This alternative would need the least amount of temporary roads that would reduce shrub cover by 3 acres short-term.

Within all alternatives, thinning trees would improve forage conditions and diversity by opening up stands that would allow for more shrub development and greater maneuverability for bats. Thinning trees would also accelerate those trees remaining to LOS, which in turn would improve roosting conditions for the bats across the project area long-term. Proposed openings would eventually provide shrub cover for bat foraging habitat, which over time would become a younger forested stands. Negative impacts, which are expected to be short-term impacts, would be mowing and burning shrub cover. Reducing the amount of shrub cover within the project area would reduce the substrate for prey species that bats depend upon. The timing of burning would coincide to prevent the least impacts to hibernating bats.

Cumulative Impacts—Alternatives 2, 3, and 4

Currently, habitat acres and home range acres for each of these bat species is unknown within the watershed and across the Deschutes National Forest. The MIS analysis for the Townsend's big-eared bat (USDA Forest Service 2012A) is based on cave habitat across the Forest, not on roosting or foraging habitat acreages. Foraging habitat is assumed to be abundant because of these specie's wide-range foraging capabilities.

As an ongoing project considered in the cumulative effects analysis, the West Bend Vegetation Management

Project may impact the Townsend's big-eared bat, pallid bat, and fringed myotis or their habitat by treating 10,545 acres of roosting and foraging habitat in the watershed (potentially up to 16%) with commercial thinning, mowing and underburning. Implementation of action alternatives for the Rocket Project area would treat between 6,453 to 8,788 acres of bat roosting habitat (potentially impacting an additional 10% - 14% of the watershed) and 3,978 to 7,866 acres of bat prey species habitat (potentially impacting an additional 6% - 12% of the watershed) depending upon the alternative chosen. The treatments would not remove all foraging or roosting habitat as patches of shrubs would be left within treatment areas as well as ponderosa pine snags and trees 21" and larger (except within openings).

Along with the West Bend Vegetation Management Project, the Rocket project may result in short-term negative cumulative effects to these bat species' due to potential disturbance and reduction of foraging habitat in the North Unit Diversion Dam – Deschutes River Watershed from treatment activities.

With these short-term negative cumulative effects from potential disturbance of roosts and reduction of foraging habitat from the Rocket project and West Bend project are the additional cumulative effects to bat species that also utilize Lava River Cave for hibernation and are consistently disturbed by the ongoing illegal recreational visitation to the cave during the months of October through April.

Determination

All action alternatives would have both beneficial and negative impacts to bats, their habitat, and their prey species. The impacts vary by alternative by percentage of habitat impacted across the project area. Variability of habitat would remain across the project area with all alternatives, with a10-30% retention of shrubs that would remain after mowing and burning and 50-77% of the forested project area remaining unchanged (depending upon the alternative chosen). It is assumed that species presence would still be maintained with any of these alternatives. Based on these impacts and the application of project design criteria, the determination for all action alternatives is *May impact individuals or habitat, but would not likely contribute to a trend toward federal listing* for the Townsend's big-eared bat, the pallid bat, and the fringed myotis.

The Rocket project alternatives would be consistent with standards and guidelines for caves and bats in the Forest Plan (CV-3, CV-4, CV-5, CV-6, WL-70) and the Monument Plan (M-5). This project would not contribute to a negative change in viability to the Townsend's big-eared bat on the Deschutes National Forest.

Johnson's Hairstreak

Existing Condition

The Johnson's hairstreak butterfly is found from southwest British Columbia southward into the Coast Ranges to San Francisco in California; south in the Cascades and Sierra Nevada to Yosemite and also in the Blue Mountains of eastern Oregon. In Oregon its ranking is listed as S2, 'Imperiled,' very rare, or local throughout its range or found locally in a restricted range (NatureServe 2012).

Suitable habitat for this species is described as coniferous forests, especially old growth (Opler et al. 2006) and old growth coniferous forests with red firs, western hemlocks, or gray pines on which its parasitic (mistletoe) hosts grows (NatureServe 2012). Johnson's hairstreak is believed to feed generally on all dwarf mistletoe species throughout its range, and to perhaps specialize on locally available dwarf mistletoes in specific localities (Schmitt and Spiegel 2008). Miller and Hammond (2007) describe suitable habitat as almost identical to the northern spotted owl except the butterfly does not occur south of central California. The caterpillar food plant is western dwarf mistletoe. Adults find nectar on low growing plants such as whitethorn ceanothus and Mt. Hood pussypaws (NatureServe 2012 and USDA, NRCS 2008). Miller and Hammond (2007) described management practices to benefit this species need to promote the maintenance of mature and old-growth conifers at middle to low elevations on the west slope of the Cascade Mountains and Coast Range.

Threats to this species includes timber harvest in mistletoe infested areas, large stand replacement fires, Btk

(insecticide) use, herbicide use on forage species, and possible hybridization with the Thicket Hairstreak (NatureServe 2012 and USDA NRCS 2008).

Opler et al. (2006) shows Johnson's hairstreak documentation for western and central Oregon plus the Blue Mountains in northeastern Oregon. The species is suspected to occur on the Deschutes National Forest in the following plant associations – lodgepole pine, ponderosa pine, Douglas-fir, white fir, silver fir, western hemlock, and subalpine fir where the average tree size is 15"dbh or greater (an estimated 200,000 acres on the Forest), but currently there is no confirmed documentation on the Forest. A survey protocol was released in April 2010 (Davis et al. 2010) and formal surveys using the protocol were conducted on the Deschutes National Forest during the summer of 2010. Larvae were collected from dwarf mistletoe from the Crescent Ranger District; however, species identification determined the larvae were not Johnson hairstreak. Because the species is closely associated with dwarf mistletoe which is widespread in the project area, the Johnson's hairstreak is assumed to occur. Schmitt and Spiegel (2008) state that claims of dwarf mistletoes occurring solely in old growth or are dependent upon old growth are erroneous. Dwarf mistletoe generally increases in incidence and intensity in older stands, although even young stands readily host dwarf mistletoe and maturing stands may be severely infected if they have been continually infected by a residual overstory. They also state that in the absence of recent large scale disturbance, dwarf mistletoe infestation levels can occur in early, mid, and late successional stands. Incidental observations within the 22,682 acre project indicate dwarf mistletoe is very common and infection is assumed to be present in all seral stage classes which could serve as a host for the caterpillar.

Direct and Indirect Impacts—Alternative 1

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 infection. Although this butterfly has yet to be confirmed on the Forest, potential suitable habitat would be maintained based on the widespread presence of dwarf mistletoe in all plant associations across the 22,682 acre project area. Over decades, the older and largest diameter trees may eventually weaken from severe mistletoe infections and succumb to beetle attacks and/or drought. However, until the trees' death, the infection would continue to spread to the understory trees and perpetuate the life cycle of mistletoe while at the same time providing habitat for the Johnson's hairstreak.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Table 51 summarizes the acres of potential Johnson's hairstreak habitat removed by alternative. The selection of any action alternative would result in the commercial thinning, small diameter thinning, and prescribed underburning of forested stands that include trees infected with western dwarf mistletoe. These actions would reduce but not eradicate mistletoe presence in the 22,682 acre project area. Consequently, mistletoe infection would continue to exist within actively treated stands (they would remain fully stocked, with exception of created openings), as well as forested stands not selected for treatment. These treatment actions would be consistent with recommendations from Miller and Hammond (2007) that promoting the maintenance of mature and old-growth conifer forests would benefit this species.

Prescribed underburning would occur on ponderosa pine dominated stands and may result in the reduction of host plants such as ceanothus and pussypaws within burn units. The amount of area left unburned post-treatment varies depending upon several factors including the time of year the burn treatment occurs and the type of ignition (hand or aerial). On average 10-30% retention of shrubs and forbs can occur within a burn unit, providing deer browse, nesting cover for birds, and as host plants for butterflies. This retention, plus leaving a number of acres within the project area untreated, would maintain the presence of mistletoe infection and host plants widely distributed across the entire 22,682 acre project area.

Temporary roads could have a short-term impact to host plants due to the reduction in shrub/forb cover. Overall these impacts are expected to be limited because they are short-term and the roads would be rehabilitated.

Table 51: Potential Johnson's hairstreak habitat acres impacted by tree and fuels treatments by alternative.

Habitat	Existing Condition	Alternative 2	Alternative 3	Alternative 4
Acres of Dwarf Mistletoe (Percentage of Forested Area) Impacted	17,434	Harvest - 6,453 acres (37%)	Harvest – 3,957 acres (23%)	Harvest – 8,788 acres (50%)
		Fuels - 7,321 acres (42%)	Fuels – 3,978 acres (23%)	Fuels – 7,866 acres (45%)

Alternative 4 proposes the largest amount of potential loss of Johnson's hairstreak habitat at 8,788 acres or 50% of the forested acres. Of this acreage, 61 acres that are directly or indirectly designed to reduce mistletoe by creating small openings (3-12 acres in size) by removing all trees under 21 inches. Any trees 21 inches and over that may have mistletoe, would potentially by topped to provide snag habitat. Fuels treatment would treat almost 1,000 acres less, potentially reducing butterfly habitat over 45% of the forested acres. Approximately 5.8 miles of temporary roads would be constructed, removing all shrub and forb habitat within the road prism.

Alternative 2 harvests less acreage than Alternative 4 at 6,453 acres, with 22 acres of this allotted to create openings similar to those discussed above. Fuels treatments are similar to those of Alternative 4, potentially reducing butterfly habitat across 42% of the forested acres. Approximately 5.3 miles of temporary roads would be constructed, removing all shrub and forb habitat within the road prism.

Alternative 3 would have the least impact to the Johnson's hairstreak and its larvae by harvesting and conducting fuels treatments within 23% of the forested acres. Larger than Alternative 2, though, would be the acreage of created openings at 38 acres. Even so, this alternative would maintain more mistletoe habitat across the landscape for Johnson's hairstreak larvae and more low growing plants for adults to feed on. Approximately 2.8 miles of temporary roads would be constructed, removing all shrub and forb habitat within the road prism.

All impacts are expected to be short-term, as mistletoe would still persist across the project area, and shrubs and forbs reduced within fuels units and removed within the temporary road prism would re-grow within 5-10 years to pre-disturbance condition.

Cumulative Impacts—Alternatives 2, 3, and 4

The West Bend project would treat approximately 10,545 acres of potential Johnson's hairstreak habitat in the watershed. Implementation of action alternatives for the Rocket project area would treat between 3,957 to 8,788 acres of Johnson's hairstreak habitat depending upon the alternative. This could potentially reduce Johnson's hairstreak habitat across12% of the Forest. Due to the amount of habitat in the watersheds and across the Deschutes National Forest, the site specific nature of the treatments for all action alternatives would result in very minor impacts to the Johnson's hairstreak and its habitat. Therefore, there are no adverse cumulative impacts to the Johnson's hairstreak population or its habitat as a result of any action alternative.

Determination

Alternative 4 would have the greatest potential for mistletoe reduction and impact on host plants and food sources for the Johnson's hairstreak, while Alternative 3 would have the least impact to this species. All alternatives would remove this habitat that could potentially be occupied by Johnson's hairstreaks or their larvae. However, because of the widespread occurrence of mistletoe within the project area, retention of fully stocked stands within the units (except openings), a 10-30% retention of shrubs and forbs that remain after mowing and burning, and 50-77 % of the forested project area remaining unchanged, it is assumed species presence would still be maintained with any of these alternatives. Based on these assumptions, the

determination is that the Rocket project May impact individuals or habitat, but would not likely contribute to a trend toward federal listing for the Johnson's hairstreak.

Western Bumblebee

Existing Condition

The western bumblebee was once widespread and common throughout the western United States and western Canada before 1998. Since 1998, populations of this bumblebee species have declined drastically throughout parts of its former range. Populations in central California, Oregon, Washington, and southern British Columbia have mostly disappeared. NatureServe (2012) reported this species has declined about 70-100% since the late 1990s in many places, especially from British Columbia to California. Other recent observations in Oregon were documented in Wallowa County in 2008 and near Mt. Hood in 2009 (NatureServe 2012). Local observations have been as recent as 2011 in the Sunriver area and at Sparks Lake.

Habitat alterations including those that could destroy, fragment, alter, degrade or reduce the food supply produced by flowers, as well as destruction of nest sites and hibernation sites for overwintering queens, such as abandoned rodent burrows and bird nests, adversely affect these bees. Agriculture and urban development alter landscapes and habitat required by bumblebees. The sizes of bumblebee populations diminish and inbreeding becomes more common as habitats become fragmented. This in turn decreases the genetic diversity and increases the risk of population decline (NatureServe 2012).

When exotic plants invade and dominate native grasslands, they may threaten bumblebees by competing with the native nectar and pollen plants relied upon by bumblebees. A small invasive parasite of the honeybee, the small hive beetle (*Aethina tumida*), can also infest bumblebee colonies. Although it has not been well studied it could severely impact bumblebee colonies. The invasion of exotic plants and insects should be restricted as much as possible by reducing the rate of introduction of new species and by controlling populations of invasives (NatureServe 2012).

This species has been observed on the District, but there is currently no District or Forest data to determine occupancy or acres of suitable habitat. Since bitterbrush is the dominant plant species that occurs in the project area and is a flowering plant, it is assumed that it may potentially provide western bumblebee habitat. Another flowering shrub within the project area is Greenleaf manzanita. Habitat for nest sites and hibernation sites are also readily available within the project area.

Direct and Indirect Impacts—Alternative 1

The selection of this alternative would result in no immediate impact to western bumblebees because no vegetation management actions would occur to reduce flowering plant populations or alter or destroy nest and hibernation sites. Potentially suitable habitat would be maintained based on the widespread presence of bitterbrush across the project area.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

The selection of any action alternative would result in the crushing of flowering plants and potential destruction of nest/hibernation burrows by large machinery. Prescribed burning could result in the direct mortality of bees and reduce the amount of bitterbrush and other flowering plants available in the project area. The amount of area left unburned post-treatment varies depending upon several factors including the time of year the burn treatment occurs and the type of ignition (hand or aerial). On average, 10-30% retention of shrubs and forbs can occur within a burn unit, providing deer browse, nesting cover for birds, and flowering shrubs and other plants for bumblebees. This retention, plus leaving a number of acres within the project area untreated, would maintain the presence of undisturbed ground and flowering plants widely distributed across the entire 22,682 acre project area.

Table 52 summarizes the acres of potential western bumblebee habitat disturbed (ground based disturbances

from machinery during logging) and removed by fuels activities.

Table 52: Potential acres and percentage of forested acres of Johnson's hairstreak habitat proposed for tree and fuels treatments by alternative.

Habitat	Potential Existing Condition	Alternative 2	Alternative 3	Alternative 4
Acres of habitat disturbed or removed (Percentage of forested area disturbed or removed)	17,434	Harvest – 7,370 acres (42%)	Harvest – 5,645 acres (32%)	Harvest – 9,940 acres (57%)
		Fuels - 7,321 acres (42%)	Fuels – 3,978 acres (23%)	Fuels – 7,866 acres (45%)

Alternative 4 proposes the largest amount of ground disturbance at 9,940 acres or 57% of the forested acres within the project area. Fuels treatments could reduce flowering plants (i.e. bitterbrush and manzanita) by 45% (7,866 acres) across the forested acres of the project area. Approximately 5.8 miles of temporary roads would be constructed, removing all flowering shrub and forb habitat within the road prism. Alternative 4 would have the greatest impact because of the larger treatment footprint creating a higher potential of destructing nest/hibernation burrows, the greatest potential loss of a food source by crushing vegetation during harvest treatments and mowing and loss during prescribed burning, and a higher potential of direct mortality of bee individuals. This alternative presents the greatest potential of crushing or disturbing a nest or hibernation site.

Alternative 2 disturbs less ground acreage than Alternative 4 at 7,370 acres (42% of the forested acres), with a similar reduction of flowering plants (7,321 acres) across the project area. Approximately 5.3 miles of temporary roads would be constructed, removing all flowering shrub and forb habitat within the road prism.

Alternative 3 would have the least impact to the western bumblebee from ground disturbance during harvesting (10% less than Alternative 2 and 25% less than Alternative 4) and from fuels treatments (19% less than Alternative 2 and 22% less than Alternative 4). Approximately 2.8 miles of temporary roads would be constructed, removing all flowering shrub and forb habitat within the road prism. This alternative, having the smallest treatment footprint within the forested acres, would have a lower potential to destroy nest/hibernation burrows, the least potential loss of the bumblebees food source by crushing vegetation during harvest activities and mowing and loss during prescribed fire, and a decreased potential of direct mortality to bee individuals.

All impacts are expected to be short-term, as the potential to destroy a nest/hibernation burrow would diminish after project activities are complete and flowering shrubs and other flowering plants reduced within fuels units would re-grow within 5-10 years to pre-disturbance conditions.

Cumulative Impacts—Alternatives 2, 3, and 4

The West Bend Vegetation Management Project would treat 14,545 acres of western bumble habitat by pre-commercial thinning, commercial thinning, mowing and underburning in the watershed. Implementation of action alternatives for the Rocket project area would treat between 5,645 to 9,940 acres of western bumblebee habitat (depending upon the alternative chosen). It is unknown how much actual western bumblebee habitat is available within the 64,226 acre watershed that both of these projects occur within. Much of this acreage could provide areas that contain burrows suitable for hives and overwintering queens and flowering shrubs for foraging (minus roads, lava flows, and water). There could still be a 30-50% reduction of available habitat within the watershed for the bumblebee, having short-term cumulative impacts on the species. Due to the amount of habitat available in the watersheds and across the Forest, and the short-term reduction of habitat, the site specific nature of the treatments for all action alternatives would result in minor overall impacts to the western bumblebee and its habitat.

Determination

Alternative 4 would have the greatest potential to impact western bumblebees because of the larger acreage of forested habitat that would be treated by harvest and fuels activities, creating a higher potential to destroy nest/hibernation burrows and reducing the amount of food source available by crushing the plant during harvest treatments, mowing the shrubs, and loss during prescribed burning. Alternative 2 would have the next greatest potential impact, while Alternative 3 would have the least impact. However, 43-68% of the project area (including harvest and fuels activities and depending upon the alternative chosen) would remain unchanged, plus it is expected that after mowing and prescribed fire, 10-30% of shrubs and forbs within those units would be retained; it is assumed species presence would still be maintained with any of these alternatives. Based on these assumptions, the Rocket Project *May impact individuals or habitat, but would not likely contribute to a trend toward federal listing for the western bumblebee*.

White-Headed Woodpecker and Lewis' Woodpecker

Snags, Down Wood, and Green Tree Replacements

Because an important habitat component for these two species is large snags in open ponderosa pine forest, the following information on dead wood across the Forest and in the project's watershed is provided here.

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity and habitat for numerous wildlife species which depend on snags and logs for all or parts of their life cycle (Laudenslayer 2002). In forested environments, approximately 93 wildlife species are associated with snags including 4 amphibians, 63 birds, and 26 mammal species (Rose et al. 2001). The types of snag use include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating. Snags come in all sizes and go through decay processes that change them from standing hard to soft wood, then on the ground to continue decaying into soil nutrients. Not every stage of a snag's decay process is utilized by the same species, but rather a whole array at various stages or conditions.

Snags are the main contributors to dead wood which provide organic and inorganic nutrients in soil development, microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and structure for riparian associated species in streams and ponds. Size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. However, in general, larger sized logs are used by more species than smaller logs (Bull et al. 1997). Logs that lie along a contour are used more than those lying across contours.

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. For example, in a study conducted by Brown et al. (2003) in western Montana, optimum levels of down woody material for providing acceptable risks of fire hazard and fire severity while providing desirable amounts for soil productivity, soil protection, and wildlife needs were calculated and variable by forest type. Levels representing the high end for pre-settlement conditions were found as follows: 5 to 10 tons per acre for warm, dry ponderosa pine and Douglas-fir types, 10 to 20 tons per acre for cool Douglas-fir types, and 8 to 24 tons per acre for cool lodgepole pine and lower subalpine fir types.

Down wood abundance on the Deschutes National Forest is highly variable due to a limited availability of water and nutrients. This, combined with overcrowded stand conditions due to previous fire suppression, has led to tree mortality above historical levels, especially within smaller size classes (see Tables 15 - 18). In particular, plant association groups (PAGs) that tend to be drier (i.e., ponderosa pine and mixed conifer dry) may recruit a higher level of down wood today than under historical conditions. Previous fire suppression in the project area has decreased the consumption rate of down wood while other human practices such as firewood gathering has removed down wood.

Deschutes NF Forest Plan S&Gs

Standards and guidelines in the Deschutes NF Forest Plan which apply to species associated with snags and down wood include WL-37, WL-38, WL-72, and WL-73:

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.

Eastside Screens

The Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (known as the Eastside Screens) addresses the need for project design to include the principles of landscape ecology and conservation biology (USDA Forest Service 1995). Screen 3, the Wildlife Screen, represents direction and parameters based on general scientific principles and concepts. The purpose of the Wildlife Screen is to maintain options in the short-term for the conservation of wildlife species associated with late and old structural stages in eastern Oregon and Washington. This direction generally equates to 2.25 snags per acre for ponderosa pine and mixed conifer and 1.80 snags per acre in lodgepole pine. Specifically the direction for snags and down woody material are: 1) maintaining snags and green tree replacements (GTRs) of ≥15 inches dbh at 100% maximum potential population (MPP) for all vegetation types except lodgepole pine; 2) for lodgepole pine, maintain snags and green tree replacements of >10 inches dbh at 100% MPP; and 3) down logs ranging between 3 and 20 pieces per acre depending upon vegetative series (Table 53). The down log criteria are not intended to preclude the use of prescribed fire as an activity fuels treatment. Fire prescription parameters would ensure that consumption would not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes below. Table 54 lists the estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs).

Table 53: Forest Plan Down Wood Requirements.

Sale Activities				
Tree Species	**Pieces per acre**	**Diameter Small End**	**Piece Length**	**Total Lineal Length**
Ponderosa pine	3-6	12 inches	>6 feet	20-40 feet
Mixed conifer	15-20	12 inches	>6 feet	100-140 feet
Lodgepole pine	15-20	8 inches	>8 feet	120-160 feet
Prescribed Fire				
Consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes above.				

Table 54: Estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs) is as follows.

	Habitat Type		
	Ponderosa Pine	**Mixed Conifer**	**Lodgepole Pine**
100% MPP based on best available science	4 snags per acre	4 snags per acre	6 snags per acre
GTRs @ 13-19 inches residual stand*	8 tpa	8 tpa	6 tpa

*This concurs with the 10-19 inch average dbh for the small/medium structure stage defined in DecAID.

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 (USDA Forest Service 1994). 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. All of the Rocket project area occurs east of the Northwest Forest Plan line.

Biological Potential

Habitat requirements, including snag and down woody material levels, were described in the Forest Plan, WLTL, and amended Eastside Screens using information 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 using maximum the potential population method (Bull et al. 1997, Rose et al. 2001). These snag levels, under certain conditions, may not be adequate for some species, particularly for secondary cavity nesters. In addition, the Forest Plan 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. 2012) is used as the best available science for the Rocket snag analysis. DecAID is a web-based advisory tool that helps managers evaluate impacts 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 (HRV)

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 inches dbh) at 6 to 14 snags per acre (4.5 to 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 et al. 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 inches dbh when calculating biomass, whereas Harrod et al. (1998) estimated densities for size classes as small as 6 inches 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 inches dbh, of which 0.405 snags are greater than 20 inches 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. 2012) for Ponderosa pine/Douglas-fir and eastside mixed conifer habitat types for small and medium trees.

How DecAID was Reviewed for the Rocket Project Area

This snag and down wood analysis is intended to be a coarse level analysis of snag density and distribution in the Rocket Project area. At least 20 square miles (12,800 acres) in each habitat type is suggested as a minimum size for an analysis (Mellen-McLean et al. 2012). The North Unit Diversion Dam-Deschutes River Watershed (HUC 10) and the Sugar Pine Butte-Little Deschutes River Subwatershed (HUC 12) and were used for an appropriate comparison to the vegetation inventory data in DecAID for the Rocket Project area.

The PAGs in the Rocket Project area were compared to habitat types in DecAID (Table 101). 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 55. Plant Association Groups and corresponding DecAID habitat types in the Rocket Project area.

Plant Association Group in Rocket Project area	DecAID Habitat Type	Number of Acres
Ponderosa pine (wet and dry)	Ponderosa Pine/Douglas Fir	19,808
Mixed conifer (wet and dry)	Eastside Mixed Conifer	4,088
Lodgepole Pine (wet and dry)	Lodgepole Pine	1,391

An HRV analysis of existing snag density and down wood across the Deschutes National Forest and at the 5th field watershed (HUC 10) level using information from DecAID and the Ochoco and Deschutes Viable Ecosystems Management Guide (*Viable*). 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 Rocket Project area.

Forestwide Snag Density Existing Conditions and HRV

Table 56 and Table 57 list the forestwide number of acres with snags ≥10 and ≥20 inches dbh in the PP/DF, EMC, LP, and MMC habitat types categorized by snag densities (i.e., number of snags per acre). The PP/DF is the dominant habitat type, followed by LP, EMC, and MMC. The LP and MMC habitat types do not occur in the Rocket Project area and will not be further addressed.

Table 56: Forestwide acres with snags ≥10 inches dbh by habitat type.

Habitat Type	0	>0 to 6	>6 to 12	>12 to 24	>24 to 36	>36	Total Acres
PP/DF	258,587	167,405	46,295	10,894	2,052	914	486,148
EMC	50,293	100,335	79,614	53,685	27,688	25,418	337,034
LP	157,253	117,618	39,977	15,652	6,807	5,063	342,370
MMC	6,502	12,931	41,507	64,192	30,033	21,268	176,434
						Total	**1,341,986**

Table 57: Forestwide acres with snags ≥20 inches dbh by habitat type.

Habitat Type	0	>0 to 4	>4 to 8	>8 to 12	>12 to 16	>16	Total Acres
PPDF	373,171	109,068	3,870	31	5	2	486,148
EMC	126,158	162,298	36,404	9,054	2,539	581	337,034
LP	278,128	58,236	4,893	686	99	328	342,370
MMC	36,954	57,678	51,872	19,090	6,778	4,062	176,434
						Total	**1,341,986**

The HRV analysis for snag densities was also completed at the forestwide scale using information reported in DecAID and the Viable Ecosystems model. The HRV was based on the existing condition for snag densities and not the reference conditions. As shown in Table 58, for snags ≥10 inches dbh in the PP/DF habitat type, only the >0 to 4 snags per acre category is above HRV, while the remaining categories are within or slightly below HRV. Approximately 15% of the existing landscape in the EMC type has zero snags per acre which is within HRV (8 to 25%). The EMC is within HRV for the >0 to 6 snag density category, above HRV in the >6 to 12 and >36 categories, and within or slightly above HRV for the higher snag density categories.

Table 58: Forestwide percent of the Landscape with snags ≥10 inches dbh compared to HRV.

Habitat Type	Snag Density	0	>0 to 4	>4 to 12	>12 to 24	>24 to 36	>36	Total%
PP/DF (486,148 acres)	HRV	55-61	19-27	13-15	3-5	0-1	0-1	100%
	Existing	53	34	10	2	0	0	100%
Habitat Type	**Snag Density**	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
EMC (337,034 acres)	HRV	8-25	28-31	15-16	16-22	6-10	5-7	100%
	Existing	15	30	24	16	8	8	100%

Information reported in DecAID tables (unharvested plots for snags ≥10 inches (24.5cm) dbh) PP/DF_O.Inv-14, EMC_ECB_O.Inv-14., EMC_ECB_S.Inv-14, EMC_ECB_L.Inv-14, and modified with HRV information from Viable

As shown in Table 59, for snags ≥20 inches dbh in the PP/DF habitat type, 77% of the landscape has no snags which is slightly above the HRV of 66-75%, while all the remaining categories are below HRV. Approximately 37% of the existing landscape in the EMC habitat type has no snags which is above HRV (32 to 44%), while the >0 to 4 category is above (48%) the HRV (29 to 35%), but below HRV in the remaining categories. The main deviations in snag densities on the landscape are a result of historical clearcut timber harvesting (resulting in an excess of land area without snags) and fire exclusion in the stem exclusion and late successional forests (resulting in a lack of patches with high snag densities). Other factors include thinning, prescribed fire, firewood collection, illegal cutting of large snags, and loss of snags in green forests due to wildfire.

Table 59: Forestwide percent of the Landscape with snags ≥20 inches dbh compared to HRV.

Habitat Type	Snag Density	0	>0 to 4	>4 to 8	>8 to 12	>12 to 16	>16	Total%
PP/DF (486,148 acres)	HRV	66-75	23-30	2-3	0-1	0-1	0	100%
	Existing	77	22	1.0	0.0	0.0%	0.0	100%
EMC (337,034 acres)	HRV	32-44	29-35	14-22	7-10	2-3	1-2	100%
	Existing	37	48	11	3	1.0	0.2	100%
Information reported in DecAID tables (unharvested plots for snags ≥20 inches (50cm) dbh) PP/DF_O.Inv-15, PP/DF_S.Inv-15, PP/DF_L.Inv-15, EMC_ECB_O.Inv-15., EMC_ECB_S.Inv-15, EMC_ECB_L.Inv-15, and modified with HRV information from Viable								

Snag Density in the Watersheds

Table 60 lists the existing snag density conditions for the North Unit Diversion Dam-Deschutes River watershed in the PP/DF habitat type. For snags ≥10 inches, approximately 63% of the watershed has no snags and for snags ≥20 inches dbh, 84% of the watershed has no snags. In the EMC habitat type, for snags ≥10 inches, approximately 44% of the watershed has no snags dbh and for snags ≥20 inches dbh, 70% of the watershed has no snags.

Table 60: Percent of watershed for snags ≥10 and ≥20 inches dbh.

North Unit Diversion Dam-Deschutes River Watershed							
Percent (%) of Landscape for Snags ≥ 10 inches dbh							
Snags per acre	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (41,884 acres)	63	29	3	4	1	0	100%
EMC (19,563 acres)	44	24	17	7	6	1	100%
Percent (%) of Landscape for Snags ≥ 20 inches dbh							
Snags per acre	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (41,884 acres)	84	16	0	0	0	0	100%
EMC (19,563 acres)	70	27	3	0	0	0	100%

Table 61 lists the percent of the Sugar Pine Butte-Little Deschutes River subwatershed for snags ≥10 and ≥20 inches dbh. In the PP/DF habitat type, for snags ≥10 inches dbh, approximately 50% of the watershed has no snags per acre and for snags ≥20 inches dbh, 75% of the watershed has no snags per acre. In the EMC

habitat type, for snags ≥10 inches dbh, approximately 40% of the watershed has no snags per acre and for snags ≥20 inches dbh, approximately 65% of the watershed has no snags per acre.

Table 61: Percent of subwatershed for snags ≥10 and ≥20 inches dbh.

Sugar Pine Butte-Little Deschutes River Subwatershed							
Percent (%) of Landscape for Snags ≥10 inches dbh							
Snags per acre:	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (37,248 acres)	50	37	12	1	0	0	100%
EMC (28,200 acres)	40	32	15	7	4	2	100%
Percent (%) of Landscape for Snags ≥20 inches dbh							
Snags per acre:	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (37,428 acres)	75	25	0	0	0	0	100%
EMC (28,200 acres)	65	32	3	0	0	0	100%

White-Headed Woodpecker - Existing Condition

The following information is summarized from the Species Assessment for the White-headed Woodpecker for the Deschutes National Forest (USDA Forest Service 2012b).

Wisdom et al. (2000) described white-headed woodpeckers as year-round residents with a restricted range in the Columbia Basin, occurring in the eastern slope of the Cascade Range, the Blue Mountains, the Okanogan Mountains, and mountains of Idaho. Source habitat for this species is lower montane forests of old single and multi-story interior ponderosa pine (Wisdom et al. 2000) and stands dominated by ponderosa pine (Dixon 1995, Kozma 2011). This species primarily inhabits green forests but the importance of post-fire environments is becoming more apparent.

Dixon (1995) showed a positive association in Central Oregon with nesting densities and large ponderosa pine. However, Lindstrand III and Humes (2009) documented use in southcentral Oregon in managed ponderosa pine dominated mixed conifer stands where 85% of the stands were <50 or 50 to 75 year old trees. Kozma (2011) found white-headed woodpecker nesting in ponderosa pine stands with low densities of large diameter (>20 inches dbh) trees. The mean diameter of all ponderosa pine trees was 12.9 inches dbh while the mean snag diameter in nest stands was 10 inches dbh (Kozma 2011). Most white-headed woodpecker nests are found in snags; they prefer lower to mid elevation ponderosa pine forests on flat or gently sloping terrain, ranging from 2,915 to 4,000 feet (Dixon 1995, Frenzel 2003, Buchanan et al. 2003).

In Central Oregon, Dixon (1995) found that 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. They nested more frequently in decay classes 2 and 3 (moderate decay) but roosted more frequently in decay classes 4 and 5 (advanced decay) (Dixon 1995).

White-headed woodpeckers roosted in ponderosa pine habitats with an average canopy closure of 57% (Dixon 1995). Most (65%) roost sites were located on slopes that ranged from 0 to 40% with an average of 7% (Dixon 1995). Roost site elevations ranged from 2,900 to 4,311 feet (Dixon 1995). Dixon (1995) found most (78%) roosts in cavities in ponderosa pine snags. Roost tree diameters averaged 24 inches dbh and ranged from 7 to 45 inches dbh while heights ranged from 6 to 164 feet and averaged 66 feet tall (Dixon 1995).

Foraging habitat is usually found in association with reproductive habitat. Kozma (2011) surmised that 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.

More information is available in the Biological Evaluation, including population trend and status. Conservation strategies relevant to the proposed actions include: inventory to identify stands meeting desired conditions and stands that can be managed to meet desired conditions; conduct thinning, partial cuts, group selection cuts, shelterwood, planting, snag creation, or prescribed burning as appropriate to meet desired conditions but not clear cuts or overstory removal; manage for large diameter trees through wider tree spacing and longer rotation periods; retain all snags and high cut stumps >10" dbh, soft snags, broken-topped snags, leaning logs, high stumps, downed logs, and all ponderosa pine trees >17" dbh (Altman 2000).

Table 62 lists the number of hard snags needed by the white-headed woodpecker to support various percentages of their population for areas east of the Northwest Forest Plan line. Table 63 lists the snag requirements for white-headed woodpecker regarding potential population levels.

Table 62: Snag numbers for white-headed woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Ponderosa Pine	>20 inches dbh	14
	>15 inches dbh	211
Total		**225**

Table 63: Snag requirements for white-headed woodpecker regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size (inches dbh)	Snags Per Acre Required	Comments
Des WLTL and NWFP	Ponderosa Pine and Mixed Conifer	100%	>20	0.60	Retain all possible
	Ponderosa Pine and Mixed Conifer	40%	>10	0.24	
Eastside Screens	Ponderosa Pine	100%	>15	2.25	
	Mixed Conifer	100%	>15	2.25	

Snag Density as Reported in DecAID

Table 64 displays the tolerance level information for snag density relative to the white-headed woodpecker for snags >10" dbh and snags >20" dbh in Eastside Mixed Conifer, small and large trees (EMC_S/L), Ponderosa Pine/Douglas-fir, small and large trees (PPDF_S/L), and Ponderosa Pine/Douglas-fir, open (PPDF_O) as cited in DecAID for green stands.

Table 64: Tolerance levels for snag density >10" dbh for the white-headed woodpecker as reported in DecAID in green stands.

DecAID Tolerance Levels for Snag density >10" dbh for White-headed Woodpecker in Green Stands				
Snag Size	30% tolerance level Snag Density (#/acre)	50% tolerance level Snag Density (#/acre)	80% tolerance level Snag Density (#/acre)	Number of Studies
≥10" dbh	0.3	1.9	4.3	1
≥10" dbh	0.5	1.9	4.0	2
≥10" dbh	0.3	1.7	3.7	1
DecAID tolerance levels for snag density >20" dbh for White-headed Woodpecker in Green Stands				
Snag Size	30% tolerance level Snag Density (#/acre)	50% tolerance level Snag Density (#/acre)	80% tolerance level Snag Density (#/acre)	Number of Studies

≥20" dbh	0	1.5	3.8	1
≥20" dbh	0.5	1.8	3.8	1
≥20" dbh	0.2	1.3	2.8	1

Using data from the wildlife species curves for white-headed woodpeckers from the EMC_S/L wildlife habitat types, Table 64 above shows (with 90% certainty) that for snags >10" dbh in this vegetation type:

- 30% tolerance level = 0.3 snags per acre, thus, 30% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags ≤0.3 snags per acre and 70% of the individuals within the nesting population of white-headed woodpeckers utilize areas with a density of snags >0.3 snags per acre.
- 50% tolerance level = 1.9 snags per acre, thus, 50% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags ≤1.9 snags per acre and 50% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags >1.9 snags per acre.
- 80% tolerance level = 4.3 snags per acre, thus, 80% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags ≤4.3 snags per acre and 20% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags >4.3 snags per acre.

Using data from the wildlife species curves for white-headed woodpeckers from the EMC_S/L wildlife habitat types, Table 64 above shows (with 90% certainty) that for snags >20" dbh in this vegetation type:

- 30% tolerance level = 0 snags per acre, thus, 30% of the individuals within the population of nesting white-headed woodpeckers utilize areas with no snags and 70% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags >0 snags.
- 50% tolerance level = 1.5 snags per acre, thus, 50% of the areas individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags ≤1.5 snags per acre and 50% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags >1.5 snags per acre.
- 80% tolerance level = 3.8 snags per acre, thus, 80% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags ≤3.8 snags per acre and 20% of the individuals within the population of nesting white-headed woodpeckers utilize areas with a density of snags >3.8 snags per acre.

The BE provides information on forestwide reproductive habitat by snag tolerance levels. There are 14,935 acres of white-headed woodpecker reproductive habitat in the North Unit Diversion Dam – Deschutes River watershed. Approximately 67% of the reproductive habitat with snags ≥10 inches dbh and 88% of the reproductive habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable reproductive habitat. There is no habitat for a majority of individuals as this habitat contains snags ≥20 inches which is the snag density preferred by this species. The remaining 33% of the habitat with snags ≥10 inches dbh and 11% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

There are 8,265 acres of potential white-headed woodpecker reproductive habitat in the Sugar Pine Butte-Little Deschutes River subwatershed. Approximately 49% of the reproductive habitat with snags ≥10 inches dbh and 73% of the reproductive habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable reproductive habitat. There is no habitat at the snag density for snags ≥20 inches dbh preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 51% of the

habitat with snags ≥10 inches dbh and 29% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Reproductive Habitat on the Forest

White-headed woodpecker nesting habitat was mapped using ponderosa pine dominated forests which include all ponderosa pine plant association groups (PAGs) in all seral stages (early, mid, late) in addition to other PAGs (i.e. dry white fir) in the early and mid seral stages where ponderosa pine is dominant. In addition, stand size had to be a minimum diameter of 10"dbh or greater and have open stand characteristics (based on the canopy cover level thresholds for each PAG) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat. The resulting nesting habitat was then quantified by applying the DecAID PPDF_S/L.sp22 table tolerance levels.

The Viable model indicates there are 198,330 acres of white-headed reproductive habitat distributed across 23 of 25 watersheds on the Deschutes National Forest. Based on population trends, large-scale habitat assessments, risk factors, and snag analysis, white-headed woodpecker populations are highly distributed and dispersed across the forest with low abundances.

Table 65 lists the acres of reproductive habitat available for white-headed woodpeckers across the Forest, the watershed and subwatershed the Rocket Project area occurs within, and the Rocket Project area. There are 14,935 acres in the North Unit Diversion Dam-Deschutes River, 8,265 acres in the Sugar Pine Butte-Little Deschutes River subwatershed, and 2,310 acres in the Rocket project area. There have been no sightings of white-headed woodpeckers in the project area; however, sightings have occurred in the North Unit Diversion Dam – Deschutes River Subwatershed.

Table 65: Acres of White-headed woodpecker reproductive habitat.

Spatial Scale	Acres of White-headed Woodpecker Reproductive Habitat	Percent (%)
Deschutes National Forest	198,330	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	14,935	8% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	8,265	4% of habitat forestwide
Rocket Project area	2,310	0.2% of habitat forestwide
		13% of habitat in watershed (1,916 acres)
		5% of habitat in subwatershed (394 acres)

The BE provides information on forestwide, watershed, and subwatershed reproductive habitat by snag tolerance levels. There are 14,935 acres of potential white-headed woodpecker reproductive habitat in the North Unit Diversion Dam – Deschutes River watershed. Approximately 67% of the potential reproductive habitat does not contain snags ≥10 inches dbh while an additional 21% of the potential reproductive habitat does not contain snags ≥20 inches dbh, making these acreages unlikely to be suitable reproductive habitat. Based on these numbers, a majority of the watershed does not contain habitat for individuals as 88% of the habitat does not contain snags ≥20 inches dbh, which is the snag size preferred by this species. The remaining 33% of the habitat with snags ≥10 inches dbh and 11% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

There are 8,265 acres of potential white-headed woodpecker reproductive habitat in the Sugar Pine Butte-Little Deschutes River subwatershed. Table 66 shows the existing snag distribution ≥10 and ≥20 inches dbh in reproductive habitat in the watershed by tolerance level. Approximately 49% of the potential reproductive habitat does not contain snags ≥10 inches dbh or ≥20 inches dbh, while an additional 24% of the potential reproductive habitat does not contain snags ≥20 inches dbh, making these acreages unlikely to be suitable reproductive habitat. There is no habitat at the snag density for snags ≥20 inches dbh preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 51% of the habitat with snags ≥10 inches dbh and 29% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Snag Distribution in White-headed Woodpecker Reproductive Habitat in Rocket Project Area

Table 66 shows the white-headed woodpecker habitat by snag tolerance levels in the Rocket project area. Approximately 47% of reproductive habitat does not contain snags ≥10 and ≥20 inches dbh,, while an additional 38% of the potential reproductive habitat does not contain snags ≥20 inches dbh, making these acreages unlikely to be suitable reproductive habitat. There is no habitat at the snag density preferred for nesting by a majority of individuals (>80% tolerance level) as this habitat contains snags ≥20 inches dbh which is preferred by this species. The remaining snag densities provide minimal habitat.

Table 66: Existing snag distribution ≥ 10 and ≥20 inches dbh in potential white-headed woodpecker reproductive habitat in the Rocket project area by tolerance level.

Tolerance Level	Snags per acre	Reproductive Habitat Acres in Rocket Project area	% of Habitat
Snags ≥10 inches dbh			
0	0	1,082	47
>0 to 29.9%	>0 to 0.4	63	3
30% to 49.9%	>0.4 to 2.0	456	19
50%-79.9%	>2.0 to 4.0	151	7
>80%	>4.0	558	24
	Total	2,310	100%
Snags ≥20 inches dbh			
0	0	1,964	85
>0 to 29.9%	>0 to 0.5	78	4
30% to 49.9%	>0.5 to 1.8	140	6
50%-79.9%	>1.8 to 3.8	125	5
>80%	>3.8	2	0
	Total	2,310	100%

Direct and Indirect Impacts—Alternative 1

There would be no direct impacts to the white-headed woodpecker under Alternative 1 (No Action). Indirectly, white-headed woodpecker habitat in the project area would continue to remain marginal and limited. In the short and long-term, tree growth would remain slow and ponderosa pine blackbark stands would remain dense and would grow increasingly susceptible to stand-replacement disturbances such as crown wildfire. The white-headed woodpecker's preference for open forests with large diameter trees and an open understory would not develop under Alternative 1, nor would the reintroduction of fire occur through prescribed burning. In the short-term, these stands would remain low quality habitat, and in the long-term what habitat there is would continue to degrade due to increased tree density, high canopy closure, and threat to insect and disease. By taking no action, this species' habitat would continue to decline within the project area and the subwatershed and watershed it occurs in.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Out of the 2,310 acres of white-headed woodpecker reproductive habitat in the Rocket Project area, tree treatments would occur on 897 acres under Alternative 2, on 797 acres under Alternative 3, and on 1,272 acres under Alternative 4, followed by mowing and prescribed burning (Table 67). Fuels treatments would occur on 918 acres under Alternative 2, on 577 acres under Alternative 3, and on 1,103 acres under Alternative 4 (Table 67).

Table 67: Acres of white-headed woodpecker reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	192	---	---
Thinning to 60 foot average BA	573	88	406
Thinning to mixed range BA	---	313	453
Ponderosa pine restoration	49	42	50
Plantation Thin	51	54	58
Openings in DMT	---	---	51
Ladder Fuels Reduction	32	300	254
Total acres of tree treatments	**897**	**797**	**1,272**
Project acres with no tree treatments	1,413 (61%)	1,513 (65%)	1,038 (45%)
Fuels Treatments			
Mowing only	39	390	177
Mowing and underburning	879	187	926
Total acres of fuels treatments	**918**	**577**	**1,103**
Project acres with no fuels treatments	1,392 (60%)	1,733 (75%)	1,207 (52%)

All action alternatives would include a combination of commercial harvests, openings for deer cover and mistletoe infection removal, ladder fuels reduction, and plantation thinning. Post-sale actions would include lop and scatter and/or handpiling of small diameter material or removal through the use of prescribed burning. Mowing and prescribed underburning would also occur within ponderosa pine stands with burning taking place in the spring or fall months depending on appropriate weather conditions. The combination of actions would have the capability to increase reproductive habitat suitability by reducing canopy cover in the ponderosa pine dominated stands below the 40 percent level listed as a biological objective in Altman (2000) plus would aid in maintenance of large trees by reducing their susceptibility to fire and insects while reducing competition for space and nutrients. In addition, thinning treatments (including ponderosa pine plantation thinning) would accelerate the diameter growth of smaller ponderosa pine into trees and future snags into the size class this species requires having benefits well into the future by cycling large trees and snags over time. The openings created (3-12 acres in size) would maintain any large trees >21 inches dbh as current or future nest trees. Green trees >21 inches would not be removed, unless they are heavily infected with mistletoe, then they would be topped. Levels of live tree retention in all treatments will provide adequate numbers of green tree replacements to provide future snag and down log levels.

While there are differences in the amount of acreage proposed for thinning and burning, each action alternative would result in the acres treated becoming potential suitable habitat compared to the no action alternative. The various levels of mowing and underburning with each alternative would reduce small tree and shrub density and its distribution within each unit, benefitting white-headed woodpeckers by increasing their sight distance of avian predators. It would reduce the amount of shrubs and small diameter wood that provides habitat for small mammals such as ground squirrels and chipmunks known to predate on white-headed woodpecker nestlings. The amount of area left unburned post-treatment varies depending upon

several factors including the time of year the burn treatment occurs and the type of ignition (hand or aerial). On average, 10-30% retention of shrubs would remain unburned in a mosaic pattern, thus cover would not be completely removed, but would reduce the continuity of the shrubs breaking up the cover for predators.

While harvest operations associated with timber sales may require limited snag felling for safety considerations during temporary road construction and placement of log landings, overall snag removal would be very minimal, averaging one to two percent based on monitoring by district timber sale administrators. Resource protection measures have been incorporated to limit snag felling and the loss of snags during prescribed burning operations. This strategy would be consistent with the recommendations by Altman (2000) in the Landbird Conservation Strategies for the East-Slope Cascades and white-headed woodpeckers that ponderosa pine stands have at least ten trees per acre, at least 21 inch diameter, of which two should be greater than 31 inches. There should also be at least 1.4 snags per acre, at least eight inches in diameter, with 50 percent having decay and an overall mean canopy closure of 10- 40 percent.

Similarly, burning is also designed to reduce shrub densities and thinning slash that contribute to ladder fuels, but as a result of the burning there is the risk of losing existing large snags that provide reproductive habitat. In addition, through burning operations additional snags could potentially be recruited to provide future reproductive habitat (white-headed woodpeckers need trees of moderate decay for nesting).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of white-headed woodpeckers this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Because not all of the proposed activities would occur at the same time over the entire project area, undisturbed potential reproductive habitat would be still be available for the species annually during each reproductive season.

The short-term impact from these activities would be a reduction in shrub cover, which could benefit these species by reducing cover for predators, and within the long-term it would accelerate tree growth for ponderosa pine and begin developing future quality white-headed woodpecker habitat. Within mowing and prescribed burn units, implementation from any of the action alternatives could have short-term impacts such as loss of snags during prescribed burning or snag removal for safety reasons, or by displacing individuals, but these impacts would be considered minor when considering the net benefit. Outside of current habitat, Alternative 2 would thin 5,561 acres, Alternative 3 would thin 2,769 acres, and Alternative 4 would treat 7,431 acres. All action alternatives would help to accelerate and develop ponderosa pine trees to provide for future white-headed woodpecker habitat. Prescribed underburning and mowing proposals outside of suitable habitat ranges from 3,978 acres (Alternative 3) to 7,321 acres (Alternative 2), to 7,866 acres (Alternative 4). Alternative 4 provides the largest treatments for shrub cover and thinning to promote future habitat.

In the short-term, Alternative 3 treats the fewest acres of habitat of the three alternatives and in the long-term would promote the fewest acres of fire resistant ponderosa pine stands. The longevity of existing habitat would diminish in the short-term, and as a result would produce stands that continue to remain susceptible to disease, insect infestation, and wildfire. Alternatives 2 and 4 do the best to address the risk of insect disease, and stand replacing fire and the promoting of the use of fire in the maintenance of existing ponderosa pine stands.

To assist with promoting diversity and variability on the landscape within the project area, approximately 45%-61% (depending upon the alternative) would be left as entire untreated stands as well as residual aggregated patches. Due to high stocking levels in some areas not treated, smaller diameter snags (10-15 inches dbh) would be recruited in the short-term, providing potential future nesting opportunities.

There is no proposed removal of snags under any of the three action alternatives for the Rocket Project. Incidental falling of snags may occur during operations to comply with OSHA safety regulations for hazard tree removal. These are anticipated to be minor in scope and occur randomly throughout the project area. Any snags ≥10 inches diameter breast height (dbh) felled due to OSHA safety regulations would be left on the ground to provide down wood for wildlife.

During prescribed fire treatments, incidental snags could be lost from fire reducing large snags that also

provide nesting opportunities, but trees may be converted to snags from these operations. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California were 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 inches 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). Green trees 21 inches and greater will not be removed. Levels of live tree retention in all treatments will provide adequate numbers of green tree replacements to provide future snag and down log levels.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed would occur on approximately 8,286 acres of white-headed woodpecker habitat. These treatments primarily include the West Bend Vegetation Management Project which is expected to treat 52% of the available habitat in the North Unit Diversion Dam-Deschutes River watershed (7,726 acres) through commercial thinning, mowing, and underburning. These treatments focus on managing for ponderosa pine development and sustainability and will result in long-term benefit for the white-headed woodpecker.

Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. Additional clearing and maintenance for two powerlines and a gas transmission line would remove less than 100 acres of potential habitat but this would be a permanent impact. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking would result in minor disturbance during the reproductive period.

The Rocket Project would treat an additional 5% to 9% (797 to 1,272 acres) of the available reproductive habitat in the watershed depending on the alternative. Cumulatively, when the Rocket project is added to the West Bend project, approximately 60% of the white-headed woodpecker habitat in the watershed would be treated (9,083 to 9,558 acres). In the long-term, these combined treatments would favor white-headed woodpecker habitat. None of the activities propose the removal of ponderosa pine snags that would provide reproductive habitat. A small number of snags could be lost during prescribed fire treatments; therefore, negative cumulative impacts are not expected.

Determination

Alternative 4 would have the greatest potential for shrub cover reduction and the largest potential increase in future reproductive habitat, providing the greatest benefit to the species, while Alternative 2 provides the next greatest benefit to the species. Alternative 3 would have the least amount of shrub cover reduction and the lowest potential increase in future habitat. All three alternatives would result in an improvement in suitable reproductive habitat compared to the no action alternative. In the long-term, all action alternatives would enhance nest success in these stands as well as accelerate the development of long-term LOS habitat for the white-headed woodpecker.

Timber harvest and prescribed underburning if conducted in the spring may result in limited disturbance to individuals or nesting pairs. However, with resource protection measures in place for snag retention and because a 10-30% retention of shrubs are expected to remain after mowing and burning, and 45% to 65 % of the forested project area remaining unchanged (providing shrubs and various forested conditions), it is assumed species presence would still be maintained with any of these alternatives. Over the short and long-term, these action alternatives would result in improving current reproductive habitat and providing additional acres for future reproductive habitat.

Project implementation of Alternatives 2, 3, or 4 *May impact* individuals due to disturbance but would have a *Beneficial Impact* to habitat for the white-headed woodpecker. The Rocket project would not lead to a trend

towards federal listing for the white-headed woodpecker.

The Rocket project alternatives are consistent with the Forest Plan standards and guidelines as amended by the *Eastside Screens* for Cavity-nesters (Woodpeckers) and Snags and Down Log Associated Species (WL-37, WL-38, and WL-72).

Because there is an improving habitat trend in both the Sugar Pine Butte–Little Deschutes River Subwatershed and the North Unit Dam–Deschutes River Watershed, the Rocket Project alternatives would not contribute to a negative trend in viability for the white-headed woodpecker on the Deschutes National Forest.

The Rocket Project alternatives are consistent with the standards and guidelines in the Newberry National Volcanic Monument Comprehensive Management Plan for woodpeckers.

The Rocket Project alternatives are consistent with the Conservation Strategies for the white-headed woodpecker in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington*.

Lewis' woodpecker

Existing Condition

The following information is summarized from the Species Assessment for Lewis' Woodpecker for the Deschutes National Forest (USDA Forest Service 2012c).

The Lewis's woodpecker is an uncommon permanent resident in open forests and post-fire habitats on the east side of the Cascades. Habitat for the Lewis's woodpecker is old-forest, single-storied ponderosa pine. Altman and Holmes (2000) identified the Lewis's woodpecker as a focal species for riparian woodlands with large cottonwood snags for the Columbia Plateau Landbird Strategy. This habitat is extremely rare to absent on the Deschutes National Forest. Lewis's woodpeckers have been termed "burn specialists" because the large majority of their nests are found in snags in burned pine forests. They are most abundant in recent burns (2 to 4 years) and older burns (10-30 years post-fire) (Saab and Dudley 1998, Saab et al. 2007). It is positively associated with large diameter and higher snag densities in ponderosa pine patches in more open or salvage logged areas (Saab et al. 2002, Saab et al. 2009).

Suitable conditions for nesting and foraging include increased arthropod populations, shrubby understories, open canopies, and nest cavities created by strong excavators (Saab and Dudley 1998). Lewis's woodpeckers feed on flying insects and are weak excavators and require large nest snags in an advanced state of decay that are easy to excavate or they use old cavities created by other woodpeckers, primarily northern flickers and hairy woodpeckers (Wisdom et al. 2000, Marshall et al. 2003, NatureServe 2012). Linder and Anderson (1998) estimate that optimal canopy closure for Lewis's Woodpeckers is less than 30%.

Primary threats to the Lewis's woodpecker include the loss of large snags, intensive grazing, timber harvest, salvage logging of burned ponderosa pine forests, loss of cottonwood trees, human development in breeding and wintering habitat, and human disturbance at nest sites (Tobalske 1997, Marshall et al. 2003, Abele et al. 2004, NatureServe 2012). Fire suppression in ponderosa pine forests has resulted in stands with increased stem densities (with more shade tolerant species), reduced shrub and grass understories, and increased canopy closures (Abele et al. 2004).

The Lewis' woodpecker is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for ponderosa pine forests with patches of burned old forest (Altman 2000). The biological objectives for habitat where ecologically and socially appropriate, through natural events or management, are to maintain >1% of the landscape as post-fire old ponderosa pine forest habitat or >50% of the post-fire landscape as unsalvaged. Where salvage logging is occurring in post-fire old ponderosa pine forests, maintain or provide in burns greater than 100 acres, greater than 50% of the standing and down wood, and in all burns, retain all snags greater than 20 and >50% of those be 12-20 inches dbh. In addition, snags should be clumped rather than evenly spaced with both hard

and soft decay classes to lengthen the period stands are considered suitable reproductive habitat (Altman 2000). Where ecologically appropriate, actions should be initiated in old forest habitat to maintain or provide approximately 24 snags per acre > 9 inches dbh and of these, approximately 6 snags per acre should be ≥20 inches dbh. In addition, actions should be initiated to provide recruitment of snags, particularly in areas with high risk of stand replacement fires, and to provide shrub understory with >13% cover (Altman 2000). There is no data in DecAID on snag density in green stands for the Lewis' woodpecker due to this species being highly reliant on post-fire habitats.

Table 68 displays the snag numbers for Lewis' woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL). Table 69 displays the snag requirements for Lewis' woodpecker regarding potential population levels.

Table 68: Snag numbers for Lewis' woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Ponderosa Pine	>20	14
	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	211
	Total	**225**

Table 69: Snag requirements for Lewis' woodpecker regarding potential population levels.

	Veg Type/Series	Target Percent (%) Potential Population Level	Minimum Snag Size (inches dbh)	Snags Per Acre Required
Deschutes WLTL	Ponderosa Pine and Mixed Conifer	60%	>12	0.29
Deschutes WLTL and NWFP	Ponderosa Pine and Mixed Conifer	40%	>12	0.19
Eastside Screens	Ponderosa Pine	100%	>15	2.25
	Mixed Conifer	100%	>15	2.25

DecAID Snag Density for Lewis' Woodpecker

There is no data on snag density in green stands for the Lewis' woodpecker due to this species being highly reliant on post-fire habitats. Table 70 displays tolerance level information for snag density relative to the Lewis' woodpecker for snags ≥10 inches dbh and snags ≥20 inches dbh in post-fire Eastside Mixed Conifer (EMC_PF) and post-fire Ponderosa Pine/Douglas-fir (PPDF_PF).

Table 70: Tolerance levels for the Lewis' woodpecker as reported in DecAID for post-fire habitats.

Snag Size	30% tolerance level Snag Density (#/acre)	50% tolerance level Snag Density (#/acre)	80% tolerance level Snag Density (#/acre)
>10 inches dbh EMC	24.8	43.0	71.0
>10 inches dbh PPDF	24.7	42.7	70.6
>20 inches dbh PPDF	0	6.2	16.1

Post-fire wildlife data use on snags is summarized from studies across the interior northwest, not just Oregon

and Washington. This data suggests managing for a variety of snag densities and snag sizes across burned areas to provide habitat for many species. Table 71 displays tolerance level information for snag size relative to the Lewis' woodpecker use for nesting in Eastside Mixed Conifer, Post-fire (EMC_PF) and Ponderosa Pine/Douglas-fir, Post-fire (PPDF_PF) as cited in DecAID (Mellen McLean et al. 2012).

Table 71: Tolerance levels for snag size used by Lewis' woodpeckers for nesting by habitat type.

Habitat Type Size Use	Tolerance Levels			Sample Size
	30% Snag Size (inches dbh)	50% Snag Size (inches dbh)	80% Snag Size (inches dbh)	
Eastside Mixed Conifer Post-fire Nesting	15.4	19.8	26.2	353-355
Ponderosa Pine/Douglas-fir Post-fire Nesting	15.6	19.8	26.1	400

Table 71 lists the number of acres of potential reproductive habitat based on forestwide modeling (USDA Forest Service 2012c). There are 84,978 acres of potential Lewis's woodpecker reproductive habitat on the Forest. Lewis's woodpecker populations are not highly distributed across the forest but rather are concentrated where large fire events have occurred. Minimal habitat occurs scattered in small patches across the remainder of the forest. There are 3,495 acres of reproductive habitat modeled for the North Unit Diversion Dam-Deschutes River Watershed and 289 acres of reproductive habitat modeled for the Sugar Pine Butte-Little Deschutes River Subwatershed. In the Rocket project area, there are potentially 234 acres of reproductive habitat. Half of these acres are in two blocks of approximately 60 acres each in ponderosa pine habitat in the northeastern section of the project area. These acres occur within the boundaries of the Road 18 fire that burned in 2003. The remaining 100 acres are mostly concentrated in mixed conifer habitat in the southern half of the project area north of Road 9720. The remaining small patches are widely dispersed throughout the project area. The number of acres of habitat in the project area is primarily due to most ponderosa pine stands being densely stocked and not providing the more open forest that this species prefers for nesting.

Snag densities across the landscape are low, especially for snags >20 inches dbh, which are the preferred size by this species. There is no information available on DecAID tolerance levels for this species on the Forest. There have been no sightings of Lewis's woodpeckers in the Rocket Project area to date.

Table 72: Acres of Lewis woodpecker reproductive habitat.

Spatial Scale	Acres of Lewis woodpecker Reproductive Habitat	Percent (%)
Deschutes National Forest	84,978	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	3,395	4% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	289	0.3% of habitat forestwide
Rocket Project area	214	0.3% of habitat forestwide
		4% of habitat in watershed (150 acres)
		22% of habitat in subwatershed (64 acres)

Direct and Indirect Impacts—Alternative 1

There would be no direct impacts to Lewis' woodpecker under Alternative 1 (No Action). Indirectly, continued high stand densities may impact the Lewis's woodpecker by reducing the longevity of residual large tree structure that provides reproductive habitat in the project area. In the long-term, available nest trees would be limited and the future development of larger nesting trees would be prolonged. In stands of second growth ponderosa pine, short-term impacts from high stand densities reduces the resiliency of these stands against bark beetle attack. The long-term impacts 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. Large tree structure in ponderosa pine within the watersheds and in the Rocket Project area is limited. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2012).

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Table 73 compares the number of acres of Lewis's woodpecker habitat impacted by each alternative. All three action alternatives would avoid thinning and fuels treatments in the two largest habitat blocks (approximately 60 acres each) of reproductive habitat in the northeastern portion of the project area, but would treat the several smaller blocks that occur across the project area. All action alternatives would include a combination of commercial harvests (thinning), and mistletoe infection removal, plantation thinning, and ladder fuels reduction. Post-sale actions would include lop and scatter and/or handpiling of small diameter material or removal through the use of prescribed burning. Acres of reproductive habitat treated are 65 acres under Alternative 2, 69 acres under Alternative 3, and 87 acres under Alternative 4. Mowing and prescribed underburning would also occur within ponderosa pine stands with burning taking place in the spring or fall months depending on appropriate weather conditions.

Table 73: Acres of Lewis's woodpecker reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	10	---	---
Thinning to 60 foot average BA	52	2	47
Thinning to mixed range of BA (40-80)	---	45	21
Opening in DMT (Sanitation thin)	---	---	1
Ponderosa pine restoration	2	2	2
Plantation thin	1	1	1
Ladder Fuels Reduction	0	19	15
Total acres of tree treatments	**65**	**69**	**87**
Project acres with no tree treatments	169 (72%)	165 (71%)	147 (63%)
Fuels Treatments			
Mowing only	1	13	24
Mowing and underburning	68	31	50
Total acres of fuels treatments	**60**	**44**	**74**
Project acres with no fuels treatments	174 (74%)	190 (81%)	160 (68%)

The combination of actions would have the capability to increase reproductive habitat suitability by reducing canopy cover in the ponderosa pine dominated stands plus aid in maintenance of large trees by reducing their susceptibility to fire and insects while reducing competition for space and nutrients. In addition, thinning treatments (including ponderosa pine plantation thinning) would accelerate the diameter growth of smaller ponderosa pine into trees and future snags into the size class this species requires having benefits well into the future by cycling large trees and snags over time. The openings created in deer habitat (3-12 acres in

size) would maintain any large trees ≥21" unless it is heavily infected with mistletoe and over as current or future nest trees, and would plant ponderosa pine seedlings that would provide for future habitat.

While there are differences in the amount of acreage proposed for thinning and burning, each action alternative would result in an increasing amount of reproductive habitat in the project area compared to Alternative 1 (No Action).

The various levels of mowing and underburning with each alternative would reduce shrub density and its distribution within each unit, impacting Lewis's woodpecker habitat which is positively associated with a brushy shrub understory for insect production. The amount of area left unburned post-treatment varies depending upon several factors including the time of year the burn treatment occurs and the type of ignition (hand or aerial). On average 10-30% retention of shrubs and would remain unburned in a mosaic pattern providing shrub cover of bitterbrush, ceanothus, and manzanita for insect production. This retention, plus leaving a number of acres within the project area untreated, would maintain the presence of undisturbed shrub habitat distributed across the project area.

The proposed actions within the ponderosa pine habitat would keep the stands on a trajectory to having larger average diameters. It is estimated that under the action alternatives, it would be another 20 to 30 years before the stands of larger diameter trees would be susceptible to beetle mortality. Only when these newly created larger pine have been dead for years and in further stages of decay, would new Lewis's woodpecker habitat be created; that is unless another wildfire occurs within the project area. Thus the beneficial impacts to Lewis's woodpecker reproductive habitat would not be realized for many decades.

While harvest operations associated with timber sales may require limited snag felling for safety considerations during temporary road construction and placement of log landings, overall snag removal would be very minimal, averaging one to two percent based on monitoring by district timber sale administrators. Resource protection measures have been incorporated to limit snag felling and the loss of snags during prescribed burning operations. This strategy would be consistent with the recommendations in the Landbird Conservation Strategies for the East-Slope Cascades (Altman 2000) for the retention of greater than one ponderosa pine snag per acre greater than 40 feet tall and 30 inches in diameter and an open overstory with a mean canopy cover less than 40 percent in those areas where this size snag is present. Similarly, burning is also designed to reduce shrub densities and thinning slash that contribute to ladder fuels, but as a result of the burning there is the risk of losing existing large snags that provide reproductive habitat. In addition, through burning operations additional snags could potentially be recruited to provide future reproductive habitat.

While timber harvest and spring underburning have the potential to disrupt nesting pairs of Lewis's woodpeckers this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Because not all of the proposed activities would occur at the same time over the entire project area, undisturbed potential reproductive habitat would be still be available for the species across suitable reproductive habitat in the project area.

Alternative 4 would have the greatest potential for shrub cover reduction due to prescribed fire, but the largest potential increase in future reproductive habitat. Alternative 3 would have the least amount of shrub cover reduction and the lowest potential increase in future habitat. Timber harvest and prescribed underburning if conducted in the spring may result in limited disturbance to individuals or nesting pairs and reduce foraging habitat. However, with resource protection measures in place for snag retention and because a 10-30% retention of shrubs are expected to remain after mowing and burning, and 50-77 % of the forested project area remaining unchanged (providing shrubs and various forested conditions), it is assumed species presence within the project area would not be deterred with any of these alternatives. Over the short and long-term, these action alternatives would result in improving current reproductive habitat and providing additional acres for future reproductive habitat.

The short-term impact from these activities would be a reduction in foraging habitat (loss of shrub habitat for insects), but within the long-term it would accelerate tree growth for ponderosa pine and begin developing future quality Lewis's woodpecker habitat. Within mowing and prescribed burn units, implementation from

any of the action alternatives could have short-term impacts such as loss of snags during prescribed burning or snag removal for safety reasons, or by displacing individuals, but these impacts would be considered minor when considering the net benefit. Prescribed underburning and mowing proposals outside of suitable habitat range from 3,978 acres (Alternative 3) to 7,321 acres (Alternative 2), to 7,866 acres (Alternative 4). Alternative 3 provides the largest retention of shrub cover for foraging, but the least amount of thinning to promote future habitat. All action alternatives would help to accelerate and develop ponderosa pine trees to provide for future Lewis's woodpecker habitat.

In the short-term, Alternative 3 treats the fewest acres of habitat of the three alternatives and in the long-term would promote the fewest acres of fire resistant ponderosa pine stands. The longevity of existing habitat would diminish in the short-term, and as a result will produce stands that continue to remain susceptible to disease, insect infestation, and wildfire. Although Alternative 2 and 4 do the best to address the risk of insect disease, and stand replacing fire and the promoting of the use of fire in the maintenance of existing ponderosa pine stands.

To assist with promoting diversity and variability on the landscape within the project area, approximately 63%-72% (depending upon the alternative) would be left as untreated stands as well as residual aggregated patches. Due to high stocking levels, smaller diameter snags (8 to 15 inches dbh) would be recruited in the short-term, potentially providing nesting opportunities.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River Watershed would occur primarily from the West Bend Vegetation Management Project, which is expected to treat approximately 50% of the available habitat within this watershed through commercial thinning, mowing, and underburning. Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. Additional clearing and maintenance for two powerlines and a gas transmission line would remove less than 100 acres of potential habitat but this would be a permanent impact. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking would result in minor disturbance during the reproductive period.

Implementation of action alternatives for the Rocket Project would treat an additional 2 - 3% of the habitat in the watershed (65 - 87 acres). Cumulatively, when the Rocket Project is added to the West Bend project, 52 to 53% of the habitat in the watershed would be treated. However, the treatments under both projects are not expected to negatively impact current reproductive habitat and would maintain a variety of shrub conditions throughout the project area. Therefore, negative cumulative impacts are not expected.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to habitat for Lewis' woodpecker in the Sugar Pine Butte–Little Deschutes subwatershed. Under the Rocket project alternatives, between 20 and 25 acres would be treated which is approximately 9% of the subwatershed. The Rocket treatments are not expected to negatively impact current reproductive habitat and would maintain a variety of shrub conditions throughout the project area. Therefore, negative cumulative impacts are not expected. Ongoing light recreation is anticipated to result in temporary disturbance to woodpeckers that may occur in the subwatershed.

Determination

Alternative 4 would have the greatest potential for future reproductive habitat, providing the greatest benefit to the species, while Alternative 2 provides the next greatest benefit to the species. Alternative 3 would have the lowest potential increase in future habitat. All three alternatives would result in an improvement in suitable reproductive habitat compared to the no action alternative. In the long-term, all action alternatives would enhance nest success in these stands as well as accelerate the development of long-term LOS habitat for Lewis' woodpecker.

Timber harvest and prescribed underburning if conducted in the spring may result in limited disturbance to individuals or nesting pairs. However, with resource protection measures in place for snag retention and because a 10-30% retention of shrubs are expected to remain after mowing and burning, and 43% to 77 % of

the forested project area remaining unchanged (providing shrubs and various forested conditions) species presence would still be maintained with any of these alternatives. Over the short and long-term, these action alternatives would result in improving current reproductive habitat and providing additional acres for future reproductive habitat.

Project implementation of Alternatives 2, 3, or 4 *May impact* individuals due to disturbance but would have a *Beneficial Impact* to habitat for Lewis' woodpecker. The Rocket Project would not lead to a trend towards federal listing for Lewis' woodpecker.

The Rocket project alternatives are consistent with the Forest Plan standards and guidelines as amended by the *Eastside Screens* for Cavity-nesters (Woodpeckers, WL-37, WL-38), Logs and Down Wood Associated Species (WL-72), and green tree replacements.

Because there is an improving habitat trend in both the Sugar Pine Butte–Little Deschutes River Subwatershed and the North Unit Dam–Deschutes River Watershed, the Rocket project alternatives would not result in a negative trend in viability for Lewis' woodpecker on the Deschutes National Forest.

The Rocket project alternatives are consistent with the standards and guidelines in the Newberry National Volcanic Monument Comprehensive Management Plan for woodpeckers.

The Rocket project alternatives are consistent with the Conservation Strategies for Lewis' woodpecker in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington.*

Wildlife: Management Indicator Species (MIS)

This section of the EA covers a number of wildlife topics identified in the purpose and need and key issues sections. Key issues related to wildlife MIS are: treatment within goshawk PFAs, openings created for deer habitat; and treatment within OGMAs (see page 14-16). Where species are MIS in addition to being R6 Sensitive, they have been addressed in the previous section on TES species (bald eagle, white-headed woodpecker, Lewis' woodpecker, and Townsend's big-eared bat). Information on analysis methods and modeling is provided on pages 142-145. Additional information on MIS habitat is available in the Wildlife Report, located in the project file.

Species Considered

Table 74 lists the wildlife species considered in this wildlife report. Those with *May Impact* in the far right column are analyzed. The bald eagle, golden eagle, Lewis' woodpecker, white-headed woodpecker, and Townsend's big-eared bat are Management Indicator Species but were analyzed as Region 6 Sensitive Species in a separate Biological Evaluation for the Rocket project (Borchert and York 2013). The wolverine is a Management Indicator Species but was analyzed as a federally proposed species in the Biological Evaluation for the Rocket project (Borchert and York 2013).

Table 74: Wildlife species considered. Those with *May Impact* in the far right column are analyzed in this report.

Species	Status	Habitat	Presence	Impact
Bald eagle	MIS	Large snags associated with fish bearing water bodies	No habitat	No impact
Osprey	MIS S4 Apparently secure	Large snags associated with fish bearing water bodies	No habitat	No impact

Northern goshawk	MIS S3 Vulnerable	Mature/old-growth forests; especially high canopy closure and large trees	Existing habitat and known presence	May impact
Cooper's hawk	MIS S4 Apparently secure	Similar to goshawk, can also use mature forests with high canopy closure/tree density	Existing habitat and known presence	May impact
Sharp-shinned hawk	MIS S4 Apparently secure	Similar to goshawk in addition to young, dense, even-aged stands	Existing habitat and known presence	May impact
Great blue heron	MIS S4 Apparently secure	Riparian edge habitats including lakes, streams, marshes and estuaries	No habitat	No impact
Golden eagle	MIS, BCC S4 Apparently secure	Large open areas with cliffs and rock outcrops	No habitat	No impact
Red-tailed hawk	MIS S5 Secure	Large snags, open country interspersed with forests	Existing habitat; presence not known	May impact
Mule deer	MIS S5 Secure	Mixed habitats	Existing habitat and known presence	May impact
Elk	MIS S5 Secure	Mixed habitats	Existing habitat and known presence	May impact
American marten	MIS S3 Vulnerable	Mixed conifer or high elevation late-successional forests with down woody material	Existing habitat; presence not known	May impact
Townsend's big-eared bat	Sensitive, MIS S1	Caves, lava flow, ponderosa pine habitat	Existing habitat and known presence	May impact
Wolverine	MIS, Candidate	Lodgepole pine	No denning habitat; potential dispersal habitat	No impact. Analyzed as a Proposed Species in the Biological Evaluation
Waterfowl (25 species)	MIS	Lakes, streams	No habitat	No impact
Woodpeckers				
White-headed woodpecker	Sensitive, MIS	Ponderosa pine	Existing habitat	May impact

Lewis' woodpecker	Sensitive, MIS	Ponderosa pine, burned forests	Existing habitat	May impact
Black-backed woodpecker	MIS, Landbird focal species S3 Vulnerable	Lodgepole pine forests, burned forests	Existing habitat	May impact
Three-toed woodpecker	MIS S3 Vulnerable	High elevation and lodgepole pine forests	Existing habitat	May impact
Pileated woodpecker	MIS S4 Apparently Secure	Mature to old-growth mixed conifer forests	Existing habitat	May impact
Williamson's sapsucker	MIS, Landbird Focal species, BCC	Mature/old growth conifer forests with open canopy cover	Existing habitat	May impact
Hairy woodpecker	MIS S4 Apparently Secure	Mixed conifer and ponderosa pine forests	Existing habitat	May impact
Northern flicker	MIS S5 Secure	Variety of forest types but more associated with forest edges	Existing habitat	May impact
Red-naped sapsucker	MIS S4 Apparently Secure	Riparian hardwood forests	Existing habitat	May impact
Downy woodpecker	MIS S4 Apparently Secure	Riparian hardwood forest	Existing habitat	May impact
Snags and Downed Wood Associated Species	MIS	Snags and down woody material	Existing habitat	May impact
Special/Unique habitats	MIS	Aspen	Existing habitat	May impact
Landbird Focal Species				
Species	**Status**	**Habitat**	**Presence**	**Impact**
Pygmy nuthatch	Landbird focal species, S4 Apparently Secure	Mature ponderosa pine forests and snags	Existing habitat	May impact
Chipping sparrow	Landbird focal species S4 Apparently Secure	Open understory ponderosa pine forests with regeneration	Existing habitat	May impact
Brown creeper	Landbird focal species S4 Apparently Secure	Large trees in mixed conifer forests	Existing habitat	May impact
Flammulated owl	Landbird focal species, BCC S3B Vulnerable - breeding	Interspersed grassy openings and dense thickets in mixed conifer forests	Existing habitat	May impact
Hermit thrush	Landbird focal species S4 Apparently Secure	Multi-layered/dense canopy in mixed conifer forests	Existing habitat	May impact

Olive-sided flycatcher	Landbird focal species S3B Vulnerable - breeding	Edges and openings created by wildfire in mixed conifer forests	Existing habitat	May impact
Birds of Conservation Concern and High Priority Shorebirds				
Swainson's hawk	BCC	Open country	No habitat	No impact
Ferruginous hawk	BCC	Open sagebrush flats; open country	No habitat	No impact
Prairie falcon	BCC	Rimrock, cliffs in open country	No habitat	No impact
Greater sage grouse	BCC	Sagebrush flats	No habitat	No impact
American golden plover	BCC, Shorebird	Upland tundra, rare in OR in dry mudflats and fields	No habitat	No impact
Snowy plover	BCC, Shorebird	Sandy beaches	No habitat	No impact
American avocet	BCC	Shallow water	No habitat	No impact
Solitary sandpiper	BCC, Shorebird	Small, freshwater mudflats	No habitat	No impact
Whimbrel	BCC, Shorebirds	Grassy marshes and tidal flats	No habitat	No impact
Long-billed curlew	BCC, Shorebird	Dry grasslands	No habitat	No impact
Marbled godwit	BCC	Expansive mudflats and sandflats on beaches	No habitat	No impact
Sanderling	BCC, Shorebird	Sandy beaches with wave action	No habitat	No impact
Wilson's phalarope	BCC, Shorebird	Shallow ponds in grassy marshes	No habitat	No impact
Yellow-billed cuckoo	BCC	Riparian hardwoods	No habitat	No impact
Burrowing owl	BCC	Open grassland or agricultural land	No habitat	No impact
Black swift	BCC	Damp coastal cliffs	No habitat	No impact
Loggerhead shrike	BCC	Open habitat with scattered trees and shrubs	No habitat	No impact
Gray vireo	BCC	Rocky, dry hillsides with scattered trees	No habitat	No impact
Virginia's warbler	BCC	Mountain mahogany	No habitat	No impact
Brewer's sparrow	BCC	Sagebrush habitats	No habitat	No impact
Sage sparrow	BCC	Sagebrush habitats	No habitat	No impact

Piping plover	Shorebird	Rare in OR; sandy beaches	No habitat	No impact
Mountain plover	Shorebird	Shortgrass prairies	No habitat	No impact
Buff-breasted sandpiper	Shorebird	Nests in tundra, forages on shortgrass prairie	No habitat	No impact
Black oystercatcher	Shorebird	Coastal rocks	No habitat	No impact
Upland sandpiper	Shorebird	Grassy fields with open patches	No habitat	No impact
Bristle-thighed curlew	Shorebird	Rare in OR in marshes or beaches.	No habitat	No impact
Hudsonian godwit	Shorebird	Mudflats and shallow water; nests around spruce woods	No habitat	No impact
Marbled godwit	Shorebird	Prairie ponds, mudflats and sandflats	No habitat	No impact
Black turnstone	Shorebird	Tundra, winters on rocky, coastal shores	No habitat	No impact
Surfbird	Shorebird	Nests on barren gravel hilltops, winters on rocky shorelines	No habitat	No impact
Western sandpiper	Shorebird	Mudflats and sandy beaches	No habitat	No impact
Rock sandpiper	Shorebird	Rocky shorelines	No habitat	No impact
Short-billed dowitcher	Shorebird	Mudflats and shallow muddy ponds along coast	No habitat	No impact
American woodcock	Shorebird	Damp, brushy woods	No habitat	No impact
Wilson's plover	Shorebird	Sandy beaches, sandflats or mudflats away from shoreline	No habitat	No impact
American oystercatcher	Shorebird	Rare in OR on rocky coasts	No habitat	No impact
Bar-tailed godwit	Shorebird	Low tundra in western Alaska	No habitat	No impact
Ruddy turnstone	Shorebird	Rocky and sandy shorelines	No habitat	No impact
Red Knot	Shorebird	Sandy beaches	No habitat	No impact
Dunlin	Shorebird	Sandy beaches and mudflats	No habitat	No impact
Calliope hummingbird	BCC	Open montane forest, mountain meadows, and willow thickets	No habitat	No impact

Black swift	BCC	Waterfalls, wet cliffs, caves	No habitat	No impact
Sage thrasher	BCC	Juniper, sagebrush shrublands, mountain mahogany and aspen	No habitat	No impact
Loggerhead shrike	BCC	Open country with scattered trees and shrubs	No habitat	No impact
Nashville warbler	BCC	Open deciduous and coniferous woodland, forest edge and undergrowth	No habitat	No impact
Black-chinned sparrow	BCC	Desert, shrubland/chapparal	No habitat	No impact
Willow flycatcher	BCC	Brushy areas with willow and riparian shrubs	No habitat	No impact
Pinyon jay	BCC	Pinyon/juniper woodland	No habitat	No impact
Green-tailed towhee	BCC	Sagebrush shrublands	No habitat	No impact
Black rosy-finch	BCC	Alpine rocky, grassy areas	No habitat	No impact

Landbird focal species: Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000)
Management Indicator Species: Deschutes National Forest 1990 Land and Resource Management Plan
Birds of Conservation Concern (BCC) U.S. Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) (2008)
High Priority Shorebird*s*: U.S. Fish and Wildlife Service U. S. Shorebird Conservation Plan (2004).

Refer to the Wildlife Report for information on species not analyzed in detail due to a lack of habitat. For those species the project will not result in a negative trend in viability on the Deschutes National Forest.

The Forest Plan standard and guideline WL-75 (Forest Plan page 4-60) states that habitat for species associated with springs, seeps, cliffs, and talus slopes will be protected during project development. The Rocket project area does not contain any of these habitat types. Therefore, there will be no impact to species associated with special and unique habitats. The Rocket project is consistent with standard and guidelines WL-75.

Goshawk analysis is disclosed first because it is a key issue. All other MIS species and Landbird Focal species follow goshawk.

Key Issue: Treatment within Historic Goshawk PFAs

The alternatives vary on amount of treatment within areas that have been mapped as post-fledging areas (PFAs). The three PFAs in the project area are unoccupied based on surveys conducted in 2012 and 2013. Alternative 3 includes no treatment within historic goshawk PFAs and Alternative 4 includes more than the proposed action. None of the alternatives treat within a 30-acre nest core delineated for each PFA.

Several studies have compared reproductive habitat use between coexisting accipiters in North America (Moore and Henny 1983, Reynolds et al. 1982, Reynolds 1983, Siders and Kennedy 1996). Where these species coexist, a relationship occurs in which tree height and dbh of nest trees increases in proportion to Accipiter body size (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 80-year-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) 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. Habitat for all three species exists in the Rocket project area with detections for goshawk and Cooper's hawk during 2012 surveys for northern goshawk.

Existing Condition

Please refer to the Northern Goshawk Management Indicator Species Assessment for the Deschutes National Forest for detailed information on its biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012b).

The Forest Plan S&G WL-6 states that reproductive habitat for at least 40 goshawk pairs will be provided in mixed conifer and ponderosa pine forests outside of wilderness areas and the Oregon Cascades Recreation Area. The Forest Plan S&G WL-9 states that where prospective nest sites are not known, the following physiographic and vegetative characteristics will be used:

- Mean canopy cover of 60% or greater
- Tree density of at least 195 trees per acre
- Stand age of 100 years or more
- Stand size of at least 25 acres

Within Scenario A of the Eastside Screens Standard and Guides, the direction for goshawk management is as follows:

Protect every known active and historically used goshawk nest-site from disturbance. The word historically refers to known nesting activity occurring at the site in the last 5 years. Seasonal disturbance restrictions may be implemented at sites.

- 30 acres of the most suitable reproductive habitat surrounding all active and historical nest tree(s) will be deferred from harvest.
- A 400 acre Post Fledging Area (PFA) will be established around every known active nest site. While harvest activities can occur in this area, retain the LOS stands and enhance younger stands toward LOS condition, as possible.
- The Forest Plan also established Old Growth Management Areas (OGMAs) (MA-15) to provide quality habitat for the northern goshawk, three-toed woodpecker, marten, and other old-growth associated species. The goshawk represents the ponderosa pine community.

Source habitats for the goshawk include old forest, unmanaged young forests in montane and lower montane habitat, and riparian woodland communities. Goshawks use broad landscapes that incorporate multiple spatial scales to meet their life requisites (Squires and Kennedy 2006). At least three levels are recognized during the breeding season: (1) a nest area, composed of one or more forest stands or alternate nests; (2) a post fledging area (PFA), which is an area around the nest used by adults and young from the time of fledging, when the young are still dependent on the adults for food, to independence; (3) and a foraging area that comprises the breeding pair's entire home range. In general, goshawk nest areas have large trees, dense canopies, and high canopy closure. Goshawks nest in various forest structural conditions, from open, park-

like stands of aspen (Younk and Bechard 1994) to multi-storied old forests (Reynolds 1983). Merideth (1990) noted the use of aspen by goshawks for nesting in Colorado. The stands selected were typically mixed with conifer or were small aspen patches surrounded by conifer-dominated stands. Larger diameter aspen were selected in relatively open stands on the Grand Mesa National Forest in Colorado (Merideth 1990). Shuster (1980) reported that northern goshawks in ponderosa pine dominated forests of western Colorado nested in mature aspen trees more often than in lodgepole pine or ponderosa pine trees.

The PFA is potentially important to the persistence of goshawk populations, as it provides fledgling hiding cover and foraging opportunities as fledglings learn to hunt and may correspond to the area defended by the breeding pair. 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. 2000a). During winter, some goshawks may travel short distances to lower elevations and more open habitats in all upland woodland types (Wisdom et al. 2000a). The size of the PFA ranges from 296-593 acres ; a 400 acre PFA is used for goshawk nest sites on the Deschutes National Forest (USDA Forest Service 2012b). Reproductive habitat encompasses 200 acres of forest with a 25-acre core area of highest basal area and canopy closure, surrounded by 75 acres in stem exclusion or understory re-initiation with high canopy closure. The outlying 125 acre area should contain a mix of forest structure with significant areas of open canopy mixed with more closed forest.

Foraging areas are typically 4,900-5,900 acres comprising a forest mosaic that must support a wide range of suitable prey (USDA Forest Service 2012b). Foraging areas are usually more open than nesting areas, but should contain large trees, snags, down logs, vegetative layering, and other structural elements important to prey species.

Nest core areas are the stands containing the active nest. Alternate nest stands are those stands adjacent to and most closely resemble the characteristics of the active nest core. Post-fledging areas are those stands surrounding the nest stands that meet the definitions in Youtz, et al. 2007 (close-canopied, mature forest). Surrounding and encompassing the PFAs, nest cores, and alternate nest stands are goshawk foraging areas ranging in size from 5401-6192 acres (also based on information in Youtz et al. 2007). Although Youtz et al. (2007) is based in the fire-adapted forest ecosystems of the Southwest United States; subsequent habitat descriptions in Northern Idaho (Moser and Garton 2009) and the inland Pacific Northwest (DeStefano et al. 2006) either make reference to the Southwest guidelines (DeStefano et al. 2006) or use similar territory size and descriptions (Moser and Garton 2009). Youtz et al. (2007) relate the findings that an ideal MRNG (Management Recommendations for the Northern Goshawk) landscape had home ranges spaced approximately 2.5 miles between centers. Alternate nest stands are those stands adjacent to and most closely resemble the characteristics of the active nest core.

Youtz et al. (2007) and McGrath et al. (2003) recommend that a mix of vegetation structural stages will support goshawks and their prey while also being sustainable on the landscape. Youtz et al. (2007) recommend a mix of 20% of the territory within each age class and thinning treatments be focused in the younger/smaller age classes in order to attain the larger sizes and interlocking crowns. This research also supports the Forest Plan S&G WL-3 in limiting human activity in nesting areas and PFAs during the breeding season March 1-September 30.

Potential limiting factors to goshawk reproduction include loss of nest trees from timber harvest (Squires and Reynolds 1997); loss of foraging habitat and increased susceptibility of stand-replacing fire due to fire suppression (Graham et al. 1999 as cited in NatureServe 2012, Wisdom et al. 2000a); predation by other raptors (Crocker-Bedford 1990); disturbance from logging operations and recreational use (NatureServe 2012, Squires and Reynolds 1999); and high road densities (Wisdom et al. 2000a).

There is some scientific controversy about the efficacy of the Management Recommendations for the Northern Goshawk in the Southwestern United States (MRNG) (Reynolds et. al 1992) and referenced in Youtz et al. (2007) in providing for increasing or stable populations.

Greenwald et al. (2005) and Beier et al. (2008) conclude that goshawks are not habitat generalists. Although the species may use a variety of stand species or plant associations, they are specialists for closed canopied,

large-tree structure. Their research does not support the conversion of mature stands to early seral stands to promote prey abundance because nest sites were selected in denser, mature stands with higher dead wood densities than surrounding stands. Reynolds et al. (2012) published a response to Beier et al. (2008), specifically suggesting that their methods did not adequately represent their determinations. In Beier and Ingraldi (2012), the authors responded that although the degree of decline they observed in 2008 may be argued, a decline in productivity did occur. Beier and Ingraldi (2012) supported Reynolds et al. (2012) response that the original nest sites used to establish the 1992 management goshawk recommendations should be monitored in their entirety to adequately test the recommendations.

Goshawk Reproductive Habitat on the Forest

Goshawk reproductive habitat was modeled for the forest, watershed, and project area using all PAGs except juniper, mountain hemlock, and vegetation at higher elevations (USDA Forest Service 2012b). There are 446,557 acres of reproductive habitat forestwide, 29,902 acres in the watershed, and 9,136 acres in the subwatershed (Table 75). Approximately 10,752 acres are modeled for the Rocket project area (Table 75).

Table 75: Acres of northern goshawk reproductive habitat on the Deschutes National Forest.

Spatial Scale	Acres of potential goshawk reproductive habitat	Percent (%)
Deschutes National Forest	446,402	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	29,902	7% of habitat forestwide
Sugar Pine Butte – Little Deschutes River subwatershed	9,136	2% of habitat forestwide
Rocket Project area	10,727	2% of habitat forestwide
		33% of habitat in watershed (9,877 acres)
		9% of habitat in subwatershed (850 acres)

Three goshawk nest sites occurred in the Rocket project area in the mid-1990s. Post fledging areas were delineated for each of these nest sites. Under the *Eastside Screens*, nest sites are considered active if activity has been documented at the nest site in the last 5 years (USDA 1994). However, surveys were not conducted during the 5 years prior to the beginning of the planning process for Rocket; therefore, occupancy and/or nest activity was not known. Therefore, protocol surveys were conducted in all goshawk habitat in 2012 and 2013 using the broadcast call method (Woodbridge and Hargis 2006). There were no detections of goshawk in the three historic nest sites. However, a goshawk nest was detected at the eastern boundary of the project area in 2012. Nesting was not confirmed at this site in 2012. No detections were made in 2013 during protocol surveys conducted in the project area. Surveys will continue in the PFAs and at the 2012 detection are in 2014.

Treatments in northern goshawk PFAs was a key issue identified during scoping. Treatments are proposed in two PFAs: the northern one north of the lava flow and the southern PFA south of the lava flow. A third historic PFA exists in the northeastern area of the Rocket project area; however, no treatments are proposed in this PFA.

Scoping comments expressed concern that forest management is reducing habitat by reducing the amount of dense forest and stated that there should be no thinning, burning, or widespread precommercial thinning within PFAs. Commenters are concerned that vegetation management across the Forest/region is reducing dense forest and goshawk habitat. Reference is made to a number of scientific publications, including Beier

2008, stating that goshawks tend to prefer complex forests rather than thinned areas. Not treating in the PFAs would delay the recruitment of larger diameter trees and long-term quality habitat. It would also reduce the supply of material to local/regional mills and limit local/regional job opportunities. Under all alternatives, 30-acre core nest stands in both the northern and southern PFA are not treated.

This issue is addressed with Alternative 3, where tree treatments in the two historic goshawk PFAs are dropped; and Alternative 4, where more acres of the PFA are treated.

Measurement criteria for this key issue are the number of acres treated in PFAs and the proportion of project-wide goshawk reproductive habitat acres impacted.

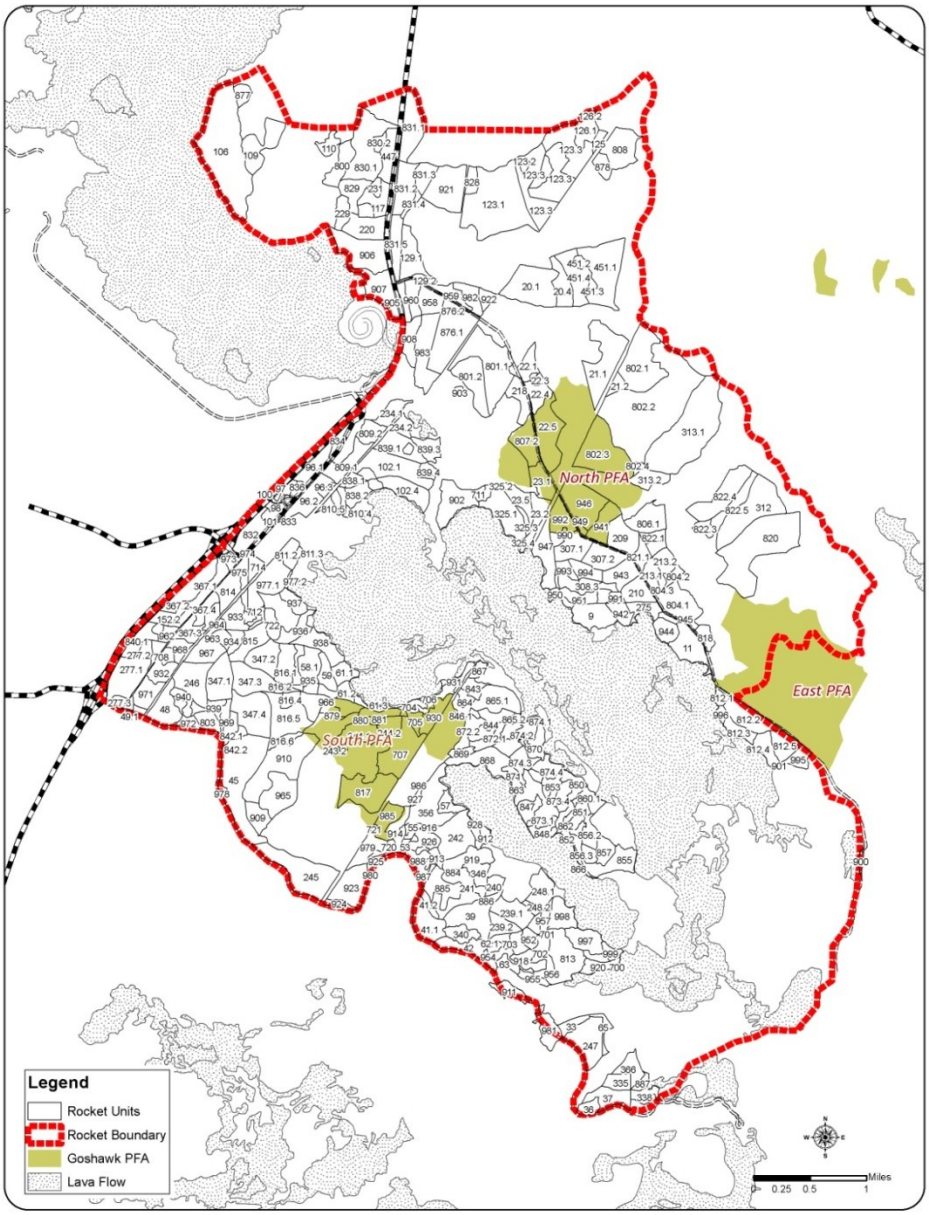


Figure 54: Location of three PFAs within Rocket project area. Alternatives 2 and 4 include thinning within the north and south PFAs, and no treatment within the East PFA. Alternative 3 includes no treatment in any of the PFAs.

Direct and Indirect Impacts – Alternative 1

There will be no direct impacts to the northern goshawk under Alternative 1 (No Action). Indirectly, areas that currently provide suitable goshawk habitat will most likely have increased tree mortality over time due to a decrease in tree vigor among all size classes which will result in the gradual loss of the existing historic large-tree component in reproductive habitat. The dry mixed conifer and lodgepole pine stands found in the more eastern parts of the project area will likely provide the best habitat under these circumstances. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013) including stands with goshawk habitat.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails in goshawk habitat will occur. These open roads and trails will continue to contribute to disturbance and reduced habitat security for the goshawk in the Rocket project area.

Direct and Indirect Impacts—Alternatives 2, 3 and 4

Of the 10,727 acres of northern goshawk reproductive habitat in the Rocket project area, tree treatments will occur on 4,796 acres under Alternative 2, on 3,686 acres under Alternative 3, and on 6,442 acres under Alternative 4 (Table 76). Within the same tree treatment units, fuels treatments will occur on 4,714 acres under Alternative 2, on 2,619 acres under Alternative 2, and on 5,133 acres under Alternative 4 (Table 76). Table 76 lists the types of tree and fuels treatments by alternative in goshawk reproductive habitat across the project area including the two historic PFAs. Table 77 lists the number of acres treated within the two PFAs under Alternatives 2, 3, and 4.

Table 76: Acres of northern goshawk reproductive habitat treated by alternative (within and outside PFAs) for the Rocket project area.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	1,391	---	
Thinning to 60 foot average BA	2,025	569	1,456
Thinning to mixed range BA (40-80)	---	1,590	3,267
Ponderosa pine restoration	219	38	250
Openings for Deer Habitat	22	18	37
Plantation Thin	324	365	541
Opening in DMT	---	15	203
Ladder Fuels Reduction	815	1,091	688
Total acres of tree treatments	**4,796**	**3,686**	**6,442**
Reproductive habitat acres (%) with no tree treatments	5,931 (55%)	7,111 (66%)	4,355 (40%)
Fuels Treatments			
Handpile/burn (Lava River Cave)	5	5	5
Mowing only	115	1,441	608
Mowing and underburning	4,594	1,173	4,520
Total acres of fuels treatments	**4,714**	**2,619**	**5,133**
Reproductive habitat acres with no fuels treatments	6,083 (56%)	8,178 (76%)	5,664 (53%)

The following table displays which units overlap the PFAs and how many acres of treatment are included in each (Table 77).

Table 77: Units and acres of treatment within PFAs by alternative.

	Alternative 2	Alternative 3	Alternative 4
South PFA Units	244, 817, 875	N/A	243, 244, 817, 875
South PFA Acres	199	0	347
North PFA Units	22, 23, 325, 802, 807	N/A	22, 23, 325, 802, 807
North PFA Acres	337	0	394
Total acres overlapping PFAs	**536**	**0**	**741**

Treatments in Goshawk Reproductive Habitat Including PFAs

Thinning in suitable goshawk reproductive habitat will occur in both second growth ponderosa pine, multi-storied ponderosa pine and mixed conifer stands containing residual old growth trees. Thinning from below in all alternatives will favor the largest ponderosa pine in pure pine stands. In mixed conifer stands, thinning will favor ponderosa pine and healthy white-fir. Thinning from below will decrease stand densities and canopy cover resulting in more open stands. Negative impacts to goshawk reproductive habitat will result from a loss of dense forests which goshawks prefer. A reduction in dense forests is anticipated to impact prey species habitat and hiding cover areas for protection of fledglings.

Two alternatives would treat stands in both PFAs: Alternatives 2 and 4. Under Alternative 2, thinning from below in the north PFA will be to 60 square feet of basal area (60 BA) on 290 acres and ladder fuels reduction on 56 acres. Under Alternative 2 in the south PFA, thinning from below will be to 60 square feet of basal area (60 BA) on 62 acres and ponderosa pine restoration on 75 acres. Under Alternative 4, thinning rom below in the north PFA will be to 60 square feet of basal area on 103 acres, and from 40 to 80 square feet of basal area (mixed BA), and sanitation thin on 39 acres. Under Alternative 4 in the south PFA, thinning from below will be to 60 square feet of basal area (60 BA) on 22 acres, from 40 to 80 square feet of basal area (mixed BA) on 46 acres and ponderosa pine restoration on 181 acres. No treatments would occur in the 30-acre historic nest cores under Alternatives 2 or 4.

No treatments are proposed in either PFA under Alternative 3.

In the ponderosa pine restoration units, the dead and live overstory lodgepole pine will be removed except for seed trees and the white fir will be left in a clumping pattern removing overstory mistletoe trees where understory development is desired and leaving clumps undisturbed to reduce disease potential. These stands will still be considered a regeneration harvest because of the variability of the final stocking. Treatments will decrease overstory canopy closure, diminishing the suitability of goshawk reproductive habitat in these areas. However, by retaining all ponderosa pine and healthy lodgepole pine and white fir in the overstory, these areas will continue to provide potential foraging habitat. Residual overstory trees will provide perch sites for the goshawk while clumps of white-fir will provide perch sites for prey habitat. Goshawks will utilize the residual overstory trees as perch sites hunting their prey species (perching birds) residing in each small clump of trees.

The project also proposes to create small group openings in deer habitat from 3 to 12 acres depending on the alternative. These stands will create small group openings approximately 5 acres in size removing 22 acres in Alternative 2, 18 acres in Alternative 3 and 37 acres in Alternative 4. In addition, these stands will also receive thinning from below associated with areas outside group openings. Negative impacts to goshawk may result from more open stands by removing dense patches which may impact prey species habitat on these acres.

Thinning from below will aid in maintaining large trees by reducing their susceptibility to fire and insects by removing competition for space and nutrients. Beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. This treatment also enhances foraging habitat if large trees are remaining with interlocking crowns. A minimum 10% of untreated areas averaged across the project area to provide deer screening will also provide small patches of dense clumps in goshawk habitat. To maintain connectivity for interior forest species such as the goshawk, untreated stands will occur throughout the ponderosa pine and mixed conifer PAG to provide dispersal and foraging for these species. The proportion of acres of goshawk reproductive habitat acres not treated across the project area is 55% under Alternative 2, 66% under Alternative 3, and 40% under Alternative 4, leaving residual habitat for this species across the project area. These areas will have a higher stocking rate and will provide some diversity of canopy cover across the landscape as these retention clumps could benefit some prey species as well as provide nesting opportunities. These untreated stands will create a matrix between the thinned stands associated with the PFA, stands receiving thinning from below to reduce fuel loading adjacent to the wildland urban interface, and stands scheduled for overstory canopy removal (HCR) due to high amount of insect and disease which are considered regeneration harvest.

Underburning will occur in stands with a more fire resistant overstory and fewer small (< 9 inches dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8 inches dbh) may be needed as a pre-treatment to fire. Mowing of brush may also occur where existing brush density and height will 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. 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. Fuels treatments will occur on 4,714 acres of goshawk reproductive habitat under Alternative 2, on 2,619 acres under Alternative 3, and on 5,133 acres under Alternative. 4. The proportion of goshawk reproductive habitat acres not treated with mowing or mowing plus underburning across the project area is 56% under Alternative 2, 76% under Alternative 3, and 53% under Alternative 4, leaving unburned residual habitat across the project area.

Within the thinning from below units, overstory structural diversity will remain, but understory complexities will be reduced through thinning, mowing, and burning, degrading foraging opportunities for the goshawk in the short-term. Long-term benefits of treatments will be a reduction of stress to overstory trees, which would accelerate the development of future old growth in the stand that will provide long-term reproductive habitat for the goshawk. Loss of the large tree component will continue to occur, but should be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below.

Alternative 3 impacts fewer acres of goshawk reproductive habitat (3,686 acres) than Alternatives 2 or 4. However, in the long-term, treatments in Alternative 3 accelerates the development of fewer acres of more fire resistant mixed conifer stands. The longevity of existing habitat will diminish in the short-term, and as a result will not promote the fire resilient ponderosa pine within these stands which are key component of goshawk habitat on eastside forests.

Under all three alternatives, approximately 37.5 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the goshawk. User created trails have occurred in both historic PFAs. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Resource Protection Measures for Goshawk

- No treatments will occur in the 30-acre historic nest core in the north and south PFAs.
- Conduct underburning in units in northern goshawk Post Fledging Areas (PFAs) between September 1 and March 1 and in coordination with a Forest wildlife biologist: North PFA: Units 22.5, 22.6,

23.1, 23.4, 802.3, 807.1, 807.2, 941, 946, 948, 949, 992; South PFA: Units 244.1, 244.2, 817. Other units of nests are encountered will also have this underburning restriction.

- Report raptors encountered before or during management activities (including layout, implementation, and post-sale activities) to a Forest wildlife biologist. A no-treatment buffer may also be placed around the nest in consultation with a Forest wildlife biologist (Forest Plan S&Gs WL-9, WL-17, and WL-25).
- Protect active goshawk nests 0.25 miles from operational disturbance during the reproductive period of March 1 to August 31. Disturbance activities include temporary road construction, small tree thinning, timber harvest, grapple piling, mowing, prescribed slash burning, and underburning operations. Seasonal restrictions may be waived in a given year if a wildlife biologist determines the species is in a non-nesting status, had a nest failure, or that the habitat is not occupied; waivers are only valid until the beginning of the next breeding season.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation management treatments will occur on approximately 8,660 acres of goshawk habitat in the North Unit Diversion Dam–Deschutes River watershed. These treatments primarily include the West Bend Vegetation Management Project which is expected to treat 8,100 acres through commercial thinning, mowing, and underburning. Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on approximately 200 acres in the project area. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor disturbance during the reproductive period.

Treatments will have both negative short and long-term impacts by reducing dense stand conditions and long-term positive impacts by accelerating the development of more fire and disease resistant open stands with large tree structure while reducing the risk of habitat loss from other large-scale disturbances.

The Rocket project will treat an additional 12% of the reproductive habitat in this watershed (3,686 to 6,442 acres). When the Rocket project is added to other ongoing and reasonably foreseeable future projects in the watershed, cumulative impacts will occur on 33% to 41% of the potential northern goshawk reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to habitat for Northern goshawk in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to woodpeckers that may occur in the subwatershed.

Determination

Implementation of the action alternatives 2, 3, or 4 will impact 3,686 to 6,442 acres of northern goshawk reproductive habitat in the Rocket project area depending on the alternative. Alternative 4 would impact the most number of goshawk reproductive habitat acres (6,442) and Alternative 3 the least (3,696 acres). Both historic PFAs in the Rocket project area will be treated with the exception of the 30-acre historic nest core. Cumulatively, in the North Unit Diversion Dam-Deschutes River, 33% to 41% of northern goshawk reproductive habitat will be impacted. No known occupied goshawk habitat will be treated.

The Rocket project is consistent with the Forest Plan standards and guidelines for Management Indicator Species for the northern goshawk (WL-6 through WL-12) as amended by the Eastside Screens. Implementation of the Rocket vegetation management project will result in a small negative trend in viability for the northern goshawk on the Deschutes National Forest.

The Rocket project is consistent with the NNVM Comprehensive Management Plan standards and guidelines for the northern goshawk (M-35).

Red-tailed Hawk

Existing Condition

Please refer to the Red-tailed Hawk species assessment for the Deschutes National Forest for detailed information on its biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012a).

The Forest Plan determined the red-tailed hawk to be a non-game species of special interest and a Management Indicator Species for large trees in mixed structural habitat. The Forest Plan S&G WL-2 states that the forest character is to be maintained 300 feet in radius around active nests and at least four dominate overstory trees suitable for nesting or perching per acre are to be left (Forest Plan, p. 4-52).

Red-tailed Hawk Reproductive Habitat Modeled across the Forest

Potential red-tailed hawk reproductive habitat was modeled across the Forest using all forest types with tree diameters 15 inches and greater at seral stages 5-7, with an open canopy cover (USDA Forest Service 2012a). Modeling parameters may overestimate reproductive habitat due to the open canopy closure threshold ratings actually being too dense in some forest types.

There are 192,492 acres forestwide, 13,856 acres in the North Unit Diversion Dam-Deschutes River watershed, and 2,627 acres in the subwatershed (Table 78). There are 2,208 acres of reproductive habitat widely distributed throughout the Rocket project area.

Table 78: Acres of Red-tailed hawk reproductive habitat.

Spatial Scale	Acres of Red-tailed hawk reproductive habitat	Percent (%)
Deschutes National Forest	192,492	100% of Forest
North Unit Diversion Dam-Deschutes River watershed	13,856	7% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	2,627	1% of habitat forestwide
Rocket Project area	2,208	1% of habitat forestwide
		12% of habitat in watershed (1,679 acres)
		20% of habitat in subwatershed (529 acres)

Red-tailed hawk nest sites are typically located in large ponderosa pine trees associated with natural openings, or harvested areas with clearcuts or shelterwood harvest in both the mixed conifer and ponderosa pine PAGs. Much of the ponderosa pine PAG in the project area, watersheds, and across the District occur in dense second growth stands that resulted from clearcutting in the early 1930s. The residual natural regeneration created a legacy of overstocked ponderosa pine stands in the late 1980s and early 1990s which led to degraded nesting conditions for the red-tailed hawk due to a lack of openings for foraging. Within the watersheds, past thinning projects have occurred primarily in stands of low-elevation second-growth ponderosa pine. These treatments were designed to reduce the risk of stand-replacing fire and promote the development of contiguous stands of future old-growth ponderosa pine, while reducing the stands increasing susceptibility to insects and disease and wildfires.

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the red-tailed hawk under Alternative 1 (No Action). Indirectly, stands with suitable nest trees that currently occur will most likely have increased mortality over time due to a decrease in tree vigor among all size classes. They will remain susceptible to bark beetle activity and the future development of larger nest trees will be prolonged. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and

extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013) including stands of potential red-tailed hawk habitat.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails in red-tailed hawk habitat will occur. These open roads and trails will continue to contribute to disturbance and reduced habitat security for the red-tailed hawk in the Rocket project area.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 2,208 acres of potential red-tailed hawk reproductive habitat in the Rocket project area, tree treatments will occur on 824 acres under Alternative 2, on 627 acres under Alternative 3, and on 1,063 acres under Alternative 4 (Table 79). Fuels treatments will occur on 818 acres under Alternative 2, 405 acres under Alternative 3, and 842 acres under Alternative 3 (Table 79). Alternative 3 will treat the least amount of red-tailed hawk reproductive habitat while Alternative 4 will treat the most amount of habitat.

Table 79: Acres of Red-tailed hawk reproductive habitat treated by alternative.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Tree Treatments				
Thinning to 40 foot average BA	---	172	---	---
Thinning to 60 foot average BA	---	336	76	365
Thinning to mixed range BA	---	---	295	339
Ponderosa pine restoration	---	76	30	90
Openings in Deer Habitat	---	2	2	8
Openings in DMT	---	---	---	31
Plantation Thin	---	148	139	169
Ladder Fuels Reduction	---	90	85	61
Total acres of tree treatments	**0**	**824**	**627**	**1,063**
Reproductive habitat acres (%) with no tree treatments	2,208 (100%)	1,384 (63%)	1,581 (72%)	1,145 (52%)
Fuels Treatments				
Mowing only	---	81	179	285
Mowing and underburning	---	737	226	557
Total acres of fuels treatments	**0**	**818**	**405**	**842**
Reproductive habitat acres (%) with no fuels treatments	2,208 (100%)	1,390 (63%)	1,803 (82%)	1,366 (62%)

No trees > 21" dbh that could provide nest trees for the red-tailed hawk are proposed for removal. During thinning operations a small number of individual snags that could potentially serve as perch or nest trees for the red-tailed hawk could be lost due to felling of snags that pose a hazard to workers and or equipment. Removal of the understory commercial sized trees (those trees that contribute to the upper canopy) in the thinning from below units, ponderosa pine restoration units, plantations, and ladder fuels reduction will improve foraging habitat by opening stands up to allow easier flight maneuverability and access to ground-dwelling mammalian prey. Thinning from below and ponderosa pine restoration treatments will help to decrease the stress on the larger overstory trees, thus accelerating the development of potential large diameter nest trees. Small group openings created for deer hiding cover will provide suitable red-tailed hawk nesting and foraging habitat by retaining large trees and snags >21 inches dbh in association with open habitat.

During prescribed fire treatments, incidental snags could be lost from fire reducing snags that also provide nesting opportunities. The reduction of shrubs from mowing and burning can impact prey species of ground-

dwelling small mammals which depend on the shrubs for cover for hiding from predators and the forbs for food. This activity will reduce the amount of available habitat for prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey in nesting areas. However, impacts from mowing and burning are short in duration (<10 years) and long-term, a higher diversity of prey habitat (grasses, forb and shrubs) is anticipated.

Alternatives 2 and 4 will have the greatest negative short-term impacts to foraging habitat due to mowing and underburning. Alternative 4 will have the greatest benefit to habitat long-term by accelerating the development of open stands with large tree structure and reducing the risk of habitat loss from high intensity or stand-replacing wildfires on more acres of potential habitat. Depending on the alternative, 52% to 72% of the potential reproductive habitat in the project area will not be treated, leaving sufficient residual areas for red-tailed hawks for nesting and foraging during the years that project operations occur (Table 79).

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the red-tailed hawk. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Resource Protection Measures—Alternatives 2, 3, and 4

Any active red-tailed hawk nest site detected before or during project operations will be protected through establishment of a 0.25 mile no treatment area and seasonal restrictions from March 1 through August 31 (Forest Plan S&Gs WL-2 through WL-5, NNVM S&G M-36).

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed will occur on approximately 9,260 acres of red-tailed hawk habitat. These projects primarily include the West Bend Vegetation Management project (approximately 8,600 acres). Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on approximately 200 acres in the project area. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

The ongoing and reasonably foreseeable actions are expected to treat 67% of the available reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed (13,856 acres). The Rocket Project alternatives will treat an additional 5% to 9% (627 to 1,063 acres) of the reproductive habitat in the watershed depending on the alternative. Cumulatively, when the Rocket project is added to the West Bend project, 71% to 75% of the habitat in the watershed will be treated (9,887 to 10,323 acres). These projects will result in short-term negative impacts to prey habitat (foraging) due to fuels treatments. These projects will have positive impacts to habitat post-treatment by opening up stands, and long-term by accelerating the development of future large tree structure and reducing the risk of habitat loss of existing habitat high intensity and/or stand-replacing wildfire.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to red-tailed habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to red-tailed hawks that may occur in the area.

Determination

Implementation of the Action Alternatives 2, 3, or 4 will impact 627 to 1,063 acres of red-tailed hawk reproductive habitat in the Rocket project area. Cumulatively in the watershed, 71 to 75% of red-tailed hawk reproductive habitat will be impacted. These impacts will be both positive and negative to foraging habitat with long-term positive benefits to reproductive habitat due to the accelerated development of large tree nest structure in reproductive habitat.

The Rocket project is consistent with the Forest Plan standards and guidelines for Management Indicator Species for the Red-tailed hawk (WL-2 through WL-5). Implementation of the Rocket vegetation management project will not result in a negative trend in viability for the red-tailed hawk on the Forest.

The Rocket project is consistent with the NNVM Comprehensive Management Plan standards and guidelines (M-26) because the area was surveyed for goshawk and active nest site would be protected if discovered and 30-acre nest stands will be left untreated for each PFA.

Cooper's hawk, and Sharp-Shinned Hawk

Existing Condition: Cooper's hawk

Please refer to the Cooper's hawk species assessment for the Deschutes National Forest for detailed information on its biology, status, threats, and habitat modeling for the Forest (USDA Forest Service 2012c).

The Cooper's hawk was chosen as a terrestrial management indicator species for providing stand diversity and retention of small habitat blocks in 50 to 80 year old black bark pine stands and mixed conifer stands. The Forest Plan S&G WL-13 states that reproductive habitat for at least 60 pairs will be provided in mixed conifer and ponderosa pine forests outside of wilderness areas and the Oregon Cascades Recreation Area. The Forest Plan S&G WL-17 states that where prospective nest sites are not known, the following physiographic and vegetative characteristics will be used:

- Mean canopy cover of 60% or greater
- Tree density of at least 365 trees per acre
- Stand age of 50 to 80 years old
- Stand size of at least 15 acres

In eastern Oregon, Cooper's hawk nested in stands that resembled even-aged, second growth stands in larger older trees (50-70 years) with deep crowns (Reynolds et al. 1982). Cooper's hawks typically select nest sites with high tree density and canopy cover which provide cover and protection from predators (Reynolds et al. 1982). Nests in eastern Oregon were commonly in deformed trees infected by dwarf mistletoe and that had heavy foliage, witches brooms, or double trunks (Reynolds et al. 1982). In the Blue Mountains in eastern Oregon, the dbh of nest trees averaged 14 to 16 inches and mistletoe was selected as the platform 50-70% of the time (Moore and Henny 1984). Several studies have documented that sapling-sized trees are a common characteristic of nest sites although the level of dependence on saplings is not well-understood (Moore and Henny 1983, Siders and Kennedy 1996). Home range size across the western U.S. varies from 1,657 acres to 5,745 acres according to the literature (USDA Forest Service 2012c). Stands of all age classes in each timber type were represented with mature ponderosa pine overstory with mixed understory of ponderosa pine and white fir the most common (Reynolds and Wight 1978).

Limited studies of foraging habitat indicate they appear to use available forests opportunistically provided the available types are not too dense for flight below or within the canopy (Reynolds 1989). Cooper's hawks in Oregon foraged primarily near the ground (Reynolds and Meslow 1984). A reduction in canopy closure and tree density can decrease the availability of nest sites, prey abundance and prey availability, and may increase vulnerability to predation. Potential activities that can limit these measures include commercial and non-commercial thinning, shelterwood and clearcut harvesting where it reduces crown cover and dense forests; fire suppression; recreation, livestock grazing, invasive plants, and fuelwood harvest.

Approximately 275,487 acres of Cooper's hawk reproductive habitat were modeled across the forest (Table 80). There are 27,310 acres of reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed and 6,292 acres in the Sugar Pine Butte-Little Deschutes River subwatershed (Table 80). Approximately 9,356 acres are modeled for the Rocket project area.

Table 80: Acres of Cooper's hawk reproductive habitat.

Spatial Scale	Acres of Cooper's Hawk Reproductive Habitat	Percent (%)
Deschutes National Forest	275,340	100%
North Unit Diversion Dam-Deschutes River watershed	27,310	10% of the habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	6,292	2% of the habitat forestwide
Rocket Project area	9,319	3% of the habitat forestwide
		33% of the habitat in the watershed (8,988 acres)
		5% of the habitat in the subwatershed (331 acres)

Existing Condition: Sharp-shinned Hawk

Please refer to the sharp-shinned hawk species assessment for the Deschutes National Forest for detailed information on its biology, status, population trend, and habitat modeling for the Forest (USDA Forest Service 2012d).

The sharp-shinned hawk was chosen as a terrestrial management indicator species for providing stand diversity and retention of small habitat blocks in 40 to 60 year old ponderosa pine stands (Forest Plan pages 4-53 and 4-54). The Forest Plan S&G WL-21 states that reproductive habitat for at least 60 pairs will be provided in mixed conifer and ponderosa pine forests outside of wilderness areas and the Oregon Cascades Recreation Area. The Forest Plan S&G WL-25 states that where prospective nest sites are not known, the following physiographic and vegetative characteristics will be used:

- Mean canopy cover of 65% or greater
- Tree density of at least 475 trees per acre
- Stand age of 40 to 60 years old
- Stand size of at least 10 acres

Similar to Cooper's hawk, reproductive habitat for the sharp-shinned hawk in eastern Oregon occurred in 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 with mature ponderosa pine overstory with mixed understory of ponderosa pine and white fir the most common (Reynolds and Wight 1978). In both the Coast Range and eastern Oregon, sharp-shinned hawks nested in young (25-50) even-aged conifer stands with single-layered canopies, primarily in white fir (Reynolds and Wight 1982). Home range sizes range from 679 to 1,136 acres (Reynolds et al. 1982).

Reynolds and Meslow (1984) estimated that sharp-shinned hawks foraged in the upper canopy zone in Oregon. The vegetation at nest sites is usually in the early successional stages and extremely dense. Nest stands were dominated by trees 3-15 inches dbh with an average of 926 trees per acre. Habitat loss decreases the availability of nest sites, prey abundance, which will limit populations as well. Precommercial or commercial thinning reduces stand densities and deeper tree crowns which increase the risk of predation for this species.

Table 81 lists the acres of sharp-shinned habitat modeled across the Forest (USDA Forest Service 2012 d). There are 426,138 acres of reproductive habitat across the Forest based, 34,922 acres in the North Unit Diversion Dam-Deschutes River watershed, and 9,323 acres in the Sugar Pine Butte-Little Deschutes River

subwatershed. Approximately 11,892 acres are modeled for the Rocket project area. There are no known historic nest sites. A sharp-shinned hawk was observed in 2011 during northern goshawk surveys but no nest was detected.

Table 81: Acres of sharp-shinned hawk reproductive habitat.

Spatial Scale	Acres of Sharp-shinned Hawk Reproductive Habitat	Percent (%)
Deschutes National Forest	426,138	100%
North Unit Diversion Dam-Deschutes River watershed	34,922	7% of the habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	9,323	2% of the habitat forestwide
Rocket Project area	11,890	3% of the habitat forestwide
		32% of the habitat in watershed (11,331 acres)
		6% of the habitat in subwatershed (559 acres)

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to Cooper's or sharp-shinned hawk reproductive habitat under Alternative 1 (No Action). Indirectly, stand densities will continue to increase due to fire suppression which will increase the amount of potential habitat over time. Areas with high stand densities that currently provide suitable habitat 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. Increased stand densities will also increase the risk of loss from insects, disease, or fire. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013).

In high density stands of second growth ponderosa pine and plantations with advanced regeneration, due to overstocking and high amounts of 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 and plantations will likely contain bark beetle outbreaks and high densities of small snags will occur within the project area, and habitat will diminish.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails will occur. These open roads and trails will continue to contribute to disturbance and reduced habitat security for raptors in the Rocket project area.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 9,319 acres of Cooper's hawk reproductive habitat in the Rocket project area, tree treatments will occur on 4,338 acres under Alternative 2, on 3,448 acres under Alternative 3, and on 5,842 acres under Alternative 4 (Table 82). Fuels treatments will occur on 4,307 acres under Alternative 2, on 2,453 acres under Alternative 2, and on 5,842 acres under Alternative 4 (Table 82).

Out of the 11,890 acres of sharp-shinned hawk reproductive habitat in the Rocket project area, tree treatments will occur on 5,475 acres under Alternative 2, on 4,009 acres under Alternative 3, and on 4,579 acres under Alternative 4 (Table 83). Fuels treatments will occur on 5,434 acres under Alternative 2, on 2,788 acres under Alternative 3, and on 3,598 acres under Alternative 4 (Table 83).

Table 82: Acres of Cooper's hawk reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	1,247	---	---
Thinning to 60 foot average BA	1,890	556	1,328
Thinning to mixed range BA	---	1,509	3,004
Ponderosa pine restoration	129	6	159
Openings in Deer Habitat	19	15	33
Openings in DMT	---	19	18
Sanitation Thin DMT	---	---	173
Plantation Thin	246	320	453
Ladder Fuels Reduction	807	1,023	674
Total acres of tree treatments	**4,338**	**3,448**	**5,842**
Reproductive habitat acre (%) with no tree treatments	4,981 (53%)	5,871 (63%)	3,477 (37%)
Fuels Treatments			
Mowing only	149	1,387	484
Mowing and underburning	4,158	1,066	4,214
Total acres of fuels treatments	**4,307**	**2,453**	**4,698**
Reproductive habitat acres (%) with no fuels treatments	5,012 (54%)	6,866 (74%)	4,621 (50%)

Table 83: Acres of Sharp-shinned hawk reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	1,561	---	---
Thinning to 60 foot average BA	2,458	691	1,076
Thinning to mixed range BA	---	1,616	2,023
Ponderosa pine restoration	225	38	38
Openings in Deer Habitat	19	15	21
Openings in DMT	---	20	24
Sanitation Thin DMT	---	7	106
Plantation Thin	348	398	474
Ladder Fuels Reduction	864	1,224	817
Total acres of tree treatments	**5,475**	**4,009**	**4,579**
Reproductive habitat acres (%) with no tree treatments	6,415 (54%)	7,881 (66%)	7,131 (60%)
Fuels Treatments			
Mowing only	183	1,561	486
Mowing and underburning	5,251	1,227	3,112
Total acres of fuels treatments	**5,434**	**2,788**	**3,598**
Reproductive habitat acres (%) with no fuels treatments	6,456 (54%)	9,102 (77%)	8,292 (70%)

Under all alternatives, thinning from below will negatively impact Cooper's and sharp-shinned hawk habitat by reducing tree density and canopy closure which increase vulnerability to nest predation from other raptors (Reynolds 1989) and because dense forests for these species are presumed to provide perch sites from which they may ambush pretty species.

Overlapping territories will potentially occur with these accipiters and the northern goshawk. Thinning in suitable habitat will occur in both second growth ponderosa pine and multi-storied mixed conifer stands. Thinning 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. Treatments aid in maintaining the largest trees where they exist and reducing their susceptibility to fire and insects by removing competition for space and nutrients.

Underburning will occur in stands with a more fire resistant overstory and fewer small (<9 inches dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8 inches dbh) may be needed as a pre-treatment to fire. Mowing (mastication) of brush may also occur where existing brush density and height will 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 reduction in potential prey species. However, adjacent untreated areas may be able to provide the structural complexity for prey species that will provide potential foraging opportunities. Alternative 4 will have the largest impact to reproductive habitat due to the reduction in stand densities and canopy cover from thinning. Alternative 3 will have the least impact to stand densities and canopy cover; however, this alternative will have the greatest short-term impact to foraging habitat with more acres mowed and underburned.

Under all three alternatives, approximately 38.6 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the Cooper's and sharp-shinned hawks. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

The following resource protection measures are incorporated into the action alternatives and assumed in the analysis to reduce or eliminate unintended/unwanted impacts:

- Implement seasonal restrictions from April 15 through August 31 on any newly discovered nest site.
- Establish a 0.25 mile no treatment area around the nest site.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation management treatments will occur on approximately 8,660 acres (32%) of Cooper's hawk and 9,600 (28%) acres of sharp-shinned hawk habitat in the North Unit Diversion Dam–Deschutes River watershed. These treatments primarily include treatments on approximately 7,900 acres of Cooper's hawk and 9,100 acres of sharp-shinned hawk reproductive habitat in the West Bend vegetation management project. Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. These treatments will have negative short-term impacts due to a reduction on stand densities and canopy cover and long-term positive benefits by reducing the risk of habitat loss due to high intensity and/or stand replacing fire. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on approximately 200 acres in the project area. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor disturbance during the reproductive period.

Of the 27,310 acres of Cooper's hawk in the watershed, the Rocket project alternatives will treat an

additional 16% to 21% of the reproductive habitat in this watershed depending on the alternative. When the Rocket project is added to other ongoing and reasonably foreseeable future projects in the watershed, cumulative impacts will occur on 48% to 53% of the potential Cooper's hawk reproductive habitat in the watershed.

Of the 34,922 acres of sharp-shinned hawk reproductive habitat in the Rocket project area, the Rocket project alternatives will treat an additional 13% to 16% acres of reproductive habitat in the watershed. When the Rocket project is added to other ongoing and reasonably foreseeable future projects in the watershed, cumulative impacts will occur on 41% to 44% of sharp-shinned hawk reproductive habitat in the watershed.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to habitat for in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to raptors that may occur in the subwatershed.

Determination

Implementation of the Action Alternatives 2, 3, or 4 will impact 3,448 to 5,842 acres of Cooper's hawk reproductive habitat and 4,009 to 5,475 acres of sharp-shinned hawk reproductive habitat in the Rocket project area. Cumulatively in the North Unit Diversion Dam-Deschutes River watershed, 48% to 53% of Cooper's and 41% to 44% of sharp-shinned reproductive habitat will be impacted.

The Rocket project is consistent with the Forest Plan standards and guidelines for Management Indicator Species for the Cooper's hawk (WL-13 through WL-20) and sharp-shinned hawk (WL-21 through WL-29). Implementation of the Rocket vegetation management project will not contribute to a negative change in viability for the Cooper's hawk or sharp-shinned hawk on the Deschutes National Forest.

The Rocket project is consistent with the NNVM Comprehensive Management Plan standards and guidelines for raptors (M-36) because active nest sites would be protected if discovered (EA p. 45).

Elk and Mule Deer

Analysis of big game (elk and mule deer) covers several management allocations, addresses numerous standards and guidelines, and habitat measures are assessed across Forest, watershed, and project scales.

One element of the mule deer analysis is considered a Key Issue (see page 15): Openings created for deer hiding cover. Other elements analyzed include deer and elk summer range; deer and elk winter range; impacts to thermal cover; open road densities.

Existing Condition: Elk

For a detailed assessment on elk biology, status, and habitat modeling for the Deschutes National Forest, please refer to the Species Assessments for Elk for the Forest (USDA Forest Service 2012e).

The elk was identified in the Forest Plan as a management indicator species (MIS) due to its socio-economic importance to the hunting community in Central Oregon and other neighboring communities. Elk management objectives (MOs) were developed with ODFW. The Forest and ODFW will cooperate in determining the level of habitat effectiveness needed to meet these objectives. Population objectives for both summer populations and winter populations are identified; annual monitoring is conducted by ODFW to determine the annual hunted population associated with the Deschutes National Forest Plan WL-42. There are no Key Elk Habitat areas and no known elk calving locations in the Rocket project area.

The northwestern area of the Rocket project area is near the Ryan Ranch Key Elk Area (directly opposite of Highway 97). The southern undercrossing constructed in 2012 in association with the past Highway 97 ODOT expansion project occurs in the Rocket project area and facilitates west-east movement from the Ryan Ranch KEHA to elk (and deer) summer and winter habitat in the Rocket project area. The Monument Plan discusses maintaining high quality thermal cover, hiding cover, screening, and providing migration routes for elk in the management zones that overlap the Rocket project area within the context of objectives to

reintroduce fire and foster development and preservation of historic, fire-based ponderosa pine old growth. Therefore, impacts to elk are analyzed for migration to the Ryan Ranch KEHA via across the Rocket project area and to the Highway 97 undercrossings and for consistency with the Monument Plan standards and guidelines.

Elk population estimates within the Paulina/East Fort Rock Wildlife Management Unit show a slightly increasing trend. Vegetation management direction within the Monument focuses on providing hiding cover, thermal cover, and migration routes. Thermal cover are those stands with enough canopy cover and stand density to help prevent elk from heat loss at night when ambient temperatures are apt to be less than body temperatures (Thomas 1979). In addition, thermal cover stands limit snow accumulation as well as providing tree trunks and low ground vegetation to reduce air speed and chill factor (Thomas 1979).

The Forest tends to produce an understory dominated by shrubs consisting of bitterbrush, snowbrush (Ceanothus), and or manzanita. Bitterbrush occurs within the lower elevation more xeric ponderosa pine stands or lodgepole pine stands with well-drained soil types. Snowbrush and manzanita are associated with higher elevation ponderosa pine and mixed conifer stands. Over the last 20 years timber harvest on the Forest has changed from clear cutting/regeneration harvests to thinning from below with objectives of reducing stand densities, minimize the risk of stand replacing wildfire, and outbreaks of insects and disease. Generally, timber harvests reduce tree canopy cover which reduces shading and can favor the growth of snowbrush, manzanita, and at lower elevations, bitterbrush. These shrubs are not preferred forage by elk and many of these areas are avoided. Subsequently, prescribed fire with frequent reentry can reduce shrub densities and promote forage such as Idaho fescue, elk and Ross's sedge. Reentry with fire can reduce shrub competition with grasses, sedges, and forbs. Grasses and forb production on the Forest typically occurs along streams and stringer meadows and as a result the majority of elk and KEHAs are associated with these areas (USDA Forest Service 2012e).

Elk herds are small and very transient, moving long distances between suitable habitats across the Forest. Summer range for elk on the Bend/Ft. Rock includes the upper Deschutes River and Fall River Corridor and associated stringer meadows. As calves become more mobile in mid to late summer, these small herds begin to move out of the drainages to higher elevations to find cooler and well shaded areas. Typically these higher elevations are where breeding takes place beginning in late summer or early fall. Elk travel large distances throughout these high elevation areas utilizing the Cascades and the various buttes west of Highway 97. Fewer elk occur east of Highway 97 and move greater distances between cover, from Walker Mountain on the southern end of the Forest, moving north using various buttes along the eastern fringe as well as Newberry Crater. Elk will continue to use these high elevation areas throughout the fall and into winter until snow accumulations force them to lower elevation habitats. Due to the size and hardiness of elk they are not as susceptible to snow accumulation as mule deer and can sometimes overwinter without making drastic elevation changes (USDA Forest Service 2012e).

Roads, and also off-road recreational activities such as ATV use and mountain biking, have significant direct and indirect effects on herd productivity (Rowland et al. 2005). Hunting, in fact, is the main source of mortality for adult elk (Wisdom et al. 2000b) outside national parks (Hal Salwasser, personal communication as cited in USDA Forest Service 2012e) and in the absence of predator populations.

Elk are more vulnerable to hunters in roaded areas than in unroaded areas. Roads also break large tracts of habitat into smaller chunks, reduce vegetative cover used by elk for security and act as a vector for exotic plant species. Elk exhibit higher stress levels and increased movement rates near roads. In addition, off-road recreation, which is increasing rapidly on public lands, also has a pronounced effect on elk behavior, causing them to flee to avoid ATVs, mountain bikes, and equestrians. Elk can spend a substantial amount of energy avoiding pervasive human disturbances. This energy cost may not be adequately accounted for in conventional assessments of elks' nutritional condition (Johnson et al. 2005).

Existing Condition: Mule Deer

For a detailed habitat assessment on mule deer biology, status, and habitat modeling for the Deschutes National Forest, please refer to the Mule Deer Species Assessment for the Deschutes National Forest (USDA

Forest Service 2012f).

Much of the Bend/Ft. Rock RD ponderosa pine PAG, including the Rocket project area, associated with MA-7 winter range on the lower elevations and the summer range on higher elevations, occurs in second growth stands created from the clearcutting that occurred in the early 1930s. This clearcut logging created highly palatable early seral forage conditions and by the mid-1960s, mule deer populations had substantially increased in Oregon. Since the mid-1960s, fire suppression and natural regeneration have led to dense stands of second growth ponderosa pine, shading out shrubs and reducing foraging opportunities.

In the mid-1970s within summer range areas on the Forest, shelterwood harvest prescriptions retained 8 to 20 live overstory trees per acre, removing the majority of overstory in these stands. This resulted in a new source of forage and deer populations peaked again in the early to mid-80s but not to the level of the 1960s. By the mid-1990s, many landscape scale thinning projects had been implemented to reduce the dense stands of second growth "black bark" ponderosa pine and beetle outbreaks that were killing trees. Although thinning in these areas increased foraging habitat, it also reduced hiding cover which exposed deer to higher levels of disturbance. By this time the human population and associated development and recreation in Central Oregon had greatly increased, leading to more vehicle collusions with deer and poaching. Today, poaching continues to be the highest cause of mortality to deer populations in central Oregon. Deer are no longer found in many historic winter ranges and occupy less suitable winter range areas.

Within the watershed, a variety of past thinning projects have occurred, primarily in stands of low- elevation second growth ponderosa pine. Treatments were designed to reduce the risk of stand-replacing fire and accelerate the development of contiguous stands of future old growth ponderosa pine, while reducing the stands increasing susceptibility to insects and disease. The majority of thinning removed trees ≤8 inches dbh, but also commercially thinned trees up to 21 inches dbh.

The Rocket project area occurs in both mule deer winter and summer range. Mule deer summer range was identified in the Forest Plan to provide management direction in forested stands at higher elevations which mule deer occupy from late spring to late fall. High quality forage in summer range includes early seral forbs and shrubs that provide nutrients for antler growth, milk production for lactating does, energy for breeding season in late fall, and maintenance of reserves to assist with winter survival. Summer habitat also includes areas specifically used for reproductive purposes. These areas should provide security from predators, isolation from other deer, and minimal competition from other ungulates. Limiting factors for the mule deer population forestwide identified in the mule deer species assessment were a lack of 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 fall rut and then directly into and through the following winter months.

Deer annually migrate between high-elevation summer range and low-elevation winter habitat. During migration, deer tend to follow broad corridors influenced by topographic features, which become less distinct as the distance from winter range increases (Thomas and Irby 1990). In addition, transition ranges may be important for weight gain during migration in some years (Thomas and Irby 1990). Winter range, corridors, and transition areas may be important to mule deer survival in severe winters (Thomas and Irby 1990) (USDA Forest Service 2012f).

Threats to mule deer within their range in the intermountain west including the Forest are poaching, habitat fragmentation due to urbanization particularly in winter range, collisions with motor vehicles, barriers to mule deer migration from roads and urbanization, invasive plants that replace native shrubs, and the expansion of juniper woodlands in the absence of fire which reduces the diversity of understory grasses, forbs, and shrubs in the absence of fire (USDA Forest Service 2012f).

Deer Habitat: Summer Range

Table 84 lists the Forest Plan Standards and Guidelines in Mule Deer Summer Range (outside of Deer Habitat MA-7). The Forest Plan S&Gs associated with summer range include hiding cover and open road

densities. Hiding cover provides escape from predation as well as avoidance from harassment potential by hunters and other recreational use. The guidelines for hiding cover states that "Hiding areas 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." The watershed is used as the implementation unit for analysis of hiding cover (USDA Forest Service 2012f). 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 (USDA Forest Service 2012f). Reduced open road densities are used to mitigate habitat impacts from vegetation management, and where minimum hiding cover S&Gs cannot be met, reduction of open road densities are used to further reduce disturbance to deer.

Table 84: Forest Plan Mule Deer Summer Range Standards and Guidelines (S&Gs).

Hiding Cover: 30% Suitable hiding cover must meet one of the following criteria. (S&G WL-54)	***Open Road Densities in the watershed (S&G WL-53)**	**Black Bark: 10% of treated stand will be in clumps to provide visual screening throughout and meet the following criteria. (S&G WL-59)**
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 harvest for at least 20 years. Small clumps will be suitable in dense stand 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 trees greater than 7 inches dbh per acre remaining after harvest. Clumps should be located away from roads.		

*The watershed is being used as the implementation unit to calculate average road density and hiding cover objectives (Forest Plan WL-53).

Table 85 lists the current summer range hiding cover percentage by watershed and subwatershed. Three out of the six subwatersheds in the North Unit Diversion Dam-Deschutes River watershed are currently below the Forest Plan S&G of 30% hiding cover. Four of the six subwatersheds in the North Unit Diversion Dam-Deschutes River watershed are below the minimum Forest Plan S&G of 30% hiding cover in summer range. The Overturf Butte-Deschutes River subwatershed does not overlap with the Rocket project area. All of the subwatersheds in the Lower Little Deschutes River watershed including the Sugar Pine Butte-Little Deschutes River watershed which overlaps with the Rocket project area are above the minimum S&G of 30% hiding cover in summer range.

Table 85: Acres and percent mule deer hiding cover in summer range in the watersheds.

Watershed (HUC 10)	Subwatershed (HUC 12)	Acres in Subwatershed	Acres of Hiding Cover in Subwatershed	% in Hiding Cover by Subwatershed
North Unit Diversion Dam-Deschutes River	Benham Falls-Deschutes River	22,550	5,644	25%*
	Lava Island Falls-Deschutes River	11,093	3,001	27%*
	Lockit Butte	8,220	4,691	57%
	Overturf Butte-Deschutes River (not in Rocket project area)	19,305	1,494	8%*
	Town of Sunriver	9,585	1,601	17%*
	Town of Sunriver-Deschutes River	12,574	4,089	33%
Lower Little Deschutes River	Kawak Butte-Little Deschutes River	11,199	5,890	53%
	Lower Paulina Creek	17,217	9,228	54%
	Sugar Pine Butte-Little Deschutes River (Rocket project area)	28,573	9,426	33%
	Town of Lapine-Little Deschutes River	3,614	1,320	37%
	Upper Paulina Creek	12,662	8,155	64%
	Wickiup Junction	8,943	4,595	51%
*Below minimum of Forest Plan Standard and guideline of 30% hiding cover in summer range.				

Table 86 lists the mule deer hiding cover acres and percentages in summer range across the Forest, in the watersheds, and in the Rocket project area based on GNN forestwide modeling (USDA Forest Service 2012f). Approximately 715,226 acres of hiding cover occur across the Deschutes National Forest, 20,520 acres in the North Unit Diversion Dam-Deschutes River watershed, 38,614 acres in the Lower Little Deschutes River watershed, and 3,810 acres in the Rocket project area. The summer range hiding cover acres on the Rocket project area make up approximately 13% of the North Unit Diversion Dam-Deschutes River watershed and 3% of the Lower Little Deschutes River watershed. The percent of hiding cover acres in the Rocket project make up approximately 0.5% of the hiding cover on the summer range across the entire Deschutes National Forest.

Table 86: Acres of Mule Deer Summer Range hiding cover.

Spatial Scale	Acres of Mule Deer Summer Range Hiding Cover	Percent (%)
Deschutes National Forest	715,226	100% of Summer Range forestwide
North Unit Diversion Dam-Deschutes River watershed	20,520	3% of Summer Range forestwide
Lower Little Deschutes River watershed	38,614	5% of Summer Range forestwide

Spatial Scale	Acres of Mule Deer Summer Range Hiding Cover	Percent (%)
Rocket Project area	2,799 acres in North Unit Diversion Dam-Deschutes River watershed	• 0.5% of Summer Range forestwide for both watersheds • 13% of Summer Range in North Unit Diversion Dam-Deschutes River watershed • 3% of Summer Range in Lower Little Deschutes River watershed
	1,011 acres in Lower Little Deschutes River watershed	

Deer Habitat: Winter Range (Management Area 7)

The Forest Plan established Management Area 7 (MA-7) to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges, considering the optimum productivity of the land. In addition, MA-7 provides opportunities for some domestic livestock forage, wood products, visual quality, and recreation opportunities. This management area contains approximately 209,684 acres of which approximately 95,400 were identified as not suitable for timber production, which provide unforested habitat and therefore may not likely contribute to thermal cover objectives. Approximately 113,500 acres of MA-7 were identified as appropriate for timber production providing forested habitat, which could contribute to both thermal and hiding cover objectives. Similar to summer range, winter range allocation has S&Gs for hiding cover and open road densities as well as thermal cover.

The guidelines for cover state that "cover should make up 40% of the land area, approximately three quarters existing as thermal cover and the remainder as hiding cover." Similar to summer range, open road densities are used to mitigate habitat impacts from vegetation management, and where hiding cover S&Gs cannot be met, open road densities are used to further eliminate disturbance from an area (USDA Forest Service 2012f).

Mule deer hiding cover, thermal cover, and open road densities were mapped for MA-7 across the Deschutes National Forest in 2012 (USDA Forest Service 2012f). Management Area 7 was then divided into subunits to directly correlate MA-7 habitat objectives to the specific herd unit areas in which the ODFW winter population census occurs. These subunits provide a basis to develop strategies for managing cover quality, diversity of seral classes of winter forage, and open road densities. Table 87 lists the Forest Plan Standards and Guidelines in Mule Deer Winter Range (MA-7).

During project planning road density information was updated with recent changes to the transportation system, and lidar data and field reconnaissance were used to identify more accurately the stands that provide thermal cover.

Table 87: General Theme and Objectives for Deer Habitat (MA- 7) Standards and Guidelines.

*Thermal Cover	**Hiding Cover	OHV Seasonal Closure M7-1	Open Road Densities M7-22	Annual Fuels Treatment M7-26
30% of the Winter Range	10% of the Winter Range	December 1 –March 31	1.0-2.5 mile/square mile	2.0 – 2.5 % of MA-7

*Where site productivity is capable of producing forested stands that provide thermal cover.

** Where site productivity is capable of producing forested stand or shrubs that provide hiding cover

The ODFW has divided Central Oregon into four Wildlife Management Units (WMUs) to manage wildlife populations—Metolius, Upper Deschutes, Paulina, and Ft. Rock. Management Objectives (MOs) for mule deer are established for each WMU. Winter population estimates are collected on the Metolius and Upper Deschutes, and the Paulina unit is split into two winter range areas—North and South Paulina. Although a portion of the Ft. Rock WMU occurs on the southern end of the Crescent Ranger District of the Deschutes National Forest, a very small portion of this winter range associated with this WMU occurs on the National Forest, therefore there is not a population MO for the Ft. Rock WMU associated with the Deschutes National Forest.

The majority of the Rocket project is within the Paulina Wildlife Management Unit (WMU). The area west of Highway 97 in the Rocket project is within the Upper Deschutes (WMU). The WMUs are designated by ODFW. The management objective (MO) for the Paulina WMU is 16,500 wintering deer. The MO for the Upper Deschutes WMU is 2,200 wintering deer. The overall trend data shows a declining mule deer population for Central Oregon including the Forest. They are currently below MOs. As a direct response, there has also been a decline in allowable harvest for both antlered and antlerless portions of the population in the Paulina WMU (and in the Metolius WMU on the Sisters Ranger District). Buck to doe ratios continue to meet the MO in the Upper Deschutes WMU; therefore, allowable harvest in this WMU 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 in both the Upper Deschutes and Paulina WMUs (USDA Forest Service 2012f).

Hiding Cover in Winter Range

Forage quality and hiding cover are the most important habitat components for ungulate populations in the Rocket area due to the high amount of disturbance animals receive from recreation use. There are 25,924 acres of deer hiding cover across the entire MA-7 on the Deschutes National Forest and 9,022 acres of hiding cover in the North Paulina Winter Range subunit. Approximately 420 acres of hiding cover exist within MA-7 in the Rocket project area (Table 88). Across the MA-7 winter range, currently 12% of the acres are in hiding cover which slightly exceeds the minimum hiding cover Forest Plan S&G of 10%. The percent of hiding cover in the North Paulina Winter Range subunit in MA-7 is at the 10% minimum level.

Table 88: Acres of Mule Deer Hiding Cover in Winter Range (MA-7).

Spatial Scale	Acres of Mule Deer Hiding Cover in MA-7	Percent (%)
MA-7 Across the Deschutes National Forest (209,684 acres)	25,924	100%
North Paulina Winter Range Subunit (88,176 acres)	9,022	35% of hiding cover in MA-7
Rocket Project area	420	2% of MA-7
		5% of subunit

Thermal Cover

There are 24,705 acres of deer thermal cover within MA-7 Deer Habitat (Winter Range) across the Forest, and 11,461 acres of mule deer thermal cover within the North Paulina Winter Range subunit associated with MA-7. Of the 2,834 acres of MA-7 winter range in the Rocket project area, approximately 1,070 acres are thermal cover for deer within in the Rocket portion of MA-7. Across the MA-7 winter range, the current 12% thermal cover does not meet the LRMP objective of 30%. The current amount of thermal cover in the North Paulina Winter subunit in MA-7 is 5%. Table 89 summarizes these acreages for MA-7. Forest-wide levels of thermal cover were determined with GNN forest-wide modeling data. A Lidar dataset was also used to evaluate how thinning and other harvest treatments in the Rocket project would affect dense forest habitat including thermal cover for deer (Schroeder 2014). Based on this Lidar dataset, treatment units were designed to provide sufficient thermal cover for mule deer across the project area.

Table 89: Acres of Mule deer thermal cover in Deer winter range (MA-7).

Spatial Scale	Acres of Mule Deer Thermal Cover in MA-7	Percent (%)
Deschutes National Forest	24,705	100% of MA-7
North Paulina Deer Winter Range Subunit	11,461	46% of MA-7
MA-7 Thermal Cover in Rocket Project area	1,070	4% of MA-7
		9% of winter range subunit

Open Road Densities: Summer Range and MA-7 Winter Range

Within the summer range associated with the watersheds overlapping the Rocket project area, open road densities are 2.76 miles per square mile in the North Unit Diversion Dam-Deschutes River watershed and 2.87 miles per square mile in the Sugar Pine Butte-Little Deschutes River subwatershed (Table 90). This currently exceeds the Forest Plan S&G of 2.5 miles per square mile for summer range. Within the North Paulina Winter Range Subunit, open road densities exist at a level of 3.72, which exceeds the Deschutes Forest Plan S&G of 1.0 to 2.5 mile per square mile in MA-7.

Table 90: Open Road Densities for Mule Deer.

Summer Range: Mule Deer Open Road Densities[1]	
Spatial Scale	**Miles per square mile**
Summer Range in the North Unit Diversion Dam-Deschutes River watershed	2.76
Summer Range in the Sugar Pine Butte-Little Deschutes River subwatershed	2.87
[1] = Forest Plan S&G of 2.5 miles per square mile in summer range	
Winter Range: Mule Deer Open Road Densities[2]	
Spatial Scale	**Miles per square mile**
North Paulina Winter Range Subunit (MA-7)	3.72
[2] =Forest Plan S&G of 1.0 mile to 2.5 miles per square mile in winter range	

Deer Habitat within the Newberry National Volcanic Monument

Standards and guidelines for deer and elk within the Newberry National Volcanic Monument are similar to the Forest Plan S&Gs with an emphasis on maintaining hiding cover, forage, thermal cover, and migration routes within the context of re-establishing historic fire-based ponderosa pine (Table 91). There are 2,634 acres of hiding cover in summer range within the Monument in the Rocket project area. There are 1,580 acres of deer winter range within the Monument in the Rocket project area. Of these acres, 83 acres are thermal cover for deer.

Table 91: Deer and Elk Standards and Guidelines for the Monument Comprehensive Management Plan.

Monument-wide Standard
M-37: For Deer and Elk: ensure clumps or screen of hiding cover along roads within the monument to reduce view distances into openings. In migration corridors, design vegetation management to provide for viable migration corridors over time in areas undertaken to reestablish historic fire-based ponderosa pine old growth may not be feasible to maintain entire corridor in these areas, provide for pockets of higher-density tree clumps/
Lava Butte Zone Standards
LZ-1: Maintain some deer migration routes, some high-quality winter forage, hiding cover, and thermal cover where feasible within fire introduction objectives. Maintain hiding and thermal cover on at least 30% of suitable range within the transition/winter range. Provide for 900 acres of bitterbrush in transition/winter range, preferably away from roads and facilities.
LX-2: Consider ways to reduce conflicts with deer migration corridors.
Transition Zone Standard
TZ-3: Maintain some migration routes for deer in this Zone. Provide for some high-quality winter forage, hiding cover, and thermal cover where feasible within the context of objectives to reintroduce fire and foster development and preservation of historic, fire-based ponderosa pine old growth. Consider ways to reduce conflicts with deer migration corridors when locating, designing and managing new facilities, roads, and trails. Avoid special uses or events which will adversely impact deer migration. Minor displacement of a few deer for a few days is allowed.

Highway 97 Undercrossings

As part of a past ODOT project to expand Highway 97, two crossings underneath the highway were constructed in 2011 to reduce vehicle collisions and facilitate east-west movement of deer and elk. The north undercrossing is a dual motor vehicle/wildlife undercrossing on Forest Road 9703. This Forest road connects the Deschutes National Forest Lava Lands Visitor Center west of Highway 97 with Lava River Cave east of Highway 97 and the Cottonwood highway exit to the south. The north undercrossing is more constrained than the southern one as it includes Road 9703, regular motor vehicle use in the absence of snow, and is located a short distance from the visitor center. The new paved Lava Lands to Sunriver recreational trail will also begin at Lava Lands Visitor Center near the north undercrossing.

The southern undercrossing is north of Road 9720 and is completely vegetated with no roads or motor vehicle use. An eight foot high fence was installed in 2012 on both the east and west sides of the highway north at Lava Butte south to the Cottonwood exit to deter ungulates from crossing the highway and to funnel the ungulates toward the undercrossings. Jump-offs were constructed north of each undercrossing on both sides of the highway to allow ungulates a way to more easily jump back into the vegetated areas behind the fences in the event they had entered the un-vegetated areas along the highway. A narrow dirt road exists along the length of both sides of the fences to allow access for long-term maintenance of the fence.

The Rocket project includes both of these undercrossings and jump-offs on the east side of Highway 97. Stands adjacent to the west side of Highway 97 of the southern undercrossing were previously treated under the South Bend HFRA project. Maintaining sufficient hiding cover at the eastside undercrossings and jump-offs in the Rocket project area to facilitate use of the undercrossings was identified as an objective in the scoping letter for the Rocket project. Preliminary information from ODFW indicates that both undercrossings are receiving regular use by deer.

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to elk or mule deer habitat under Alternative 1 (No Action). Over time, hiding cover and thermal cover will 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 and thermal cover across the Forest. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013). A high severity or stand-replacing fire event will remove most of the structure, which will prolong the development of ungulate habitat for several decades. Overall, high stand densities will result in a decrease in tree vigor among all size classes.

Summer range hiding cover habitat is more important than thermal cover in the Rocket project in that it provides the basis of building fat reserves for mule deer and elk keeping animals healthy and alive through the winter months. Disturbance species, such as ceanothus, provide an increased forage opportunity. This forage is beneficial to deer for approximately 10 to 15 years after which nutrient levels diminish. Shrubs then begin to dominate burned stands and provide cover, but in many areas with broken terrain and low precipitation, shrubs are not robust enough to provide viable cover.

Under Alternative 1, no openings will be created to enhance deer forage, cover, and migration. Development of new hiding cover patches will be dependent on disturbance events, such as fire and beetle outbreaks, creating conditions suitable for the development of a new age class of ponderosa pine. Natural regeneration of these openings to ponderosa pine will be unpredictable, being dependent on an adequate number of trees surviving the disturbance event and having heavy seed crops and favorable weather during the growing seasons shortly following the disturbance event. It is predictable, however, that shrubs will be successful naturally regenerating within these openings. Ten to twenty years after the disturbance event, shrubs will be dense and tall enough to provide deer hiding cover. While shrubs could provide hiding cover, shrubs will not achieve a height tall enough to provide deer thermal cover.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails in elk and deer habitat within the project area will occur. These open roads and trails will continue to contribute to disturbance and reduced habitat security for the elk and deer in the Rocket project area.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Hiding Cover in Summer Range in the Project Area

Of the 3,810 acres of hiding cover in summer range, tree treatments will occur on 1,232 acres under Alternative 2, on 743 acres under Alternative 3, and on 1,649 acres under Alternative 4 (Table 92). Fuels treatments will occur on 594 acres under Alternative 2, 435 acres under Alternative 3, and on 1,196 acres under Alternative 4 (Table 92). Most of the fuels treatments overlap the units with proposed tree treatments.

Table 92: Acres of mule deer hiding cover in summer range treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	359	---	---
Thinning to 60 foot average BA	387	154	363
Thinning to mixed range BA (40-80)	---	164	641
Ponderosa pine restoration	248	93	282
Openings in Deer Habitat	4	4	---
Plantation Thin	145	123	210
Opening in DMT	---	39	41
Ladder Fuels Reduction	89	166	112
Total acres of tree treatments	**1,232**	**743**	**1,649**
Summer range hiding cover acres (%) with no tree treatments	2,577 (68%)	3,066 (81%)	2,160 (57%)
Fuels Treatments			

Mowing only	33	206	321
Mowing and underburning	261	229	875
Total acres of fuels treatments	**594**	**435**	**1,196**
Summer range hiding cover acres (%) with no fuels treatments	3,215 (84%)	3,374 (89%)	2,613 (69%)

Hiding Cover in Winter Range in the Project Area

Of the 420 acres of hiding cover in winter range, tree treatments will occur on 255 acres under Alternative 2, on 198 acres under Alternative 3, and on 277 acres under Alternative 4 (Table 93). Fuels treatments will occur on 255 acres under Alternative 2, 198 acres under Alternative 3, and on 277 acres under Alternative 4Table 93). Most of the fuels treatments overlap the units with proposed tree treatments.

Table 93: Acres of mule deer hiding cover in winter range treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	33	---	
Thinning to 60 foot average BA	116	92	77
Thinning to mixed range BA (40-80)	---	39	99
Ponderosa pine restoration	---	---	
Openings in Deer Habitat	4	4	4
Plantation Thin	18	18	18
Opening in DMT	---	---	
Ladder Fuels Reduction	84	45	79
Total acres of tree treatments	**255**	**198**	**277**
Winter range hiding cover acres (%) with no tree treatments	165 (65%)	222 (53%)	143 (34%)
Fuels Treatments			
Mowing only	18	61	19
Mowing and underburning	163	15	169
Total acres of fuels treatments	**181**	**78**	**188**
Winter range hiding cover acres (%) with no fuels treatments	239 (57%)	342 (81%)	232 (55%)

Through thinning with group openings and thinning from below treatments with prescribed fire as a follow up treatment, canopy closure will be reduced, creating early seral vegetation and new areas of summer forage. High quality forage can be enhanced by prescribed fire, wildfires, and tree thinning which opens stands, enhancing shrub and forb production by reducing shading.

Suitable hiding cover is provided by stands that contain a dense understory of small trees. The majority of trees removed in thinning treatments will be small commercial-sized trees between 8 and 15 inches dbh. The boles of these trees currently provides some cover, but a secondary treatment of non-commercial thinning will occur in these stands removing dense understory trees less than 8 inches dbh. The understory provides the majority of the cover in these stands and with follow up treatments of mowing and burning there will likely be no cover remaining in these stands post treatment.

Thinning from below will maintain fully stocked stands in the overstory with fewer understory replacement trees. Although this treatment will likely reduce hiding cover, the boles of the overstory and residual

understory will continue to provide some screening for deer. Stand densities will exist at a level that will break up the site distance to provide screening as deer move to areas with higher quality hiding cover. Rock outcrops will also aid in providing some screening cover as animals move between hiding cover areas.

Hiding cover is maintained through project design by maximizing forage production and providing screening cover for individuals to disperse through the project area. In the long-term, although alternative 4 has the greatest short-term impacts to hiding cover, it is the most proactive alterative in developing future habitat by treating more acres. Treatments are designed to provide long-term foraging opportunities, while retaining existing hiding cover and developing future hiding cover throughout summer and winter habitat. Screening will also be provided in leave areas across the treatment units.

Underburning and or 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, the mowing/underburning of shrubs will result in shrub cycling, reducing the amount of late seral shrubs that have low nutrient levels and stimulating the growth and development of new early seral vegetation. The project area contains predominantly late seral ceanothus in the higher elevations with inclusion of mid seral manzanita and bitterbrush at the lower elevations. Mowing/underburning will set back large areas to early seral shrubs of bitterbrush and ceanothus stimulating the growth of herbaceous plant material and increasing summer foraging opportunities for the next 10 years. There is the possibility that prescribed fire could remove some hiding cover areas; however, the objectives are to retain viable cover through the implementation of prescribed fire. The prescribed fire treatments may also reduce some down logs across the project area, which provide cover opportunities for bedding at night and security for fawns while does are away foraging.

Thermal Cover

Out of 1,070 acres of thermal cover, tree treatments will occur on 553 acres under Alternative 2, on 269 acres under Alternative 3, and on 553 acres under Alternative 4 (Table 94). Fuels treatments will occur on 553 acres under Alternative 2, on 79 acres under Alternative 3, and on 496 acres under Alternative 4 (Table 94) which overlap most of the units with tree treatments. However, mowing only or mowing and underburning treatments are not anticipated to affect thermal cover because the overstory canopy would not be reduced.

Table 94: Acres of mule deer thermal cover associated with each treatment type by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	18	---	---
Thinning to 60 foot average BA	2189	143	159
Thinning to mixed range BA (40-80)	---	13	195
Openings in Deer Habitat	7	7	7
Total acres of tree treatments	**214**	**163**	**261**
Thermal cover acres (%) with no tree treatments	856 (80%)	907 (85%)	809 (69%)
Fuel Treatments			
Mowing only	3	26	---
Mowing and underburning	550	53	496
Total Acres of fuel treatment	553	79	496

Thermal cover stands provide high amounts of overstory canopy cover greater than or equal to 40%. However, bitterbrush is the primary forage for deer in winter months and is not shade tolerant. Typically thermal cover stands lack bitterbrush due to shading from their high canopy closure. Studies conducted in northeastern Oregon have found no measurable benefits of thermal cover for deer (and elk) in winter or

summer range (Johnson et al. 2005, Coe and Woodward 2013). Instead, quality hiding cover, particularly near suitable foraging areas, provides the most benefit to deer during winter and summer as it protects them from predators and other disturbances including recreational disturbance.

In the Rocket project area, tree treatments in all three alternatives would reduce canopy closures and open up stands from thinning from below in deer thermal cover with the goal of creating a better diversity of forbs and shrubs for winter and early spring forage. Alternatives 2 and 4 propose tree treatments on 214 and 261 acres while Alternative 3 proposes treatments on 163 acres of thermal cover modeled forestwide. Even though all three alternatives will reduce canopy cover below the 40% canopy cover Forest Plan standard and guideline, tree treatments will better diversify the availability of forbs and shrubs for winter and early spring forage for deer throughout the project area. Although creation of deer openings (see below) will also reduce a small number of acres modeled as thermal cover, the location of these openings have been distributed across the project area to facilitate movement of deer (and elk) by providing quality hiding cover in strategic locations. The percent of modeled thermal cover that will not be treated and which will remain in the project area is 80% under Alternative 2, 85% under Alternative 3, and 76% under Alternative 4.

Mowing/and or burning on 553 acres under Alternative 2, 79 acres under Alternative 3, and 496 acres under Alternative 4 will provide higher quality forage within the project area. Fuels treatment with the low elevation pine stands are designed to be implemented on a 5 to 10 year rotation to allow plants to recovering, providing a rotation of highly palatable stand of early seral shrubs and forbs. The percent of modeled thermal cover that will not receive fuels treatments is 48% under Alternative 2, 83% under Alternative 3, and 46% under Alternative 4.

Because all three alternatives would reduce modeled thermal cover in tree treatments below the 40% Forest Plan standard and guidelines, a Forest Plan amendment is described below in the section on Forest Plan consistency.

Key Issue: Openings in Deer Habitat

The proposal to create openings became a key issue during scoping because some members of the public are opposed to the proposed size, and some feel that more should be created than the proposed action. This issue is also analyzed in detail in the forested vegetation section (pages 106 – 110).

Some stands within Deer Habitat (MA-7) provide cover but are underutilized due to large stand acreages. The interior of the stands do not provide forage, which is an essential component of cover. In order to have a more optimum cover/forage ratio, each action alternative proposes to create a variety of openings to improve hiding cover and reduce mistletoe infection in the Deer Habitat land allocation and in the NNVM Lava Butte Zone, whose management objectives include providing some habitat for deer and elk migration (Table 95). These openings will increase the potential use by deer through an increase in forage and edge habitat.

The proposed openings range in size from 5 openings of 4 to 5 acres (Alternative 1), 6 openings of 4 to 12 acres (Alternative 3), and 11 openings from 3 to 12 acres (Alternative 4). These openings will be replanted to ponderosa pine following harvest. Some members of the public were opposed to this approach during scoping. Conversely, ODFW is supportive of the proposal and would prefer to see openings created in more than just the Deer Habitat land allocation. Rather than planting, some members of the public suggest relying on natural regeneration to reforest the openings. Some members of the public oppose creating openings greater than 1.5 acres, stating larger openings will not mimic natural openings which they believe will generally be about 0.5 to 1.5 acres in size.

Table 95: Openings in Deer Habitat (MA-7) by alternative.

Management Allocation	Alternative 2			Alternative 3			Alternative 4		
	Number of Openings	Size Range (Acres)	Total Acres	Number of Openings	Size Range (Acres)	Total Acres	Number of Openings	Size Range (Acres)	Total Acres
Deer Habitat	3	4 - 5	14	3	4 - 5	14	5	4 - 7	26
General Forest	0	---	0	2	8 - 12	20	2.5	4 - 12	22
NNVM, Lava Butte Zone	1	---	4	0	---	0	2	3 - 4	7
Scenic Views, Partial Retention Foreground	1	---	4	1	---	4	1.5	4	6
TOTAL	**5**	**4 - 5**	**22**	**6**	**4 - 12**	**38**	**11**	**3 - 12**	**61**

The sizes of all proposed openings are consistent with the Deschutes Forest Plan standard and guidelines for openings (M9-10, TM-16, TM-58, WL-54, WL-59, TM-16). The largest openings, 8 and 12 acres in size, will be located within the General Forest management area and will be less than half the 40 acre size limit described in the Forest Plan. Smaller openings 4 to 5 acres in size will be a suitable size for providing visual screening for deer. The smallest opening, 3 acres in size, will be slightly smaller than the size described in the Forest Plan as suitable for providing visual screening. This range of historic patch size in the ponderosa pine habitat type may have occurred in the project area based on three studies although differences in spatial scale analyses for these studies does not allow for easy comparison (see Forested Vegetation section and Silviculture Specialist Report).

Proposed openings are in stands dominated by dense (≥25% crown canopy cover) stands of ponderosa pine that range in size from 5 to 20.9 inches dbh and are 70 to 90 years old. Within these stands, larger diameter (≥ 21 inches dbh) older trees (greater than 150 years old) are uncommon, occurring as scattered individual trees or scattered groups of trees. Plantations dating from 1970 to 1985 are scattered throughout the project area. These plantations, approximately 30 to 40 years old, provide some age class diversity within the landscape and provide deer hiding cover patches of varying sizes.

All areas where openings will be created have been previously thinned and are primarily single story. Spatial distribution of trees varies by unit, with the most open stand conditions in units with an objective of mistletoe reduction. Shrub canopy cover, specifically greenleaf manzanita, is high within these more open units. Stocking of trees 21 inches dbh and larger varies by unit. Highest stocking is found in the three openings proposed between Highway 97 and the lava flow: Units 716, 811.3, and 839.2. Two of the three units are located within NNVM. Remaining units have few, if any, of these larger diameter trees.

Removal of all ponderosa pine <21 inches dbh will remove essentially all trees within the boundary of the treatment units. This removal of trees and the subsequent reduction of shrub canopy cover by mowing and or burning will create conditions suitable for the development of a new age class of ponderosa pine. Planting will assure a sufficient number of trees become established to provide future hiding cover for deer. Ten to twenty years after planting, trees will have grown to a height of at least six feet and openings will begin to provide deer hiding cover (Deppmeier 2006). These patches could continue to provide hiding cover for at least an additional 10 to 30 years, as evidenced by older plantations within the project area. After 30 to 40 years, trees within these patches will be approaching or have achieved a height of at least 30 feet, the recommended height for thermal cover.

Hiding cover is limited in the western portion of the Rocket project area in deer winter range, particularly in and near the north/south connectivity corridor that leads between the southern and northern undercrossings. Creation of openings were designed to accelerate hiding cover patches that will facilitate movement between these undercrossings and in the deer winter range habitat in the northeastern portion of the project area.

Alternative 4 provides the most amount of acres in hiding cover through openings with 37 acres in 11 different openings.

Open Road Densities

Under all three alternatives, approximately 38.6 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the elk and mule deer. Table 96 lists the open road densities under the no action alternative and for alternatives 2, 3, and 4.

Under Alternatives 2, 3, and 4, open road density will decrease from 2.76 to 2.43 miles of open road per square mile in summer range in the North Unit Diversion Dam-Deschutes River watershed, thus meeting the Forest Plan S&G of 2.5 miles of open road per square mile in the watershed. Approximately 90% of the Rocket project area occurs in the North Unit Diversion Dam-Deschutes River watershed; thus 90% of the Rocket project area meets the Forest Plan open road density standard and guideline.

Under Alternatives 2, 3, and 4, open road density will decrease from 2.87 to 2.77 miles of open road per square mile in summer range in the Sugar Pine Butte-Little Deschutes River subwatershed, which is approximately 10% of the Rocket project area. This reduction will not meet the meet the Forest Plan S&G of 2.5 miles of open road per square mile in the subwatershed; however, it will reduce the open road density in this subwatershed by 4% and move the open road density toward meeting the Forest Plan standard and guidelines. Under Alternatives 2, 3, and 4, open road density will decrease from 3.72 to 3.15 miles of open road per square mile in summer range in the North Paulina Winter Range Subunit (MA-7). This reduction will not meet the meet the Forest Plan S&G of 1.0 to 2.5 miles of open road per square mile in mule deer winter range; however, it will reduce the open road density in winter range by 15% and move the open road density toward the Forest Plan standard and guideline.

Upon further evaluation, although the open road density in the Sugar Pine Butte-Little Deschutes River subwatershed and the mule deer winter range will be above the open road density standards, reductions; the majority of the Rocket area (90%) is within the North Unit Diversion Dam-Deschutes River watershed where the Forest Plan open road density standard and guideline will be met due to the proposed road closures and decommissionings in the Rocket project alternatives 2, 3, and 4. Overall, there will be a net benefit for the Rocket project from proposed road closures and decommissionings.

Table 96. Open road densities under each alternative.

Summer Range: Mule Deer Open Road Densities (miles/square mile)[1]		
Spatial Scale	**Alt.1 (No action)**	**Alts. 2, 3, and 4**
Summer Range in the North Unit Diversion Dam-Deschutes River watershed	2.76	2.43
Summer Range in the Sugar Pine Butte-Little Deschutes River subwatershed	2.87	2.77
[1] = Forest Plan S&G of 2.5 miles per square mile in summer range		
Winter Range: Mule Deer Open Road Densities (miles/square mile)[2]		
Spatial Scale	**Alt. 1 (No action)**	**Alts. 2, 3, and 4**
North Paulina Winter Range Subunit (MA-7)	3.72	3.15
[2] =Forest Plan S&G of 1.0 mile to 2.5 miles per square mile in winter range		

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable future actions in the watersheds include the West Bend vegetation project which will thin, mow, and underburn hiding cover and thermal cover in summer range and deer habitat. Table 97 lists the cumulative tree treatment acres treated in deer hiding cover and thermal cover.

Table 97: Cumulative acres with tree treatments in deer hiding cover and thermal cover.

	Hiding Cover				Thermal Cover	
Existing Hiding and Thermal Cover Acres (ac)	Entire Summer Range (715,226 ac)	Summer Range in the Watersheds* (59,134 ac)	Entire MA-7 Winter Range (25,924 ac)	North Paulina Winter Range Subunit (9,022 ac)	Entire MA-7 Winter Range (24,705 ac)	North Paulina Winter Range Subunit (11,461 ac)
West Bend (Alternative 2)	0.5% (3,843 ac)	7% (3,843 ac)	2% (605 ac)	0	5% (1,124 ac)	0
Rocket	0.1% to 0.2% (743 to 1,649 ac)	1% to 2% (743 to 1,649 ac)	1% (198 to 255 ac)	2% to 3% (198 to 255 ac)	1% (214 to 261 ac)	2% (214 to 261 ac)
Cumulative	0.6% to 0.7% (4,586 to 5,492 ac)	8% to 9% (4,586 to 5,492 ac)	3% (803 to 860 ac)	2% to 3% (198 to 255 ac)	6% (1,759 to 1,806 ac)	2% (214 to 261 ac)
*North Unit Diversion Dam-Deschutes River and Sugar Pine Butte-Little Deschutes River watersheds						

Hiding cover for summer range across the Forest exceeds Forest Plan standards and guidelines with 45% of the entire summer range area providing hiding cover. Commonly, those watersheds that are below hiding cover standards forestwide have typically received landscape scale stand-replacing fire in the last 10 years. Currently 36% of both watersheds in summer range that overlap the Rocket project area have hiding cover, which exceeds the Forest Plan standard and guideline minimum of 30%. Cumulatively under the West Bend and Rocket action alternatives, hiding cover will decrease 7% in summer range. However, most of the Rocket project area is in black bark ponderosa pine (50 to 80 year old stands). Forest Plan standard and guideline WL-59 states that these stands should not be considered in evaluating conformance in meeting the 30% minimum of hiding cover in the implementation units (i.e., watersheds). Instead, standard and guidelineWL-59 states that in black bark pine, approximately 10% of treated stands will be in clumps throughout the [project] area; therefore the Rocket project will retain 10% of the project area in clumps averaged throughout the project area and meet standards and guides.

The analysis in the EA for the Sunriver to Lava Lands Visitor's Center concluded that the paved trail project would impact a small amount of suitable elk and deer habitat (less than 1% at the watershed scale). Effects were anticipated to be primarily potential disturbance; road density reduction and signage were anticipated to partially mitigate this disturbance.

Thermal cover for the entire MA-7 Deer Habitat across the Forest is currently 12%, which is below the Forest Plan standard and guideline of 30%. Cumulatively, the West Bend and Rocket tree treatments will reduce canopy cover below the 40% standard guideline from 12% to 11% of the area across the entire MA-7 Deer Habitat. Mowing and burning is not expected to reduce thermal cover. Since MA-7 is already below the Forest Plan standard and guideline for thermal cover and the West Bend and Rocket project alternatives cumulatively propose to further reduce thermal cover from 12% to 11%, a Forest Plan Amendment will be completed for the Rocket project. Based on the Lidar1dataset, however, adequate thermal cover is provided across the Rocket project area.

There are no proposed road closures under the West Bend project. However, user-created OHV trails will be obliterated and restored under this project. All Rocket action alternatives will close 38.6 miles of Level 2 open roads, decommission 5.4 miles of Level 1 closed roads, and obliterate and restore 35 miles of OHV user-created trails.

Determination

The Rocket project alternatives will impact hiding cover in the entire summer range by less than 1% and from 1% to 2% in summer range that overlaps the watersheds, reduce hiding cover in MA-7 winter range by 1%, and reduce canopy cover in thermal cover in MA-7 winter range by less than 1%. Cumulatively, less than 1% of hiding cover in the entire summer range will be impacted, 8% to 9% of summer range hiding cover that overlaps the watersheds will be impacted, and 6% of thermal cover in the entire MA-7 winter range will be impacted. In addition, approximately 34% to 81% of the hiding cover and 48% to 75% of the thermal cover in the Rocket project area will remain untreated.

Sufficient habitat exists to maintain the viability of this species in the watershed and across the Forest and continue to provide habitat to meet the Forest Plan objectives by retaining thermal and hiding cover and maximizing foraging opportunities. Treatments in both the West Bend and Rocket projects will accelerate the future development of hiding cover and some thermal cover while maintaining viable foraging habitat in the project area and in the watersheds.

The Rocket project is consistent with the Monument Plan standards and guidelines for elk and mule deer (M-37, LZ-1 and TZ-3) because clumps and stands of hiding cover will be provided, and viable migration corridors were considered and incorporated into the design of the alternatives; high quality forage, thermal and hiding cover are maintained or promoted; and a substantial amount of roads are proposed for closure.

Implementation of the Rocket project is not consistent with the Forest Plan standard and guideline for deer thermal cover. A Forest Plan Amendment is included in all action alternatives (see page 37) that addresses the further reduction of thermal cover in MA-7. The Rocket project alternatives are consistent with the remaining Forest Plan standards and guidelines for mule deer. All three action alternatives will reduce open road densities in MA-7 and in the watersheds toward meeting Forest Plan standard and guidelines. The Rocket project will not contribute to a negative trend in viability for the mule deer on the Deschutes National Forest.

As described in the description of alternatives (p. 37) an amendment to the LRMP MA-7 objective for thermal cover is required to fully implement any of the action alternatives. The General Theme and Objectives for thermal cover (LRMP page 4-113) state *"…with cover making up to 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover…"* . Following thinning, about 30% of the MA-7 portion of the project area would provide thermal cover (Alternative 2 retains 29%, Alternative 3 31%, and Alternative 4 29%). This ratio of thermal cover does not exist across the entire MA-7, and it is particularly low in areas of low site productivity.

Effects of the overall project to mule deer are described previously in this section. By focusing on the important habitat components in this area, such as high quality forage and strategically located cover, the tree treatments will better diversity availability of forbs and shrubs for winter and early spring forage for deer throughout the project area, mowing and/or burning will provide higher quality forage within the project area, and road closures and decommissioning will improve habitat effectiveness. Current research suggests that thermal cover has little influence over animal energy balance and performance, but cover for deer is important because it provides security and protection from predators and human disturbance. There is also concurrence from the local Oregon Department of Fish and Wildlife on this strategy in the winter range.

In accordance with FSM 1926.51, the following items describe non-significant amendments with a discussion of how the actions address these items:

1. *Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;*

   Multiple-use goals and objectives for long-term land and resource management are not altered with this amendment. This project took a landscape approach to managing deer habitat by identifying the appropriate locations and relative importance of thermal and hiding cover.

2. *Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;*

   As stated above, the multiple-use goals and objectives are not significantly changed with the amendment, which is a minor adjustment to a management prescription. The resulting modification of 553 acres of thermal cover stands under Alternative 4 leaves MA-7 at 11% thermal cover, which is a 1% change across MA-7 when considered cumulatively with other projects.

3. *Minor changes in standards and guidelines; and/or*

   The Forest Plan provides a general objective of 30% thermal cover, not a standard and guideline.

4. *Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.*

   The amendment will provide opportunities to address the specific needs of big game in and around the Rocket landscape. Limiting factors for mule deer are quality forage and cover; therefore, the amendment will improve the Forest's ability to meet the objectives of MA-7.

Late and Old-Structure (LOS) Forest Habitat , Old-Growth Management Areas, and Connectivity Corridors

Key Issue: Treatment within OGMAs

Existing Condition: OGMAs

The Forest Plan designated OGMAs (i.e. Management Area 15) and provides Standards and Guidelines (Forest Plan 4-149-151) for their management. In addition, the Wildlife Program and Activity Schedule in the Forest Plan Goal 4 (Chapter 5, Implementation of the Forest Plan, Appendix 15-4) has an objective of determining the existing condition together with management needs, if any, of Old Growth Management Areas. It also directs two activities: 1) survey to determine how much is old growth and identify management needs, and 2) prepare a management strategy for old growth management areas in need of special treatment measures.

There are two Forest Plan allocated OGMAs (Forest Plan MA-15) in the Rocket project area. The goal of OGMA is to provide naturally evolved old growth forest ecosystems for (1) habitat for plant and animal species associated with old growth forest ecosystems, (2) representations of landscape ecology, (3) public enjoyment of large, old-tree environments, and (4) the needs of the public from an aesthetic and spiritual sense. Old growth areas will also contribute to the biodiversity of the Forest (Forest Plan 4-149).

The distribution and minimum size of the OGMAs are based on the habitat requirements of old growth associated management indicator species. The northern goshawk was the selected MIS species for the ponderosa pine forest type, the American marten represents the mixed conifer forest type and the northern three-toed or black-backed woodpeckers represent the lodgepole pine forest type.

Much of the north OGMA has been thinned, most recently in 1971. It can be characterized as single-story, immature ponderosa pine. Large trees are not common enough for any of this OGMA to be classified as LOS. Only small portions of the south OGMA have been thinned, with most recent thinning dating from 1987 and 1999. Thinned areas are single-story, immature ponderosa pine. Outside thinned areas, this OGMA is multi-story ponderosa pine. A portion has enough large diameter trees to be classified as LOS. Tree density is high in both OGMAs, with 89 percent of the combined area exceeding the upper management zone for these areas.

Existing Condition: LOS

Late and old structure forest habitat is defined by the Eastside Screens as multi-strata stands with large trees and single strata stands with large trees. A large tree is defined as being ≥ 21 inches dbh. Multi-stratum stands are comprised of two or more tree canopy layers and two or more cohorts of trees. Medium and large

sized trees dominate the overstory but trees of all size classes may be present. Stand structure and tree sizes are diverse. Single stratum LOS stands are comprised of a single dominant canopy stratum consisting of medium or large sized trees. Large trees are common. Young trees are absent or few in the understory. The stand may appear "park-like." The analysis to determine LOS identified stands where large trees are common, but does not attempt to provide an age for the stands.

The amount of late and old structure forest habitat in the Rocket Project area is limited due to previous timber harvest in the early to mid-part of the 20th century. The late-open structural stage of ponderosa pine biophysical environment is below the Historical Range of Variability (HRV), defined as conditions in the pre-European settlement area. Refer to pages 109 - 129 for the complete HRV and LOS analysis. Low amounts of this habitat limit the abundance of LOS associated wildlife species in the area, such as the northern goshawk, flammulated owl, white-headed woodpecker, pygmy nuthatch, white-breasted nuthatch, and brown creeper.

Exiting Condition: Connectivity Corridors

Maintaining connectivity between habitats, particularly late and old structured habitat, is important for numerous wildlife species to allow free movement, interaction of adults, and dispersal of young. Management direction pertaining to maintaining connectivity between late and old structured stands, in addition to designated old growth management areas, is provided by the Eastside Screens.

Eastside Screen direction is to maintain or enhance the current level of connectivity between LOS stands and between all Forest Plan designated OGMAs by maintaining stands between them. LOS stands and OGMAs need to be connected to each other inside the project area, as well as, to adjacent project areas, by at least two directions. Connectivity corridor stands should be those in which medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential. Stand widths should be at least 400 feet wide at their narrowest point. If stands meeting this description are not available then the next best stands should be used for connections. The length of corridors between LOS stands and OGMAs should be as short as possible.

Harvesting is permitted in connectivity corridors if canopy closures are maintained within the top on-third of site potential, which is considered to be canopy closures where the relative density is at or above the lower management zone or 67% of the upper management zone.

Direct and Indirect Impacts—Alternative 1 and 3

There will be no direct impacts to OGMAs, LOS habitat, or connectivity corridors under Alternatives 1 or 3. Indirectly, this alternative will forgo the opportunity to reduce the likelihood of a high intensity and/or stand-replacing fire through treatments. No treatments to reduce tree stocking will occur with these alternatives and the existing condition will not change in the short term. Most of the area in the OGMAs will remain stocked above the upper management zone, a stocking level that is too high to provide resiliency against bark beetle attack and too high to ensure large tree structure will be maintained or develop. At endemic levels, individual or small groups of trees could be killed annually. If an outbreak of mountain pine beetle occurs, however, up to half the trees and up to 67 percent of the current basal area, mostly in the largest trees, could have expected mortality (Barrett 1979). In discussing the results of a 35-year study on ponderosa pine response to thinning and understory removal, Cochran and Barrett (1999) state that "the reduction of growth rates of even the largest trees with increasing stand densities indicates that unmanaged stands that escape thinning through fire or other disturbances will progress very slowly toward mid-or late seral conditions."

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails will occur. Together, these open roads and trails will continue to contribute to disturbance and habitat fragmentation for species associated with OGMAs, LOS habitat, and connectivity corridors.

Under Alternative 3, road closures and trail restoration described previously will benefit habitat security and reduce disturbance for marten. Thinning across the project area may reduce the degree of benefit from restoration of user-created trails by opening stands and potentially providing greater access to illegal OHV use.

Direct and Indirect Impacts—Alternatives 2 and 4

OGMAS

Table 98 lists the acres of OGMAs treated by alternative. The activities proposed in the OGMAs all involve thinning and favoring the retention of ponderosa pine.

Alternative 2 includes thinning within portions of two OGMAs where they have previously been thinned. One of the comments pertaining to OGMAs received during scoping suggested thinning to reduce beetle risk should not be a goal unless old growth characteristics are at risk. Alternatives address this issue by varying the acres of treatment with the OGMAs. Alternative 3 drops all treatment within OGMAs while Alternative 4 increases the amount of treatment (Table 98).

Table 98: Treatments in OGMAs for Alternatives 2 and 4.

Rocket OGMAs Location and Treatment Unit	Alternative 2			Alternative 4		
	Treatment	Acres	% of OGMA	Treatment	Acres	% of OGMA
North (98 Acres)						
808	40 BA Thin/Mow/Burn	44	45%	Mix BA Thin	44	45%
878	---	---	---	Mix BA Thin	13	13%
Subtotal		44	45%		57	58%
South (155 Acres)						
816.6	60 BA Thin/Mow/Burn	11	7%	Mix BA Thin/Mow/Burn	11	7%
910	---	---		Mix BA Thin/Mow/Burn	93	60%
965	---	---		Mix BA Thin/Mow/Burn	50	32%
Subtotal		11	7%		153	99%
TOTAL (253 Acres)		55	22%		211	83%

Thinning treatments proposed with Alternatives 2 and 4 will reduce the proportion of the OGMAs exceeding the upper management zone (130 SDI) from 89 percent to 68 and 38 percent, respectively. While Alternative 4 will thin more acres inside OGMAs, use of the mixed BA thinning treatment will retain more of the existing larger diameter trees compared to that retained with the 40 BA thinning treatment in Alternative 2 (See Forested Vegetation). By reducing tree density, both thinning treatments will maintain or improve tree diameter growth rates and reduce the risk of bark beetle outbreak, improving the potential to maintain existing large tree structure and develop additional large tree structure (see Forested Vegetation).

The proposed actions in the OGMA will reduce the risk of wildfire within it through mowing and underburning. The proposed thinning is largely focused in the dry ponderosa and mixed conifer associations. The thinning will favor the growth and development of ponderosa pine, while retaining more of the fir and lodgepole pine on the north-facing slopes.

LOS

All action alternatives propose thinning treatments to move towards historic conditions for LOS Alternative 2 proposes the most extensive use of 40 BA thinning, which would reduce tree densities to approximately the same as LOS reference conditions. A portion of acres proposed for thinning are within areas classified as LOS, with treatment method and LOS treatment acres varying by alternative. Alternative 3 treats the fewest acres of LOS through timber sales, foregoing much of the thinning in these areas to retain existing dense forest conditions. Alternative 4 not only treats the most acres of LOS which primarily occur in ponderosa pine, except for a small amount in the mixed conifer wet. No alternative would create openings in areas classified as LOS (see Table 11 for amounts of LOS treated with timber harvest by Alternative). An amendment to allow harvest within LOS stages below HRV is described on pages 37-38 and within the Forested Vegetation section.

Overall within the LOS stands, overstory structural diversity will remain, while understory complexities 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 species such as the Northern goshawk. Long-term benefits of treatments will be a reduction of stress to overstory promoting the longevity, but also to promote the development of future old growth in the stand that will provide long-term nesting habitat.

In the short-term, Alternative 4 affects fewer acres of habitat than Alternative 2. However, in the long-term treatments do not promote the development of a more fire resistant mixed conifer stands or promote the development of LOS ponderosa pine by creating structural heterogeneity. The longevity of existing habitat will diminish in the short-term, and as a result will not promote the fire resilient ponderosa pine within these stands which are a key component of goshawk habitat on eastside forests. Alternative 3 is the most proactive alternative to the management of long-term goshawk habitat across the project area and does the best job at maintaining existing habitat while developing long-term future habitat.

Connectivity Corridors

Within the connectivity corridors, impacts will occur to canopy closure due to the proposed thinning and ladder fuel reduction treatments that could reduce some of the suitability of the current habitat for old-growth focal species such as the goshawk, marten, and black-backed woodpecker. However, all treatments that occur in connectivity corridors will maintain the canopy closure to the upper third of the site management zone. Fuels treatments are not anticipated to impact canopy closures within the connectivity corridors.

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for species associated with LOS. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation management actions in OGMAs and connectivity corridors in the North Unit Diversion Dam-Deschutes River watershed include minor habitat alteration due to removal and maintenance for proposed powerlines and gas line installation. The West Bend Vegetation Management Project does not treat within any OGMAs or connectivity corridors but will thin within some LOS stands to promote the development of future old growth to provide long-term LOS habitat; with both projects combined there would be no net loss of LOS as all large tree structure is retained. Recreation is anticipated to continue in both the watershed and subwatershed resulting in minor disturbance in the GOMAs and connectivity corridors.

Determination

The Forest Plan, including the Eastside Screens direction, has been reviewed for consistency. While there will be removal of lodgepole pine snags and down wood, the project area is above the snags and down wood required by direction and above levels as determined under best available science. In addition, no ponderosa pine snags of any diameter are proposed for removal and new snags and down wood will be recruited during prescribed burning. The Eastside screens direction to maintain all remnant late and old seral and/or structural live trees >21 inches dbh will recruit this size class in the long-term. Treatments in the corridors will also be consistent with the Eastside Screens, by removing the smaller diameter trees and maintaining the larger tree component. Standards and guidelines for OGMAs will also be met.

Recommended management actions for the OGMAs include the following:

- Discouragement of dispersed camping within the OGMAs.
- Monitor the existing road closures and if any are breeched, immediately address the problem via closure or obliteration to maintain solitude within the OGMA.
- Monitor proposed road closures under the Rocket project after treatments are completed, and if any are breeched, immediately address the problem via closure or obliteration to maintain solitude within

the OGMA.

- Monitor user-created trails and if any detected, immediately address the problem via signage and/or obliteration to maintain solitude within the OGMA
- Any thinning should attempt to leave adequate down and dead wood for prey species (e.g., large logs, slash piles).

Scenario A of the interim wildlife standard applies since one of the ponderosa pine LOS successional stages is below HRV and both mixed conifer LOS successional stages are below HRV.

No net loss of late and old structure (LOS). Rocket alternatives would change LOS canopy conditions from closed to open, but there would be no reduction in the total proportion of late successional stages.

No timber sale harvest activities within LOS stages below HRV. The proposed Forest Plan amendment addressing this direction would allow timber sale harvest activities within LOS.

Maintain all remnant late and old seral and/or live trees greater than or equal to 21 inches dbh. Proposed harvest treatments would retain all live trees greater than or equal to 21 inches dbh.

Manipulate vegetative structure to move it towards LOS. Harvest associated with Alternatives 2, 3, and 4 would move stands towards LOS. Thinning would favor retention of the best, most dominant trees, generally the trees best suited to quickly achieve diameters of at least 21 inches. Reduced stand density will maintain or accelerate tree diameter growth and will reduce conditions favorable for bark beetle outbreak. Accelerated diameter growth and reduced beetle hazard would maintain or accelerate the trajectory towards LOS.

Maintain open, park-like stand conditions where this occurred historically. Harvest associated with Alternatives 2, 3 and 4 would reduce the amount of ponderosa pine, mid-successional closed canopy structures, moving closer to conditions that occurred historically.

Snag, Down Wood, and Green Tree Replacements

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity and habitat for numerous wildlife species which depend on snags and logs for all or parts of their life cycle (Laudenslayer 2002). In forested environments, approximately 93 wildlife species are associated with snags including 4 amphibians, 63 birds, and 26 mammal species (Rose et al. 2001). The types of snag use include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating. Snags come in all sizes and go through decay processes that change them from standing hard to soft wood, then on the ground to continue decaying into soil nutrients. Not every stage of a snag's decay process is utilized by the same species, but rather a whole array at various stages or conditions.

Snags are the main contributors to down wood which provide organic and inorganic nutrients in soil development, microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and structure for riparian associated species in streams and ponds. Size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. However, in general, larger sized logs are used by more species than smaller logs (Bull et al. 1997). Logs that lie along a contour are used more than those lying across contours.

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. Optimum levels of down woody material for providing acceptable risks of fire hazard and fire severity while providing desirable amounts for soil productivity, soil protection, and wildlife needs were calculated for warm dry forest types and cool subalpine forest types in Western Montana by Brown et al. (2003). Levels representing the high end for pre-settlement conditions were found as follows: 5 to 10 tons per acre for warm, dry ponderosa pine and Douglas-fir types, 10 to 20 tons per acre for cool Douglas-fir types, and 8 to 24 tons per acre for cool lodgepole pine and lower subalpine fir types (Brown et al. 2003).

Down wood abundance on the Forest is highly variable due to a limited availability of water and nutrients.

This, combined with overcrowded stand conditions due to previous fire suppression, has led to tree mortality above historical levels, especially within smaller size classes. In particular, plant association groups (PAGs) that tend to be drier (i.e., ponderosa pine and mixed conifer dry) may recruit a higher level of down wood today than under historical conditions. Previous fire suppression in the project area has decreased the consumption rate of down wood while other human practices such as firewood gathering has removed down wood.

The PAGs that occur within the Rocket project area are ponderosa pine, mixed conifer, and lodgepole pine. Wildlife species highly associated with these PAGs include the following Forest Plan Management Indicator Species (MIS): American marten, Williamson's sapsucker, pileated woodpecker white-headed woodpecker, Lewis' woodpecker, black-backed woodpecker, three-toed woodpecker, hairy woodpecker, and northern flicker. In addition, the flammulated owl and pygmy nuthatch are included because they are focal landbird species (Altman 2000) and/or Birds of Conservation Concern (USDI Fish and Wildlife Service 2008).

Forest Plan Standards and Guidelines (S&Gs)

Standards and guidelines in the Forest Plan 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.

Eastside Screens

The Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (known as the *Eastside Screens*) addresses the need for project design to include the principles of landscape ecology and conservation biology (USDA Forest Service 1995). Screen 3, the Wildlife Screen, represents direction and parameters based on general scientific principles and concepts. The purpose of the Wildlife Screen is to maintain options in the short-term for the conservation of wildlife species associated with late and old structural stages in eastern Oregon and Washington. This direction generally equates to approximately 2.25 snags per acre for the ponderosa pine and mixed conifer and 1.80 snags per acre in lodgepole pine. Specifically the direction for snags and down woody material are: 1) maintaining snags and green tree replacements (GTRs) of ≥15 inches dbh at 100% maximum potential population (MPP) for all vegetation types except lodgepole pine; 2) for lodgepole pine, maintain snags and green tree replacements of >10 inches dbh at 100% MPP; and 3) down logs ranging between 3 and 20 pieces per acre depending upon vegetative series (Table 99). The down log criteria are not intended to preclude the use of prescribed fire as an activity fuels modification treatment. Fire prescription parameters will ensure that consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes below.

Table 100 lists the estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs).

Table 99: Forest Plan Down Wood Requirements.

Sale Activities				
Tree Species	Pieces per acre	Diameter Small End (dbh)	Piece Length	Total Lineal Length
Ponderosa pine	3-6	13 inches	>6 feet	20-40 feet
Mixed conifer	15-20	13 inches	>6 feet	100-140 feet
Lodgepole pine	15-20	8 inches	>8 feet	120-160 feet
Prescribed Fire Parameter				
Consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes above.				

Table 100: Estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs) is as follows.

	Habitat Type		
	Ponderosa Pine	**Mixed Conifer**	**Lodgepole Pine**
100% MPP based on best available science	4 snags per acre	4 snags per acre	6 snags per acre
GTRs @ 13-19 inches residual stand*	8 tpa	8 tpa	6 tpa

*This concurs with the 10-19 inch average dbh for the small/medium structure stage defined in DecAID.

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.

Biological Potential

Habitat requirements, including snag and down woody material levels, were described in the Forest Plan, WLTL, and amended Eastside Screens using information 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 using the maximum potential population method (Bull et al. 1997, Rose et al. 2001). These snag levels, under certain conditions, may not be adequate for some species, particularly for secondary cavity nesters. In addition, the Forest Plan 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. 2012) is used as the best available science for the Rocket snag analysis. DecAID is a web-based advisory tool that helps managers evaluate impacts 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 (HRV)

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 inches dbh) at 6 to 14 snags per acre (4.5 to 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 et al. 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. Agee (2002) assumed fire helped to decompose snag patches and after 5 fires at 10 year intervals, snags will be completely consumed. Agee (2002) compared his estimates to Harrod et al. (1998) but assumed an average snag diameter of 30 inches dbh when calculating biomass, whereas Harrod et al. (1998) estimated densities for size classes as small as 6 inches 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 inches dbh, of which 0.405 snags are greater than 20 inches 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. 2012) for Ponderosa pine/Douglas-fir and eastside mixed conifer habitat types for small and medium trees.

How DecAID was Reviewed for the Rocket Project Area

This snag and down wood analysis is intended to be a coarse level analysis of snag density and distribution in the Rocket project area. At least 20 square miles (12,800 acres) in each habitat type is suggested as a minimum size for an analysis (Mellen-McLean et al. 2012). The North Unit Diversion Dam-Deschutes River watershed (HUC 10) and the Sugar Pine Butte-Little Deschutes River subwatershed (HUC 12) and were used for an appropriate comparison to the vegetation inventory data in DecAID for the Rocket Project area.

The PAGs in the Rocket project area were compared to habitat types in DecAID (Table 101). 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; and (2) eastside mixed conifer (EMC) which best represents the mixed conifer wet (MCW) and mixed conifer dry (MCD) PAGs. In the Rocket area, ponderosa pine is

the dominant species, lodgepole pine occasionally found as individual, scattered trees or in groups.

Table 101: Plant Association Groups and corresponding DecAID habitat types in the Rocket project area.

Plant Association Group in Rocket Project area	DecAID Habitat Type	Number of Acres
Ponderosa pine (wet and dry)	Ponderosa Pine/Douglas Fir	15,429
Mixed conifer (wet and dry)	Eastside Mixed Conifer	1,980

An HRV analysis of existing snag density and down wood across the Forest and at the 5th field watershed (HUC 10) level using information from DecAID and the Ochoco and Deschutes Viable Ecosystems Management Guide. 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 will be expected to occur in the Rocket project 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. 2012). 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. 2012). 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 inches dbh) for white-headed woodpeckers is as follows:

Tolerance Level	Snags Per Acre	Explanation
30% tolerance level	0.3	Areas with < 0.3 snags per acre will 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 will be expected to nest in areas with > 0.3 snags per acre.
50% tolerance level	1.7	Half the individuals within the population will be expected to nest in areas with <1.7 snags per acre and the other half will be expected to nest in areas with >1.7 snags per acre.
80% tolerance level	3.7	80% of the individuals within the population of white headed woodpeckers will be expected to nest in areas with <3.7 snags per acre and conversely 20% of the population will be expected to nest in areas with >3.7 snags per acre.

Summary of Impacts to Snags, Down Wood, and Green Tree Replacements

There is no proposed removal of snags under any of the three action alternatives for the Rocket project area.

Incidental falling of snags may occur during operations to comply with OSHA safety regulations for hazard tree removal. These are anticipated to be minor in scope and occur randomly throughout the project area. Any snags ≥10 inches dbh felled due to OSHA safety regulations will be left on the ground to provide down wood for wildlife.

Green trees 21 inches and greater will not be felled and removed. Levels of live tree retention in all treatments will provide adequate numbers of green tree replacements to provide future snag and down log levels.

Fuels treatments proposed under alternatives 2, 3, and 4 will consume snags, down wood and reduce the understory complexity which may impact species associated with down wood (American marten, woodpeckers, focal landbirds/Birds of Conservation Concern) but will not contribute to an overall downward trend of species' viability at the Forest level.

The Rocket project action alternatives are consistent with the Forest Plan standards and guidelines (S&Gs) WL-37 and WL-38, as amended by the Eastside Screens, and the Biological Objectives for focal landbird species.

Existing Condition

Snag density at the Forest level is contained in the Wildlife Report. The following tables show snag densities at the watershed level. Table 102 lists the existing snag density conditions for the North Unit Diversion Dam-Deschutes River watershed in the PP/DF habitat type. For snags ≥10 inches, approximately 63% of the watershed has no snags and for snags ≥20 inches dbh, 84% of the watershed has no snags. In the EMC habitat type, for snags ≥10 inches, approximately 44% of the watershed has no snags dbh and for snags ≥20 inches dbh, 70% of the watershed has no snags. In the LP habitat type for snags ≥10 inches dbh, approximately 39% of the watershed has no snags per acre and for snags ≥20 inches dbh, 83% of the watershed has no snags.

Table 102: Percent of North Unit Diversion Dam-Deschutes River watershed for snags ≥10 and ≥20 inches dbh by habitat type.

Percent (%) of Landscape for Snags ≥ 10 inches dbh							
Snags per acre	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (41,884 acres)	63	29	3	4	1	0	100%
EMC (19,563 acres)	44	24	17	7	6	1	100%
LP (25,961 acres)	39	43	10	7	1	0	100%
Percent (%) of Landscape for Snags ≥ 20 inches dbh							
Snags per acre	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (41,884 acres)	84	16	0	0	0	0	100%
EMC (19,563 acres)	70	27	3	0	0	0	100%
LP (25,961 acres)	83	16	1	0	0	0	100%

Table 103 lists the percent of the Sugar Pine Butte-Little Deschutes River subwatershed for snags ≥10 and ≥20 inches dbh. In the PP/DF habitat type, for snags ≥10 inches dbh, approximately 50% of the watershed has no snags per acre and for snags ≥20 inches dbh, 75% of the watershed has no snags per acre. In the EMC habitat type, for snags ≥10 inches dbh, approximately 40% of the watershed has no snags per acre and for snags ≥20 inches dbh, approximately 65% of the watershed has no snags per acre. In the LP habitat type, approximately 38% of the watershed has no snags per acre and for snags ≥20 inches dbh, approximately 81% of the watershed has no snags per acre.

Table 103: Percent of Sugar Pine Butte-Little Deschutes River subwatershed for snags ≥10 and ≥20 inches dbh by habitat type.

Percent (%) of Landscape for Snags ≥10 inches dbh							
Snags per acre:	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (37,248 acres)	50	37	12	1	0	0	100%
EMC (28,200 acres)*	40	32	15	7	4	2	100%
LP (27,533 acres)	38	37	20	3	1	1	100%
Percent (%) of Landscape for Snags ≥20 inches dbh							
Snags per acre:	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (37,428 acres)	75	25	0	0	0	0	100%
EMC (28,200 acres)*	65	32	3	0	0	0	100%
LP (27,533 acres)	81	18	1	0	0	0	100%

*EMC includes both watersheds for minimum analysis area

Information on down wood levels across the Forest is contained in the Wildlife Report. The following provides data on down wood within the watersheds. Table 104 lists show the existing conditions for down wood in the North Unit Diversion Dam–Deschutes River watershed. In the PP/DF habitat type, approximately 40% of the watershed and has no down wood ≥5 inches dbh and 81% has no down wood ≥20 inches dbh. In the EMC habitat type, approximately 4% has no down wood ≥5 inches dbh and 71% has no down wood ≥20 inches dbh. In the LP habitat type, approximately 7% has no down wood ≥5 inches dbh and 86% has no down wood ≥20 inches dbh.

Table 104: Existing down wood in the North Unit Diversion Dam-Deschutes River watershed.

Percent (%) of watershed with down wood cover ≥5 inches dbh							
% Down Wood	**0**	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total %**
PPDF (41,884 acres)	40	56	3	1	0	0	100%
EMC (19,563 acres)	4	66	19	8	3	0	100%
LP (25,961 acres)	7	55	26	9	2	0	100%
Percent (%) of watershed with down wood cover ≥20 inches dbh							
% Down Wood	**0**	**>0 to 4**	**>4 to 10**	**>10**	**Total %**		
PPDF (41,884 acres)	81	19	0	0	100%		
EMC (19,563 acres)	71	27	0	2	100%		
LP (25,961 acres)	86	14	0	0	100%		

Table 105 lists show the existing conditions for down wood in the Sugar Pine Butte-Little Deschutes River subwatershed. Approximately 25% in PP/DF habitat type does not have down wood ≥5 inches dbh and 74% does not have down wood ≥20 inches dbh. Most of the down wood percent in the EMC and LP habitat types is between 0 and 8% of the watershed. There is no down wood cover ≥20 inches dbh in 74% of the PP/DF, 69% of the EMC, and 76% of the LP.

Table 105: Existing down wood in the Sugar Pine Butte-Little Deschutes River subwatershed by habitat type.

Percent (%) of watershed with down wood cover ≥ 5 inches dbh							
	0	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total %**
PPDF (37,248 acres)	25	64	0	1	2	0	100%
EMC (28,200 acres)	4	65	22	6	3	0	100%
LP (27,533 acres)	10	58	22	6	4	0	100%
Percent (%) of watershed with down wood cover ≥ 20 inches dbh							

	0	>0 to 4	>4 to 10	>10	Total %
PPDF (37,248 acres)	74	26	0	0	100%
EMC (28,200 acres)	69	28	0	2	100%
LP (27,533 acres)	76	23	0	0	100%

Direct and Indirect Impacts to Snags, Down Wood, and Green Tree Replacements—

Alternative 1

There are no known direct impacts to snags, down wood, or green tree replacements (GTRs) under Alternative 1 (No Action). Currently there are a limited number of large snags on the landscape. Current fuel continuity due to increased fuel loadings from 100 years of fire suppression has put the landscape at risk of large fires. 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 time until snags are available on the landscape. In addition there are limited large trees to provide future large snag habitat. 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 will 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 will generally be less than 20 inches dbh size classes, the preferred size class by many species of wildlife. Green tree replacements will also remain at existing levels across the landscape and all trees will 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 and/or stand replacement fire which may reduce current habitat conditions for a larger number of species. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013).

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 also limited large trees ≥ 21 inches dbh available for future large down wood recruitment. Increased stand densities perpetuates the problem of losing large structure over time, which these 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. These species require snags for nesting and utilize softer snags (moderate decay). These structures will be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Minor incidental loss of snags may occur during treatments due to safety requirements for removal of danger trees during operations; however these are incidental and will 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.

Under Alternatives 2, 3, and 4, green trees ≥21 inches dbh (future large snags) will not be felled and removed. The number and size of GTRs will be decreased by proposed tree treatments; however, levels retained in all treatments will provide adequate numbers of GTRs to provide future snags and down logs. Prescribed burning may affect GTRs by killing some residual trees, or parts of trees, in the units.

In ponderosa pine restoration units, standing dead and down lodgepole pine will be removed (commercial thinning) to favor growth of ponderosa pine trees. No snags >21 inches dbh would be removed. The lodgepole pine in these units occurs as single trees or in small clumps in ponderosa pine habitat historically dominated by ponderosa pine. In these ponderosa pine restoration units where potential American marten

habitat occurs, high density patches of down wood will be retained in units 33, 65, 247, 37, 335, 366, 812.1, 812.2, 812.3, 812.4, 912.5, 887, 995, and 996.

In deer openings and in openings in dwarf mistletoe-infected stands, small openings of 3 to 12 acres will be created in second growth ponderosa pine stands by removing all trees below 21" dbh, followed by mowing and/or underburning. The openings would then be planted with ponderosa pine seedlings to regenerate new cover stands. Within openings, mistletoe-infected ponderosa pine ≥ 21" dbh would be made into snags by topping or girdling; and outside openings, mistletoe-infected ponderosa pine within 40 feet of the opening edge would be cut and removed if < 21" dbh, or made into snags if ≥ 21" dbh.

All three alternatives propose understory treatments including non-commercial thinning, whip falling, and/or ladder fuel reduction units across all habitat types (ponderosa pine, mixed conifer, and lodgepole pine). These activities will not have impacts to snags, logs, and GTRs in the short-term, but may have some beneficial impacts to these habitat components in the long-term by creating stand conditions that will 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 landscape reducing the risk of larger scale disturbance events. Areas not treated will have a higher stocking rate and provide some diversity of canopy cover across the landscape. 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 the 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 Barrett (1999) showed that 30 years after thinning on the 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 landscape scale fire event, which should reduce the risk to individual large snags and trees. Impacts to snags from prescribed underburning will vary under the alternatives with underburning proposed on 7,027 acres under Alternative 2, on 1,670 acres under Alternative 3, and 6,748 acres under Alternative 4.

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). 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).

Fuels treatments will reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could minimize predation pressures on some species of wildlife such as the white-headed woodpecker, thereby benefitting this species. Within the areas that have prescribed fire

identified, there is also potential of changing large snags into down wood. 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 (Horton and Manann 1988). Burning prescriptions and pre-ignition fuels reduction are designed to minimize the loss of large snags.

As outlined in the Eastside Screens, the Rocket project will maintain 20 to 40 lineal feet of down wood in ponderosa pine and 100-140 lineal feet of down wood in mixed conifer per acre with no more than 3 inches of total consumption after fuels treatments including underburning. 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, underburning and mastication treatments for all three alternatives is anticipated to increase stand resiliency to wildfire and reduce competition with established trees in the long-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 of a larger scale disturbance events. In addition, some of the areas identified for no treatment occur within higher site potential areas (i.e. riparian habitat conservation areas), which allows them to produce large trees with greater canopy closure. These areas have the potential to provide habitat.

Overall, Alternative 3 will have the least impacts to snags, down wood, and GTRs due to fewer acres treated.

Cumulative Impacts—Snags and Down Wood—Alternatives 2, 3, and 4

Timber harvest, wildfire and fuels management, road maintenance, danger tree removal, and firewood cutting have contributed to the distribution and density of snags and down wood across the Rocket cumulative impacts analysis area. Private lands are not managed species associated with snags, down wood, and green tree replacements. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long-term.

Vegetation Management

Extensive harvest activities, primarily clearcutting, occurred in the watersheds during the 1920s and 1930s. Thinning and other harvest activities in the 1970-1990s removed most or all overstory trees and likely retained minimal snag and down wood habitat.

Sales planned west of the spotted owl line after 1994 utilized the Northwest Forest Plan standards and guidelines and followed Late-Successional Reserve Assessment guidelines by plant association group. These guidelines ranged from 4 to 13 snags per acre depending on the plant association group, and 120 linear feet of down wood at least 16 inches in diameter and 16 feet long. Sales planned after 1995 east of the owl line utilized the Eastside Screens, which calls for 2.25 snags ≥ 20 inches dbh per acre and 20 to 40 lineal feet per acre in ponderosa pine and 100-140 lineal feet per acre in mixed conifer. It is assumed that harvest units occurring within this time frame retained 1 to 4 snags per acre. Both the NWFP standards and guidelines and the Eastside Screens are applicable to the West Bend project area which is within the cumulative effects analysis area.

Shelterwood harvest prescriptions (1975 to present) retained 8 to 20 live overstory trees providing for some future large snag and log habitat as the younger stand develops into a mature stand, but will have eliminated the understory and mid-story cover and feeding substrate. Removal of snags does not normally occur with this treatment; however incidental removal occurs due to safety reasons.

Ongoing vegetation management projects in the watersheds, primarily the West Bend Vegetation Management project, focus on reducing understory vegetation to reduce risk of loss from wildfire. It is assumed that snags will not be impacted from these projects other than incidental falling due to OSHA safety requirements. However, smaller sized down woody material may be consumed depending on treatments

proposed. Overall, these impacts are expected to be minor and future recruitment of down wood will be available in the remaining stand. A western spruce budworm epidemic occurred in the analysis area starting in the late 1980s and continued into the early 1990s. Tree mortality and defoliation occurred throughout. This event produced a small pulse of dead wood habitat at slightly elevated levels.

Fire and Fuels Reduction

Approximately 6,500 acres have burned in the watersheds from 1979-1990, with 995 of these acres occurring in the Rocket project area. These events created pulses of higher snag and down wood densities than will normally occur with natural succession. However, these high density snag areas are short-lived with most snags falling down within 25 years.

Fuels reduction projects include mowing, burning, and thinning stands from below. Burning varies but may include underburning, jackpot burning of concentrations, pile burning, or some combination of these activities. A reduction in down woody material is usually associated with these activities with some incidental snag loss. Material impacted primarily includes smaller size classes (<15 inches dbh) and those in more advanced decayed stages (Decay Classes 3-5). These treatments, however, may reduce the risk of loss to existing large snags and logs by reducing ground and ladder fuels.

Insects and Disease

Mountain pine beetle affects lodgepole pine and ponderosa pine. Western pine beetle impacts mostly large old ponderosa pine and the fir engraver impacts the true firs including white fir and subalpine fir. The stands in the West Bend project area, for bark beetle susceptibility, are separated into three main species groups, lodgepole pine, mixed conifer wet and ponderosa pine dominated stands.

Mixed conifer wet stands are highly variable within and between stands. White fir, lodgepole pine and ponderosa pine trees can be found in different stocking levels and in these stands high densities and lodgepole pine are the main reason for bark beetle mortality.

Ponderosa pine stands are susceptible where stocking levels are high or lodgepole pine >9 inches dbh is in proximity. The proximity of lodgepole pine allows emerging bark beetles to attack ponderosa pine even though they are a less desired host. Unlike in lodgepole pine the bark beetle does not cause more contagion of impacts. Mortality of ponderosa pine and lodgepole pine typically is throughout the diameter ranges in the stand and may even be emphasized in the larger tree size groups. White fir in these stands have so far escaped the effects of fir engraver. High densities leave white fir susceptible to outbreaks of fir engraver especially if a drought cycle occurs.

Ponderosa pine stands found in the ponderosa pine and mixed conifer dry plant association groups dominate the Rocket project area. These stands are blackbark stands and most were established in the 1920s and 30s and some as late as the 1960s. Many stands are pure ponderosa pine but stands with higher productivity may have lodgepole pine or some white fir tree stocking. Unmanaged stands tend to be dense with poles and larger blackbark trees and typically have heavy fuels from beetle mortality. The fuels are mostly down dead lodgepole pine from previous beetle infestations; however ponderosa pine and white fir mortality is becoming more common due to tree stress caused by heavy stocking levels. Managed stands of ponderosa pine have been precommercially or commercially thinned and are now 60–130 square feet of basal area. These stands have responded to lower stocking levels with increased growth, crown volume and understory tree and brush establishment. However, many of these stands still contain lodgepole pine and are above the UMZ.

Currently mountain pine beetles are infecting stands and causing mortality throughout the Rocket project area and the watershed. This impact is occurring in mixed conifer, ponderosa pine and mixed lodgepole and ponderosa pine stands.

Danger Tree

Danger tree activities include the routine removal of snags along roads, high use recreation areas, and facilities. This activity occurs approximately 160 feet (one site potential tree height) on either side of roads

and from high use areas. Snag habitat remains in these areas however as they pose a danger to the public or facilities they are removed, therefore these areas are not managed for this habitat component. Snag levels continue to decline around these facilities. Danger tree removal has increased due to an increase in recreational trails, facilities, and parking areas.

Determination

The Rocket action alternatives 2, 3, and 4 do not propose falling of snags. Incidental removal of snags may occur to meet OSHA safety requirements during treatment activities.

The Rocket action alternatives 2, 3, and 4 do not propose falling of green trees ≥21 inches dbh. Sufficient levels of green tree replacements will be retained to provide future recruitment of snags and down wood.

Prescribed fire activities are anticipated to result in the removal of some down wood on 1,670 to 7,027 acres depending on the alternative.

The Rocket project is consistent with the Forest Plan standards and guidelines WL-37 and WL-38, and amended Eastside Screens (Table 106).

Table 106: Consistency with Forest Plan standards and guidelines WL-37 and WL-38, and amended Eastside Screens for the Rocket project.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-37 – As amended by the Eastside Screens, snags will be maintained to provide 100 percent of potential population levels of cavity nesting species. In addition live replacement trees will be left during any harvest to assure 100 percent of population potential through the rotations.	Meets	No snags are targeted for harvest except for lodgepole pine in ponderosa pine restoration units where it occurs singly or in small clumps. Sufficient retention trees will be provided for future snags in the Rocket project area.
WL-38 – Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.	Meets	No snags are targeted for harvest except for lodgepole pine in restoration units where it occurs singly or in small clumps. Sufficient trees will be provided for future snags in the Rocket project area..
WL-38 – As amended by the Eastside Screens, 20 to 40 lineal feet per acre in ponderosa pine and 100-140 lineal feet per acre in mixed conifer will be retained.	Meets	Down lodgepole pine wood may be removed in ponderosa pine restoration units with mitigation measures in place to leave areas of high-density down wood. Snags >10 inches dbh identified as hazards will be felled and left as down wood. Mitigation measures have been placed to ensure the required lineal feet of down wood remains post prescribed fire.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
Eastside Screen – Fire prescription parameters will ensure that that consumption will not exceed 3 inches total (1 ½ inches per side) of diameter reduction in the 20 to 40 lineal feet per acre of ponderosa pine and the 100-140 lineal feet per acre of mixed conifer.	Meets	Mitigation measures have been placed to ensure the required lineal feet of down wood remains post prescribed fire.

American marten

Existing Condition

Please refer to the American Marten Management Indicator Species Assessment for detailed information on its biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012g). Habitat assumptions for the Forest were based on studies on the Fremont-Winema National Forest (Raphael and Jones 1997) and the Blue Mountains in Oregon (Bull and Heater 2000, 2001a, and 2001b, Wisdom et al. 2000a) and western Washington (Raphael and Jones 1997).

The Forest Plan established Old Growth Management Areas (MA-15) to provide habitat for the American (pine) marten and other old growth associated species. In all, 32,800 acres were allocated to maintain landscape ecology needs, preserve aesthetic or social old growth values, and provide old-growth habitat for wildlife. It was estimated that long-term (50 years), old-growth forest will amount to approximately 270,200 acres (Forest Plan FEIS ROD pages 20-21). The Forest Plan predicted habitat was available for 450 to 1,285 marten pairs. The Eastside Screens deferred harvest of certain late and old structure stands and prohibited the harvest of live trees greater >21 inches dbh.

Martens are very susceptible to predation and avoid open habitats dominated by grasses, forbs, and saplings, especially in winter. Martens do not hibernate during winter but either rest or hunt beneath the snow in spaces created by complex physical structure close to the ground. In Oregon, canopy closure at rest sites in lodgepole pine dominated stands averaged 36% in snow periods and 27% in snow-free periods. Down wood and slash piles were important resting and denning structures in Central Oregon. Natal and maternal dens occur in trees, snags, or logs, often in large structures characteristic of late-successional forests. They often use fallen logs as runways. Forested riparian habitats are important travel corridors. They also are more active during summer than winter. Summer rest sites may be in hollow trees, squirrel nests, mistletoe brooms, ground burrows, and stumps. Raphael and Jones (1997) study in lodgepole pine forests concluded that denning sites averaged 30 percent canopy cover.

Factors that can influence marten populations include habitat fragmentation, mortality from intraspecific strife during territorial interactions, predation by raptors and other terrestrial carnivores, and fluctuations in prey abundance and availability. Range-wide, past extensive logging and trapping led to extirpations in some areas and loss/degradation of habitat due to timber harvest remains a threat in some areas. Loss of down wood and a resultant loss in prey availability and subnivean access due to fuels treatments can impact marten populations. Home range sizes tended to be larger as the road density increased (Godbout and Ouellet 2008).

Snag Density and Down Wood Percent Cover as Reported in DecAID

Raphael and Jones (1997) found that down wood and slash piles were important resting and denning structures in the eastern Cascades of central Oregon, where forests in their study area were dominated by lodgepole pine. See the Wildlife Report for details. On the Forest, denning habitat was modeled using all PAGs except juniper and ponderosa pine without the presence of lodgepole pine (USDA FS 2012g). There

are approximately 433,973 acres of potential marten denning habitat forestwide. There are large fairly well-connected blocks particularly on the Crescent and Bend-Ft. Rock Ranger Districts. The Sisters Ranger District as the northern end of the Forest has been heavily impacted by the beetle outbreaks in the 1980s followed by wildfires between 2000 and 2012. The B&B and Eyerly fires especially, resulted in reduced connectivity to the National Forest lands to the south as well as northward onto the Warm Springs Tribal Lands. Details of snags and down wood modeling at the Forest level is located in the Wildlife Report.

The Rocket project area has approximately 1,137 acres of potential marten denning habitat. This habitat is concentrated in the southeastern area in the mixed conifer habitat, in the southern area of the NNVM "peninsula" and two older aged ponderosa pine units. The Rocket project area does not contain any montane mixed conifer habitat type. 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.

Marten use large diameter snags when available at fairly robust densities. The mean, or 50% tolerance interval, is 4 per acre. Table 107 illustrates the availability of this habitat for marten on the landscape and the Rocket project area. Less than 20% of the lodgepole pine and eastside mixed conifer habitat type forestwide currently have densities at or above the 50% tolerance interval. It is uncommon to have the large snag densities at the >50% tolerance interval for marten in the Rocket project area. In the watersheds that overlap the project area, 3% to 4% of the habitat meets the 30-50% tolerance interval, and 15% of the Rocket project area meets this tolerance interval for large snag density (>= 21 inches dbh). Forestwide, higher densities of large snags appear more common in the montane mixed conifer habitat type (Table 108), which does not occur in the Rocket project area. Although large logs (>20 inches large end diameter) and high densities of logs (% cover) are important habitat features for denning, resting and hunting, the levels at which marten are most apt to use them (>50% tolerance interval) are not common on the Forest.

Table 107: Distribution of snags >20 inches tolerance intervals for marten denning habitat.

	Snags per acre						% of Landscape				
Spatial Scale	**0**	**>0-30%**	**>30-50%**	**>50-80%**	**>80%**	**Total Acres**	**0**	**>0-30%**	**>30-50%**	**>50-80%**	**>80%**
	0	**>0-2.8**	**>2.8-7.7**	**>7.7-15.2**	**>15.2**		**0**	**>0-2.8**	**>2.8-7.7**	**>7.7-15.2**	**>15.2**
Deschutes National Forest	231,980	93,951	75,437	28,514	4,092	433,974	53	22	17	7	1
North Unit Diversion Dam-Deschutes River watershed	5,074	1,660	327	2	0	7,063	72	24	5	0	0
Sugar Pine Butte-Little Deschutes River subwatershed	2,312	2,070	731	0	0	5,114	45	40	14	0	0
Rocket Project	554	431	167	0	0	1,152	48	37	15	0	0

Table 108: Forestwide historic range of variability and existing percentage of habitat types used by marten with large diameter snags.

	Percent (%) of Forest for snags ≥20 inches dbh in snags per acre						
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**
EMC	HRV	32-44	29-35	14-22	7-10	2-3	1-2
	Existing	37%	48%	11%	3%	1%	0.2%
LP	HRV	72-83	15-20	1-7	0-2	0	0
	Existing	81%	17%	1%	0.2%	0.0%	0.1%
MMC	HRV	14-47	16-30	9-25	6-18	2-7	2-7
	Existing	21%	33%	29%	11%	4%	2%
			30-50% tolerance interval		50-80% tolerance interval		80%+ tolerance interval
Information from DecAID 2.0 tables (unharvested plots for snags ≥20 inches dbh EMC_ECB_O.Inv-15., EMC_ECB_S.Inv-15, EMC_ECB_L.Inv-15, LP_O.Inv-15, LP_S.Inv-15, MMC_O.Inv-15, MMC_S.Inv-15, MMC_L.Inv-15, and modified with HRV information from Viable							

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the American marten under Alternative 1 (No Action). Indirectly, dead trees recruited as down logs over time will accumulate in concentrations that provide subnivean foraging and resting opportunities for marten. Within mixed conifer stands, areas that currently provide suitable marten habitat will most likely have increased mortality due to tree stress from competition. In the short-term, available denning habitat will be limited. Long-term, the future development of late and old structure characteristics will be prolonged as well as stands that have sufficient canopy cover to provide protection from predation.

Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013). A high-intensity and/or stand-replacing fire event could reduce marten denning habitat, which will prolong the development of marten habitat for several decades.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails in marten habitat will occur. These open roads and trails will continue to contribute to disturbance and reduced habitat security for the marten in the Rocket project area.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 1,137 acres of marten denning habitat in the Rocket project area, tree treatments will occur on 270 acres under Alternative 2, on 78 acres under Alternative 3, and on 360 acres under Alternative 4 (Table 109). Fuels treatments will occur on 262 acres under Alternative 2, on 42 acres under Alternative 3, and on 250 acres under Alternative 3. Alternative 3 will have the least impacts to marten denning habitat due to fewer acres of treatment (Table 109).

Table 109: Acres of American marten denning habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	26	---	---
Thinning to 60 foot average BA	14	5	21
Thinning to mixed range BA (40-80)	---	32	99
Ponderosa pine restoration	220	37	215
Aspen Enhancement	1	1	1
Plantation Thin	9	---	21
Opening in DMT	---	---	3
Ladder Fuels Reduction	---	3	---
Total acres of tree treatments	**270**	**78**	**360**
Denning habitat acres (%) with no tree treatments	882 (77%)	1,074 (94%)	792 (69%)
Fuels Treatments			
Mowing only	1	29	79
Mowing and underburning	261	13	171
Total acres of fuels treatments	**262**	**42**	**250**
Denning habitat acres (%) with no fuels treatments	890 (77%)	1,110 (96%)	902 (78%)

No large trees >21 inches dbh that could provide denning sites for marten are proposed for removal. During thinning operations a small number of individual snags that could potentially serve as den sites could be lost due to felling of snags that pose a hazard to workers and or equipment; however, these are anticipated to be a small number across the project area. The ponderosa pine restoration units account for the biggest impact to marten due to the removal of standing dead and down lodgepole pine trees. In these units, trees to be cut include all lodgepole pine 7-20.9" dbh and all true fir 7-20.9" dbh either with less than 50% live crown ratio or growing within or touching the dripline of desirable ponderosa pine of any size. Treatment of lodgepole pine or true fir less than 7" dbh would depend on ponderosa pine stocking, proposed use of prescribed fire, and management area objectives. Treatment would vary from cutting all trees in this size class to retaining some to meet desired stocking levels. If removing lodgepole pine or true fir in this size class reduces stocking below minimum levels, ponderosa pine would be planted to at least minimum stocking levels in areas 3 acres or larger. In addition to lodgepole pine and true fir, ponderosa pine would be cut and removed if of poor vigor, mistletoe infected, or excess to desired stocking (40-80 sq. ft. of basal area per acre). Negative impacts may result from more open stands by removing dense patches, creating areas where marten are more susceptible to predation. Mitigation for the impacts to marten in the ponderosa pine restoration units will be to leave high density pockets of down wood in potential denning habitat in units 33, 65, 247, 37, 335, 366, 887, 812.1, 812.2, 812.3, 812.4, 995 and 996.

Thinning from below in marten denning habitat is expected to degrade denning habitat to marginal levels due to the removal of the mid-story while maintaining the overstory canopy closure. Regardless of the PAG impacted, there will be a reduction in ground cover and down wood from the post-treatment activities, resulting in less physical structure near the ground that contributes to protection from raptor predation. All alternatives may degrade marten foraging habitat since these actions reduce the quantity of cover habitat for marten prey species.

The percent of denning habitat that will not be treated is approximately 77% under Alternative 2, 94% under Alternative 3, and 69% under Alternative 4, leaving a majority of the available marten denning habitat

untreated in the project area. Long-term benefits of treatments will be a reduction of stress to the overstory promoting the longevity of the residual large tree structure and providing long-term habitat.

Underburning will occur in a small amount of the available marten denning habitat Mowing of brush may also occur where existing brush density and height will 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 short-term degradation of prey species habitat with the consumption/loss of some softer snags, down woody material, and brush. The percent of denning habitat that will not receive fuels treatments is approximately 77% under Alternative 2, 96% under Alternative 3, and 78% under Alternative 4, leaving a majority of the available marten denning habitat untreated with fire in the project area.

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for marten. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and potentially providing greater access from illegal OHV use.

Resource protection measures require retention of high density pockets in the following units: 33, 65, 247, 37, 335, 366, 887, 812.1, 812.2, 812.3, 812.4, 995, and 996.

Cumulative Impacts—Alternatives 2, 3, and 4

Because of the large amount of potential habitat that has experienced mortality from beetle outbreaks in the watersheds, habitat for the marten is expected to decline in the North Unit Diversion Dam-Deschutes River watershed over time. Ongoing and reasonably foreseeable actions in marten denning habitat that contribute to cumulative impacts include treatments on 370 acres in the West Bend vegetation management project. Treatments will reduce denning habitat in the short-term through a reduction of stand densities, canopy cover, and down wood but will also accelerate the long-term development of future large tree structure and reduce the risk of habitat loss from high intensity and/or stand-replacing fire.

Of the 7,063 acres of marten denning habitat in the watershed, the Rocket action alternatives 2, 3, and 4 will treat an additional 0.2% to 4% of the potential habitat in the watershed (13 to 269 acres). Cumulatively, when the Rocket project is added to other ongoing and reasonably foreseeable actions in the watershed, 5% to 9% of the denning habitat in the watershed will be treated. The vegetation management treatments will reduce marten denning habitat to marginal conditions in the short-term (20-30 years), while accelerating the development of future large tree structure and reducing the risk of habitat loss to high intensity and/or stand-replacing fire.

Of the 5,114 acres of marten denning habitat in the Sugar Pine Butte-Little Deschutes River subwatershed, the Rocket action alternatives 2, 3, and 4 will treat 2% of the total habitat in the subwatershed (65 to 91 acres). There are no other ongoing and reasonably foreseeable actions that will impact marten denning habitat in the subwatershed.

Determination

The Rocket action alternatives will reduce 6% to 31% (13 to 269 acres) of the denning habitat in the project area, depending on the alternative, through thinning of stand densities, reduction in canopy closure, and consumption of down wood from fuels treatments. Treatments will not preclude use in the project area by marten in the short or long-term; approximately 69% to 94% of the marten denning habitat in the project area will not be treated depending on the alternative. Cumulatively, up to 9% of the marten denning habitat in the watershed and 2% of the denning habitat in the subwatershed will be impacted. Treatments will accelerate the development of future large tree structure and down wood and reduce the risk of habitat loss due to high intensity and/or stand-replacing fire.

The Rocket project is consistent with the Forest Plan standards and guidelines for Management Indicator Species and Snags and Down Wood Associated Species with the mitigation measure of leaving areas of high-density down woody material in denning habitat. The Rocket project will result in a small negative trend in viability for the American marten on the Forest.

Cavity-Nesting Birds, Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington, Birds of Conservation Concern, and High Priority Shorebirds

This section analyzes impacts to Cavity-Nesting Birds (Woodpeckers), Landbird Focal Species, and Birds of Conservation Concern. Species are grouped according to habitat type for analysis.

Cavity-Nesting Birds: Woodpeckers and Nuthatches

Woodpeckers are a management indicator species group for the forest. This group was chosen to represent all wildlife species which use cavities for nesting. On the forest, eleven woodpecker species excavate cavities used by other species of hole-nesters incapable of excavating their own nest site. These woodpeckers, as well as many of the secondary cavity nesters, consume forest insects thereby contributing a valuable suppression influence on forest pests (USDA Forest Service 1990, page 3-17). Table 110 lists eleven species of cavity nesters that occur on the Forest and those with habitat in the Rocket project area.

Table 110: Cavity-Nesting birds on the Forest and potential habitat in the Rocket Project area.

Habitat	Species	Habitat in Rocket Project area
Lodgepole pine - old growth	Black-backed woodpecker	Yes
Deciduous/mixed deciduous and conifer or riparian - Aspen or riparian cottonwood	Downy woodpecker	Yes
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 mature and old-growth conifer forest	Red-breasted nuthatch	Yes
Aspen with ponderosa pine - Riparian aspen or cottonwood	Red-breasted sapsucker	Yes
Aspen - large trees with regeneration	Red-naped sapsucker	Yes
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's sapsucker	Yes

Landbird Focal Species

Table 111 lists specific habitat types, the habitat feature conservation focus, and potential habitat for the species in the Rocket project area. Both white-headed woodpecker and Lewis' woodpecker are Region 6 Sensitive Species that are associated with ponderosa pine. Consistency with the biological objectives in the Conservation Strategy for these two species was evaluated in the Biological Evaluation for the Rocket project and so are addressed previously in this EA.

Table 111: Priority habitat features and associated landbird focal species for the Eastslope Cascades.

Habitat Type	Habitat Feature	Focal Landbird Species for Central Oregon	Habitat in Rocket Project area
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	Yes
Subalpine fir	Patchy presence	Blue Grouse	No

Birds of Conservation Concern and High Priority Shorebirds

Executive order 13186 directs 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 Register 2001). The USFWS developed a list of Birds of Conservation Concern (BCC) to meet this goal (USDI Fish and Wildlife Service 2008). 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.

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. The 2008 list was derived from three conservation plans: Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004), the United States Shorebird Conservation Plan (USDI Fish and Wildlife Service 2004), and the North American Waterbird Conservation Plan (Kushlan et al. 2002). Conservation concerns include population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors.

Bird Conservation Regions were developed based on similar geographic parameters and are the basic units for bird conservation efforts. The Rocket project area occurs in the Bird Conservation Region 9 (Great Basin).

Table 112 lists the species of concern, the preferred habitat, and potential habitat in the Rocket project area.

The U.S. Shorebird Conservation Plan (USDI FWS 2004) identifies the conservation status of U.S. and Canadian shorebird populations. There is no habitat for any of the high priority shorebirds identified in the U.S. Shorebird Conservation Plan. None of the alternatives including the no action alternative will convert existing stands to shorebird habitat. Therefore, there will be *No impact* to any shorebird as a result of the Rocket project.

Table 112: Species in Bird Conservation Region 9 and potential habitat in the Rocket Project area.

Bird Species	Preferred Habitat	Habitat in Rocket Project area
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' Woodpecker	Ponderosa pine forests	Yes
Williamson's Sapsucker	Ponderosa pine forests	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

Old-growth Lodgepole Pine and Post-fire Habitat: Black-backed Woodpecker and Three-toed Woodpecker

Existing Conditions

Please refer to the forestwide assessments for the black-backed and three-toed woodpeckers on the Forest for detailed information on biology, status, threats, and habitat modeling (USDA Forest Service 2012h and USDA Forest Service 2012i). Additional information is contained in the Wildlife Report. The conservation status based on the Nature Serve ranking indicate the black-backed and three-toed woodpeckers are secure globally and nationally, and vulnerable at the state level.

Table 113 lists the snag numbers for black-backed and three-toed woodpeckers by vegetative series and snag sizes for areas east of the NWFP line on the Forest. There are no specific snag numbers given for the black-backed woodpecker in the Forest WLTL. Table 113 lists snag requirements for black-backed and three-toed woodpeckers regarding potential population levels. Therefore, since this species uses similar habitat and habitat conditions, requirements for the three-toed woodpecker are also used for the black-backed woodpecker.

Table 113: Snag numbers for black-backed and three-toed woodpeckers by vegetative series and snag sizes for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Mixed Conifer	>20 inches dbh	14
	>15 inches dbh	211
Total		225
Lodgepole Pine	>12 inches dbh	59
	>10 inches dbh	121
	Total	180

Table 114: Snag requirements for black-backed and three-toed woodpeckers regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size (inches dbh)	Snags/Acre Required	Comments
Des WLTL and NWFP	Mixed Conifer, White Fir, Lodgepole Pine	100%	>12 inches dbh	0.06 snags/ac	Retain all possible
	Mixed Conifer, White Fir, Lodgepole Pine	40%	>12 inches dbh	0.02 snags/ac	
Eastside Screens	Mixed Conifer	100%	>15 inches dbh	2.25 snags/ac	
	Lodgepole Pine	100%	>10 inches dbh	1.80 snags/ac	

Snag and Down Wood in Black-backed Woodpecker Reproductive Habitat as Reported in DecAID

Table 115 and Table 116 list the DecAID tolerance levels for snag sizes and dead wood in green stands used by black-backed woodpeckers for nesting, roosting, or foraging based on DecAID.

Table 115: Range of DecAID tolerance levels for snag size used by black-backed woodpeckers across habitat types.

Type of Use	Black-backed woodpecker: DecAID Tolerance Levels for snags		
	30% Snag Size (inches dbh)	50% Snag Size (inches dbh)	80% Snag Size (inches dbh)
Nesting	8.1- 8.8	10.7-13.2	13.5-20.5
Roosting	6.7-6.9	10.9	16.5-16.8
Foraging	8-12.0	12.1-14.8	18.2-19.2
Mellen-MClean et al. 2012			

Table 116: DecAID tolerance levels for dead wood for the black-backed woodpecker in green stands.

Dead Wood	30% tolerance level	50% tolerance level	80% tolerance level
≥10 inches dbh Snags (#/acre)	2.5	13.6	29.2
≥5.5-6.0 inches dbh (% cover)	4.7	13	25.1
DecAID Version 2.1: Tables EMC_S/L.sp-22, PPDF_S/L.sp-22; Tables EMC_S/L.sp-24, LP_S/L.sp-24			

The Wildlife Report provides information on snag distribution in reproductive habitat across the Forest. There are 16,359 acres of reproductive habitat in the North Unit Diversion Dam – Deschutes River watershed, which is 20% of the habitat available in the watershed and 4% of the habitat available forestwide. Table 117 shows the existing snag distribution ≥10 inches dbh in black-backed woodpecker reproductive habitat in the watershed. Approximately 54% of the reproductive habitat has no snags, making it unlikely to be suitable reproductive habitat. There is no habitat provided at the snag density preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 46% of habitat provides varying levels of habitat for individuals.

Table 117: Existing snag distribution ≥10 inches dbh in black-backed woodpecker reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed.

Tolerance Level	Snags per acre	Watershed Nesting Acres	% of Habitat
0	0	8,820	54
>0-30%	>0 to 2.5	3,761	23
>30-50%	>2.5 to 13.6	2,919	18
>50-80%	>13.6 to 29.2	816	5
>80%	>29.2	43	0
	Total	16,359 acres	100%
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

There are 8,201 acres of reproductive habitat in the Sugar Pine Butte-Little Deschutes River subwatershed, which is 29% of the habitat available in the subwatershed and 2% of the habitat available forestwide (Table 118). Approximately 30% of the reproductive habitat has no snags, making it unlikely to be suitable reproductive habitat. Approximately 1% of the habitat provides habitat at the snag density preferred by a majority of individuals for nesting (>80% tolerance level). The remaining 69% of habitat provides varying levels of habitat for individuals.

Table 118: Existing snag distribution ≥10 inches dbh in black-backed woodpecker reproductive habitat in the Sugar Pine butte-Little Deschutes River subwatershed.

Tolerance Level	Snags per acre	Subwatershed Nesting Acres	% of Habitat
0	0	2,437	30
>0-30%	>0 to 2.5	2,465	30
>30-50%	>2.5 to 13.6	1,965	36
>50-80%	>13.6 to 29.2	280	3
>80%	>29.2	54	1
	Total	8,201 acres	100%
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

Table 119 lists the acres of potential reproductive habitat modeled across the Forest (USDA Forest Service 2012h). Black-backed woodpecker nesting habitat was mapped using lodgepole pine dominated forests which include all lodgepole pine plant association groups in all seral stages (early, mid, late) in addition to other PAGs (i.e. mixed conifer and ponderosa pine) in the early and mid seral stages where lodgepole pine is dominant. There are 446,003 acres forestwide distributed across 22 of 27 watersheds. Based on population trends, large-scale habitat assessments, risk factors, and snag analysis, black-backed woodpeckers are highly distributed and dispersed across the Forest with low abundances. There are 16,359 acres in the North Unit Diversion Dam-Deschutes River watershed and 8,201 acre in the Sugar Pine Butte-Little Deschutes River subwatershed. Within the Rocket project area, there are 3,311 acres of potential reproductive habitat.

Table 119: Acres of black-backed woodpecker reproductive habitat at Forest, watershed and project levels.

Spatial Scale	Acres of Black-backed woodpecker Reproductive Habitat	Percent (%)
Deschutes National Forest	446,003	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	16,359	4% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	8,201	2% of habitat forestwide
Rocket Project area	3,311	1% of habitat forestwide
		14% of habitat in watershed (2,222 acres)
		13% of habitat in subwatershed (1,089 acres)

Snag Distribution for Black-backed Woodpecker Reproductive Habitat in the Rocket Project Area

Table 120 shows the existing snag distribution ≥10 inches dbh in black-backed woodpecker reproductive habitat in the project area by tolerance level. There are 3,330 acres of reproductive habitat for the black-backed woodpecker in the Rocket project area which is 2% of the habitat available forestwide. Approximately 42% of the reproductive habitat has no snags, making it unlikely to be suitable reproductive habitat. Less than 1% of the habitat provided at the snag density preferred for nesting by a majority of individuals (>80% tolerance level) occurs in the project area. The remaining 57% of habitat provides varying levels of habitat for individuals.

Table 120: Existing snag distribution ≥10 inches dbh in the Rocket Project area by tolerance level for the black-backed woodpecker.

Tolerance Level	Snags per acre	Black-backed Woodpecker Reproductive Habitat in Rocket Project area	% of Habitat
0	0	1,397	42
>0-30%	>0 to 2.5	1,212	36
>30-50%	>2.5 to 13.6	636	19
>50-80%	>13.6 to 29.2	81	2
>80%	>29.2	5	<1
	Total	3,331	100%
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

Down Wood Density for Black-backed Woodpecker Reported in DecAID

Table 121 lists the tolerance levels relative to the black-backed woodpecker for down wood ≥6 inches dbh and down wood ≥5.5 inches dbh in eastside mixed conifer, small and large trees (EMC_S/L) and lodgepole pine, small and large trees (LP_S/L). The data points in DecAID for black-backed woodpeckers (Goggans et al. 1989) should be used with caution. The data includes some sites in lodgepole pine and montane mixed conifer forest habitat types, which tend to have higher percent cover of down wood than those on eastside mixed conifer sites. In addition, these data were collected during a mountain pine beetle outbreak and thus dead wood levels were elevated.

Table 121: Tolerance levels for black-backed woodpecker as reported in DecAID for down wood cover.

Snag Size	30% tolerance level Down Wood Cover (%)	50% tolerance level Down Wood Cover (%)	80% tolerance level Down Wood Cover (%)
≥6.0 inches dbh	4.7	13	25.1
≥5.5 inches dbh	4.7	13	25.1
DecAID Version 2.1: tables EMC_S/L.sp-24 and LP_S/L.sp-24			

The Wildlife Report provides information on the down wood distribution across the Forest. Table 122 shows that the distribution of reproductive habitat is roughly similar in both watersheds, with 16-17% of the habitat in the watersheds not providing any down wood and no habitat providing down wood cover at the percent preferred for a majority of individuals. The remaining 83% provides habitat for individuals at varying levels in both watersheds.

Table 122: Down wood distribution in the watersheds by tolerance levels for black-backed woodpeckers for down wood ≥5 inches dbh.

North Unit Diversion Dam–Deschutes River Watershed			
Tolerance Levels	**% Down Wood Cover**	**Watershed Reproductive habitat Acres**	**% of Habitat**
0	0	2,700	17
>0-30%	>0 to 4.7	11,532	70
>30-50%	>4.7 to 13.0	1,970	12
>50-80%	>13.0 to 25.1	158	1
>80%	>25.1	0	0
	Total	16,359 acres	100%

Sugar Pine Butte Little Deschutes River Subwatershed			
Tolerance Level	**% Down Wood Cover**	**Subwatershed Reproductive habitat Acres**	**% of Habitat**
0	0	1,289	16
>0-30%	>0 to 4.7	5,151	63
>30-50%	>4.7 to 13.0	1,679	20
>50-80%	>13.0 to 25.1	83	1
>80%	>25.1	0	0
	Total	8,201 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood Cover in Black-backed Woodpecker Habitat in the Rocket Project Area

Table 123 shows the down wood percent cover by tolerance level for black-backed woodpecker in the Rocket project area. Approximately 29% of the habitat has no down wood making it unlikely to be suitable reproductive habitat. There is no down wood cover at the density preferred by majority of individuals (>80% tolerance level). The remaining 71% provides varying levels of habitat for individuals.

Table 123: Existing down wood distribution ≥5 inches dbh in black-backed woodpecker reproductive habitat in the Rocket project area by tolerance level.

Tolerance Level	% Down Wood Cover	Black-backed Woodpecker Acres of Reproductive Habitat in Rocket Project Area	% of Habitat
0	0	954	29
>0-30%	>0 to 4.7	1,976	59
>30-50%	>4.7 to 13.0	385	12
>50-80%	>13.0 to 25.1	16	<1%
>80%	>25.1	0	0
	Total	3,330 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 a1,976nd LP_S/L.sp-24			

Three-toed Woodpecker Reproductive Habitat on the Forest

Table 124 lists the acres of reproductive habitat across the Forest (USDA Forest Service 2012i). There are 367,499 acres of reproductive habitat modeled across the Forest distributed across 23 of 25 watersheds. Based on population trends, large-scale habitat assessments, risk factors, and snag analysis, three-toed woodpecker populations are highly distributed and dispersed across the forest with low abundances. There are 10,832 acres in the North Unit Diversion Dam-Deschutes River Watershed and 6,266 acres in the Sugar Pine Butte-Little Deschutes River Subwatershed. There are 2,355 acres in the Rocket project area.

Table 124: Acres of Three-toed woodpecker reproductive habitat at Forest, watershed, and project scale.

Spatial Scale	Acres of Three-toed Woodpecker Reproductive Habitat	Percent (%)
Deschutes National Forest	367,499	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River Watershed	10,832	3% of habitat forestwide
Sugar Pine Butte-Little Deschutes River Subwatershed	6,266	2% of habitat forestwide

Rocket Project area	2,355	0.6% of habitat forestwide
		14% of habitat in watershed (1,499 acres)
		14% of habitat in subwatershed (856 acres)

Snag Distribution for Three-toed Woodpecker Reproductive Habitat in the Watersheds

Table 125 shows the existing snag distribution in the watersheds by tolerance levels for snags ≥10 inches dbh. There are 10,832 acres in the North Unit Diversion Dam–Deschutes River watershed and 6,266 acres in the Sugar Pine Butte-Little Deschutes River subwatershed of three-toed woodpecker reproductive habitat. Approximately 50% of the North Unit Diversion Dam–Deschutes River watershed and 26% of the Sugar Pine Butte-Little Deschutes River subwatershed does not contain snags ≥10 inches dbh (zero snags per acre). Less than 1% of the reproductive habitat in the watersheds provide habitat at densities preferred by this species for nesting (≥80% tolerance level). The remaining 49% of the North Unit Diversion Dam–Deschutes River watershed and 73% of the Sugar Pine Butte-Little Deschutes River subwatershed provide varying levels of habitat for individuals.

Table 125: Existing snag distribution in the watersheds by tolerance levels for three-toed woodpeckers for snags ≥10 inches dbh.

North Unit Diversion Dam–Deschutes River Watershed			
Tolerance Level	**Snags per acre**	**Watershed Reproductive habitat Acres**	**% of Habitat**
0	0	5,430	50
>0-30%	>0 to 2.5	2,012	19
>30-50%	>2.5 to 13.6	2,609	24
>50-80%	>13.6 to 29.2	740	7
>80%	>29.2	40	<1
	Total	10,832	100%
Sugar Pine Butte-Little Deschutes River Subwatershed			
Tolerance Level	**Snags per acre**	**Subwatershed Reproductive habitat Acres**	**% of Habitat**
0	0	1,637	26
>0-30%	>0 to 2.5	2,030	32
>30-50%	>2.5 to 13.6	2,401	38
>50-80%	>13.6 to 29.2	180	3
>80%	>29.2	18	<1
	Total	6,266 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Snag Distribution for Three-toed Woodpecker Reproductive Habitat in the Rocket Project Area

Table 126 shows the existing snag distribution for snags ≥10 inches dbh in the project area by tolerance level for the three-toed woodpecker. Approximately 39% of the reproductive habitat does not contain snags making it unlikely to be used for nesting. Less than 1% of the habitat with the snag density preferred by a majority of individuals occurs in the project area (>80% tolerance level). The remaining 61% of the habitat provides snags at varying levels for individuals.

Table 126: Existing snag distribution ≥10 inches dbh for the three-toed woodpecker in the Rocket project area by tolerance level.

Tolerance Level	Snags per acre	Three-toed woodpecker Reproductive Habitat Acres in Rocket Project area	% of Habitat
0	0	938	39
>0-30%	>0 to 2.5	927	39
>30-50%	>2.5 to 13.6	469	20
>50-80%	>13.6 to 29.2	38	2
>80%	>29.2	4	<1
	Total	2,376 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood HRV

A HRV analysis of down wood density was completed for the Forest using information from DecAID and the Viable Ecosystems model. The HRV was based on the existing condition for down wood density and not the reference condition. The following table lists HRV information for the percent of the landscape with down wood ≥5 inches dbh in the eastside mixed conifer habitat type. The existing condition (3%) for the percentage of the landscape with no down wood is less than documented for historic levels (22 to 30%) (Table 127). However, the existing condition for the remaining down wood percent cover categories with the exception of ≥16% is above HRV at 57%, 30%, 6%, and 4% respectively. This is likely due to a combination of factors. Fire suppression, in addition to insect and disease events, has resulted in high mortality in the smaller size class trees. These smaller sized trees have a high fall down rates and thus end up as down woody material.

The HRV analysis shows the amount of reproductive habitat for the three-toed woodpecker and the percent of the landscape with snags ≥10 inches dbh falls outside historical estimates for low snag densities and are below HRV for high snag densities. DecAID tolerance intervals indicates that most reproductive habitat on forest contains moderate snag densities with only 4% providing for the majority of individuals. In addition, down wood percent cover falls outside historical estimates with the majority of the forest containing moderate to high down wood densities.

Table 127: HRV analysis of the Forest with percent down wood cover in eastside mixed conifer.

Habitat Type	Percent (%) of Landscape for Down Wood ≥5 inches dbh in Down Wood Percent Cover						
	Down Wood % Cover	0	>0 to 4	>4 to 8	>8 to 10	>10 to 16	>16
EMC	HRV	22-30	53-54	13-19	2-3	1-3	0
	Existing	3%	57%	30%	6%	4%	0

The Wildlife Report provides information on forest-wide down wood distribution in three-toed woodpecker habitat. There are 10,832 acres in the North Unit Diversion Dam–Deschutes River watershed and 2,973 acres in the Sugar Pine Butte-Little Deschutes River subwatershed of three-toed woodpecker reproductive habitat. Table 128 shows the down wood distribution in the watersheds by tolerance levels. Approximately 13% of the reproductive habitat in the North Unit Diversion Dam – Deschutes River watershed and 17% of the reproductive habitat in the Lower Little Deschutes River watershed has no down wood.

Table 128: Down wood distribution ≥5 inches dbh by watershed for three-toed woodpeckers.

North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Levels	**Down Wood/Acre**	**Watershed Nesting Acres**	**% of Habitat**
0	0	1,461	13
>0-30%	>0 to 6.5	7,690	71
>30-50%	>6.5 to 17.0	1,681	16
>50-80%	>17 to 32.0	No data fits this category	0
>80%	>32.0	No data fits this category	0
	Total	10,832 acres	100%
Sugar Pine Butte-Little Deschutes River Subwatershed			
Tolerance Levels	**Down Wood/Acre**	**Subwatershed Nesting Acres**	**% of Habitat**
0	0	850	14
>0-30%	>0 to 6.5	4,269	68
>30-50%	>6.5 to 17.0	1,148	18
>50-80%	>17 to 32.0	No data fits this category	0
>80%	>32.0	No data fits this category	0
	Total	6,266 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood Cover in Three-toed Woodpecker Reproductive Habitat in the Rocket Project area

There are 2,376 acres of three-toed woodpecker reproductive habitat in the Rocket project area. Table 129 shows the down wood ≥5 inches dbh by tolerance level. Approximately 28% of the reproductive habitat does not have any down wood making it unlikely to provide suitable habitat. No data fit the >50-80% and >80% tolerance level categories. The remaining 72% provides habitat at varying levels for individuals.

Table 129: Down wood distribution ≥5 inches dbh for the three-toed woodpecker in the Rocket project area for by tolerance level.

Tolerance Level	Down Wood/Acre	Three-toed Woodpecker Reproductive habitat in Project area	% of Habitat
0	0	664	28
>0-30%	>0 to 6.5	1,493	63
>30-50%	>6.5 to 17.0	219	9
>50-80%	>17.0 to 32.0	No data fits this category	0
>80%	>32	No data fits this category	0
	Total	2,376 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the black-backed or three-toed woodpecker under Alternative 1. Indirectly, habitat trends will continue with increased stand densities, canopy cover, down woody debris and snags in the mixed conifer plant association group. However; loss of large structure will also continue with increased stand densities due to white fir outcompeting ponderosa pine. The project area will continue to become increasingly susceptible to a large scale stand-replacing fire. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013). High-intensity and/or stand-replacing fires will provide short-term nesting habitat for these woodpeckers. However, fire created snags typically only provide foraging habitat as insects occupy habitat directly after

the fire. In addition, fire killed trees typically only last as snags for approximately 9-10 years before they start to fall from decay and wind shear. The recruitment of large standing and down structure will be prolonged under this alternative.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails in woodpecker habitat will occur. Together these open roads and trails will continue to contribute to disturbance and habitat fragmentation for black-backed and three-toed woodpeckers.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 3,311 acres of black-backed woodpecker reproductive habitat in the Rocket project area, tree treatments will occur on 1,002 acres under Alternative 2, on 955 acres under Alternative 3, and on 1,706 acres under Alternative 4 (Table 130). Fuels treatments will occur on 967 acres under Alternative 2, on 695 acres under Alternative 3, and on 1,367 acres under Alternative 4 (Table 130). Alternative 3 will treat the least amount of habitat for this species.

Table 130: Acres of Black-backed woodpecker reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	226	---	---
Thinning to 60 foot average BA	359	70	337
Thinning to mixed range BA	---	403	720
Ponderosa pine restoration	314	118	317
Aspen Enhancement	1	1	1
Plantation Thin	87	139	163
Sanitation Thin	---	---	5
Ladder Fuels Reduction	35	294	163
Total acres of tree treatments	**1,022**	**955**	**1,706**
Reproductive habitat acres (%) with no tree treatments	2,289 (69%)	2,356 (71%)	1,605 (49%)
Fuels Treatments			
Mowing only	35	486	442
Mowing and underburning	932	209	925
Total acres of fuels treatments	**967**	**695**	**1,367**
Reproductive habitat acres (%) with no fuels treatments	2,344 (71%)	2,616 (79%)	1,944 (59%)

Of the 2,311 acres of three-toed woodpecker reproductive habitat in the Rocket project area, tree treatments will occur on 767 acres under Alternative 2, on 821 acres under Alternative 3, and on 1,329 acres under Alternative 4 (Table 131). Fuels treatments will occur on 720 acres under Alternative 2, on 572 acres under Alternative 3, and 1,067 acres under Alternative 4 (Table 131). Alternative 3 will treat the least amount of habitat for this species.

Table 131: Acres of three-toed woodpecker reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	143	---	---
Thinning to 60 foot average BA	247	65	226
Thinning to mixed range BA	---	291	570
Ponderosa pine restoration	287	112	268
Sanitation Thin 21 inches	---	---	2
Plantation Thin	59	109	125
Ladder Fuels Reduction	31	244	138
Total acres of tree treatments	767	821	1,329
Reproductive habitat acres (%) with no tree treatments	1,544 (67%)	1,490 (61%)	982 (43%)
Fuels Treatments			
Mowing only	22	427	319
Mowing and underburning	698	145	748
Total acres of fuels treatments	720	572	1,067
Reproductive habitat acres (%) with no fuels treatments	1,591 (69%)	1,739 (75%)	1,244 (54%)

With the exception of occasional felling of snags that pose a hazard to human safety during timber sale operations, commercial harvest treatments will have no direct impacts to snags or coarse woody material habitats in ponderosa pine and mixed conifer habitats. In the ponderosa pine restoration units, lodgepole pine and true fir are growing in areas historically dominated by ponderosa pine would be cut and removed (commercial thin). Trees to be cut would include all lodgepole pine 7-20.9" dbh and all true fir 7-20.9" dbh either with less than 50% live crown ratio or growing within or touching the dripline of desirable ponderosa pine of any size. Treatment of lodgepole pine or true fir less than 7" dbh would depend on ponderosa pine stocking, proposed use of prescribed fire, and management area objectives. Dead lodgepole pine, standing and down, will be removed. The removal of dead and down lodgepole pine will negatively impact reproductive habitat for the black-backed woodpecker on 314 acres under Alternative 2, 118 acres under Alternative 3, and 317 acres under Alternative 4 in the ponderosa pine restoration units. The removal of dead and down lodgepole pine will negatively impact reproductive habitat for the three-toed woodpecker on 287 acres under Alternative 2, 112 acres under Alternative 3, and 268 acres under Alternative 4 in the ponderosa pine restoration units.

For both woodpecker species, treatments associated with thinning from below, plantation thin, and ladder fuels will reduce denser stands, reducing the quality of the habitat for black-backed and three-toed woodpecker which prefer dense forests of smaller sized lodgepole pine trees. Trees will directly impact green tree replacements by reducing the number of residual green trees in treatment units. However the units will retain sufficient green tree replacements to provide sufficient future snag densities for habitat types.

In the short-term, thinning from below and prescribed fire will reduce the dense understory in the ponderosa pine and mixed conifer removing potential foraging habitat. Reducing understory densities will not preclude foraging, but will limit the abundance of foraging habitat, thus changing foraging behavior to focus on residual areas of denser habitat. The percent of the Rocket project area that will not be treated is 67% under Alternative 2, 61% under Alternative 3, and 43% under Alternative 4. Areas of high density pockets of down wood that will remain untreated to benefit American marten in the ponderosa pine units will also benefit the black-backed and three-toed woodpeckers.

Under all three action alternatives, there will be a decrease in black-backed and three-toed woodpecker habitat as larger areas of beetle outbreaks or burned forest will be reduced in the project area in the short-term due to stand density reduction and removal of dead and down lodgepole pine. Because black-backed woodpeckers utilize trees with heart-rot for nesting and actively seek mountain pine beetle infested trees for foraging, the green tree density reduction planned will also reduce current and future nesting opportunities where thinning will occur.

Under all three alternatives, approximately 38.6 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the black-backed and three-toed woodpeckers. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Table 132 lists the biological objectives under the Eastslope Cascades Conservation Strategy for the black-backed woodpecker which also applies to the three-toed woodpecker. The Rocket project is not applicable to this objective because no actions will occur in lodgepole pine stands, although some treatments in mixed conifer stands with lodgepole pine will occur.

Table 132: Landbird Conservation Strategy biological objectives for the black-backed woodpecker.

Black-backed Woodpecker	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Other species to benefit from objectives: Three-toed Woodpecker	Where ecologically appropriate, initiate actions in lodgepole pine forest to maintain or provide: >1,000 acres of lodgepole pine forest dominated by and managed for late successional conditions	Not applicable	Untreated areas associated with the LPP community will exceed the recommended level.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed will occur on approximately 6,560 acres of black-backed woodpecker reproductive habitat and 2,760 acres of three-toed woodpecker reproductive habitat. These projects primarily include the West Bend Vegetation Management project (approximately 6,000 acres of black-backed woodpecker habitat and 2,200 acres of three-toed woodpecker acres). Small units remain for thinning and fuels treatments on approximately 560 acres for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on approximately 200 acres. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

The ongoing and reasonably foreseeable actions are expected to treat 40% of the available black-backed woodpecker reproductive habitat and 20% of the three-toed woodpecker habitat in the watershed. The Rocket action alternatives will treat an additional 6% to 10% of the black-backed woodpecker reproductive habitat and 7% to 12% of the three-toed woodpecker habitat in the watershed depending on the alternative. Cumulatively, when the Rocket project is added to the other ongoing and reasonably foreseeable future actions, approximately 46% to 50% of the black-backed woodpecker habitat in the watershed will be treated and 27% to 32% of the three-toed woodpecker habitat will be treated. These projects will result in short-term negative impacts to prey habitat (foraging) due to fuels treatments. These projects will reduce reproductive habitat in the project area. Residual habitat will be available in the watershed in stands not treated. Both the

West Bend and Rocket project will accelerate the development of future large tree structure and down wood while reducing the risk of habitat loss due to high intensity and/or stand-replacing wildfire.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to black-backed or three-toed woodpecker reproductive habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to woodpeckers that may occur in the area.

Determination

The Rocket project action alternatives will impact 31% to 51% of the black-backed woodpecker habitat and 33% to 57% of the three-toed woodpecker reproductive habitat in the Rocket project area. Alternative 4 will have the greatest impacts and Alternative 3 the least impacts for both species. Cumulatively, in the North Unit Diversion Dam-Deschutes River watershed, approximately 46% to 50% of the black-backed woodpecker habitat and 27% to 32% of the three-toed woodpecker habitat will be treated. Across the Forest, this watershed comprises a small percentage of the black-backed woodpecker reproductive habitat at 4% and of the three-toed woodpecker reproductive habitat at 3%.

The Rocket project action alternatives are consistent with the Forest Plan standards and guidelines for Management Indicator Species (Cavity-Nesters) and Logs and Down Wood Associated Species as amended by the *Eastside Screens*. Implementation of the Rocket vegetation management project will result in a small negative trend in viability for the black-backed woodpecker or three-toed woodpecker on the Forest.

The biological objective in the Conservation Strategy of the East-Slope Cascade Mountains for the black-backed woodpecker is not applicable in the Rocket project area (Table 132).

Ponderosa Pine: Large Trees and Snags —Pygmy nuthatch, Red-breasted nuthatch, White-breasted nuthatch, and Chipping sparrow

Existing Conditions: Nuthatches

All three nuthatch species are closely associated with mature or old growth ponderosa pine forests but may be found in mixed conifer forests dominated by ponderosa pine. 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). Pygmy and white-breasted nuthatches excavate their own cavities.

Although pygmy nuthatches can utilize smaller and well-decayed ponderosa pine snags, they compete with other cavity nesters including the white-headed woodpecker and white-breasted nuthatch for ponderosa pine snags. Large snags are limited in the Rocket project area.

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).

The desired condition for nuthatch species in ponderosa pine forest is a large tree, single layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration. Landbird conservation in ponderosa pine forests emphasizes maintaining healthy ecosystems through representative focal species for three habitat conditions mentioned above (i.e. large trees, large snags, and open understory).

Conservation strategies for habitat management for the pygmy nuthatch include: (1) use of prescribed burning and/or thinning when and where appropriate to reduce fuel loads and accelerate development of late-seral conditions; (2) retain all large trees, especially ponderosa pine >20 inches dbh; (3) initiate snag creation and recruitment where necessary; (4) retain all existing snags and broken-topped trees in units; (5) implement road closures (obliteration); and (5) minimize invasion of exotic and noxious weeds and soil erosion.

Existing Conditions: Chipping Sparrow

Chipping sparrows are a focal species of more open ponderosa pine stands with active regeneration. They will nest relatively close to the ground in young pine trees 4 to 8 feet height. Their habitat is limited by the more even-aged, tall, and high density stand structure of the proposed treatment units. Conservation issues and strategies for this focal species are the same as the ones for white-headed woodpeckers and pygmy nuthatches. Chipping sparrows are apparently secure within Oregon (NatureServe 2012), and impacts to habitat will be made more on a qualitative rather than quantitative basis.

Table 133 lists the number of acres of reproductive habitat for nuthatches and chipping sparrow forestwide, in the watersheds, and in the Rocket project area. The number of reproductive habitat acres calculated for white-headed woodpecker is used for nuthatches and chipping sparrow because they have similar habitat requirements. There are 14,935 acres in the North Unit Diversion Dam-Deschutes River, 8,265 acres in the Sugar Pine Butte-Little Deschutes River subwatershed, and 2,310 acres in the Rocket project area.

Table 133: Acres of habitat for nuthatches and chipping sparrow.

Spatial Scale	Acres of Reproductive Habitat for Nuthatches and Chipping Sparrow	Percent (%)
Deschutes National Forest	198,330	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	14,935	8% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	8,265	4% of habitat forestwide
Rocket Project area	2,310	0.2% of habitat forestwide
		13% of habitat in watershed (1,916 acres)
		5% of habitat in subwatershed (394 acres)

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to pygmy nuthatch, red-breasted nuthatch, white-breasted nuthatch, or chipping sparrow under Alternative 1. Indirectly, snag habitat will be provided in the short and long-term. Previously treated stands will continue to grow, providing future late-structural habitat. Untreated dense stands will 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 will not only retard the development of large diameter (>21 inches) ponderosa pine and white-fir trees and future snags but also may hasten the development of smaller diameter snags and coarse woody debris as a result of mortality from bark beetles, disease, or fire. Large snags and downed logs will continue to be limited for the nuthatches.

Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013). The increased fire risk that will result, will put these limited habitat features at risk. If a high intensity wildfire did burn through the project area, habitat for many of

these species will be lost. Most species of MIS woodpeckers take advantage of snags and insect infestation following fire at varying degrees (Saab and Dudley 1998).

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.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails will occur. Together, these open roads and trails will continue to contribute to disturbance and habitat fragmentation for nuthatches and chipping sparrow.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Table 134 lists the acres of habitat treated by action alternative. Of the 2,310 acres in the Rocket project area, tree treatments will occur on 897 acres under Alternative 2, on 797 acres under Alternative 3, and on 1,272 acres under Alternative 4 (Table 134). Fuels treatments will occur on 918 acres under Alternative 2, on 577 acres under Alternative 3, and on 1,103 acres under Alternative 4 (Table 134).

Table 134: Acres of habitat treated for nuthatches and chipping sparrow by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	192	---	---
Thinning to 60 foot average BA	573	88	406
Thinning to mixed range BA	---	313	453
Ponderosa pine restoration	49	42	50
Plantation Thin	51	54	58
Openings in DMT	---	---	51
Ladder Fuels Reduction	32	300	254
Total acres of tree treatments	**897**	**797**	**1,272**
Reproductive habitat acres with no tree treatments	1,413 (61%)	1,513 (65%)	1,038 (45%)
Fuels Treatments			
Mowing only	39	390	177
Mowing and underburning	879	187	926
Total acres of fuels treatments	**918**	**577**	**1,103**
Reproductive habitat acres with no fuels treatments	1,392 (60%)	1,733 (75%)	1,207 (52%)

With the exception of occasional felling of snags that may pose a hazard to human safety during thinning operations, tree treatments will have no direct impacts to snags or coarse woody material habitats in ponderosa pine habitat for these species. Commercial harvest will directly impact green tree replacements (future large snags) by reducing the number of trees in treatment units. However, the units will retain sufficient green tree replacements to exceed levels for snag recruitment in the long-term. Large trees greater than 21 inches will not be targeted for removal in any treatment type.

Long-term benefits due to thinning from below will accelerate the development of large ponderosa pine trees.

Pygmy nuthatches can use a variety of ponderosa pine stands so long as there are larger or older ponderosa pines present within it. Thinning may reduce foraging substrate (i.e. stressed trees with insects) and underburning may create smaller snags in the short term, but in the long-term habitat will be improved over these acres treated through the development and growth of larger ponderosa pines.

Each species utilizes ponderosa pine habitat in a unique way, for example chipping sparrow is dependent on large trees and snags, but uses regenerating understories for foraging. Nuthatches forage in the upper canopy on the outer braches within needle clusters. All species utilize a variety of uneven aged stands at some point during the breeding season. Habitat associated with each treatment type varies greatly for these species, but all stand types provide habitat.

Disturbance to habitat may occur during treatments which may result in altering their foraging locations or behavior. All species are dependent on large tree habitat and ponderosa pine 21 inches and greater will not be targeted for removal in any treatment type. In addition large snags are not targeted for removal, but there is a possibility for incidental loss of snags during treatments.

Overall, thinning from below or plantation thinning in second growth ponderosa pine stands will treat the majority of suitable habitat for pygmy and white breasted nuthatch in the project area. Thinned areas will open up stands which should benefit these species. Treatments will accelerate the development of future LOS ponderosa pine stands as well as recruiting tree development in the understory providing addition foraging areas for chipping sparrow. Thinning will also open up site distances around suitable nest trees, which should help these species with predator avoidance around nest sites. In addition the thinning will reduce ladder fuels associated with large trees. Ladder fuel reduction will decrease risk of losing the remaining large trees. In addition, removal of the understory in overstocked stands will decrease the competition for nutrients and water, which should also lower the susceptibility to insects and disease. An important benefit to thinning is the reduction in beetle caused mortality.

Currently, there are a limited number of large snags and trees available as well as replacement large trees within ponderosa pine stands. Many of the future large trees 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 Barrett (1999) were able to show that 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Increasing growth rates will benefit these species by creating more contiguous stands of available suitable habitat in the long-term.

Burning treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Reduction of fuels will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Fuels treatments will also reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could reduce predation pressures to cavity nesters. There is the potential to lose snags during burning operations that provide reproductive habitat as well as the potential to recruit new snags during this process.

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. Long-term benefits of treatments will be a reduction of stress to 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 habitat.

Similarly, in units with 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, 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 reduce some foraging habitat for the chipping sparrow and white-breasted nuthatch the use younger stands for foraging habitat in the short-term.

In the short-term, Alternative 4 affects fewer acres of habitat than Alternative 2. However, in the long-term treatments associated with Alternative 4 are the most proactive in promoting the development of more fire resistant stands. The longevity of existing habitat will diminish in the short-term, and as a result will not promote more fire resilient stands of ponderosa pine dominated mixed conifer.

Under all three alternatives, approximately 38.6 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for nuthatch species and the chipping sparrow. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Table 135 lists the Landbird Conservation Strategy Biological Objectives for the pygmy nuthatch and chipping sparrow. The Rocket project is either consistent with the objectives, or the objective does not apply.

Table 135: Landbird Conservation Strategy biological objectives for pygmy nuthatch and chipping sparrow.

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 inches dbh and at least 2 trees >31 inches dbh	Not applicable	No trees > 21 inches will be removed in the project area with the exception of a small number of interspersed trees that may be felled to meet safety requirements. Trees > 21" dbh are not common and it is unlikely that a mean of 10 trees / acre > 21 inches dbh and 2 trees > 31 inches dbh is currently provided. Treatments will accelerate the development of large trees in the project area moving the condition towards meeting the biological objective in the long term.
	Provide a mean of 1.4 snags/acre >8 inches dbh with 50% >25 inches dbh in a moderate to advanced state of decay	Yes	Due to the amount of mortality within the watershed sufficient snags > 8' dbh exist to meet this requirement as well as those retained in the project area. No snags >25 inches will be removed in the project area with the exception of a small number of interspersed trees that may be felled to meet safety requirements. Snags >25 inches dbh are not common across the project area in the existing condition.
	CHIPPING SPARROW		
	Interspersion of herbaceous ground cover w/shrub and regeneration	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-15%

	pine patches		of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat. The percent of habitat for the chipping sparrow remaining untreated are 61% under Alternative 2, 65% under Alternative 3, and 45% under Alternative 4.
	20-60% cover in shrubs (including small trees) and >20% of shrub layer in regeneration sapling conifers, mean canopy cover 10-30%	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-15% of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat. The percent of habitat for the chipping sparrow remaining untreated are 61% under Alternative 2, 65% under Alternative 3, and 45% under Alternative 4.
	Ensure a mix of understory conditions such that 10 to 30% of the landscape meets site level conditions as describe above	Yes	>30% of the project area will be retained as untreated habitat and will meet site level conditions as described. The percent of habitat for the chipping sparrow remaining untreated are 61% under Alternative 2, 65% under Alternative 3, and 45% under Alternative 4.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed will occur on approximately 8,286 acres of habitat for nuthatches and the chipping sparrow. These treatments primarily include the West Bend Vegetation Management Project which is expected to treat 52% of the available habitat in the North Unit Diversion Dam-Deschutes River watershed (7,726 acres) through commercial thinning, mowing, and underburning. These treatments focus on managing for ponderosa pine development and sustainability and will result in long-term benefits to habitat.

Small units remain for thinning and fuels treatments within 560 acres for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on approximately 200 acres in the project area. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor disturbance during the reproductive period.

The Rocket Project will treat an additional 5% to 9% (797 to 1,272 acres) of the available reproductive habitat in the watershed depending on the alternative. Cumulatively, when the Rocket project is added to the West Bend project, approximately 60% of the habitat in the watershed will be treated (9,083 to 9,558 acres). In the long-term, these combined treatments will favor habitat for these species. None of the activities propose the removal of ponderosa pine snags that will provide reproductive habitat. A small number of snags could be lost during prescribed fire treatments; therefore, negative cumulative impacts are not expected.

Determination

Implementation of the Rocket project action alternatives i consistent with the Standards and Guidelines for the Forest Plan for Management Indicator Species (Cavity-Nesters).

Implementation of the Rocket project action alternatives is either consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains for pygmy nuthatch and chipping sparrow or they do not apply (Table 135).

Late Successional Mixed Conifer: Brown Creeper, Flammulated Owl, Hermit Thrush, and Pileated Woodpecker

Existing Conditions: Brown Creeper

The brown creeper is a focal species for large trees in the mixed conifer PAG. Marshall et al. (2003) cites literature that suggests creeper numbers are reduced by clear cutting and thinning, but they will utilize closed canopied stands. To determine potential habitat, white or Douglas-fir associations with some larger trees (>15 inches dbh) and at least 40% canopy closure were considered. Brown creeper habitat is limited by the lack of Douglas-fir in many of the mixed conifer stands. Mellen-McLean et al. (2012) suggests that brown creepers will utilize snags 9 to 20 inches dbh, but there was no information in regards to densities.

Conservation issues for this species include loss of large diameter trees (especially Douglas-fir) to logging (Altman 2000). This species is likely a forest interior species that avoids edges and openings. Conservation strategies include: (1) maintaining stands in the largest tracts possible to reduce the amount of edge and fragmentation; (2) designating areas of unmanaged late-successional forest likely to provide the most suitable reproductive habitat; (3) managing for large diameter trees through longer rotation periods; and (4) retention of trees in clumps in harvest units and primarily of Douglas-fir.

Existing Conditions: Flammulated Owl

The flammulated owl is a focal species of grassy openings and dense thickets in late-successional mixed conifer plant associations. NatureServe (2012) reports nesting densities of 1 nest per 247 acres for flammulated owls in Oregon. Flammulated owl reproductive habitat in the Rocket project area is defined as stands with a ponderosa pine component, large to medium sized trees, and at least 10% canopy closure to represent openings.

Conservation issues for this species include: (1) loss of mature and old-growth trees and snags for nest and roost sites; (2) loss of open understory because of invasion of exotics and fire intolerant species; and (3) loss of small patches of dense thickets for roosting. The conservation strategies relevant to the proposed actions include: (1) leaving patches of dense sapling thickets to function as roost sites; (2) retaining snags >12 inches dbh; (3) creating snags or nest boxes as a short-term supplement; and (4) maintaining grassy openings.

Existing Conditions: Hermit Thrush

The hermit thrush is a focal species of dense, multi-layered mixed conifer stands (Altman 2000). It 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. 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).

Conservation issues include the loss or alteration of habitats (loss of understory and structural complexity) from fire, grazing, and winter recreational activities. The conservation strategy listed to address the issues for this species is to retain tracts of forest as unmanaged or lightly managed to ensure structural diversity. Habitat in the project area is defined as multi-layered habitat in montane, eastside, and ponderosa pine/Douglas-fir mixed conifer stands with canopy closure ≥ 40%.

Existing Conditions: Pileated Woodpecker

Please refer to the species assessment for the pileated woodpecker on the Forest for more details on biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012j).

The pileated woodpecker is a year-round resident in older forests on the eastside of the Cascades. Source habitats include late seral stages of subalpine, montane, lower-montane, and riparian woodland communities (Wisdom et al. 2000a). Bull and Holthausen (1993) found that snags >20 inches dbh was the best predictor of pileated woodpecker density. They also found pileated woodpecker abundance positively increased with the amount of forests with no logging, >60% canopy closure, and old growth. Nest trees are usually found in trees with solid wood whereas roost trees are found in hollow trees. Numerous limbs may hinder movement up or down the trunk and may enhance access by predators.

Bull et al. (2007) found that insect outbreaks are a natural disturbance event integral to maintaining nesting, roosting, and foraging habitat because they provide a supply of down wood. In northeastern Oregon, pileateds foraged extensively on downed structures; the average diameter and length of down wood with recent excavations ranged from 7.8 to 8.6 inches dbh and 16 to 29.5 feet in length. Pileateds select for large diameter snags for foraging which provide greater volume of carpenter ants and beetle larvae (Raley and Aubry 2005). Bull (1980) surmised pileateds likely foraged on bark beetles in snags in Central Oregon.

NatureServe (2012) lists the pileated woodpecker as vulnerable for the state of Oregon; however, data from the North American Breeding Bird Surveys indicate an increasing population trend in both the Great Basin and statewide. The Partners in Flight species assessment database indicates this is a Regional Species of Concern. Increases in source habitat have occurred in both Ecological Reporting Units that cover the Forest due to a shift from shade intolerant to shade tolerant trees species in the lower montane and montane communities.

Loss of large diameter live and dead trees, down woody material, and canopy closure due to timber harvest eliminates nest and roost sites, foraging habitat, and cover from avian predators. Prescribed fire and mechanical fuel reduction treatments were found to reduce the amount of foraging habitat (snags, stumps, and down logs) and abundance of ant prey in the short term (1 to 3 years).

Pileated Woodpecker Snag Numbers: Wildlife Tree and Log Implementation Strategy

Table 136 lists the snag numbers for pileated woodpeckers by vegetative series and snag sizes for areas east of the NWFP line on the Forest (WLTL). Table 137 lists the snag requirements for the pileated woodpecker to support various potential population levels.

Table 136: Snag numbers for pileated woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support various % population levels for the Pileated Woodpecker
Ponderosa Pine	>20	14
	>15	211
	Total	225
Mixed Conifer	>20	14
	>15	211
	Total	225

Table 137: Snag requirements for the pileated woodpecker regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size (inches dbh)	Snags Per Acre Required
Deschutes WLTL	Ponderosa Pine, White Fir and Mixed Conifer	60%	>20	0.04
Deschutes WLTL and NWFP	Ponderosa Pine, White Fir and Mixed Conifer	40%	>20	0.02
Eastside Screens	Ponderosa Pine	100%	>15	2.25
	Mixed Conifer	100%	>15	2.25

The Wildlife Report provides information on forest-wide distribution of pileated woodpecker habitat including snag distribution.

Table 138 lists the snag distribution in pileated woodpecker reproductive habitat by tolerance levels in the North Unit Diversion Dam-Deschutes River watershed for snags ≥10 and ≥20 inches dbh based on DecAID. There is no reproductive habitat at the level preferred by a majority of individuals (>80% tolerance interval). Approximately 4% of reproductive habitat has no snags ≥10 inches dbh and 27% has no snags ≥20 inches dbh making it unlikely to provide suitable reproductive habitat. The remaining 96% of the habitat with snags ≥10 inches dbh and 74% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 138: Snag distribution in pileated woodpecker reproductive habitat by tolerance levels in the North Unit Diversion Dam-Deschutes River watershed.

Snag Distribution ≥10 inches dbh			
Tolerance Level	**Snags per acre**	**Pileated Woodpecker Reproductive Habitat Acres**	**% of Habitat**
0	0	30	4
>0-30%	>0 to 14.9	630	85
>30-50%	>14.9 to 30.1	81	11
>50-80%	>30.1 to 49.3	1	0
>80%	>49.3	1	0
	Total	743 acres	100%
Snag Distribution ≥20 inches dbh			
Tolerance Level	**Snags per acre**	**Pileated Woodpecker Reproductive Habitat Acres**	**% of Habitat**
0	0	198	27
>0-30%	>0 to 3.5	376	51
>30-50%	>3.5 to 7.8	169	23
>50-80%	>7.8 to 18.4	0	0
>80%	>18.4	0	0
Total		743 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Table 139 lists the snag distribution in pileated woodpecker reproductive habitat by tolerance levels in the Sugar Pine Butte-Little Deschutes River subwatershed. None of the reproductive habitat provides for the

majority of individuals at the levels preferred for nesting (>80% tolerance interval). Approximately 3% of reproductive habitat has no snags ≥10 inches dbh and 8% of reproductive habitat has no snags ≥20 inches dbh making it unlikely to be suitable reproductive habitat (Table 22). The remaining 96% of the habitat with snags ≥10 inches dbh and 92% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 139: Snag distribution in pileated woodpecker reproductive habitat by tolerance levels in the Sugar Pine Butte-Little Deschutes River subwatershed.

Snag Distribution ≥10 inches dbh			
Tolerance Level	**Snags per acre**	**Pileated Woodpecker Reproductive Habitat Acres**	**% of Habitat**
0	0	41	3
>0-30%	>0 to 14.9	1,215	93
>30-50%	>14.9 to 30.1	44	2
>50-80%	>30.1 to 49.3	1	1
>80%	>49.3	0	0
	Total	1,301 acres	100%
Snag Distribution ≥20 inches dbh			
Tolerance Level	**Snags per acre**	**Pileated Woodpecker Reproductive Habitat Acres**	**% of Habitat**
0	0	110	8
>0-30%	>0 to 3.5	606	47
>30-50%	>3.5 to 7.8	585	45
>50-80%	>7.8 to 18.4	0	0
>80%	>18.4	0	0
	Total	1,301 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood

Table 140 lists the down wood distribution in pileated woodpecker reproductive habitat on the Forest. Currently, 6% of the reproductive habitat forestwide (178,480 acres) does not contain any downed wood ≥5 inches dbh making it unlikely to provide suitable reproductive habitat. Approximately 28% contains down wood cover preferred by a majority of individuals (>80% tolerance level). The remaining 71% of the habitat provides varying levels of habitat for individuals.

In the North Unit Diversion Dam-Deschutes River watershed, approximately 55% contains down wood cover preferred by a majority of individuals. Only 1% of the reproductive habitat (743 acres) does not contain any downed wood habitat ≥5 inches dbh. The remaining 44% of the habitat in the watershed provides varying levels of habitat for individuals.

In the Sugar Pine Butte-Little Deschutes River subwatershed, approximately 17% contains down wood cover preferred by a majority of individuals. Only 1% of the reproductive habitat (1,301 acres) does not contain any downed wood habitat ≥5 inches dbh. The remaining 82% of the habitat in the subwatershed provides varying levels of habitat for individuals.

In the Rocket project area, there is no reproductive habitat that provides down wood ≥5 inches dbh at the level preferred by a majority of individuals. Less than 1% of the 21 acres does not provide down wood ≥5 inches dbh. The remaining 99% of the habitat provides varying levels of habitat for individuals.

Table 140: Down wood distribution for pileated woodpeckers for down wood ≥5 inches dbh.

Tolerance Interval	0	>0 to 30%	>30 to 50%	>50 to 80%	>80%	Total Acres
Percent Down Wood Cover	0	>0 to 4	>4 to 4.5	>4.5 to 5.1	>5.1	
Forestwide	11,302 (6%)	93,567 (52%)	11,339 (6%)	12,529 (7%)	49,743 (28%)	178,480 (100%)
North Unit Diversion Dam-Deschutes River Watershed	7 (1%)	212 (28%)	15 (2%)	107 (14%)	402 (55%)	743 (100%)
Sugar Pine Butte-Little Deschutes River Subwatershed	19 (1%)	250 (19%)	2 (0%)	804 (63%)	225 (17%)	1,301 (100%)
Rocket Project area	0.4 (<1%)	13 (61%)	7 (33%)	1 (5%)	0 (0%)	21 (100%)

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the brown creeper, flammulated owl, hermit thrush, or pileated woodpecker under Alternative 1 (No action). Indirectly, snag habitat will continue to be provided in the short and long-term. Previously treated stands will continue to grow providing future late-structural habitat. Untreated dense stands will continue to see increased snag recruitment through tree mortality from natural disturbances such as wildfire, wind events, insect and disease pathogens, and lightning. High tree density in some of the ponderosa pine and mixed conifer stands will not only retard the development of large diameter (>21 inches) ponderosa pine and white-fir trees and future snags but also may hasten the development of smaller diameter snags and down wood as a result of mortality from bark beetles, disease, or fire.

Large snags >21" dbh and large downed logs will continue to be limited for the brown creeper, flammulated owl, and pileated woodpecker. Dense stands of large and small diameter green trees will deteriorate in the short-term. Due to stand densities, large trees will develop slowly over the long-term and large snags for nesting will be limited in the project area.

Habitat for species that are more dependent on closed canopies and dense understories such as the hermit thrush will continue to increase over time. White-fir will continue to out-compete ponderosa pine which will result 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. 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.

Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013).

Under Alternative 1, closure of approximately 38.6 miles of Level 2 open roads will not occur, nor will decommissioning of 5.4 miles of Closed Level 1 roads and restoration of 35 miles of user-created OHV trails. Together, these open roads and trails will continue to contribute to disturbance and habitat fragmentation for these species.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 204 acres of pileated woodpecker reproductive habitat in the Rocket project area, tree treatments will occur on 3 acres under Alternative 2, zero acres under Alternative 3 and 19 acres under Alternative 4 (Table 141). No fuels treatments will occur under Alternatives 2 and 3, and 19 acres will occur under Alternative 4 (Table 141). These acres are also used to estimate reproductive habitat acres for the brown creeper, flammulated owl, and hermit thrush.

Table 141: Acres of pileated woodpecker reproductive habitat treated by alternative for the Rocket project area.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	3	---	---
Thinning to mixed range BA	---	---	19
Total acres of tree treatments	**3**	**0**	**19**
Reproductive habitat acres (%) with no tree treatments	201 (99%)	204 (100%)	185 (91%)
Fuels Treatments			
Mowing only	---	---	19
Total acres of fuels treatments	**0**	**0**	**19**
Reproductive habitat acres (%) with no fuels treatments	204 (100%)	204 (100%)	185 (91%)

With the exception of occasional felling of snags that may pose a hazard to human safety during thinning operations, tree treatments will have no direct impacts to snags or coarse woody material habitats except for lodgepole pine trees in the ponderosa pine restoration units. Commercial harvest will directly impact green tree replacements (future large snags) by reducing the number of trees in treatment units. However, the units will retain sufficient green tree replacements to exceed levels for snag recruitment in the long-term. Large trees greater than 21 inches will not be targeted for removal in any treatment type.

Overall, thinning from below or plantation thinning in second growth ponderosa pine stands will treat the majority of suitable habitat in the project area. Currently there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees are in 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 Barrett (1999) were able to show that 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Increasing growth rates will benefit these species by creating more contiguous stands of available suitable habitat in the long-term.

Reduction of fuels will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Fuels treatments will also reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could reduce predation pressures to cavity nesters. Fuels treatments could also enhance flammulated owl foraging habitat by promoting grass/forb/shrub complexities which will increase insect production. There is the potential to lose a small number of large green ponderosa pine during burning operations; however trees will remain as potential reproductive habitat.

Between 91% and 99% of the potential habitat in the project area will not be treated, leaving sufficient residual habitat for these species.

Under all three alternatives, approximately 38.6 miles of Level 2 open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the brown creeper, hermit thrush, flammulated owl, and pileated woodpecker. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Table 142 lists the biological objectives in the Eastslope Cascade Landbird Conservation Strategy for brown creeper, hermit thrush, and flammulated owl in mixed conifer. These biological objectives also benefit the pileated woodpecker.

Table 142: Eastslope Cascades Landbird Conservation Strategy biological objectives for brown creeper, flammulated owl, and hermit thrush.

Landbird Strategy Biological Objectives	Does Not Meet, Meets, Not Applicable	Rationale
BROWN CREEPER		
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 inches dbh with at least 2 trees >24 inches dbh	Meets	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
FLAMMULATED OWL		
>10 snags/100 acres, >12in. dbh and >6ft. tall	Meets	No ponderosa pine snags will be targeted for removal
>20 trees/8 acres, >21 in. dbh to function as recruitment snags	Meets	This project proposes to thin stand from below favoring ponderosa pine >20 in. dbh for retention where it occurs.
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.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed will occur on approximately 100 acres of pileated reproductive habitat. These projects primarily include the West Bend Vegetation Management project (82 acres) with a small number of acres remaining to be treated in the Fuzzy, and NNVM demo project. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on about 200 acres. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

The ongoing and reasonably foreseeable actions are expected to treat 1% of the pileated woodpecker reproductive habitat in the watershed. The Rocket action alternatives will treat an additional 0.1% of the reproductive habitat depending on the alternative. Cumulatively, when the Rocket project is added to the other ongoing and reasonably foreseeable future actions, approximately 1% of the pileated woodpecker habitat in the watershed will be treated. Residual habitat will be available in the watershed in stands not treated.

All of these projects are likely to improve habitat for flammulated owls in the long term but may be negative in the short-term. Many of the proposed and recent completed treatments have thinned the ponderosa pine

stands and appear more even aged, open and less "clumpy". Provisions within each of these project areas for big game hiding cover has provided the small dense patches that flammulated owls use. In the project area, the hiding cover is in much larger patches. It is uncertain whether this satisfies the needs of flammulated owls or if the patches are too large and widespread.

Cumulatively there will be a decrease in dense understory habitat; reducing foraging opportunities, especially for both the hermit thrush and pileated woodpecker, since the focus will be thinning dense stands of unhealthy white-fir and lodgepole pine. However, 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 to the pileated woodpecker, brown creeper, and hermit thrush. Large untreated blocks of habitat have been retained through the project area prove habitat connectivity as well as retention of habitat within each treatment unit. The project will accelerate the development of future large tree structure in mixed conifer stands while reducing the risk of habitat loss due to high intensity and/or stand replacing fire.

There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to pileated woodpecker habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to individual brown creepers, flammulated owls, hermit thrushes, and pileated woodpeckers that may occur in the area.

Determination

Implementation of the Rocket action alternatives will reduce less than 1% (up to 19) acres of habitat in the Rocket project area for these species. Cumulatively in the watersheds, 1% of potential reproductive habitat will be treated.

Implementation of the Rocket action alternatives is consistent with the Standards and Guidelines for the Forest Plan for the pileated woodpecker (Management Indicator Species: Cavity-Nesters) and for Logs and Down Wood Associated Species.

Implementation of the Rocket project action alternatives will not result in a negative change in viability for the pileated woodpecker on the Forest.

Implementation of the Rocket action alternatives is consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains for the brown creeper, flammulated owl, and hermit thrush. The proposed actions, in conjunction with other forest management projects in the project area, are expected to increase the density of large diameter snags in ponderosa pine.

Large Snags in Late-Successional Mixed Conifer: Williamson's sapsucker

Existing Conditions: Williamson's sapsucker

Please refer to the species assessment for Williamson's sapsucker on the Forest for more detailed information on biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012k).

Habitat for the Williamson's sapsucker includes old forest interior ponderosa pine, old forest aspen, and old forest cottonwood-willow, as well as old forest single and multi-strata grand/white fir, and interior Douglas-fir. Studies have shown they use both live and dead trees about equally. Live trees used by the Williamson's sapsucker for nesting usually contain advanced heartwood decay as they are weak excavators. These trees may have more opportunity for fungi invasion and heartwood decay which may suggest that the decay condition is more important than the tree species. Of the nests in dead trees, most retained much of the original bark suggesting the trees had been dead less than 3 years. Approximately 59% of nest trees in northern Washington were in decay class 1 (recently dead) while 24% were found in decay classes 2 and 3 (little to moderate decay).

The Williamson's sapsucker is a focal landbird species for large snags in the mixed conifer PAG. Conservation issues relevant to the proposed actions include loss of large diameter snags to logging and fire suppression that has resulted in closed understories which inhibit growth of large trees. The biological

objectives include: (1) extend rotation ages to retain snags; (2) retain largest live trees, particularly dying or defective trees in harvest units; (3) retain known or suitable nesting and roosting snags; and (4) restrict access from fuelwood cutters.

Although this species is highly adaptable and able to withstand disturbance, it is likely that the condition (i.e., heartwood decay), structural characteristics (tree diameter and height), and abundance of suitable nest trees are limiting factors influencing distribution and abundance in some areas of their range. Loss of large diameter snags can be attributed to logging, firewood removal, and danger tree removal. Fire suppression has resulted in a shift from shade intolerant species (western larch, western white pine, and ponderosa pine) to shade tolerant species (white fir, grand fir, and Douglas-fir). This shift has resulted in overstocked stands which inhibit the growth of large trees that are more susceptible to loss from fire, insects, and disease. Because the Williamson's sapsucker prefers softer substrate for excavation, these structures are more readily lost to fire, including prescribed fire.

Williamson's Sapsucker Snag Numbers: Wildlife Tree and Log Implementation Strategy

Table 143 lists the snag numbers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Table 144 lists the snag requirements for the Williamson's sapsucker to support various percentages of their population.

Table 143: Snag numbers for Williamson's sapsucker by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Ponderosa Pine	>20	14
	>15	211
	Total	225
Mixed Conifer	>20	14
	>15	211
	Total	225

Table 144: Snag requirements for the Williamson's sapsucker regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size (inches dbh)	Snags/Acre Required	Comments
Des WLTL and NWFP	Ponderosa Pine and Mixed Conifer	100%	>20	0.60	Retain all possible
	Ponderosa Pine and Mixed Conifer	40%	>10	0.24	
Eastside Screens	Ponderosa Pine	100%	>15	2.25	
	Mixed Conifer	100%	>15	2.25	

Williamson's Sapsucker Reproductive Habitat across the Forest

Based on modeling, there are approximately 243,364 acres of Williamson's sapsucker reproductive habitat on the Forest (Table 145). This habitat is fairly evenly distributed across 24 of 26 watersheds. Based on population trends, large-scale habitat assessments, risk factors, and snag analysis, Williamson's sapsucker populations are highly distributed and dispersed across the forest with low abundances. There are 14,805 acres of reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed, 8,204 acres in the Sugar Pine Butte-Little Deschutes River subwatershed, and 1,485 acres of in the Rocket project area (Table 145).

Table 145: Acres of Williamson's sapsucker reproductive habitat.

Spatial Scale	Acres of Williamson's sapsucker reproductive habitat	Percent (%)
Deschutes National Forest	243,364	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River Watershed	14,805	6% of habitat forestwide
Sugar Pine Butte-Little Deschutes River Subwatershed	8,204	3% of habitat forestwide
Rocket Project area	1,464	0.6% of habitat forestwide
		7% of habitat in watershed (961 acres)
		6% of habitat in subwatershed (503 acres)

Snag Distribution in Williamson's Sapsucker Reproductive Habitat on the Forest

Table 146 lists the existing snag distribution in Williamson's sapsucker reproductive habitat forestwide. Approximately 34% of the snags ≥10 inches dbh and 53% of the snags ≥20 inches dbh do not provide habitat for Williamson's sapsucker. Very little reproductive habitat forestwide (397 acres) provides for the majority of individuals as this habitat contains snags >20 inches dbh which are preferred by this species for nesting (>80% tolerance level). The remaining 66% of the habitat with snags ≥10 inches dbh and 47% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals. Approximately 3% of the reproductive habitat provides for >50 to 80% of the individuals.

Table 146: Existing snag distribution >10 inches dbh in Williamson's sapsucker reproductive habitat on the Forest. The highlighted density reflects current Standard and Guidelines.

Snag Distribution ≥10 inches dbh			
Tolerance Level	**Snags per acre**	**Williamson's Sapsucker Reproductive habitat Acres Forestwide**	**% of Habitat**
0	0	82,713	34%
>0-30%	>0 to 14.0	126,319	52%
>30-50%	>14.0 to 28.4	23,263	10%
>50-80%	>28.4 to 49.7	8,284	3%
>80%	>49.7	2,785	1%
	Total	243,364 acres	100%
Snag Distribution ≥20 inches dbh			
Tolerance Level	**Snags per acre**	**Williamson's Sapsucker Reproductive habitat Acres Forestwide**	**% of Habitat**

0	0	128,190	53%
>0-30%	>0 to 3.3	83,437	34%
>30-50%	>3.3 to 8.6	24,788	10%
>50-80%	>8.6 to 16.6	6,552	3%
>80%	>16.6	397	0%
Total		243,364 acres	100%
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Existing Snag Density and Forestwide HRV of Snag Density for Eastside Mixed Conifer

Table 147 compares the existing snag density in the eastside mixed conifer habitat type with the forestwide HRV. The existing condition (37%) for the percentage of the Forest with no snags is within the historical range of variability (32-44%). However, the existing condition for the low density snag category (0 to 4 snags per acre) is above HRV at 48% while the moderate to high snag density categories are all below HRV. This is likely because snag reductions have occurred due to vegetation management activities including historic harvesting where lower snag levels were retained, thinning, prescribed fire, and firewood collection, as well as illegal cutting of large snags and loss of snags in green forests due to wildfire.

Table 147: HRV analysis of the Forest with >20 inches dbh snags in the eastside mixed conifer habitat type. The highlighted density reflects current Standard and Guidelines.

Habitat Type	Percent (%) of Forest for Snags ≥20 inches dbh (Snags Per Acre)						
	Snag Density	0	0 to 4	>4 to 8	>8 to 12	>12 to 16	>16
EMC	Forestwide HRV	32 to 44	29 to 35	14 to 22	7 to 10	2 to 3	1 to 2
	Existing	37	48	11	3	1	0.2

Existing Reproductive Habitat and Forestwide HRV of Snag Density for Eastside Mixed Conifer

When considering just Williamson's sapsucker reproductive habitat (species specific data), approximately 53% of the Williamson's sapsucker reproductive habitat contains no snags ≥20 inches dbh (Table 148). The existing condition is higher than the percent of the forested landscape with no snags ≥20 inches dbh (32 to 44%) displayed for HRV for eastside mixed conifer habitat type. When comparing the 0 to 8.6 snags per acre category to the corresponding 0 to 8 snags per acre HRV category, the existing condition (44%) is within the HRV values of 43 to 57%. The opposite is true for the percent of the forest with higher snag densities. The existing condition for percent of the landscape with >8.6 snags per acre (3%) is well below that of the corresponding HRV values of >8 snags per acre (10 to 15%) which has negative impacts to the Williamson's sapsucker.

Table 148: Comparison of existing Williamson's sapsucker reproductive habitat to HRV for snags ≥20 inches dbh).

Williamson's sapsucker	Snag Density (snags per acre)		
	0	**0 to 8.6 (DecAID) 0 to 8.0 (HRV)**	**>8.6 (DecAID) >8.0 (HRV)**
Forestwide HRV	32-44%	43-57%	10-15%
Existing Reproductive habitat	53%	44%	3%

Snag Distribution in Williamson's Sapsucker Reproductive Habitat in the Watersheds

Table 149 lists the snag distribution in Williamson's sapsucker reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed for snags ≥10 and ≥20 inches dbh. Currently, 62% of reproductive habitat with snags ≥10 inches dbh and 81% of reproductive habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable reproductive habitat. There is no habitat provided for the majority of individuals as this habitat contains snags ≥20 inches dbh which are preferred by this species for nesting. The remaining 38% of the habitat with snags ≥10 inches dbh and 20% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 149: Snag distribution by tolerance levels for Williamson's sapsucker for snags ≥10 and ≥20 inches dbh in the North Unit Diversion Dam–Deschutes River Watershed.

North Unit Diversion Dam–Deschutes River Watershed			
Tolerance Level	**Snags per acre**	**Williamson's Sapsucker Reproductive habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	9,161	62
>0-29.9%	>0 to 14	5,025	34
30-49.9%	>14 to 28.4	593	4
50-79.9%	>28.4 to 49.7	13	0
>80%	>49.7	14	0
	Total	14,805	100%
Snags ≥20 inches dbh			
0	0	11,939	81
>0-29.9%	>0 to 3.3	2,469	17
30-49.9%	>3.3 to 8.6	395	3
50-79.9%	>8.6 to 16.6	2	0
>80	>16.6	0	0
	Total	14,935 acres	100%

Table 150 lists the snag distribution in Williamson's sapsucker reproductive habitat in the Sugar Pine Butte-Little Deschutes River subwatershed for snags ≥10 and ≥20 inches dbh. Currently, 42% of reproductive habitat with snags ≥10 inches dbh and 62% of reproductive habitat with snags ≥20 inches dbh do not contain any snag habitat making it unlikely to be suitable reproductive habitat. There is no habitat provided for the majority of individuals as this habitat contains snags ≥20 inches dbh which are preferred by this species for nesting. The remaining 58% of the habitat with snags ≥10 inches dbh and 38% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 150: Snag distribution by tolerance levels for Williamson's sapsucker for snags ≥10 and ≥20 inches dbh in the Sugar Pine Butte-Little Deschutes River subwatershed.

Tolerance Level	Snags per acre	Williamson's Sapsucker Reproductive habitat Acres	% of Habitat
Snags ≥10 inches dbh			
0	0	3,440	42
>0-29.9%	>0 to 14	4,419	55
30-49.9%	>14 to 28.4	216	3
50-79.9%	>28.4 to 49.7	28	0

>80%	>49.7	0	0
	Total	8,103 acres	100%
Snags ≥20 inches dbh			
0	0	5,039	62
>0-29.9%	>0 to 3.3	2,333	29
30-49.9%	>3.3 to 8.6	731	9
50-79.9%	>8.6 to 16.6	0	0
>80	>16.6	0	0
	Total	8,103 acres	100%

Snag Distribution in Williamson's Sapsucker Reproductive Habitat in the Rocket Project Area

Table 151 lists the snag distribution in Williamson's sapsucker reproductive habitat in the Rocket project area for snags ≥10 and ≥20 inches dbh. Currently, 37% of reproductive habitat with snags >10 inches dbh and 56% of reproductive habitat with snags >20 inches dbh do not contain any snag habitat making it unlikely to be suitable reproductive habitat. There is no habitat provided for the majority of individuals as this habitat contains snags ≥20 inches dbh which are preferred by this species for nesting. The remaining 63% of the habitat with snags ≥10 inches dbh and 44% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 151: Snag distribution by tolerance levels for Williamson's sapsucker for snags ≥10 and ≥20 inches dbh in the Sugar Pine Butte-Little Deschutes River subwatershed.

Tolerance Level	Snags per acre	Williamson's Sapsucker Reproductive Habitat Acres	% of Habitat
Snags ≥10 inches dbh			
0	0	543	37
>0-29.9%	>0 to 14	907	61
30-49.9%	>14 to 28.4	35	2
50-79.9%	>28.4 to 49.7	<1	0
>80%	>49.7	0	0
	Total	1,485 acres	100%
Snags ≥20 inches dbh			
0	0	830	56
>0-29.9%	>0 to 3.3	489	33
30-49.9%	>3.3 to 8.6	166	11
50-79.9%	>8.6 to 16.6	0	0
>80	>16.6	0	0
	Total	1,485 acres	100%

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the Williamson's sapsucker under Alternative 1 (No action). Indirectly, snag habitat will continue to be provided in the short and long-term. Previously treated stands will continue to grow providing future late-structural habitat. Untreated dense stands will 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 will not only retard the development of large diameter (>21 inches) ponderosa pine and white-fir trees and future snags but also may hasten the development of smaller diameter snags and down wood as a result of mortality from bark beetles, disease, or fire.

Large snags and large downed logs will continue to be limited for the Williamson's sapsucker. The increased fire risk will put these limited habitat features at risk. The Williamson's sapsucker will 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 will deteriorate in the short-term. Due to stand densities very few large trees will develop over the long-term and large snags for nesting will be limited in the project area.

Habitat for species that are more dependent on closed canopies and dense understories will continue to increase over time. White-fir will continue to out-compete ponderosa pine which will result 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. 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.

Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013).

Under Alternative 1, closure of approximately 38.6 miles of Level 2 open roads will not occur, nor will decommissioning of 5.4 miles of Closed Level 1 roads and restoration of 35 miles of user-created OHV trails. Together, these open roads and trails will continue to contribute to disturbance and habitat fragmentation for these species.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 1,485 acres of Williamson's sapsucker reproductive habitat in the Rocket project area, tree treatments will occur on 249 acres under Alternative 2, on 134 acres under Alternative 3, and on 405 acres under Alternative 4 (Table 152). Fuels treatments will occur on 258 acres under Alternative 2, on 169 acres under Alternative 3, and on 289 acres under Alternative 4 (Table 152).

Table 152: Acres of Williamsons' sapsucker reproductive habitat treated by alternative for the Rocket project area.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	78	---	---
Thinning to 60 foot average BA	106	2	107
Thinning to mixed range BA	---	---	145
Ponderosa pine restoration	53	31	57
Plantation Thin	12	12	13
Ladder Fuels Reduction	---	89	81
Sanitation Thin DMT	---	---	2
Total acres of tree treatments	**249**	**134**	**405**
Reproductive habitat acres (%) with no tree treatments	1,236 (83%)	1,351 (91%)	1,080 (73%)
Fuels Treatments			
Mowing only	3	94	115
Mowing and underburning	265	75	174
Total acres of fuels treatments	**268**	**169**	**289**
Reproductive habitat acres (%) with no fuels treatments	1,217 (82%)	1,316 (89%)	1,196 (81%)

The Williamson's sapsucker is dependent on large snags. Large trees >21 inches dbh (future large snags) are not targeted for removal. With the exception of occasional felling of snags that may pose a hazard to human safety during thinning operations, tree treatments will have no direct impacts to snags or coarse woody material habitats. Commercial harvest will directly impact green tree replacements (future large snags) by reducing the number of trees in treatment units. However, the units will retain sufficient green tree replacements to exceed levels for snag recruitment in the long-term.

Overall, thinning from below or plantation thinning in second growth ponderosa pine stands will treat the majority of suitable habitat within the project area. Thinning will open up site distances around suitable nest trees, which should help these species with predator avoidance around nest sites. In addition the thinning will reduce ladder fuels associated with large trees. Ladder fuel reduction will decrease risk of losing the remaining large trees. In addition, removal of understory in overstocked stands will decrease the competition for nutrients and water, which should also lower the susceptibility to insects and disease. An important benefit to thinning is the reduction in beetle caused mortality (Cochran and Barrett 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 are in 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 Barrett (1999) were able to show that 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Increasing growth rates will benefit these species by creating more contiguous stands of available suitable habitat in the long-term.

Reduction of fuels will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Fuels treatments will also reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could reduce predation pressures to cavity nesters.

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the brown creeper, hermit thrush, flammulated owl, and Williamson's sapsucker. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

All project alternatives meet the biological objectives in the Landbird Conservation Strategy for Williamsons' sapsucker: within ponderosa pine provide 1 snag per acre >18 inches in ponderosa pine with a mean canopy cover of 25 to 75%. No ponderosa pine snags are targeted for removal. The project alternatives will thin green stands from below. Residual canopy closures will exist on the low end of the 25 to 75% canopy cover range.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable vegetation treatments in the North Unit Diversion Dam–Deschutes River watershed will occur on approximately 100 acres of Williamson's sapsucker reproductive habitat. These projects primarily include the West Bend Vegetation Management project (82 acres) with a small number of acres remaining to be treated in the Fuzzy, and NNVM demo project. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on about 200 acres. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

The ongoing and reasonably foreseeable actions are expected to treat 1% of the pileated woodpecker reproductive habitat in the watershed. The Rocket action alternatives will treat an additional 1% of the reproductive habitat depending on the alternative. Cumulatively, when the Rocket project is added to the

other ongoing and reasonably foreseeable future actions, approximately 2% of the Williamson's sapsucker habitat in the watershed will be treated. Residual habitat will be available in the watershed in stands not treated. There are no ongoing and reasonably foreseeable actions contributing to cumulative impacts to Williamson's sapsucker habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to individuals that may occur in the area.

Determination

Implementation of the Rocket action alternatives will treat between 9 and 27% of the potential Williamson's sapsucker reproductive habitat in the Rocket project area. Alternative will treat the least amount of habitat (134 acres) and Alternative 4 will treat the most (405 acres). Cumulatively in the watersheds, 2% of the reproductive habitat for Williamson's sapsucker in the watersheds will be reduced. Implementation of the Rocket alternatives is consistent with the S&Gs for the Forest Plan for the species and the logs and down wood associated species. Implementation of action alternatives is also consistent with biological objectives outlined in the Conservation Strategy for the Eastslope Cascades Mountains for Williamson's sapsucker.

Mixed Conifer, Edges, and Openings Created by Wildfire: Olive-sided flycatcher and Hairy woodpecker

Existing Conditions: Olive-sided Flycatcher

The olive-sided flycatcher is a summer resident that breeds in low densities throughout coniferous forests of Oregon. It prefers forest openings or edge habitats along meadows, harvest units, rivers, bogs, and marshes (Marshall et al. 2003). 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). Nesting success for the flycatcher was highest in forest burns where snags and scattered tall, live trees remain (Marshall et al. 2003 and Wisdom et al. 2000a).

Statewide, Breeding Bird Survey population trends show a highly significant decline of 5.1% per year from 1966 to 1996. However, the Columbia Basin (Southern Cascades) shows increases of >60% for the olive-sided flycatcher compared to other areas. Factors potentially contributing to population declines include habitat loss through logging, fire suppression, and lack of insect prey resources (Marshall et al. 2003 p. 376). In addition, the juxtaposition of early and late seral habitats becomes less favorable where altered fire regimes result in fewer but larger fires (Wisdom et al. 2000a).

Conservation issues in the Eastslope Cascades Landbird Conservation Strategy related to the proposed alternatives in Rocket include: (1) changes in fire regimes that have resulted in fewer but larger fires that reduce amount of edge between early and late seral forest; and (2) brush control limits understory growth that provides insect productivity.

Existing Conditions: Hairy Woodpecker

For detailed information on this species biology, status, threats, and habitat modeling across the Forest, please refer to the Forestwide Species Assessment for the Hairy Woodpecker (USDA Forest Service 2012l).

The hairy woodpecker occurs primarily in mixed conifer and ponderosa pine forests adjacent to deciduous stands and is most common in burns or areas with mountain pine beetles (Marshall et al. 2003). There is some preference for older stands but where old trees are absent, they prefer thinned stands. They nest in dead trees with light to moderate decay. Bull et al. (1986) found that in northeastern Oregon this species nested in relatively open stands with low basal area, low stem densities, and open canopies (39% canopy cover). Most nests are in dead trees less than 5 years and preferred snags are 10 to 20 inches dbh (Bull et al. 1986, Lundquist 1988, and Kozma 2009).

Murphy and Lenhausen (1998) and Covert-Bratland et al. (2006) found that hairys were abundant 1 to 2 years post-fire and then decreased whereas Kriesel and Stein (1999) found hairy woodpeckers were the most abundant woodpecker over a 4 year post-burn period. This species also had greater relative abundance in high severity areas than in moderate severity areas (Murphy and Lenhausen 1998, Kriesel and Stein 1999,

Covert-Bratland et al. 2006).

The Breeding Bird Survey data (1966-2000) for Oregon shows a non-significant decline of 0.5% annually. Primary threats to the hairy woodpecker include loss of old-growth and large snags from wildfire suppression, timber harvest, and salvage of fire-killed trees. Other threats include predation and competition for nest cavities.

Conservation issues in the Conservation Strategy include: (1) changes in fire regimes that have resulted in fewer but larger fires that reduce the amount of edge between early and late seral forest; and (2) brush control which limits understory growth and greater insect productivity.

Hairy Woodpecker Snag Numbers: Wildlife Tree and Log Implementation Strategy

Table 153 lists the snag numbers for hairy woodpeckers by vegetative series and snag sizes for areas east of the NWFP line on the Forest.

Table 154 lists the number of hard snags needed by the Hairy woodpecker to support various percentages of their populations.

Table 153: Snag numbers for hairy woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Ponderosa Pine	>20	14
	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	211
	Total	**225**
Lodgepole Pine	>12	59
	>10	121
	Total	**180**

Table 154: Snag requirements for the hairy woodpecker regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size (inches dbh)	Snags Per Acre Required
Des WLTL and NWFP	Ponderosa Pine, Mixed Conifer, and Lodgepole	60	>10	1.54
	Ponderosa Pine, Mixed Conifer, and Lodgepole Pine	40	>10	1.15
Eastside Screens	Ponderosa Pine	100	>15	2.25
	Mixed Conifer	100	>15	2.25
	Lodgepole Pine	100	>10	1.80

Hairy Woodpecker Reproductive Habitat

Table 155 lists the number of acres of hairy woodpecker reproductive habitat modeled across the forest (USDA Forest Service 2012l). There 507,920 acres of reproductive habitat forestwide. Currently, 24 of 27 watersheds have hairy woodpecker reproductive habitat which is fairly evenly distributed across the watersheds. Based on population trends, risk factors, and snag analysis, hairy woodpecker populations are

highly distributed and dispersed across the forest with moderate to high abundance. There are 45,004 acres of reproductive habitat modeled in the North Unit Diversion Dam-Deschutes River watershed and 14,183 acres in the Sugar Pine Butte-Little Deschutes River subwatershed. There are 2,598 acres of reproductive habitat modeled in the Rocket project area.

Table 155: Acres of Hairy woodpecker reproductive habitat.

Spatial Scale	Acres of Hairy woodpecker Reproductive Habitat	Percent (%)
Deschutes National Forest	507,920	100% of Forest
North Unit Diversion Dam-Deschutes River watershed	45,004	9% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	14,183	3% of habitat forestwide
Rocket Project area	2,598	0.5% of habitat forestwide
		4% of habitat in watershed (1,823 acres)
		6% of habitat in subwatershed (775 acres)

Snag Distribution in Hairy Woodpecker Reproductive Habitat on the Forest

Table 156 lists the existing snag distribution for hairy woodpecker reproductive habitat with snags ≥10 inches dbh in green habitats across the Forest based on DecAID. Approximately 51% does not contain any snag habitat, making it unlikely to be suitable reproductive habitat. Approximately 19% of the reproductive habitat provides for the majority of individuals as this habitat is preferred by this species for nesting. The remaining 30% of the habitat provides varying levels of habitat for individuals.

Table 156: Existing snag distribution ≥10 inches dbh in hairy woodpecker reproductive habitat on the Forest.

Snags Per Acre	Nesting Parameters	Hairy Woodpecker Reproductive habitat Forestwide	% of Habitat
0	No reproductive habitat	259,208	51%
>0 to 0.1	Providing minimal reproductive habitat	No Data Fit This Category	0%
>0.1 to 3.7	Providing reproductive habitat	154,193	30%
>3.7	Providing optimal reproductive habitat	94,520	19%
	Total	507,920 acres	100%

Historical Range of Variability in Eastside Mixed Conifer Habitat Type

Table 157 lists the HRV for the percent of the habitat available forestwide with snags >10 inches dbh in the eastside mixed conifer habitat type, the dominant habitat type and size used by the hairy woodpecker. The existing condition (15%) for the percentage of the Forest with no snags is less than historic levels (18-25%). The existing condition for the 6 to 12 snags per acre category is also above HRV at 24% as is the high density snag category of >36 (8%). The existing condition for the remaining snag density categories are within historic levels. Fire suppression in mixed conifer stands has led to overstocked stands where white fir is encroaching. Competition for resources has led to increased mortality particularly in the smaller diameter

sizes. In addition, the forest has experienced large-scale wildfires in the last 10 years with many areas experiencing stand replacement or mixed severity fire.

Table 157: HRV analysis of the Forest with ≥10 inches dbh snags in the eastside mixed conifer habitat type.

Habitat Type	Percent (%) of Forest for Snags ≥10 inches dbh: Snags Per Acre						
	Snag Density	0	>0 to 6	>6 to 12	>12 to 24	>24 to 36	>36
EMC	HRV	18-25%	28-31%	15-16%	16-22%	6-10%	5-7%
	Existing	15%	30%	24%	16%	8%	8%

Comparison of Hairy Woodpecker Reproductive Habitat to HRV

Table 158 compares the hairy woodpecker reproductive habitat to the HRV in the eastside mixed conifer habitat type. Approximately 51% of the hairy woodpecker reproductive habitat with snags >10 inches dbh contains no snags. This is well above the percent of the Forest with snags ≥10 inches dbh (18-25%) for the HRV in the eastside mixed conifer habitat type. When comparing the remaining snags per acre categories to the corresponding snags per acre HRV categories, the existing condition (49%) is lower than the HRV values of 70-86%, which is not beneficial for the hairy woodpecker.

Table 158: Comparison of existing hairy woodpecker reproductive habitat to HRV.

Hairy Woodpecker	Snag Density (snags/acre)	
	0	>0.1 (Bate) >0 (HRV)
EMC HRV	15%	70-86%
Existing Reproductive Habitat	51%	49%

Snag Distribution in Hairy Woodpecker Reproductive Habitat in the Watersheds

Table 159 lists the existing snag distribution ≥10 inches dbh in hairy woodpecker reproductive habitat in the watersheds. In the North Unit Diversion Dam-Deschutes River watershed, approximately 63% does not contain any snag habitat making it unlikely to be suitable reproductive habitat. Approximately 8% of the reproductive habitat provides for the majority of individuals as this habitat is preferred by this species for nesting. The remaining 28% of the habitat provides varying levels of habitat for individuals.

In the Sugar Pine Butte-Little Deschutes River subwatershed, approximately 52% does not contain any snag habitat making it unlikely to be suitable reproductive habitat. Approximately 11% of the reproductive habitat provides for the majority of individuals as this habitat is preferred by this species for nesting. The remaining 37% of the habitat provides varying levels of habitat for individuals.

Table 159: Snag distribution ≥10 inches dbh in hairy woodpecker reproductive habitat in the watersheds.

North Unit Diversion Dam-Deschutes River Watershed			
Snags Per Acre	Nesting Parameters	Reproductive habitat	% of Habitat
0	No reproductive habitat	28,505	63
>0 to 0.1	Providing minimal reproductive habitat	No Data Fit This Category	0
>0.1 to 3.7	Providing reproductive habitat	12,815	28
>3.7	Providing optimal reproductive	3,683	8

	habitat		
	Total	45,004 acres	100%
Sugar Pine Butte-Little Deschutes River Subwatershed			
Snags Per Acre	**Nesting Parameters**	**Reproductive habitat**	**% of Habitat**
0	No reproductive habitat	7,390	52
>0 to 0.1	Providing minimal reproductive habitat	No Data Fit This Category	0
>0.1 to 3.7	Providing reproductive habitat	5,199	37
>3.7	Providing optimal reproductive habitat	1,594	11
	Total	14,183 acres	100%

Snag Distribution in Hairy Woodpecker Reproductive Habitat in Rocket Project Area

Table 160 lists the snag distribution in hairy woodpecker reproductive habitat in the Rocket project area. Approximately 54% of the project area does not contain any snag habitat making it unlikely to be suitable reproductive habitat. Approximately 12% of the project area provides for the majority of individuals as this type of habitat is preferred by this species for nesting (>3.7 snags per acre). The remaining 34% of the habitat provides varying levels of habitat for individuals.

Table 160: Snag distribution in hairy woodpecker reproductive habitat for the Rocket project area.

Snags Per Acre	Nesting Parameters	Reproductive habitat Acres	% of Habitat
0	No reproductive habitat	7,209	54
>0 to 0.1	Providing minimal reproductive habitat	No Data Fit This category	0
>0.1 to 3.7	Providing reproductive habitat	4,511	34
>3.7	Providing optimal reproductive habitat	1,592	12
	Total	13,312 acres	100%

Direct and Indirect Impacts for Olive-sided Flycatcher and Hairy Woodpecker—Alternative 1

The number of habitat acres for the hair woodpecker is also used to estimate impacts to the habitat acres for the olive-sided flycatcher due to similar habitat requirements. There will be no direct impacts to the olive-sided flycatcher or hairy woodpecker under Alternative 1 (No Action). Fire suppression has created denser conditions than what historically occurred which has resulted in a decline in open pine habitat. Over time, stocking density in suitable habitat will continue to increase, making trees susceptible to fire, which would benefit this species by providing early post-fire habitat but also potentially result in the loss of large snags need for nesting.

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails will occur. Together these open roads and trails will continue to contribute to disturbance and habitat fragmentation for the olive-sided flycatcher and Hairy woodpecker.

Direct and Indirect Impacts for Olive-sided Flycatcher and Hairy Woodpecker—Alternatives 2, 3, and 4

Of the 13,312 acres of reproductive habitat for the olive-sided flycatcher and hairy woodpecker in the Rocket project area, tree treatments will occur on 6,226 acres under Alternative 2, on 4,752 acres under Alternative 3, and on 8,232 acres under alternative 4 (Table 161). Fuels treatments will occur on 6,226 acres under Alternative 2, on 3,298 acres under Alternative 3, and on 6,604 acres under Alternative 4 (Table 161). Alternative 3 will treat the least amount of reproductive habitat for both species.

Table 161: Acres of reproductive habitat for olive-sided flycatcher and hairy woodpecker treated by alternative for the Rocket project area.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	1,668	---	---
Thinning to 60 foot average BA	2,905	833	2,084
Thinning to mixed range BA	---	1,913	3,754
Ponderosa pine restoration	321	51	350
Aspen enhancement	1	1	1
Openings in DMT	---	20	24
Openings in Deer Habitat	22	18	37
Plantation Thin	432	473	660
Sanitation Thin	---	7	302
Ladder Fuels Reduction	877	1,436	1,020
Total acres of tree treatments	**6,226**	**4,752**	**8,232**
Reproductive habitat acres (%) with no tree treatments	7,086 (53%)	8,560 (64%)	5,080 (38%)
Fuels Treatments			
Mowing only	238	1,899	721
Mowing and underburning	5,988	1,399	5,883
Total acres of fuels treatments	**6,226**	**3,298**	**6,604**
Reproductive habitat acres (%) with no fuels treatments	7,086 (53%)	10,014 (75%)	6,708 (50%)

All of the action alternatives will create some habitat for the olive-sided flycatcher by thinning and opening stands creating more edge. The fuels objectives in the project area are to create conditions whereby wildfires can be fought more effectively in the future. Wildfires will still occur in the area; however the intent of the proposed actions may make the fires less intense and extensive. Hairy woodpeckers benefit from high-intensity fires, although not on an extensive scale. Alternative 4 will treat the most amount of habitat with Alternative 3 treating the least.

Under all the action alternatives, commercial thinning from below will focus on maintaining the overstory trees in pure ponderosa pine and mixed conifer dry stands, providing overstory large tree structure. Long-term beneficial impacts of small tree thinning will be the reduction of habitat fragmentation by promoting the development of suitable habitat at an accelerated rate. Short-term beneficial impacts will be seen in the reduction of risk to existing suitable habitat and foraging habitat. This treatment will beneficial to the flycatcher and hairy woodpecker long-term by accelerating the development of large snags in more open stands for nesting and foraging habitat.

The units in mixed conifer stands contain high mortality levels from insect and disease. Treatment will remove fuel loading in these units, retaining the healthiest largest trees in the stands, and favoring ponderosa pine where it exists. The average diameter of trees removed is approximately 14 inches and in general the trees in these stands are small.

Proposed prescribed fire treatments will create a mosaic of burned and unburned habitat. This will promote

habitat for the flycatcher and hairy woodpecker by creating edge habitat adjacent to burned areas that will improve foraging opportunities for insect foraging at least short-term. In addition, the newly burned stands will provide both beetle foraging for the hairy woodpecker and a complex mixture of fire killed and green overstory to create some optimum reproductive habitat.

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for the olive-sided flycatcher and the hairy woodpecker. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Table 162 lists the Landbird Conservation Strategy biological objectives for the Mixed Conifer, Edges, and Openings Created by Wildfire conservation focus for the olive-sided flycatcher. These biological objectives also apply to the hairy woodpecker. The Rocket action alternatives either meet or are not applicable to these biological objectives.

Table 162: Eastslope Cascades Landbird Conservation Strategy biological objectives for Mixed Conifer, Edges, and Openings Created by Wildfire.

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Olive-sided Flycatcher	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.
Other species to benefit 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: 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 retain all trees/snags >20 inches dbh and >50% of those 12-20 inches 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 inches dbh and >50% of those 12-20 inches 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.

Cumulative Impacts—Alternatives 2, 3, and 4

Ongoing and reasonably foreseeable actions are expected to treat 36% (16,000 acres) of the available reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed. Of these, the West Bend

vegetation management project will treat approximately 15,500 acres of reproductive habitat. Small units remain for thinning and fuels treatments within approximately 560 acres for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts on about 200 acres. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

Of the 13,312 acres of reproductive habitat in the Rocket project area, the Rocket action alternatives will treat an additional 11% to 18% (4,752 to 8,232 acres) in the watershed. When the Rocket project is added to other projects, cumulatively 47% to 54% of reproductive habitat for the olive-sided flycatcher and hairy woodpecker will be treated in the watershed. The West Bend and Rocket project treatments will improve habitat conditions in the short and long-term by opening up stands which will improve foraging conditions. This will accelerate the development of more fire and disease resistant open stands containing large tree structure, and reduce the risk of loss of existing habitat from high intensity and/or stand-replacing fire.

There are no ongoing and reasonably foreseeable vegetation management actions contributing to cumulative impacts to olive-sided flycatcher and hairy woodpecker reproductive habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to individuals that may occur in the area.

Determination

The Rocket action alternatives will treat 47% to 62% of the olive-sided flycatcher and hairy woodpecker habitat in the Rocket project area. Cumulatively in the watersheds, 47% to 54% of the reproductive habitat will be treated, resulting in positive impacts to habitat for these species in the watershed.

Implementation of the Rocket action alternatives is consistent with the Standards and Guidelines for the Forest Plan for the hairy woodpecker (Management Indicator Species Cavity-Nesters) and for Logs and Down Wood Associated Species.

Implementation of the Rocket project action alternatives will not contribute to a negative change in viability for the hairy woodpecker on the Forest.

Implementation of the Rocket action alternatives is consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains for the olive-sided flycatcher.

Coniferous Forests: Edges – Northern flicker

Existing Conditions

Please refer to the forestwide assessment for more detailed information of the northern flicker biology, status, threats, and habitat modeling on the Forest (USDA Forest Service 2012m).

Northern flickers are perhaps the most common resident woodpecker in Oregon and can use a variety of habitat types from wilderness to backyards. The northern flicker creates more cavities, especially larger cavity sizes, for cavity nesting species than any other woodpecker species (Hutto and Gallo 2006). Most studies have found flickers prefer to nest in open habitats characterized by low basal area, low canopy cover, large snags, and high herbaceous cover (Bull 1980, Bull et al. 1986, and Marshall et al. 2003). In northeastern Oregon, nest stands contained an average of 7% log cover of logs greater than 10 inches dbh (Bull 1980).

The northern flicker is a unique woodpecker species in that it forages almost exclusively on the ground during the summer, specializing on ants and beetle larvae (Bull 1980, Bull et al. 1986, Elchuk and Wiebe 2002, and Weibe and Moore 2008). Foraging locations are characterized by short vegetation and bare ground (Elchuk and Wiebe 2002). Elchuk and Wiebe (2002) and Wiebe and Moore (2008) found that flickers tend to forage near forest edges or near small clumps of trees, possibly seeking escape cover from predators. Bull (1980) found foraging changed to excavating in dead and down woody material in the fall reflecting a decrease in ground insect availability.

Northern flickers tend to be the most abundant cavity nester in post-fire environments (Haggard and Gaines 2001, Hutto and Gallo 2006). Several studies report they occupied both logged and unlogged burn areas (Saab and Dudley 1998, Haggard and Gaines 2001, Hejl and McFadzen 2000, Saab et al. 2002, and Hutto and Gallo 2006). Haggard and Gaines (2001) found flickers nested in all treatments, including control areas, but were most abundant in stands with medium snag density (37-86 snags/acre). Saab et al. (2007) found northern flicker nest densities significantly higher in unlogged burn areas with nest densities increasing with time in both logged and unlogged areas.

Breeding Bird Survey Population trend data indicate a decreasing population trend in Oregon and in the Great Basin Bird Conservation Region. Factors for this trend include loss of open habitat and large snags from fire suppression, harvest, and post-fire salvage, competition with European starlings, pesticides, and introduction of non-native ants.

Northern Flicker Snag Numbers: Wildlife Tree and Log Implementation Strategy

Table 163 lists the snag numbers for northern flicker by vegetative series and snag sizes for areas east of the NWFP line on the Forest. Table 164 lists the number of hard snags needed by the northern flicker to support various percentages of their populations.

Table 163: Snag numbers for northern flicker by vegetative series and snag size for areas east of the NWFP line on the Forest (WLTL).

Vegetative Series	Minimum Snag Diameter (inches dbh)	Snags per 100 acres to support 100% maximum potential population
Ponderosa Pine	>20	14
	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	225
	Total	**225**
Lodgepole Pine	>12	59
	>10	121
	Total	**180**

Table 164: Snag requirements for the northern flicker regarding potential population levels.

	Veg Type/Series	Target % Potential Population Level	Minimum Snag Size in inches dbh	Snags Per Acre Required	Comments
Des WLTL and NWFP	Ponderosa Pine, Mixed Conifer, White Fir, and Lodgepole Pine	100%	>20	0.48	Retain all possible
	Ponderosa Pine, Mixed Conifer, White Fir, and Lodgepole Pine	40%	>15	0.19	
Eastside Screens	Ponderosa Pine	100%	>12	2.25	
	Mixed Conifer	100%	>12	2.25	
	Lodgepole Pine	100%	>12	1.80	

Northern Flicker Reproductive Habitat Modeled Across the Forest

Table 165 lists the number of acres of northern flicker reproductive habitat modeled across the forest (USDA Forest Service 2012m). There are 219,576 acres forestwide. Based on population trends, large-scale habitat assessments, risk factors, and snag analysis, northern flicker populations are highly distributed and dispersed across the forest with moderate abundances. There are 16,028 acres in the North Unit Diversion Dam-Deschutes River watershed and 8,543 acres in the Sugar Pine Butte-Little Deschutes River subwatershed. In the Rocket project area, there are 2,666 acres of reproductive habitat modeled.

Table 165: Acres of Northern flicker reproductive habitat.

Spatial Scale	Northern Flicker Reproductive Habitat Acres	Percent (%)
Deschutes National Forest	219,575	100% of habitat forestwide
North Unit Diversion Dam-Deschutes River watershed	16,028	7% of habitat forestwide
Sugar Pine Butte-Little Deschutes River subwatershed	8,543	4% of habitat forestwide
Rocket Project area	2,593	1% of habitat forestwide
		13% of habitat in watershed (2,118 acres)
		6% of habitat in subwatershed (476 acres)

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to the northern flicker under Alternative 1. Indirectly, large trees will continue to be at an increased risk to insect, disease, and wildfire due to overstocked stands. Currently, 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. In the event of fire, existing snags may be consumed and replaced with hard snags but generally this will not preclude use by flickers. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013).

Under Alternative 1, no road closures, decommissionings, or restoration of user-created motorized trails will occur. Together, these open roads and trails will continue to contribute to disturbance and habitat fragmentation for nesting Northern flickers.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Of the 2,593 acres in the Rocket project area, tree treatments will occur on 1,050 acres under Alternative 2, on 927 acres under Alternative 3, and on 1,433 acres under Alternative 4 (Table 166). Fuels treatments will occur on 1,069 acres under Alternative 2, on 603 acres under Alternative 3, and on 1,251 acres under Alternative 4 (Table 166).

Table 166: Acres of northern flicker reproductive habitat treated by alternative.

	Alternative 2	Alternative 3	Alternative 4
Tree Treatments			
Thinning to 40 foot average BA	209	---	---
Thinning to 60 foot average BA	572	186	454
Thinning to mixed range BA	---	325	475
Ponderosa pine restoration	176	46	180
Aspen enhancement	1	1	1
Plantation Thin	60	65	70
Ladder Fuels Reduction	32	304	253
Total acres of tree treatments	1,050	927	1,433
Reproductive habitat acres (%) with no tree treatments	1,543 (60%)	1,666 (64%)	1,160 (45%)
Fuels Treatments			
Mowing only	41	405	187
Mowing and underburning	1,028	198	1,064
Total acres of fuels treatments	1,069	603	1,251
Reproductive habitat acres (%) with no fuels treatments	1,524 (59%)	2,063 (80%)	1,415 (55%)

Large nest trees are currently limited in the Rocket project area because the majority of trees occur as small to medium in early and mid-seral stands. Past regeneration harvest that created large openings provided areas more conducive for the flicker; however these regeneration harvests are about 40 years old and understory stand densities do not provide habitat any longer. The thinning and fuels treatments planned under the action alternatives in both mixed conifer and ponderosa pine are designed to reduce the risk of high intensity wildfires in the short-term. Treatments will retain residual stand LOS characteristics in the project area and promote the development of LOS habitat in the long-term. Treatments will thin plantations which will open these areas for use by the flicker in the short-term and accelerate the development of large tree structure in theses plantations in the long-term. Treatments will maintain the largest and healthiest tree in the overstory, continuing to provide habitat also enhancing habitat by reducing stand densities to provide better foraging opportunities and access to the forest floor.

With the exception of occasional felling of snags that may pose a hazard to human safety during thinning operations, tree treatments will have no direct impacts to snags or coarse woody material habitats. Commercial harvest will directly impact green tree replacements by reducing the number of trees in treatment units. However, the units will retain sufficient green tree replacements to exceed levels for snag recruitment in the long-term. Thinning will likely reduce some foraging opportunities in the short-term.

Although the recruitment of dead wood habitats will be slow, tree treatments will provide beneficial indirect impacts by accelerating the growth of green tree replacements, ultimately providing larger diameter snags and down wood long-term. As the stands age, additional snags and logs will develop, providing a higher diversity of habitat and structure. As a result, stands will contain more abundant reproductive habitat. In the short-term, commercial thinning from below and thinning of plantation with advance regeneration will reduce the dense understory in the ponderosa pine and mixed conifer stands, which could promote ground foraging for the flicker.

Proposed fuels treatments will reduce the risk of high intensity and/or stand-replacing wildfire by thinning the understory and reducing ladder fuels. Treatments will accelerate stand development, providing long-term habitat for the flicker which prefers a variety of habitat types but prefers mature stands.

Under all three alternatives, approximately 38.6 miles of Level 2 Open roads will be closed to motorized vehicles, 5.4 miles of Level 1 closed roads will be decommissioned, and 35 miles of user-created motorized trails will be obliterated and restored after project treatments which will benefit habitat security and reduce disturbance for Northern flicker. Thinning across the project area may reduce the degree of the benefit from restoration of user-created trails by opening up stands and providing access to illegal OHV use.

Cumulative Impacts—Alternatives 2, 3, and 4

The ongoing and reasonably foreseeable actions are expected to treat 52% (8,360 acres) of the available reproductive habitat in the North Unit Diversion Dam-Deschutes River watershed. Of these, the West Bend vegetation management project will treat approximately 7,800 acres of Northern flicker reproductive habitat. Small units remain for thinning and fuels treatments (approximately 560 acres) for the Fuzzy, South Bend, and the NNVM Demo projects. Minimal impacts will occur in association with clearing and maintenance for two powerlines and a gas transmission line but these will be permanent impacts. Ongoing recreation including motorized and non-motorized trail use, dispersed camping, and hiking will result in minor impacts to habitat and disturbance during the reproductive period.

Of the 2,666 acres of Northern flicker reproductive habitat in the Rocket project area, the Rocket action alternatives will treat an additional 6% to 9% (927 to 1,433 acres) in the watershed. When the Rocket project is added to other projects, cumulatively 58% to 61% of northern flicker reproductive habitat will be treated in the watershed. The West Bend and Rocket project treatments will improve habitat conditions in the short and long-term for the Northern flicker by accelerating the development of more fire and disease resistant open stands containing large tree structure and reducing the risk of loss of existing habitat from high intensity and/or stand-replacing fire.

There are no ongoing and reasonably foreseeable vegetation management actions contributing to cumulative impacts to Northern flicker habitat in the Sugar Pine Butte–Little Deschutes subwatershed. Ongoing light recreation is anticipated to result in temporary disturbance to individuals that may occur in the area.

Determination

The Rocket action alternatives will treat 6% to 9% (927 to 1,433 acres) of the northern flicker habitat in the watershed. Cumulatively in the watersheds, 58 to 61% of the potential habitat in the watershed will be treated. Although there may be incidental impacts if existing snags were removed for safety reasons, impacts to habitat will be beneficial in the short and long-term for the northern flicker.

The Rocket project action alternatives are consistent with the Forest Plan standards and guidelines for the northern flicker (Management Indicator Species for Cavity-Nesters) and for Logs and Down Wood Associated Species.

The Rocket project action alternatives will contribute to a positive change in viability for the Northern flicker on the Forest.

Aspen: Red-breasted Sapsucker, Red-naped Sapsucker, Downy woodpecker

Existing Condition

The Rocket project area contains approximately 5 acres of aspen habitat in the eastern area of the project (Unit 900). This aspen stand is within the goshawk territory detected in 2012.

The red-naped sapsucker has been called a double keystone species as it appears to play two main roles that help to support different suites of species. It drills sap wells which provides a significant portion of its summer diet but this sap is stolen by over 40 other species. Therefore, sapsuckers make a rich resource available to numerous species during reproductive times and when they are storing fat for winter migration or hibernation (Daily et al. 1993). In addition, the red-naped sapsucker provides nesting cavities to

secondary cavity nesting species, some species which have been found to be highly associated with the presence of sapsuckers (Daily et al. 1993). They are primarily found in riparian areas or coniferous forests that include aspen (Marshall et al. 2003, NatureServe 2012). However, it is also found in cottonwood, alder, and pine forests and less frequently in mixed conifer forests (Marshall et al. 2003), as well as aspen-fir parklands, montane conifer forests, and subalpine forest edges (Walters et al. 2002). Nest trees are usually 10 to 20 inches dbh.

In green habitats, the downy woodpecker is associated with deciduous and mixed deciduous-coniferous forests or riparian areas (Marshall et al. 2003, NatureServe 2012). Downy woodpeckers occur in Oregon primarily in low to moderate elevation deciduous stands of aspen or riparian cottonwood or less often in coniferous forest (Thomas et al. 1979, Marshall et al. 2003). It is a primary cavity nester that prefers soft snags for nest sites (Marshall et al. 2003)), usually in trees 10 to 14 inches dbh. This species usually nests in a dead stub of living or dead trees and usually in wood with an advanced stage of heartrot (Marshall et al. 2003, NatureServe 2012). Potential threats to downy woodpeckers include degradation/alteration or loss of habitat, loss of snags and decayed trees, natural causes, and human induced factors (Marshall et al. 2003).

Direct and Indirect Impacts—Alternative 1

There will be no direct impacts to aspen under Alternative 1 (No Action). Indirectly, stress due to competition with conifers will continue to prolong the development of larger aspen trees. Most of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings (15,242 acres in moderate, high and extreme) indicate that many of the stands are at risk of being lost during a wildfire event (Enna 2013) including unit 900.

Direct and Indirect Impacts—Alternatives 2, 3, and 4

Under all action alternatives, the aspen in Unit 900 will be thinned to reduce tree stress and promote growth. Treatments in all action alternatives will benefit both the red-naped sapsucker and downy woodpecker through the development of a healthier and more fire resilient aspen stand for long-term habitat. Table 167 lists the biological objectives for the Red-naped sapsucker.

Table 167: Biological Objectives for Red-naped sapsucker.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
Red-naped Sapsucker In Aspen Stands Other species to benefit: Red-breasted sapsucker, downy woodpecker, and Northern goshawk	Provide >10% cover of saplings	Yes	Treatments in aspen stands are designed to increase the aspen sapling cover percent.
	Provide >1.5 trees and >1.5 snags per acres at least 39 feet tall and 10 inches in dbh	Yes	Treatments will fell live conifers, so aspen and conifer snags will remain. In addition, large aspen will not be removed.
	Initiate actions in aspen habitat to maintain or provide some areas with natural or mechanical disturbances.	Yes	Treatments will be a mechanical disturbance to reduce the competition from conifers.

Cumulative Impacts—Alternatives 2, 3, and 4

Two projects in the North Unit Diversion Dam-Deschutes River watershed will remove conifers in aspen habitat: 30 acres with the Deschutes Aspen Project and 20 acres in the West-Bend project will remove conifers within 20 acres of aspen habitat, benefitting aspen habitat long-term. Treatments in both projects

will reduce competition between conifers and aspen and stimulate regeneration, but will not remove any aspen. Both projects will enhance future nesting and foraging habitat for the red-naped sapsucker, red-breasted sapsucker, and downy woodpecker.

Determination

Implementation of the Rocket action alternatives 2, 3, or 4 will result in positive impacts to habitat for the red-breasted sapsucker, red-naped sapsucker, and downy woodpecker by accelerating the development of larger aspen trees which could potentially be used for future nest trees.

The Rocket action alternatives are consistent with the Forest Plan S&Gs for Management Indicator Species: Cavity Nesters. The Rocket action alternatives will contribute to a positive change in viability for the red-breasted sapsucker, red-naped sapsucker, and downy woodpecker on the Forest.

The Rocket action alternatives are consistent with the Biological Objectives in the Conservation Strategy for the red-naped sapsucker.

Soil Resources

Introduction and Existing Condition

Interpretations and descriptions contained in the Soil Resources Special Report rely heavily on local information derived from the Deschutes National Forest's Soil Resource Inventory (SRI, Larson 1976) and digital spatial data in the Forest Service's corporate Geographic Information System (GIS). These information sources were used along with topographic maps, aerial photographs, silvicultural reports, field-based reconnaissance and sampling, various related project reports, and agency directives to characterize local conditions and support analysis used to predict environmental consequences of the Alternatives. Actions addressed here include those associated with proposed timber harvest activities, silvicultural and forest health treatments, habitat enhancement, the presence and use of roads, mechanical fuels reduction, and prescribed fire.

Description of the affected environment is detailed in the Soil Resources Specialist Report. A brief summary is provided here. Climate is generally characterized by hot dry summers and cold moist winters. Precipitation varies from about 34 inches in southeast to about 18 inches in northwest; two-thirds of precipitation occurs during late fall and winter and much of it accumulates as snowpack. There are no perennial or intermittent stream channels in the project area. The project area sits on the northwestern flank of the Newberry shield volcano complex, and is dominated by terrain of volcanic origin.

Landforms are primarily gently to moderately-sloping lava plaint (59%) and nearly barren rough and broken lava fields (25%). Slopes on the lava plains are generally less than 15 percent except for localized areas on outcrops and ridges that may exceed 30 percent for short pitches. Other steep slopes are associated with cinder cones and buttes that dot the project area. Precipitation rapidly percolates into permeable soils and porous bedrock and is delivered to aquifers as deep seepage or to the Deschutes River as subsurface flow.

The Deschutes National Forest's Soil Resource Inventory (SRI) sufficiently depicts the general location, extent, and characteristics of different soils mapped in the project area. Soils can be grouped into general categories based on parent materials, landform, and response to land use. Table 168 displays general soil groups and their relative proportions in the project area (a soil base map is available in the Soil Resource Specialist Report).

Table 168: General Soil Groups and Their Extent in the Project Area.

General Soil Groups	Soil Map Unit Identifiers[1]	Percent of Project Area
Young basaltic lava fields, little to no vegetative cover	1	24
Ash over basaltic lava, sparse forest cover	11, 14	2
Ash over basaltic lava, variably stocked forest cover	74, 76, LD, LG, LX, LY	5
Ash over basaltic residuum[2], gentle to moderate slopes, variable to well-stocked forest cover	64, 65, 66, 70 6A, 6B, LE, LK, 6G	61
Recent cindery ash over ash over basaltic residuum, gentle to steep slopes, well-stocked forest cover	93	2
Cinder cones, moderate to steep slopes, poor to well stocked forest cover	9, 81, 82	6

[1]SRI (Larson 1976)
[2] Soil that has weathered and developed in-place from an initial parent material (rock)

The degree to which all of the ash-mantled soils are susceptible to surface erosion, compaction, and displacement is fairly uniform. Depending on slope steepness, the inherent surface erosion potential of the ash-mantled soils is low to moderate. This is primarily attributed to their sandy textures, high permeability

and infiltration rate, the dominant gentle terrain, and absence of surface water features or connected drainage networks to erode through soils.

The susceptibility to compaction is also low to moderate, primarily due to low bulk density and coarse to medium textures. A certain amount of natural recovery from compaction happens over time due to freeze-thaw action, root penetration, and the activity of soil fauna and macro biota. Recovery can be considerable where the degree of compaction is not heavy or overly hardened. Susceptibility to displacement is moderate to high depending on moisture status and slope. Ash- or pumice-mantled soils are non-cohesive and can be easily displaced by ground disturbance, particularly when very dry or on steep slopes.

Soil productivity in the project area is strongly correlated to precipitation, topographic position, soil temperature and moisture regimes, soil depth, and soil texture. Sites exhibiting the highest productivity account for about 17% of the project area, and occur in the southeastern portion of the project area at higher elevations where annual precipitation is the greatest, also on northerly aspects of most of the buttes. They support mixed conifer stands with ponderosa pine. The majority (54%) of the area however exhibits moderate productivity, and supports the ponderosa pine and the mixed pine sites.

Because of the properties, characteristics, and productivity of the ash-mantled soil groups in the project area, they function to provide a number of important ecosystem functions. They serve as an effective growing medium that store and cycle nutrients and water, furnishes habitat for beneficial soil biota and symbionts, produces biomass, and supports and regenerates a contiguous forest cover. They are capable of yielding fully-stocked forest stands, and soil quality is favorable for supporting forest ecosystems and associated land uses. Generally speaking, they are not overly sensitive to ground disturbance, possess few limitations, and are relatively resilient.

Sites exhibiting the lowest productivity are associated primarily with the nearly barren rough and broken lava fields, rocky ridges and outcrops, and shallow rocky soils (about 28% of the project area). Considered to be unsuitable for commercial timber value, they have a limited capacity to support a well-stocked contiguous forest cover. Shallow rocky sites can be difficult to restore. For example, subsoiling to ameliorate heavy compaction could be ineffective, and tree planting impractical. Low productivity soils lack resilience, and are slow to recover from disturbance.

Frost-pockets also have low site productivity. Here, cold soil temperatures prevail because of the low topographic setting. Though they support ponderosa pine, they are typically sporadically stocked and have poor growth rates. Seedlings are at risk of frost damage. Effective ground cover (i.e. litter and duff) is discontinuous and in places wholly lacking and the soil is droughty in the summer.

This too is true of certain cinder cones in the project area, where the south aspects of several buttes vegetation is sparse, absent, or dominated by brush. Slopes are comprised of unconsolidated cinders or coarse pumice-like subsoil. Conditions are usually droughty as there is little water retention. Often, soil creep (i.e., the slow imperceptible movement of soil particles downhill) is somewhat pronounced, and the slopes are very susceptible to ground disturbance. The development and strength of tree roots can be repressed. The north side of these same buttes however can be fairly productive. Because they receive less solar radiation, the annual snowpack lasts longer into the spring and evapotranspiration rates are lower, so the aspect can remain moist later into the growing season compared to the southern side.

Some soils in the Pacific Northwest exhibit a high potential for developing hydrophobic conditions as a result of high severity fire. Intense heat can alter certain organic compounds in the soil, which causes hydrocarbons to coat and sometimes bridge individual soil particles, thus preventing absorption and reducing pore space that causes soils to become temporarily water repellent. If widespread, water repellency has been shown to indirectly increase the potential for runoff and overland flow, leading to accelerated surface erosion (DeBano 1981).

Sites the most susceptible to hydrophobicity in the project area are where snowbrush and green-leaf manzanita are principle components of the understory, or in mixed conifer stands where soil organic layers are more thick and dense. These generally occur in the eastern half of the project area, and include most of

the buttes. High-intensity fire on these sites could induce water repellency, making them prone to accelerated erosion in response to a high precipitation or runoff event.

Sensitive Soil Types

A subset of soil types across 37 percent (approximately 8,300 acres) of the project area are considered to be sensitive or potentially sensitive to disturbance (see Figure 55). In the project area sensitive soils include shallow broken, uneven lava flows and ridges, frost pockets, bare cinder surfaces, and steep slopes (>30%). Considered to be "sensitive", these soil types lack resilience, which limits their capability to fully recover and function after disturbance. Recovery from disturbance may be prolonged and long-term site productivity may be diminished. Maintaining or enhancing their intrinsic productivity necessitates conservation or restorative actions. Table 169displays the groups of sensitive and potentially sensitive soils that occur and their relative extent.

Table 169: Sensitive Soil Groups and Their Relative Extent

Sensitive Soil Groups	Percent of Project Area
Young basaltic lava fields, little to no vegetative cover	24
Broken, uneven basalt outcrops and ridges, sparse forest cover	4
Steep slopes (>30%)	6
Frost pockets, gentle slopes	3
Barren cinders	<1
Total	37

Young basaltic lava fields with little to no vegetative cover comprise about 24 percent of the project area (ex. the large conspicuous lava field that emanates from the foot of Mokst Butte and divides the project nearly in north and south halves). These lavas erupted after Mt. Mazama, so they were not covered by a layer of ash. Without soil, the do not support contiguous stands of forest, and are considered to be unsuitable for commercial timber management. Other features from older lava flows also occur, and include rough broken, uneven basalt outcrops and ridges. They comprise another 4 percent of the project area and are generally sparsely stocked, although in places they can support forested patches. Even though soil is nearly absent, or shallow on rocky lava features, there are trees growing in places because of available moisture that collects in the fissures and crevices of the highly fractured basalt. For the most part, lava features are considered to be inoperable ground.

Steep slopes (≥30%) comprise about 6 percent of the project area. They are located primarily on buttes and cinder cones, but also include short steep pitches of lava outcrops and ridges. Soils consist mostly of coarse cindery colluvium or mixed cinders and ash. They are generally shallower at the top and deeper at the bottom and are non-cohesive and loose. Northern aspects usually exhibit high productivity because they receive the greatest amount of annual precipitation and a deeper snow pack, which provides available water longer into the growing season. On southern aspects productivity is comparatively lower. Sites are notably drier and brushy. Permeability of soils on the buttes is very high, so surface erosion potential is only moderate despite the steepness of slope.

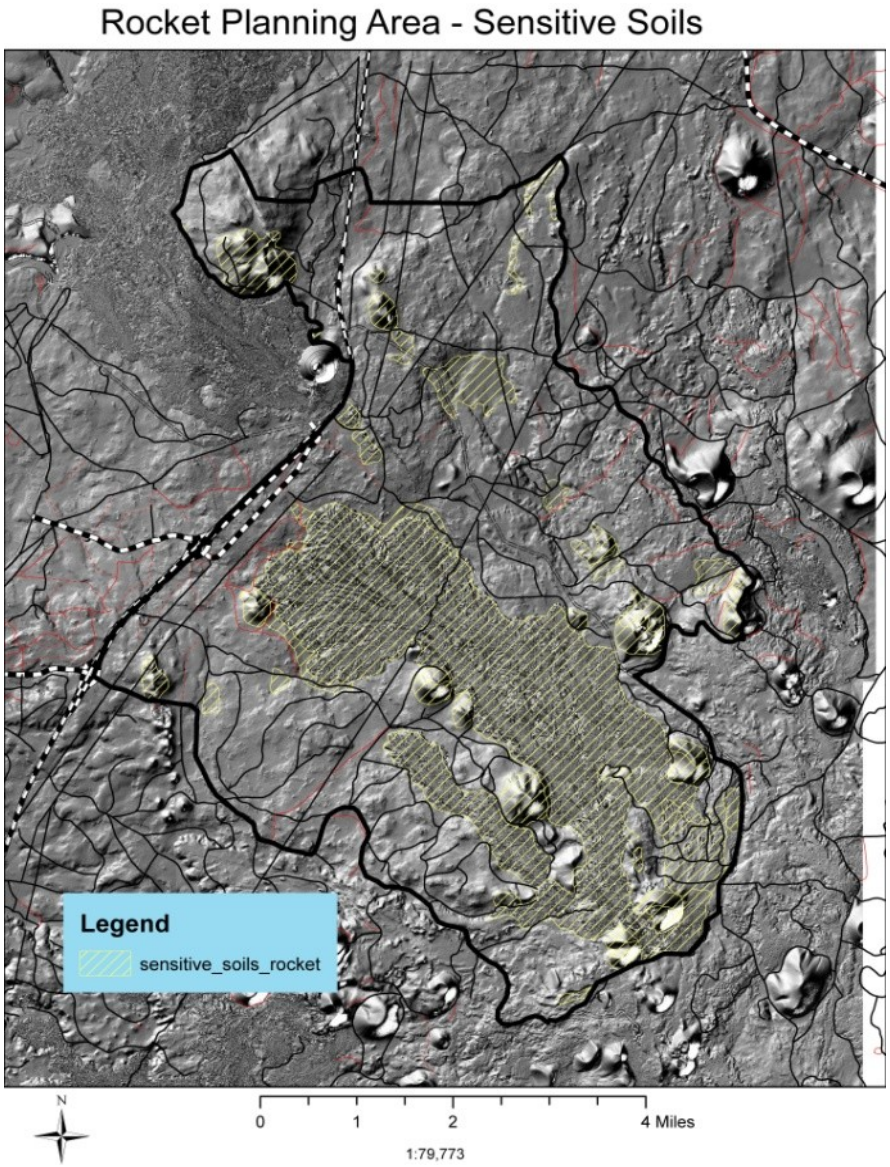


Figure 55: Sensitive soil types in the Rocket project area

Soils on slopes are very susceptible to displacement, particularly in the dry summer months, and ground disturbance from heavy equipment can truncate topsoil and organic horizons easily. Where slopes are the steepest (>50%), soils are subject to downhill creep by gravitational and other natural forces. Soil creep is a slow form of mass wasting that can be greatly exacerbated when disturbed. Resilience on slopes is low to moderate depending on the aspect. On southerly aspects, recovery of inherent productivity after disturbance could be prolonged, and heavy brush invasion is typical.

Frost pockets comprise 3 percent of the project area. These are low-lying depressions where cold air tends to gather and average annual soil temperature is comparatively low. Though these sites support ponderosa pine, productivity is low and they are mostly poorly stocked. The litter, duff, and topsoil horizons (layers) are relatively thin, primarily due to the low productivity. Yet these layers are crucial to what little productive capacity these soils possess, but because they are thin they are particularly prone to disturbance, which can lead to an excessive loss of organic material, and the effective ground cover easily denuded. Resilience in frost pockets is low, and inherent productivity after ground disturbance can be substantially diminished for the long-term.

There are several unmapped inclusions that were encountered during field reconnaissance. These are small areas where contrasting soil types, landforms, or geologic features are located. In the project area these include a rift fault, a few isolated stands of aspen, and a pumice plain. The fault extends roughly from Mokst Butte northwest across Green Mountain, and is in places exposed as a lava tube between U.S. Highway 97 and the powerlines that cross the large lava field. The exposed segments of the feature are very linear, about 2 miles in length and vary from about 40 to 50 feet in width. It demarks part of the northern boundary of the Newberry National Volcanic Monument, and is very rocky along its length.

Also associated with several of the lava fields and ridges in the project area are several small and isolated aspen stands. Aspen on the Bend-Ft. Rock Ranger District tend to be found where water is close to the surface, such as around seeps or springs, where precipitation is stored in lava or rock outcrop fissures, or where there are perched or high water tables. In the project area most of these stands are on inoperable rocky terrain, but several are located on the margins of the large lava field on operable ground and have been heavily encroached by lodgepole pine. Soils on these sites are cold and there is greater moisture content in the subsurface horizons. They are susceptible to ground disturbance and seedlings are at risk of frost damage.

A plain composed of red cinders and pumice is located just east of Mokst Butte. About half of it is non-forest, and the other half supports mixed pine sites that are poorly stocked and lack shrubs, grasses, and forbs in the understory. Ground cover is nearly absent and productivity is very poor. The plain lies mostly within the Mokst Butte Research Natural Area where forest management is deferred. These soils are very susceptible to ground disturbance because they are very loose, non-cohesive, have low water retention capability, and have little to no surface organics.

Existing Soil Conditions

The degree of management that has occurred since the early 1900s has been extensive in the project area, in large part due to its proximity to Bend. Of the area that is considered available forest (i.e., about 77%, which excludes the sparsely vegetated and young lava fields and rough, broken basalt outcrops and ridges), about 95 percent has undergone some form of management previously. Early in the 1900s, these lands were owned by the local sawmills, so nearly all of the accessible lands had been logged prior to their acquisition by the Forest Service.

Railroad logging, ground-based mechanical logging, reforestation and plantation establishment, reconstruction and continued use of roads, and other forest related management activities have occurred periodically for decades. There have also been several wildfires, prescribed fire, and slash pile burning. Off-highway vehicle use, particularly by motorcycle riders who have been creating unauthorized trails has also been ongoing. Combined these activities have resulted in a measure of ground disturbance, affecting soil quality to a variable degree.

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (USDA 2012). Soil quality can be dynamic. Soil properties can change depending on how soil is managed. Management activities can affect soil organic matter, soil structure, soil depth, and water and nutrient holding capacity. Soils respond differently to management depending on the inherent properties of the soil and the characteristics of the terrain. Ground disturbing activities have the potential to result in detrimental soil conditions which can adversely affect the long-term productivity of a site.

Prior to the 1980s soil quality standards, best management practices (BMP's), and mitigation measures were less developed and not as effective at limiting and containing detrimental soil impacts as they are now. The degree of ground disturbance was often greater than what is typically acceptable by today's standards. Since then, natural recovery from impacts has occurred to some degree depending on the inherent productivity of a site; however residual impacts remain and are detectable in many of the extensively managed stands. Detrimental soil conditions most commonly associated with the extensive land use that has occurred include heavy compaction, displacement, excessive removal of organic materials, and a minor degree of severely

burned soils (for official definitions see Forest Service Handbook, section 2520.8-1, 1998 in the Appendices).

During field reconnaissance heavy compaction and displacement were nearly always observed where there were old railway lines, roads, landings, primary skid trails, old mechanically scarified plantations, and trails (i.e., hiking or mountain bike); or where numerous repeated passes of heavy equipment had occurred. Topsoil and organic horizons have been displaced or depleted on some sites where old railroad logging activities and camps once occurred or along existing utility corridors. Severely scorched soils were observed only at a few isolated spots where large log pieces had burned such as where slash had been burned on old landings.

Soil quality has been degraded where detrimental soil conditions persist, and long-term site productivity is diminished on those sites. Roads that are part of the travel network (i.e. system roads) have been converted to a non-forest status. Other sites such as non-system roads, un-restored landings, and primary skid trails will remain heavily compacted and recovery will be prolonged. Detrimental impacts are also long-lasting where they have been incurred on sensitive soil types. Sampling data in the project area indicate that the extent of detrimental soil conditions in stands that have been logged more than once is typically at least 10 percent and in cases greater. Stands entered fewer times, or that have not been subjected to any ground-based disturbance in over 20 years tend to exhibit a lesser extent of detrimental soil conditions. In the stands proposed for treatments, the extent of detrimental soil conditions is low (i.e. less than 10%) in about a little more than half of them, in the remainder the extent of detrimental soil conditions is higher.

Restoration efforts such as road obliteration and subsoiling have taken place to offset some of the detrimental ground disturbance, mostly on decommissioned roads, as well as old landings and primary skid trails. Old landings and primary skid trails have been subsoiled across about 218 acres of the project area over the past fifteen years to ameliorate the effects of heavy compaction and to facilitate site preparation for natural regeneration and tree planting.

There is a stand condition of special note in the project area. In the 1950s and 60s mechanical scarification was used to reduce the influence of competing vegetation that was hindering the establishment and growth of tree seedlings, primarily heavy brush that had invaded in the early and late 1940s. Roughly 843 acres were scarified using bulldozers, most of which were planted with seedlings afterward to either establish new plantations or to interplant in existing young stands. The extent of ground disturbance that resulted from the mechanical scarification was substantial, often altering surface terrain features so that afterward the ground resembled terracing, particularly on slopes. Compaction can still be observed on scarified sites however it is not considered to be detrimental. This is because the dozers only made one or two passes over the same piece of ground, there was no need to repetitively scarify once brush was removed and trees were planted. As a peripheral benefit, the moderate degree of compaction and the terracing could have acted to decrease water loss by decreasing infiltration rates, which may have increased moisture retention.

Displacement on the other hand was nearly ubiquitous on the scarified acres. Surface organics (i.e., litter and duff) and top soil were mixed together then scraped and re-deposited into berms between the planting rows. During field reconnaissance, mixed humus and topsoil horizons were observable in the berms. It is believed that the degree of displacement that resulted from scarification was mostly detrimental, and likely to have diminished inherent site productivity initially. But removal of the brush provided the newly planted seedlings with full access to available soil resources and site occupancy without competition. For over 40 years soil function on the machine scarified sites has been recovering. Their nutrient status has improved as a result of an increase in the production and turn over of roots, litter, and soil biota. In that time the inherent resiliency of the soils has been such that they have continued to support growth of the young stands, which have remained fully stocked and exhibited moderate to high growth rates. Due to that resilient capacity, these stands now have grown dense and closed, and competition among individual trees for soil resources, light, and growing space has become limiting.

Sensitive Soils

Sensitive soils have also been affected by management and land use. These include most of the frost pockets, the slopes of several of the smaller buttes, and on some of the forested lavas where ground-based operations were feasible. Operations in the last several decades however have avoided these soil types. The extent of detrimental conditions across the sensitive soils that were affected is low to moderate on average (i.e., 5 to 10%). There is also about 17 miles of roads that cross over sensitive soil types, where the ground has been committed to infrastructure objectives. The majority of the road miles are small segments crossing through dry frost pockets, on steep slopes of several buttes, and over some forested lavas.

Roads, Trails, and Created Openings

There are roughly 142 miles of both open and closed inventoried system roads. There also is a notable amount of un-inventoried non-system roads. System roads represent soils where land use has been dedicated to the transportation infrastructure, converted to a semi-permanent non-productive condition. Heavily compacted, they are no longer used as growing sites. Over the last several decades, about 4 to 6 percent of the original total road miles have been permanently decommissioned, where soils are recovering and slowly reverting back to productive growing sites, or have been converted to trails where they remain dedicated to other uses such as mountain bike riding. Some of the closed and decommissioned roads have been breeched by motorized users, where recovery and re-vegetation has been thwarted.

It is estimated that there are at least 97 miles of unauthorized, user-created, single-track motorcycle trails that average about 2-foot wide in the project area. Their surfaces are heavily compacted and in places rutted, and they have been converted to a non-vegetated condition. Although their relative impact is considered low, as use continues they will become a long-lasting scar on the surface of the ground.

There have also been about 500 acres of openings created in the project area. Most were cleared for utility corridors. The Gas Transmission North line is about a 150 to 200 feet wide clearing, as is the Midstate Electric's power line corridor. These are maintained in a non-forest condition, although small trees, brush, and grasses grow there. Several cinder pits are located on small buttes and used periodically as the need arises, the amount to less than 10 acres. Their floors are hardened surfaces that are no longer capable of supporting trees, and will remain as non-forested patches until otherwise scheduled for reclamation sometime in the future.

Surface Erosion Potential

Surface erosion potential is inherently low across the majority of the project area, except on the steeper slopes where it is rated as moderate. Erosion rates are not currently accelerated to a noteworthy degree from all the past activity. Natural re-establishment of grasses, forbs, brush, tree regeneration, and reforestation has acted to effectively provide ground cover. The presence of hardened surfaces has induced a minor degree of accelerated erosion on certain sloped road segments where runoff is intercepted or there are exposed cut-banks. Small gullies have formed on the treads of certain segments that are more heavily traveled. Segments are located on both collector and secondary spur routes, of which the affected length is estimated to be about 5-6 percent of the total road miles in the project area. There is no risk of sediment being delivered to a water body from these segments because there are no water features in the area.

Coarse Woody Debris

The amount and distribution of downed coarse woody debris (CWD) has also been affected by all of the forest management activities that have occurred. CWD functions to retain moisture and moderate soil temperature. It provides habitat that supports a diversity of fungi and macro/micro invertebrates that are beneficial to soil quality, help assimilate organic carbon, and facilitate nutrient cycling. Quantities of CWD are low in some stands, particularly the dry ponderosa pine stands that were railroad logged and then thinned in the 1960s, and in some of the older scarified plantations that were established.

Attempts to retain sufficient quantities of CWD in managed stands have been a standard Best Management Practice (BMP) implemented to varying degrees over the last several decades depending on residual

amounts. Overall, there are sufficient quantities of existing and future CWD to contribute to soil function and quality across most of the eastern half of the project area, and in the dense overstocked stands where mortality is occurring. But in many of the previously thinned young ponderosa stands of the western half CWD is not overly abundant. Recruitment from standing residual trees should recur to serve as a future source.

In summary, except for those sites where detrimental soil conditions persist, soil quality across the majority of the project area is still in relatively good condition. Soils are functioning to support and maintain long-term site productivity. If they have been subject to disturbance or if they support densely stocked stands where growth has slowed they are in a status of either recovery or stasis. Due to their productive capability and resilience they continue to function to their capability, and despite the high level of prior extensive management serve as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover.

Soil Resource Protection

Protecting and conserving soil resources has been a long standing objective relative to management on National Forests. At a national level, direction has been in place for decades in Forest Service Manual 2550 that, depending on the region, translates into specific standards and guidelines that are defined in the Land and Resource Management Plans (LRMP) of individual National Forests. Generally, these objectives are aimed at maintaining or enhancing long-term site productivity so that the inherent capability and function of soil resources to support forest or range plant communities and provide for ecosystem services (ex. nutrient cycling or water storage) is enduring.

At smaller scales, achieving these objectives entails methods and practices that are implemented at the project level when activities are taking place. Referred to as Best Management Practices (BMPs), these are typically standard methods of operations intended to either avoid or minimize unwanted impacts (i.e., detrimental soil disturbance). They may become even more refined at the site-level, where project design is tailored to particular conditions and specific features of the local landscape.

Application of broad-scale conservation objectives, coupled with the implementation of site-level design and protection measures is intended to contain the accrual of detrimental soil impacts that can occur as a result of ground disturbing activities, and limit their extent to an acceptable degree. Together these are the principle means for protecting and conserving soil resources so that long-term site productivity is assured.

Forest-Wide Standards and Guidelines

Direction for managing soil resources within the project area include the Deschutes National Forest Land and Resource Management Plan (LRMP, USFS 1989) and the Newberry National Volcanic Monument (NNVM) Management Plan (USFS 1994). Both define standards and guidelines (S&Gs) intended specifically to maintain long-term site productivity and minimize or prevent undesirable impacts to soil resources on lands within their purview. Standards and guidelines relative to soils are considered to be more restrictive in the NNVM plan than those from the LRMP, and have precedence within the monument.

Central to the S&Gs in both management plans is the minimization, or containment of, or rehabilitation of detrimental soil disturbance. Definitions of the types of detrimental soil impacts are listed in the Appendices, but essentially they are of the kind that adversely affects the inherent capability of the soil to function, impairing long-term site productivity. Typically these impacts are associated where disturbance has been heavy such as roads, landings, and primary skid trails. But they may also occur as a result of other ground disturbing activities, particularly those that impact a site repetitively.

Standards and Guidelines applicable to the proposed activities of the Rocket project, and applicable to lands *outside* of the NNVM include the following paraphrased from Chapter 4, pages 70 and 71 of the LRMP:

SL-1. Management activities will be prescribed to promote maintenance or enhancement of soil productivity. The potential for detrimental soil damages will be specifically addressed through project environmental analysis.

SL-3. Leave a minimum of 80 percent of an activity area in a condition of acceptable productivity for trees and other managed vegetation following land management activities.

SL-4. Any sites where this direction cannot be met will require rehabilitation.

SL-5. The use of mechanical equipment in sensitive soil areas will be regulated to protect the soil resources.

SL-6. In order to minimize erosion by water and wind, ground cover objectives should be met within the first 2 years after an activity is completed.

Standards and Guidelines relative to soil resources within the NNVM include the following, paraphrased from pages 21 to 23 of the Monument's management plan:

M-7: Project planning shall include measures to protect and where desirable enhance soil productivity, and to mitigate disturbance to the soil resource. The intent is to retain the land's capability to support natural plant establishment and growth.

- Within recreational developments, administrative sites and trails, some decrease in soil productivity is unavoidable. Where feasible, accelerated loss of surface soils due to visitor use should be corrected, using native materials and vegetation where possible. New trails will be located, and existing trails may be relocated, to avoid sensitive and wet-soil areas, such as meadows, lake shorelines, and riparian areas.
- In prescribed burning activities, where feasible, avoid burn piles or burning high concentrations of fuels on sensitive soils and/or steep slopes.

M-13: Where feasible and practical, favor manual methods for vegetation restoration activities. If mechanized equipment must be used, choose equipment and methods that avoid or reduce undesirable impacts to soils and damage to vegetation intended to remain on the site. The following guidelines are some ways to avoid or reduce undesirable impacts when heavy machinery is used:

- Consider aerial or cable systems on slopes sensitive to soil displacement
- Use designated travel routes for heavy equipment
- Limit machinery operations to times when soils are least likely to be disturbed or compacted, such as when they're dry, frozen, or covered with snow.

M-14: Machine piling of slash during fuels treatments should be used only when no other method can accomplish objectives, and should generally be avoided on slopes over 30 percent. Minimize impacts of machine piling by piling no more than needed to break up fuel continuity.

Not all ground disturbance is considered to be detrimental or long-lasting. There also is a degree of detrimental soil impacts that are unavoidable and considered acceptable. In view of the LRMP S&Gs, particularly SL-3, the extent of detrimental soil disturbance considered to be acceptable is 20 percent of an activity area, which is also stated in Forest Service Manual Regional Guidance (FSM 2520.98-1, Region 6 Supplement 1998). Beyond that degree, detrimental soil conditions is to be contained by either avoidance or prevention (i.e., project design or BMPs), or ameliorated through mitigation (mitigation is addressed in this report as a subsection of Section 4, Environmental Consequences). In the regional direction there are also provisions that address circumstances when a proposed activity would occur in an area where the extent of detrimental soil conditions already exceeds the 20 percent mark. In this case, post-operation detrimental soil conditions should not exceed what they were prior to the activity.

Project Design Criteria and Best Management Practices

Practices listed in Chapter 2 are oriented toward avoiding or minimizing detrimental soil disturbance and are specific to achieving the NNVM plan and LRMP S&Gs for soil resources. Project Design Criteria (PDCs), which are typically site specific, can differ between alternatives depending on the proposed activities. See the Appendices for unit-specific detail and listings.

PDCs and BMPs intended to minimize ground disturbance are usually implemented at the same time and place of an activity. While PDCs are more site- or condition-specific, BMPs are considered standard operating procedures and apply to all activities. Some are intended specifically to minimize ground disturbance. A common example would be to re-use existing landings in an activity area rather than create new ones.

PDCs that address specific soil concerns in the Rocket project area are listed in the Resource Protection Measure section beginning on page 32. Primary concerns include: areas where the extent of detrimental soil disturbance is already high (i.e. >10% of an activity area), which accounts for about 41 percent of the stands proposed for treatment. PDCs to be employed where these concerns prevail are intended to provide a greater level of protection than standard BMPs. The analysis of the effects of the proposed activities assumes the implementation of BMPs and PDCs. See Appendix C for more detail and unit-specific listings.

Analysis Methods and Assumptions

Analysis of the anticipated effects to soil resources was conducted using a methodology that is essentially qualitative, but with a quantitative component. The quantitative extent of detrimental soil conditions was estimated using sampling data, field reconnaissance, GIS analysis, and aerial photographic interpretation; which also functioned as the basis for deriving and validating assumptions and inferences. Effects to soil quality were determined qualitatively based upon select physical and biological properties fundamental to the sensitivity and resilience of soils to certain types of disturbances. Factoring both the quantitative extent of detrimental soil conditions with the qualitative assessment of response to disturbance served as the method for predicting the potential effects to soil quality.

Generally, thinning of dense stands is considered a means of enhancing the dynamic productivity of a site. In overstocked stands the demand on soil water, nutrient capital, and growing space are at a premium. Tree growth is slowed measurably by competition for these resources along with light. Thinning overstressed stands can improve a site's growing environment and enhance the availability of soil resources for the remaining vegetation (Busse et al 2008, Busse and Riegel 2005, Oliver and Larson 1996, Busse et al 1996). If the extent of detrimental soil conditions that result from ground-based mechanical treatments is kept to a minimum, thinning could benefit long-term site productivity. Thinning however is not usually considered an ameliorative treatment that is expressly used to mitigate or offset the extent of detrimental soil conditions caused by ground disturbance from heavy equipment.

Overstory treatments would be commercial timber harvest activities where mechanized cutting and skidding of logs would necessitate a landing and skid trail network, and in places temporary roads for product transport. Overstory treatments in dense, overstocked stands typically require a post-harvest understory treatment to remove small diameter, non-commercial trees followed by slash abatement. Combined, these are the activities that transmit the greatest potential for direct effects to soil resources that can increase the extent of detrimental soil conditions.

This sequence of operations can take years to complete. If slash is treated mechanically and piled using heavy equipment then a stand can be subject to multiple machine entries in a sequence. These are the types of operations where ground disturbance is greatest and notable increases in the extent of detrimental soil conditions can be expected. Non-commercial thinning treatments or fuels reduction may also use heavy equipment and cause increases. For successive mechanized treatments, mitigation, BMPs and action-specific design criteria are usually necessary to contain detrimental soil conditions from increasing beyond an unwanted level. For management sequences that involve multiple machine entries and that occur in previously treated stands, maintaining soil quality often requires amelioration of detrimental soil impacts afterward. Due to the multi-year nature of sequenced treatments however, and the timing and availability of funding, mitigation may not occur until 5 years or more post-harvest.

Non-mechanized treatments such as precommercial thinning, or thinning to reduce ladder fuels are typically a sequence of hand treatments where ground disturbance is negligible. Heavy equipment and machinery are not always used. Prescribed fire and pile-burning are generally considered to be similarly light-handed,

primarily because the scope and magnitude of safety practices, control methods, contingency plans, burning procedures, and smoke regulations typically result in a light severity burn. Underburning is also used to emulate a more natural disturbance regime, and is a means for re-introducing fire to forest types more inherently adapted and prone to frequent, low-intensity wildfire. Underburning is typically used as a tool for the long-term maintenance of the understory to prevent the build-up of ladder fuels, and generally occurs 2 to 10 years after harvest. Often it is preceded by a fuels reduction treatment such as mowing to facilitate control of fire behavior, burn intensity, and duration.

Effects to soil resources from the combination of thinning and underburning is a trade-off for the effects that could be realized if wildfire were to burn with extreme behavior and intensity in dense overstocked stands where fire has been excluded. In the dense overstocked stands, wildfire could cause prolonged and intense heating, resulting directly in detrimentally burned soil conditions. Soil organic matter, essential nutrients, and biota could be volatilized; indirectly leading to a long-term decline in site productivity. The accumulation of organic biomass could remain diminished over the long-term, especially on sites where productivity is low. Re-colonization by soil organisms would occur slower since new plant growth and soil organics would take longer to reestablish and accumulate. In turn, essential nutrients, particularly nitrogen that had been volatilized as a result of intense heat, would take longer to replenish than compared to a light intensity burn.

High severity fire could also severely compromise soil ecological diversity; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer plant species that could be slower to develop into a more diverse composition. Sites of marginal productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonized burned over ground; particularly sensitive soils (i.e., droughty, low precipitation, shallow rocky soils, steep south-facing slopes, and frost-prone soils). An extreme wildfire event could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic runoff events and wind. Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality.

In contrast prescribed burns are typically low intensity and low severity fires that are implemented 2 to 10 years after thinning to curtail the build-up of re-growth, in-growth, and detritus such as brush, small trees, and fine fuels. Except for leave patches that have been retained, canopy conditions have been opened up by previous thinning so they are less prone to intense and severe crown fire. Prescribed underburns are planned so that flame intensity and burn duration are controlled and limited. The majority of the larger trees (typically $\geq$8”) are intended to be retained.

Variation of burn intensity is intended to be minimal, ranging primarily between low and moderate levels with smaller patches occasionally burning hotter. Often there are also an abundance of unburned patches where the continuity of the understory and fuel bed is irregular. There is hazard associated with underburning. Even though underburning can enhance site productivity by reducing understory competition, and it could reduce the threat of losing a dense stand by intense wildfire, there is a risk of losing control. Should an underburn “get away” and burn too hot, it could denude the effective ground cover, exposing bare soil that could lead indirectly to accelerated surface erosion. Additionally, without a measure of recovery of the understory, the advantageous effects of root and litter production and turnover, and the increase in soil biota would be truncated, lessening the capability to cycle available of essential nutrients (Busse et al 1996).

Detrimental soil conditions resulting from prescribed underburns are typically low, with the extent of severe soil scorching being proportional to the severity of fire at the soil surface, and the location, concentration, arrangement, and soundness of larger fuels close to or in contact with the soil surface such as old stumps and downed logs. Certain sensitive soils such as droughty sites, frost pockets, and shallow rocky soils; or highly disturbed sites can be an exception where prescribed fire can have deleterious effects on productivity and function. Monitoring data on the Bend-Fort Rock District indicate that the extent of detrimental soil burning resulting from prescribed fire averages less than 5 percent. Central to these findings is that much of the underburning is typically conducted after mechanical treatments have removed the bulk of the slash and biomass that was on-site prior to initial entry. Detrimentally burned soil conditions after prescribed

underburns are typically only observed where large, dead, partially sound fuels have burned hot for a long duration.

Soil organisms are essential to long-term site productivity (Borchers and Perry 1990). Invertebrates such as earthworms and insects; microbiota such as bacteria, algae, protozoa, rotifers and nematodes; symbiotic organisms such as nitrogen-fixing bacteria and mycorrhizal fungi are instrumental in the cycling and transformation of nutrients available for plant uptake. Organic matter in litter, duff, and topsoil horizons serve as the medium where soil biota and organisms thrive. Effects of prescribed underburning to soil nutrient status and soil biota are proportional to the depth and extent of forest floor consumed (McNabb and Cromack 1990). Light intensity burns characteristically only char the top several inches of the litter and duff without consuming them entirely across large contiguous patches. Because the degree of heat becomes less lethal to soil biota with depth, unconsumed organic matter and surviving plants on the forest floor and in the soil surface provides refuge where surviving organisms and seeds can re-colonize and germinate. Fine detritus from intact overstory trees annually shed needles and twigs where they begin to re-develop, or contribute to an effective ground cover.

Microorganisms, particularly symbionts like nitrogen-fixing bacteria and mycorrhizal fungi help restore soil function by re-assimilating and converting essential nutrients such as nitrogen into forms available for plant uptake and facilitating nutrient cycling. Immediately following light intensity fire there is an initial release of cations and nutrients into the char and ash from combusted plant tissues for soil microorganisms to utilize and take advantage of (Debano et al. 2005). In fire adapted ecosystems where the historical regime is characterized by short return intervals this contributes to the capability of soil biota to recover quickly so that negative effects of low intensity fire to their diversity and function are low. After prescribed underburning their ability to assimilate, convert, cycle, and fix nutrients should become fully functional in the near-term. Effects of light intensity underburning to the inherent nutrient status of soils would be expected to diminish in the short term as long as some proportion of the understory vegetation is retained.

The potential for light intensity underburning to induce water repellency (i.e., hydrophobicity) is low. In the western half of the project area soils are not particularly susceptible to hydrophobicity. Soils in the south-eastern two-thirds are more susceptible, but only in the event of a high intensity wildfire. Light intensity prescribed fire would not be expected to induce hydrophobic conditions. If a high intensity wildfire occurred, soils on steep slopes in the southeastern portion of the project area would be the most prone to hydrophobicity and potential high runoff and accelerated erosion.

Ground disturbance from mechanically mowing brush is considered to be negligible. Equipment types used are typically relatively light-weight and have either small rubber tracks or over inflated agricultural tractor tires that exert a low ground effect. When operating, mowers generally work back-and-forth in strips like mowing grass in a yard. They usually pass over a piece of ground only once to mow it. Their low ground effect coupled with few passes results in minimal ground disturbance. Additionally, mechanical mowing does not remove biomass, but rather reduces its size and re-arranges its distribution. The resultant mulch remains on-site and is contributed to the litter later on the forest floor where it eventually will break down to become humus (i.e., duff) and soil organic matter.

Due to the variability of ground disturbance in the Rocket project area, the quantitative extent of detrimental soil conditions was characterized for this analysis by categorizing them into condition classes. Soil condition classes represent a range of the aerial extent of detrimental soil conditions. Expressed as a percentage, the proportion of each class was estimated for every delineated unit or stand. Three soil condition classes were defined. They are:

- Soil Condition Class 1: less than 10 percent detrimental soil conditions
- Soil Condition Class 2: 10 to 20 percent detrimental soil conditions
- Soil Condition Class 3: greater than 20 percent detrimental soil conditions

The upper limit of condition classes were based on LRMP direction relative to maintaining 80 percent of an activity area in a condition of acceptable productivity (LRMP 1989). Further stratifications were based upon

the sensitivity of data to be able to estimate the gradations of detrimental soil conditions and their extent. These gradations then became a method for assessing the relative risk of a particular treatment or activity to increase the extent of detrimental soil conditions to a level that compromises soil quality and long-term site productivity. Units estimated to have a high proportion of their acreage in the uppermost condition class were identified as having the greatest potential for incurring a level of detrimental soil impacts that put at risk the productivity standards set forth in the LRMP.

There is an important detail about soil condition classes to be aware of. Though they convey an estimate of the range of detrimental soil conditions that extend across an activity area, they also passively imply the extent of soil conditions that are *not* detrimental. If for example an activity area is designated to be in soil condition class 2, meaning detrimental soil conditions comprise less than 20 percent of its area, then the converse is that soil conditions across at least 80 percent of that unit's area are in good condition. This reflects the variability of effects that is typical after ground disturbance, whereby detrimental conditions are associated with the intensity of the impact. For ground-based operations detrimental soil impacts are inextricably tied to the routes and repetitiveness of travel by heavy equipment such as the network of roads, landings, and skid trails needed for logging. Relative to fire, detrimental soil impacts are associated with the areas where burn severity and duration would be the greatest. Thus after an activity there is a proportion of the unit not heavily disturbed so overall the soil impacts could be low or nominal.

Estimates of the extent of detrimental soil conditions constitute direct effects, which primarily include heavy compaction, detrimental displacement, and excess removal of organic material. Sites where these impacts most commonly occur are roads, landings, and primary skid trails. Sensitive soils and extensively managed sites are the most prone to ground disturbance.

Direct effects such as detrimental soil conditions can indirectly affect soil quality further. For the Rocket project indirect effects were assessed qualitatively. Indirect impacts to soil quality were assessed by evaluating the cause-and-effect relationships between ground-disturbing activities and alterations to physical and biological soil characteristics that can lead to on-site losses to productivity at a later time; or off-site impacts such as sedimentation to water quality. Although this is a simplistic approach, it serves as a first approximation of potential indirect effects useful for comparing alternatives.

Indirect effects of proposed activities are primarily associated with adverse impacts to soil quality that translate to a decline of site productivity that persists into the future. This is an indirect effect in that it emerges after the direct impact on the ground. Indirect effects relative to soils that are translated off-site as a consequence of concentrated disturbance are typically associated with erosion and sedimentation. For the Rocket project area, the inherent surface erosion potential across the project area is predominantly low. Accelerated erosion is not considered to be an issue of primary concern because soils and the underlying bedrock are very porous, infiltration rates are rapid, and the drainage network is mostly disconnected and lacking surface features. Furthermore, intense highly erosive runoff events in the area do not commonly occur. There are very few linkages between the road and stream networks. Thus issues and concerns relative to road-related erosion and the indirect effects of sediment delivery are slight for the Rocket project.

Cumulative effects were analyzed qualitatively. They were assessed by evaluating existing detrimental soil conditions in relation to where proposed activities would occur. Detrimental soil conditions exist in most previously managed stands, some of which are proposed to treat again. Not all ground disturbances in previously managed stands however are detrimental. But where re-entry treatments are proposed a proportion of the existing low level disturbance will be exacerbated to some degree. Cumulatively the past, present, and reasonably foreseeable actions in the project area where ground-disturbing activities have overlapped one another constitute the basis for analysis. Ameliorative factors such as avoidance, mitigation (ex., subsoiling, fertilization, mulching, etc.), and recovery were then factored in. Simplistically, the cumulative assessment can be represented as the following qualitative sequence, which can be used to evaluate the probability of a unit's soil condition class increasing or decreasing as a result of a proposed activity:

- (existing + predicted effects + present and foreseeable actions) – (avoidance + minimization + mitigation + natural recovery)

A basic assumption to the approach was the use of a recovery factor. Based upon sampling and field reconnaissance, units where management had occurred more than 20 years ago it is inferred that the degree of heavy compaction, and especially detrimental displacement, has been alleviated somewhat, depending upon the treatment that had occurred and the soil type. Recovery from heavy compaction and displacement occurs by the combined processes of water movement, wetting and drying, frost action, daily temperature fluctuations, root growth, the actions of soil biota and biogeochemical processes, organic inputs, windthrow, burrowing animals, and time. While the assumption cannot be strictly applied across all the acreage treated 20 years prior, field sampling suggests that in some stands where older, extensive ground-based logging methods had occurred, the extent of detrimental soil conditions was less than 5 percent. Exceptions to the recovery factor assumption are present. Particularly on sensitive soils on steep slopes, shallow rocky sites, and frost pockets with very low organics and thin topsoil horizons, and older clearcut and seed tree harvest units where dozer scarification or dozer slash piling had occurred. Old landings, primary skid trails, and abandoned spurs tend to remain heavily compacted. Spatial data of past activities from the corporate database and historic aerial photographs were vital to determinations of previously managed sites.

Analysis of the direct and indirect effects was conducted at the unit scale. Units can be individual stands of trees or larger delineations of multiple stands where similar treatments are proposed. Units are the areas where ground impacting activities would occur. Cumulative effects were analyzed at the unit scale. They were also considered qualitatively at the project level, particularly in relation to soil function to discern potential effects to ecosystem services across the landscape.

Data from sampling and field reconnaissance can be found in the Soil Resource Specialist Report Appendices along with unit-specific concerns.

Environmental Consequences

Direct and Indirect Effects – No Action Alternative 1

Under the No Action alternative, ground-disturbing activities related to the proposed treatments would not occur. Measurable increases in the extent of detrimental soil conditions as a direct result of mechanical ground-based operations would not happen. Soil quality would not be expected to be diminished, but would remain compromised where existing detrimental soil conditions prevail such as roads, trails, previously used landings, and former primary skid routes. Other than the extent of existing detrimental soil conditions, soil quality across the majority of the project area would remain in good condition (i.e., the extent of detrimental soil conditions would remain below 20 percent in more than 95% of the stands proposed for treatment) despite the high level of prior extensive management. Detrimental conditions on sensitive soils would remain low to moderate, and no further mechanical ground disturbance would be expected to occur on them. Natural recovery from past impacts would slowly continue unabated.

Soil quality has been degraded where detrimental soil conditions persist, and long-term site productivity is diminished on those sites. The consequence of which, is indirectly a greatly reduced rate of tree growth. Forest Service Roads that are part of the travel network have been converted to a non forest status. Other sites such as motorcycle trails, little used non-system roads, un-restored landings, and primary skid trails will remain heavily compacted and recovery will be prolonged.

Opportunities to alleviate detrimental soil compaction as a result of proposed activities on existing landings and skid trails that would have been designated for reuse, would not be pursued. Funding for soil restoration projects would not be readily available through harvest-generated revenue. Existing detrimental conditions from past ground disturbance would remain in a status of lengthy natural recovery for several decades. Sites where subsoiling occurred to alleviate detrimental compaction would continue to recover at an enhanced rate as root development improves and soil function recovers.

Thinning and underburning that could increase soil productivity on a dense and overstocked site by alleviating competition would not occur. Wildfire suppression efforts, particularly in heavy fuel types such as

dense stands would continue. The densely stocked stands of fire-excluded forest that characterize more than 50 percent of the stands proposed for treatment would become predisposed to intensified disturbance including competition-induced stress and mortality, and a high potential for bark-beetle invasion. In the absence of naturally recurring wildfire, an abundance of standing dead trees and a heavy loading of downed coarse woody debris would continue to slowly accumulate. The build-up of biomass and dense, heavy fuels could put the stands at risk of high intensity wildfire if initial suppression attempts become foiled. In the dense overstocked stands, high severity fire could cause prolonged and intense heating if ablaze, resulting directly in detrimentally burned soil conditions.

Soil organic matter, essential nutrients, and biota could be volatilized during high intensity fire; indirectly leading to a near-term decline in site productivity. The re-growth and accumulation of organic biomass could remain deterred over the long-term, especially on highly disturbed sites and sensitive soil types. Recovery of soil quality from existing detrimental soil conditions could be set-back for decades. An extreme wildfire event could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic heavy runoff events.

The situation could become exacerbated where soils are moderately susceptible to induced hydrophobicity by high severity fire. Hydrophobicity temporarily disrupts soil function by altering its capability to retain and store water. Infiltration could be temporarily reduced, substantially heightening the potential for accelerated erosion from even normal runoff events. Indirectly, accelerated erosion diminishes soil quality and site productivity by removing some of the growing medium.

Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality. Soil ecological diversity could be severely compromised; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer species that are slower to develop symbiotic relationships with beneficial soil organisms. Sites of marginal productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonized severely burned over ground; particularly sensitive soils (i.e., dry, shallow rocky, steep south-facing slopes, and frost-prone soils).

The opportunity to improve soil quality by treating select stands would not occur, including young plantations that were established in the 1960s and 1970s Without thinning, growth rates and soil productivity in the plantations would decline as competition for nutrients, light, and growing space increased. Vertical and horizontal differentiation of trees would remain sluggish, and stand diversity would be delayed until intensified disturbance occurred naturally. The ability to enhance growth and soil productivity through active management in the plantations could be lost. Inherent soil productivity would become over-utilized and resilience under-utilized. Soil function would be committed to supporting a stagnant stand condition at risk of loss or reversion to poor forest health, rather than the development of a young stand into a vigorous mid-aged structural stage.

There would be no new temporary roads created, and no closed roads temporarily re-opened. Road maintenance and repair would continue at the current level and improvements to primary haul routes or problem sites would only be pursued on a site-by-site basis as needed. Certain segments of secondary roads with drainage control problems could remain unrepaired for years. Accelerated erosion would continue during periodic runoff events from these segments. But because there are no locations where the road network is connected to a drainage network, and there are no water bodies the indirect impact to water quality or aquatic habitat from sedimentation would remain inconsequential.

Off-road trailing resulting from un-authorized OHV users would continue to occur in the area Most is expected to recur along the routes where use has already been occurring. It can be expected that a small measure of new ones will be created despite discouragement by the Forest Service. Although a very small degree of the overall existing detrimental soil disturbance, user created trails will affect a few areas where there are sensitive soils, particularly in frost pockets and on steep slopes.

Except where detrimental conditions prevail, soils across the majority of the project area would continue functioning to support and maintain long-term site productivity. Detrimentally disturbed sites or those that

support densely stocked stands where growth has slowed will remain in a status of either slow recovery or stasis. Other than those sites however, the inherent productivity and resilience of the soils will help to maintain their functional capacity to serve as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of various plant communities.

In the absence of an extreme wildfire, effective ground cover would persist and protect soils from erosive forces, and slowly continue to develop where it is lacking as a result of previous disturbance. Needle-fall, seed, and detritus from live trees would contribute to the recruitment and maintenance of litter, duff, and soil organic material. Trees, brush, forbs, fungi, and algae would gradually continue reoccupying disturbed sites except on surfaces occupied by open roads and some once-used landings. Fine and coarse woody debris would continue to accumulate. Organic inputs and biological processes that maintain and cycle soil nutrients essential for plant growth would continue to function and develop at current levels.

Effects Common to Action Alternatives

Similarities between the three Action Alternatives include the types and extent of treatments they propose. All three propose to thin trees and reduce biomass across the majority of the available forested ground in the Rocket project area (i.e., does not include nearly barren lava, the RNA, and research plots). Primary objectives of treatments for each of the Action Alternatives would be to maintain and enhance forest health and site productivity, and reduce fuel loading.

The type of effects to soils resulting from the proposed treatments would not be unique to any single Alternative. The principle differences between them would be the magnitude of the effect based upon their disturbance footprint, and the location of an individual unit that would be either included or excluded from a treatment.

There are 129 stands amounting to about 4,117 acres that are common to each of the Action Alternatives where mechanical treatments are being proposed. All have been treated previously at least once since the 1910s, and many have been entered more than once. For this reason, the potential for increasing the extent of detrimental soil conditions in many of the stands proposed for treatment is high for each of the Action Alternatives. Table 170 displays the amount of area where the risk of increasing the extent of detrimental soil conditions beyond 20 percent of an activity unit would be high.

Table 170: Percent of the number of stands proposed for treatment that are common to the action alternatives by soil condition class.

Soil Condition Class	Percent of Treatment Unit Acreage Common to the Action Alternatives
Less than 10 percent existing detrimental soil conditions	58
Greater than 10 percent existing detrimental soil conditions	37
Greater than 20 percent existing detrimental soil conditions	5

Extent of Detrimental Soil Conditions

As a direct result of conducting overstory and understory treatments on previously treated areas, the potential for the extent of detrimental soil conditions to increase above LRMP standards is high on about 42 percent of the stands that are common to the action alternatives. These include activity units or portions of them where the extent of detrimental soil conditions is already moderate or high (i.e., soil condition classes 2 and 3). Of particular note is a subset of these units where prescribed treatments include both mechanical harvest and mechanical post-harvest activities. These are the units where the risk of direct effects diminishing soil quality is the greatest, potentially reducing inherent long-term site productivity and the capability of the soil to support a fully stocked healthy forest. Application of BMPs, PDCs and mitigation would be necessary to contain detrimental soil conditions and to maintain or restore soil quality to pre-treatment conditions.

Also, within these acres are included about 843 acres of young ponderosa pine plantations that were established in the 1960s following mechanical scarification. These plantations are notable because of the extent of ground disturbance that had occurred as a result of the past scarification. The risk is high for direct ground disturbance to potentially diminish soil quality in these stands. Ground disturbance from back-to-back mechanized entries would be contained using BMPs and PDCs so as to minimize impacts to the ongoing recovery of soil function so that the beneficial response of thinning to site productivity can be realized.

Mechanical overstory and mechanical understory treatments would also occur in activity units across about 58 percent of the stands common to the action alternatives where the extent of detrimental soil conditions is comparatively low (i.e., soil condition classes 1 and 2). These are primarily units where there has been little past management, or where many years have passed since the last entry. Detrimental soil conditions would be expected to increase as a result of ground-based operations in these units but their extent would be contained by implementing BMPs and PDCs to minimize them. Mitigating the effects of detrimental soil conditions across these acres would not be imperative to meet LRMP standards and guidelines, although it could enhance soil quality on affected areas.

Sensitive Soils

There are about 13 stands (approx. 48 acres) proposed for treatment that are common to the Action Alternatives that overlap with 48 acres of sensitive soil types. All are within the NNVM. These include soils on the lower-third of several buttes that are underlain by cindery subsoils. Resilience to ground disturbance on these soil types is low and detrimental impacts can be long-lasting. The types of treatments that are prescribed however differ between the Action Alternatives, so the effects would not be common to each. It is estimated that the extent of detrimental soil conditions are moderately high or high (i.e., soil condition classes 2 and 3) in about 9 of those stands.

Underburning

Underburning is prescribed in many of the units that have been treated previously and where the extent of detrimental soil conditions is moderate to high (i.e., soil condition classes 2 and 3). In particular are those in the dry frost pockets that are interspersed around the western third of the project area where effective ground cover and the litter layer is patchy as a result of extensive past management on a poor site. There is potential that underburning could combust what remains of the surface organics, which are important for moisture retention and nutrient cycling on these dry cold sites. BMPs and PDCs would be necessary to insure a light intensity burn and the retention of a majority of the surface organics so that effects to them could be minimized. Beneficial effects of underburning would be simultaneously realized by reducing understory competition and releasing an initial flush of essential nutrients from combusted fuels that would contribute to site productivity.

Except for the heavily disturbed dry frost pockets, underburning would not be expected to increase the extent of detrimental soil conditions notably. Since they would be low intensity, low severity fires to curtail the build-up of re-growth, in-growth, and fine fuels in stands that have been thinned the extent of severe soil scorching would be minimal. Detrimentally burned soil conditions after prescribed underburns would only be expected where large, dead, partially sound fuels have burned hot for a long duration. Burning and mop-up would be conducted in such a manner that the majority of larger fuels would not be completely consumed.

Roads and Trails

All existing open (130.5 miles) and closed roads (12 miles) in the project area constitute a semi-permanent conversion to a non-forest status, where soils have been committed to a non-productive use. The road system would remain as the infrastructure providing access for the variety of forest users. Due to its extent no new roads would be needed to augment the existing system. But to access many of the proposed units, segments of closed roads would need to be temporarily reopened and some small non-system spur roads re-used. Closed roads to be re-opened are part of the existing system that were converted to a non-productive use.

Combined, it is estimated that on average the road system accounts for about 1 to 5 percent of the extent of detrimental soil conditions in most (96%) of the project's proposed activity units.

Because there are no streams or water bodies in the project area, there are no road-related effects to water or an aquatic system. Certain segments of the existing road system that would be used for haul routes and that provide access to activity units would be maintained and or reconstructed as directed by standard contractual requirements for harvest operations. These would include segments where there are signs of accelerated surface erosion such as on Forest Service road 9710. Drainage would be improved so that runoff would be routed to minimize its interception and concentration to abate accelerated erosion that has occurred on some segments. Sediment that has been generated from the surfaces of eroded segments would be decreased and its transport off-site thwarted.

Some units lack adequate access, and there would be a need for constructing an estimated 2.8 to 5.8 miles of temporary roads to access about 20 units that are common to the Action Alternatives. The total acreage of temporary roads would amount to less than 1 percent of the stands common to the Action Alternatives, and their mileage less than 1 percent of the system road miles in the project area. Four of those segments would be located within the NNVM and amount to about 0.4 miles. Another 0.2 miles would be located on sensitive soils, but outside of the NNVM.

To minimize new disturbance about 80 percent of the temporary road miles would be located on old abandoned spur roads, former temporary spurs, or old primary skid trails. Soils on these old travel surfaces that are to be re-used would revert from a status of recovery back to a detrimental condition temporarily. Surfaces that would constitute new temporary road miles would increase the extent of detrimental soil conditions and directly convert soils to a non-productive status for the life of their use. In about 9 of those units, the extent of detrimental soil impacts is already high. New temporary spurs would be minimally constructed as is feasible. Most would be less than 0.5 miles in length and scheduled to be obliterated and restored when no longer needed for operations. Restoration would be expected to occur within 5 years of project completion and would entail measures to hasten recovery of soil function such as de-compacting the surface, dispersing slash and organic materials over the top, and hiding or barricading access.

Unauthorized OHV use, primarily by motorcycle riders, has created about a 96-mile network of off-road trailing. Use of these trails is expected to continue even though they are illicit. Dense stands that are to be opened up by thinning are at risk of new user-created trails being routed through them, likely increasing to a small measure the extent of the unauthorized trail network. Some of the temporary roads would also be used. Though the motorcycle trails are narrow, they have been repeatedly used for years, and become somewhat trenched and compacted. While their extent is relatively minor relative to the amount of area they occupy, as long as use continues these trails could be expected to remain a long-time scar on the ground.

Leave Blocks

About 36 percent of the forested or available acres in the project area would be leave blocks common to each of the Action Alternatives (43 percent of the forested acres in the NNVM) where dense heavily stocked stand conditions prevail. Thinning and underburning that indirectly could increase the productivity of dense and overstocked stands by alleviating competition would not occur. Soils would continue to function and support stand dynamic processes, but would be utilized to their capacity. There would not be a reduction of heavy fuel accumulations in the dense stands. Such densely stocked stands of timber could be at risk of uncharacteristic disturbance including competition-induced stress and mortality, and a potential for infestation. In the absence of naturally recurring wildfire, an abundance of standing dead trees and a heavy loading of downed coarse woody debris would continue to slowly accumulate. The build-up of biomass and dense, heavy fuels would put the stands at risk of wildfire that could become extreme. In dense overstocked stands, high severity fire could cause prolonged and intense heating if ablaze, resulting directly in a total loss of the stand and some detrimentally burned soil conditions where large logs and stumps would have been consumed. Effective ground cover could be denuded, accelerating surface erosion and soil creep of exposed soils on steep slopes.

The Mokst Butte Research Natural Area (RNA) is within the NNVM and would be one of the principle leave blocks in the project area. No treatments would occur within it. The majority of the RNA is sparsely forested or non-forest, being comprised of rough, broken lava, cinders, and sensitive soils. But there are also both previously managed and unmanaged stands that occur within it. The managed stands have not been entered in decades, nearly all prior to the 1970s. The build-up of biomass and dense, heavy fuels has been occurring unchecked for many years in both the managed and unmanaged stands. There have not been any wildfires of sufficient magnitude to reduce the fuel build-up. The majority of the stands is densely overstocked or in places very brushy. Mortality from competition and beetle invasion is a serious threat. Should a wildfire break out in these stands they could be directly subject to high severity fire, which could lead to prolonged and intense heating, total loss of the stands, some detrimentally burned soil conditions, the loss of an effective ground cover, exposed soils, and an indirect but temporary increase in surface erosion.

Common also to the Action Alternatives are other large blocks where there are no treatments being proposed. These include the Mokst lava flow, other sparsely forested lavas, some of the sparsely forested frost pockets, the tops and steep slopes of a half dozen buttes, stands that have been thinned in the last 10 years, some research plots, and some created openings such as utility corridors and rock pits. The majority of the rough broken lava flows are within the NNVM. In the stands that have been previously managed, the extent of detrimental soil conditions is high in almost one-third of them. Leave blocks can be considered avoidance areas, where soil conditions would not be affected by planned treatments. Soil conditions would remain fully functional or in a status of gradual natural recovery if there had been previous management. Combined, these are avoidance blocks where soils would remain as is.

Summary Conclusions

Summarily, except where there are detrimental conditions, soils across the majority of the project area would continue functioning to support and maintain long-term site productivity despite which Action Alternative is implemented. The extent of detrimental soil conditions in activity units would increase to moderate (i.e. soil condition class 2) where impacts were low prior to planned treatments. The extent of detrimental soil conditions would remain low to moderate (i.e., soil condition classes 1 and 2) in activity units where only understory hand treatments would occur. In leave areas, the extent of detrimental soil conditions would not increase. Additive to these are the portions of units where, despite the condition class, soil disturbance would not be heavy. Because even if the soil condition class is estimated to be 2 (i.e., the extent of detrimental soil conditions is 10 to 15 percent of the activity area), the converse is that at least 85 percent of the unit would not be detrimentally disturbed.

Due to their productivity and resilience, the soils across the largest part of the forested portion of the project area would retain their capability, serving as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of diverse age groups. Sites most at risk of not meeting LRMP S&Gs include planned mechanical treatments where the extent of detrimental soil conditions is currently high as a result of previous treatments. Where the extent of detrimental soil conditions would be expected to exceed LRMP S&Gs, mitigation would be implemented to alleviate heavy compaction resulting from repetitive mechanical disturbance. De-compaction practices would help to hasten the recovery of soil function on temporary roads, skid trails and landings.

Alternative 2 (Proposed Action) – Direct and Indirect Effects

The principle feature of Alternative 2 relative to effects on soils is its footprint, the second highest of the Action Alternatives. Alternative 2 proposes treatments across 42 percent (7,405 acres) of the available forested area. The remaining 58 percent would consist of both recently thinned stands and densely stocked ones that would be left as is under this alternative. About 5 percent of the stands proposed for treatment in this Alternative are exclusive only to it. Effects to soil resources would be similar to those described as common to all of the Action Alternatives but for the footprint. Direct impacts to the soils would result where mechanical operations using heavy equipment would occur. In particular, detrimental soil conditions would be expected where the skidding network was subject to multiple repetitive passes by machinery over the same piece of ground, particularly the temporary roads, landings, and primary skid trails.

Table 171 displays soil disturbance indicators exclusive to Alternative 2. About 23 percent of the available forested acres proposed for treatment include activity units where the extent of detrimental soil conditions is moderate to high (i.e., greater than 10% of the activity unit), due primarily to the presence of roads and a skidding network that was created from mechanical operations of the past. These units pose the greatest risk to soil resources, and are where restoration would likely be needed to reduce the extent of detrimental soil conditions to a pre-treatment level. The extent of detrimental soil conditions would be expected to approach or exceed 20 percent of the activity units as a result of ground disturbance from heavy equipment. Maintaining or enhancing soil productivity according to LRMP standards and guidelines could only be achieved by employing BMPs, PDCs, and mitigation that would either avoid, minimize, and ameliorate the heavy ground disturbance attributed to the creation and use of temporary roads, landings, and primary skid trails.

Table 171: Soil disturbance indicators for alternative 2.

Soil Disturbance Indicator	Percent of Forested Area
Activity units where the extent of detrimental soil conditions is less than 10 percent	19
Activity units where the extent of detrimental soil conditions is greater than 10 percent	23
Treatments on Sensitive Soils	3
Leave blocks of untreated densely stocked forest	44

About 3 percent (511 acres) of the available forested acres proposed for treatments would occur on sensitive soil types. They include portions of several of the dry cold frost pockets, and some of the less severe (i.e., ≤30%), lower and mid slopes of several cinder cones. About one-fifth of those acres would be thinning by hand of young plantations. Ground disturbance would be nominal because there would not be any mechanical treatments. The remaining acres however would be thinned mechanically using heavy equipment, and would include 0.2 miles of temporary road. The majority of the mechanical thinning on sensitive soils would be in the NNVM.

Because sensitive soil types are susceptible to ground disturbance, specific BMPs to protect them would be necessary to contain and minimize detrimental soil impacts. To conserve and maintain long-term site productivity, post-harvest restorative actions would also be implemented to ameliorate the heavy ground disturbance attributed to the creation and use of the skidding network to enhance recovery from disturbance. Thinning the dense stands on these sensitive soils would reduce competition so that site resources (i.e., light, water, nutrients, and growing space) could be allocated more fully to supporting tree growth. Competition-induced stress and mortality would be diminished so that stand health could become more vigorous and resilient to insects and high intensity fire. The function of the soil to support a forest cover would be better utilized. The risk for high-severity fire to negatively impact sensitive soil types and rendering them incapable of supporting a long-term forest cover would be reduced substantially.

Leave blocks of untreated, densely stocked forest patches would amount to 44 percent of the available forest under Alternative 2, and 51 percent of the available forest in the NNVM, the second highest amount of the Action Alternatives. The dense stands would utilize soil and site resources to their maximum extent and competition for them would remain very high. Stress-induced mortality would continue to ensue, making the stands susceptible to insect and disease that would lead to a buildup of heavy fuel concentrations. These stands would be at risk of high severity fire completely denuding them.

High severity fire could also severely compromise soil ecological diversity; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer plant species that could be slower to develop into a more diverse composition. Sites of marginal productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonize burned over ground; particularly sensitive soils. An extreme wildfire event

could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic runoff events and wind. Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality.

Alternative 3 – Direct and Indirect Effects

The principle feature of Alternative 3 relative to effects on soils is its footprint. Alternative 3 proposes treatments across 32 percent (5,676 acres) of the available forested acres, the least amount of the Action Alternatives. The remaining 68 percent of untreated forest would consist of both recently thinned stands and densely stocked ones that would be left as is under this alternative. None of the stands proposed for treatment in this Alternative are exclusive to it. Effects to soil resources would be similar to those described as common to all of the Action Alternatives but for this footprint. Direct impacts to the soils would result where mechanical operations using heavy equipment would occur. In particular, detrimental soil conditions would be expected where the skidding network was subject to multiple repetitive passes by machinery over the same piece of ground, particularly the temporary roads, landings, and primary skid trails.

Table 172 displays soil disturbance indicators exclusive to Alternative 3. About 17 percent of the available forest acres proposed for treatment include activity units where the extent of detrimental soil conditions is moderate to high (i.e., greater than 10% of the activity unit), due primarily to the presence of roads and a skidding network that was created from mechanical operations of the past. These units pose the greatest risk to soil resources, and are where restoration would likely be needed to reduce the extent of detrimental soil conditions to a pre-treatment level. The extent of detrimental soil conditions would be expected to approach or exceed 20 percent of the activity units as a result of ground disturbance from heavy equipment. Maintaining or enhancing soil productivity according to LRMP standards and guidelines could only be achieved by employing BMPs, PDCs, and mitigation that would either avoid, minimize, and ameliorate the heavy ground disturbance attributed to the creation and use of temporary roads, landings, and primary skid trails.

Table 172: Soil disturbance indicators for Alternative 3.

Soil Disturbance Indicator	Percent of Forested Area
Activity units where the extent of detrimental soil conditions is less than 10 percent	15
Activity units where the extent of detrimental soil conditions is greater than 10 percent	17
Treatments on Sensitive Soils	1
Leave blocks of untreated densely stocked forest	53

About 1 percent (228 acres) of the available forested acres proposed for treatments would occur on sensitive soil types, the least of the Action Alternatives. They include small portions of several of the dry cold frost pockets, and some of the less severe (i.e., ≤30%), lower and mid slopes of several cinder cones. About one-fifth of those acres would be thinning by hand of young plantations, and would include all of the treatments on sensitive soils in the NNVM. Ground disturbance would be nominal because there would not be any mechanical treatments. The remaining acres however would be thinned mechanically using heavy equipment. There would not be any road segments constructed on sensitive soils.

Under Alternative 3, mechanical thinning on sensitive soils would encompass small patches of dense stands. Specific BMPs to protect them would be employed to contain and minimize detrimental soil impacts. Some post-harvest restorative actions would be needed to conserve long-term site productivity where short segments of the skidding network encroach upon sensitive soils. Thinning the small dense patches on these sensitive soils would reduce competition so that site resources (i.e., light, water, nutrients, and growing space) could be allocated more fully to supporting tree growth. Competition-induced stress and mortality would be diminished so that these portions of stands tree health could become more vigorous and resilient.

The risk for high-severity fire to negatively impact sensitive soil types and rendering them incapable of supporting a long-term forest cover would be reduced substantially.

- Less than 10 percent existing detrimental soil conditions: 48
- Greater than 10 percent existing detrimental soil conditions: 52

Leave blocks of untreated, densely stocked forest patches would amount to 53 percent of the available forest under Alternative 2, and 69 percent of the available forest in the NNVM, the highest amount of the Action Alternatives. Dense stands would utilize soil and site resources to their maximum extent and competition for them would remain very high. Stress-induced mortality would continue to ensue, making the stands susceptible to insect and disease that would lead to a buildup of heavy fuel concentrations. These stands would be at risk of high severity fire completely denuding them.

High severity fire could also severely compromise soil ecological diversity; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer plant species that could be slower to develop into a more diverse composition. Sites of marginal productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonize burned over ground; particularly sensitive soils. An extreme wildfire event could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic runoff events and wind. Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality.

Alternative 4 – Direct and Indirect Effects

Like the other Action Alternatives, the principle feature of Alternative 4 relative to effects on soils is its footprint, the greatest of the Action Alternatives. Alternative 4 proposes treatments across 57 percent (9,971 acres) of the available forested area, the most of the Action Alternatives. The remaining 43 percent of untreated forest would consist of both recently thinned stands and densely stocked ones that would be left as is under this alternative. About 16 percent of the stands proposed for treatment in this Alternative are exclusive only to it. Effects to soil resources would be similar to those described as common to all of the Action Alternatives. Direct impacts to the soils would result where mechanical operations using heavy equipment would occur. Detrimental soil conditions would be expected where the skidding network was subject to multiple repetitive passes by machinery over the same piece of ground, particularly the temporary roads, landings, and primary skid trails.

Table 173 displays soil disturbance indicators exclusive to Alternative 4. About 27 percent of the available forest acres proposed for treatment include activity units where the extent of detrimental soil conditions is moderate to high (i.e., greater than 10% of the activity unit), due primarily to the presence of roads and a skidding network that was created from mechanical operations of the past. These units pose the greatest risk to soil resources, and are where restoration would likely be needed to reduce the extent of detrimental soil conditions to a pre-treatment level. The extent of detrimental soil conditions would be expected to approach or exceed 20 percent of the activity units as a result of ground disturbance from heavy equipment. Maintaining or enhancing soil productivity according to LRMP standards and guidelines could only be achieved by employing BMPs, PDCs, and mitigation that would either avoid, minimize, and ameliorate the heavy ground disturbance attributed to the creation and use of temporary roads, landings, and primary skid trails.

Table 173: Soil disturbance indicators for alternative 4.

Soil Disturbance Indicator	Percent of Forested Area
Activity units where the extent of detrimental soil conditions is less than 10 percent	29
Activity units where the extent of detrimental soil conditions is greater than 10 percent	27
Treatments on Sensitive Soils	3
Leave blocks of untreated, densely stocked forest	36

About 3 percent (505 acres) of the available forested acres proposed for treatments would occur on sensitive soil types. They include portions of several of the dry cold frost pockets, and some of the less severe (i.e., ≤30%), lower and mid slopes of several cinder cones. A little less than half of those acres would be thinning by hand of young plantations. Ground disturbance would be nominal because there would not be any mechanical treatments. The remaining acres however would be thinned mechanically using heavy equipment, and would include 0.2 miles of temporary road. The majority of the mechanical thinning on sensitive soils would be in the NNVM.

Because sensitive soil types are susceptible to ground disturbance, specific BMPs to protect them would be necessary to contain and minimize detrimental soil impacts. To conserve and maintain long-term site productivity, post-harvest restorative actions would also be implemented to ameliorate the heavy ground disturbance attributed to the creation and use of the skidding network to enhance recovery from disturbance. Thinning the dense stands on these sensitive soils would reduce competition so that site resources (i.e., light, water, nutrients, and growing space) could be allocated more fully to supporting tree growth. Competition-induced stress and mortality would be diminished so that stand health could become more vigorous and resilient to insects and high intensity fire. The function of the soil to support a forest cover would be better utilized. The risk for high-severity fire to negatively impact sensitive soil types and rendering them incapable of supporting a long-term forest cover would be reduced substantially.

Leave blocks of untreated, densely stocked forest patches would amount to 36 percent of the available forest under Alternative 4, and 43 percent of the available forest in the NNVM, the lowest amount of the Action Alternatives. This puts at risk the fewest amount of acres where competition induced stress and mortality would remain very high, susceptible to insect and disease, and susceptible to high severity fire. Soil ecological diversity and function to support a contiguous forest cover would be less susceptible to high fire severity effects across a greater amount of area. More sites of marginal productivity could be defended from high-severity fire, including the exposure of bare soils over large areas.

Mitigation and Restorative Actions

Measures to avoid or minimize unwanted impacts to soil resources are primarily BMPs and PDCs, which are addressed in Section 3.0 of this report. They are standard operating procedures as well as specific measures that are prescribed on a project-by-project basis. Mitigation or restoration is a practice in which a restorative action is needed to ameliorate unavoidable adverse effects. In this context those would be the extent of detrimental soil conditions accrued in activity units where it is already high. Without mitigation or restoration, achieving LRMP S&Gs would not be feasible, and less than 80 percent of some activity areas would be in a condition of acceptable productivity. Or stated in the converse, the extent of detrimental soil conditions would exceed 20 percent of the activity areas without post-harvest mitigation. Mitigation would be necessary to restore soil quality. For a listing of specific unit concerns see the Appendices.

Restoration would consist of de-compaction of hardened surfaces, obliterating temporary roads, and possible soil amendments (i.e., mulch) in dry pine sites where the extent of detrimental soil conditions is high. Subsoiling would be used as a means for reducing the extent of detrimental soil conditions by ameliorating heavy compaction on landings and converging segments of primary skid trails. In some cases particularly in dry pine sites mulch, wood chips, or slash mats could be added as a protective ground cover and soil amendment where feasible. All of the temporary roads would be reclaimed as well. This would entail decompacting the road surface, installing waterbars as needed, and hiding their entry or barricading it. Those in dry pine sites could also be covered with a layer of mulch or wood chips across their surface.

Activity units where mitigation would be necessary are those where existing detrimental soil conditions are high. These include units where mechanized treatments would occur, and in some of them there are sensitive soils on steep slopes or in draws. These are units where ground-based disturbance could be expected to increase the extent of detrimental soil conditions beyond the 20 percent standard, and impacts would need to be restored in order to maintain soil quality and inherent productivity.

Cumulative Effects

Cumulative effects to soil resources were analyzed qualitatively by evaluating the past, present, and reasonably foreseeable actions in the project area where ground-disturbing activities would overlap one another. Effects were assessed at two scales, the unit and the project area. Focally, and at the unit scale these would be sites where there are existing detrimental soil conditions from previous management and re-entry is planned. Equally to be factored are sites where restoration and mitigation activities such as subsoiling or soil amendments have occurred to ameliorate detrimental conditions.

At the project level, cumulative effects were also considered relative to whether or not soils were functioning to their capability and providing ecosystem services across the landscape, because soil types can differ markedly in their response to management. More broad-scale in context it is a look at how the capability to produce biomass and maintain a contiguous forest of diverse complexity has been affected. Inherent soil productivity, regulation of nutrient cycling and availability, and water storage are some important ecosystem services that in turn indirectly support beneficial uses such as habitat for a variety of wildlife species, recreational opportunities, and wood products for human use.

If implemented, treatments would result in more than 95 percent of the area having undergone some form of forest management at least once since the 1960s. All of the proposed treatments would enter stands that have been treated previously. For this reason, the potential for cumulatively accruing detrimental soil conditions in many of the units planned for treatment is high.

Not all ground disturbances in previously managed stands is detrimental, a proportion is low level disturbance. Light and moderate levels of disturbance are detectable where ground-based operations have occurred in the past. Entering these sites again can exacerbate lower-level disturbance so that it is transformed to a detrimental soil condition. Units where the detrimental soil conditions are currently high are especially at risk of cumulative effects, where without restoration activities, inherent soil quality and productivity could be diminished.

As a result of extensive management in the past the extent of detrimental soil conditions is moderate or high (i.e., soil condition classes 2 and 3) on about half of the available forested acres. The extent of detrimental soil conditions could be expected to increase in these units as a result of re-entering them, as the cumulative impact of recurring ground disturbance over the same area would be realized. Units where mechanical harvest and post-harvest treatments (including mechanical slash abatement) would be most prone to cumulative effects that would exceed LRMP S&Gs. Minimizing the cumulative effect through PDCs, BMPs, and mitigation would be necessary to maintain a condition of acceptable productivity across 80 percent of each of the affected activity units (an LRMP S&G) where the current extent of detrimental soil conditions is high see Appendix C for listing of units).

There are proposed treatments that have a proportion of them underlain by sensitive soil types It is estimated that the extent of detrimental soil conditions are low to moderate (i.e., soil condition classes 1 and 2) on nearly half. Re-entry with mechanical treatments would occur on the majority of them. Sensitive soils most at risk are dry frost pockets and lower to mid slopes of cinder buttes, particularly those that have been harvested previously where railroad logging, dozer slash-piling, or dozer scarification had occurred. Additionally there are about 0.2 miles of temporary roads that would be built in a dry frost pocket. The risk of diminishing soil quality as a result of recurring mechanical treatments and construction of the temporary road would be high and cumulative effects potentially long lasting. Thus implementing PDCs, BMPs, and mitigation would be paramount to maintaining soil quality on sensitive soils and minimizing cumulative effects on those sites.

Prescribed underburning would typically occur 2 to 10 years after treatments are completed. Intent of underburning is to maintain a low fuel condition in the understory. Often there has been a period of recovery after a treatment prior to the re-introduction of fire. In-growth and re-growth of the understory that has occurred during that time, along with an accumulation of detritus, litter, and effective ground cover contributes to the recovery of soil disturbance. If control of flame length was lost, and low burn intensity not

achieved underburning could reset that recovery back to a post-disturbance condition, and above-ground biomass could be substantially reduced. Units where the extent of detrimental soil conditions was high or where sensitive soils occurred would be most prone to a cumulative impact that arrests recovery of nutrient status and the development of humus rich organics on the forest floor which contribute to the maintenance of inherent site productivity for the short-term, particularly heavily disturbed dry pine sites in frost pockets and on cindery slopes prone to soil creep on some of the buttes in the project area.

The presence and use of the road system would continue, where soils have been converted to a non-forest condition. Improvements planned for Forest Road 9710 and 9720 would help to minimize erosion on their treads. But the road system accounts for less than 3 percent of the project area. New temporary roads would add another 2.8 to 5.8 miles. Nearly all would be located on old abandoned spurs or old skid trails, minimizing new disturbance. Temporary roads would be renewed disturbance and amount to an accrual of additional detrimental soil conditions that would remain in a detrimental status until restored and converted to a status of recovery.

OHV use has contributed a small percentage to the accrual of detrimental soil impacts too. Un-authorized motorcycle use could increase because dense forested stands would be opened up, giving sight to new opportunities for user-created trails. Although a very small component of cumulative effects, this use could contribute to affected sites that would become identifiable. Some of the use has has affected sensitive dry frost pockets and step cindery slopes.

Combined, all these site impacts over the past 50 years have affected soils across the project area, and are indicative of an area that is heavily used by a variety of users. There have been, however, a substantial amount of improvements and restoration too. Thinning and removal of diseased or bark-beetle infested timber and thinning in young stands has occurred across much of the project area (>25%). These activities have served to enhance site productivity by alleviating competition and improving growth rates, and they have reduced fuel loading lowering the risk of loss to wildfire. Tree planting has also occurred across much of the area, particularly the ponderosa pine sites, to hasten stand establishment. These activities have imparted a degree of positive effect that offsets some of the cumulative accrual of detrimental soil conditions.

Road improvements and on-going maintenance continue to minimize effects of intercepted runoff on primary travel routes. Erosion attributed to road-concentrated runoff is a notable problem on some segments. There have been some road segments decommissioned (about 4% of original miles), where soils have been de-compacted. Currently soils are in a status of recovery to eventually convert them back to a productive status. Additionally, landings and primary skid trails have been subsoiled on about 15 percent of the project area, ameliorating heavy compaction, restoring natural infiltration, and enhancing rooting capability. Roadside eradication of noxious and invasive weeds along utility corridors and in rock pits has also occurred to help maintain health of native vegetation. These too are activities that have imparted a degree of positive effect that offsets some of the cumulative accrual of detrimental soil conditions.

Despite all of the extensive management in the project area soils across the majority of the project area would continue functioning to support and maintain long-term site productivity following the proposed activities, except where there are detrimental conditions. In the majority of the activity units despite the condition class, soils would remain intact. Even if the soil condition class is estimated to be moderate to high (i.e., the extent of detrimental soil conditions $\geq$ 10 percent of an activity area), the converse is that the majority of soils in the unit are not in a detrimental condition. Due to their productivity and resilience most soils will retain their capability, serving as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of diverse age groups.

Unavoidable Adverse Impacts

Unavoidable adverse impacts would be focused where ground disturbing activities would be repetitive. Impacts would primarily be associated with the skid trail network needed for ground-based operations, where detrimental soil conditions would be incurred. The skid trail network would include landings, primary skid trails, and temporary roads where use by heavy equipment and truck traffic would be concentrated. These

would be converted to a temporary non-vegetated status, and the removal of organic layers and topsoil along with detrimental compaction would impair site productivity and soil quality unless impacts were mitigated.

Short-Term Effects versus Long-Term Productivity

Overstory and understory treatments and post-project underburning constitute ground disturbing activities. Direct effects range from light and moderate levels of disturbance to detrimental soil impacts such as heavy compaction, accelerated erosion, or an excess removal of organic material. Throughout the sequence of treatments, light and moderate ground disturbance would occur over a considerable amount of area in an activity unit. While not severe enough in magnitude or extent to be considered detrimental these are sites where travel by heavy equipment has been limited, or where low intensity underburning has only lightly or moderately charred the litter and surface organics. Although the ground has been disturbed, soil quality has not been degraded to the point that long-term site productivity is diminished. Soils where ground disturbance has been light or moderate would be expected to retain their inherent capability and function as a growing medium that continues to produce biomass and support forested plant communities.

Management activities would remove a substantial amount of above-ground biomass from the forest in the first several activities in the treatment sequence. There would also be a considerable amount that remains on-site, both at the unit scale and at the project level. At the unit scale the majority of the litter and duff layer would remain after treatment, except in temporary roads, landings, and primary skid trails. Ground cover including forbs, brush, and seedlings would too. Thinning would remove on average upwards of 40 to 60 percent of the trees, meaning that 60 to 40 percent would be retained. After release growth rates would increase and stand productivity be enhanced as stands that are opened up would have renewed vigor. Competition for available soil nutrients, water, growing space, and light would be less. Because of an increase in available light understory development would flourish. In the absence of detrimental soil conditions, inherent productivity would stimulate re-growth, in-growth, and recruitment of individual plants. Above-ground biomass would slowly accumulate and build, providing recruitment of detritus to the litter and duff layers for future assimilation into topsoil organics that fuel soil biota and their function to cycle nutrients. Surface organics would also continue to promote retention of soil moisture.

Across the project area, untreated areas and leave blocks would continue to be sources of seed, litter, and forest cover in various structural stages. Proposed treatments would capture site growing potential through release of competition. Unencumbered sites would continue to produce forest vegetation across the entire project area. With the exception of roads that have been committed to a non-productive use and where detrimental soil conditions occur. The inherent productivity and resiliency of the soils in the project area would maintain soil quality and long-term site productivity.

To access many of the proposed units, segments of closed roads would need to be temporarily reopened and about 2.8 to 5.8 miles of temporary spurs built. Closed roads to be re-opened are part of the existing system that converted ground to a non-productive use. They would remain even if re-closed after operations. Temporary roads will be a new short-term soil impact where productivity will be impaired until restored (i.e., within five years after close of operations). Once restored those surface would revert back to a condition where they would become capable of becoming productive.

Irreversible and Irretrievable Commitment of Resources

Due to its extent no new roads would be needed to augment the existing system. All existing open and closed roads in the project area constitute a semi-permanent conversion to a non-forest status, where soils have been committed to a non-productive use. The road system would remain and function as the infrastructure providing access for the variety of the forest users. Arterial roads would be expected to serve as primary ingress/egress routes through the forest for the long-term, as would the gravel and native surfaced collector routes. Some local spurs and minor roads could be considered redundant in the future and subject to decommissioning, restoring their surface so that soil can recover and become productive. Future decommissioning would be determined on a project-by-project basis.

Botany: Threatened, Endangered, and Sensitive Species

Introduction and Existing Condition

There are no known proposed, threatened, endangered, or sensitive (TES) plant sites within the project area. The closest known site is the pumice moonwort (*Botrychium pumicola*), about 3.5 direct miles away within the Newberry Crater.

A Biological Evaluation (BE) was completed to document consideration of threatened, endangered, and sensitive plants. The BE complies with Forest Service Manual 2672.4 and the Endangered Species Act of 1973 (Subpart B; 402.12, section 7 consultation). The BE evaluates Sensitive plant species from the current Regional Forester's Sensitive Species List is dated December 2011 that are documented or suspected to occur on the Deschutes National Forest. The BE is located in the Rocket project file.

Thorough surveys were conducted in and adjacent to the Rocket project in the 1990s prior to implementation of other projects. These surveys include: Black Bark 1998, Natural Fuels Reduction 1996, North End Buttes 1991, and ET in 1993. The areas surveyed were deemed to be those with the highest potential for carrying TES plant species habitat; no TES plants were located. According to the 2011 Sensitive plant list, the only species with potential habitat in the Rocket is *Castilleja chlorotica*.

Field surveys were conducted in 2012 to check for *Castilleja chlorotica* in the listed areas of potential habitat as described in the Newberry National Volcanic Monument Comprehensive Management Plan. Within these areas, potential habitat was located on lava domes but *Castilleja chlorotica* was not observed. This may be partly due to the dense canopy on the lava domes and other unknown conditions necessary for its survival and establishment. Management mitigations will not be required for the species because there were no plants documented.

Environmental Consequences

Alternative 1

The No Action Alternative would have no direct, indirect, or cumulative effects on any threatened, endangered, or sensitive species because no actions will be taken in the project area because there are no TES species present.

Alternatives 2, 3, and 4

There will be no direct, indirect, or cumulative effects on Proposed, Endangered, Threatened, or Sensitive plant species because none have been located within the project area.

Forest Plan Consistency

The Rocket project is consistent with management direction pertinent to TES plants in the Deschutes LRMP (1990). Records were checked for previously known TES plant populations (Standard and Guide TE-1); suitable habitat was identified (TE-2), and a field reconnaissance was performed to try to locate populations within the project area, at the proper time of year when TES plant species in question would be found (TE-3).

Invasive Plants / Noxious Weeds

Introduction and Existing Condition

A noxious weed risk assessment was conducted and it determined that the action alternatives for the Rocket project have a high risk of introducing or spreading noxious weeds into the project area. This risk is mitigated with resource protection measures, including prevention practices, described on pages 39-40.

The current condition is the result of past activities throughout the Rocket project, including logging, planting, grazing, and wildfire suppression, all of which may have contributed to the amount of documented

weed sites in the project area. A direct link is not apparent, however, since most of the weed sites are roadside and not relegated to such sites as landings or skid roads.

Table 174: Known Weed Sites in the Rocket Project Area

Species	Site	Activity Units
Spotted knapweed/diffuse knapweed/Dalmation toadflax/Medusahead	Hwy. 97	96, 97, 98, 99, 100, 152, 220, 277, 447, 831, 832, 834, 840 Medusahead not within a unit
Spotted knapweed	9710	831
Spotted knapweed	SE of Hwy. 97	99
Spotted knapweed	72 rd. north of Lava Butte	220
Dalmation toadflax	9710/220	22, 807
Dalmation toadflax	9711	802
Spotted knapweed	9710	801
Spotted knapweed	9710/380	210, 275
Spotted knapweed	9710/100	801

Risk Ranking

The following factors were considered in determining the level of risk for the introduction or spread of noxious weeds:

Vectors (if contained in project proposal) ranked in order of weed introduction risk:

1. Heavy equipment (implied ground disturbance)
2. Importing soil/cinders
3. Off-highway vehicles
4. Grazing (long-term disturbance)
5. Pack animals (short-term disturbance)
6. Plant restoration
7. Recreationists (e.g. hikers, mountain bikers)
8. Forest Service project vehicles

The project proposal and existence of vectors was reviewed to determine if the risk is high, moderate, or low. Following are the definitions:

High	Known weeds in / adjacent to project area; AND
	Any of vectors #1-8 in project area; AND
	Project operation in/adjacent to weed populations.
Moderate	Any of vectors #1-5 present in project area.
Low	Any of vectors #6-8 in project area; OR
	Known weeds in/adjacent to project area without vector presence.

A risk ranking of HIGH is appropriate for this project because heavy equipment will be brought into the area (which brings a risk of importing weed seeds or parts with it), and there are known weed populations within and near the project. Following the prevention measures (listed with Resource Protection Measures p. 39: cleaning equipment, avoiding known weed sites, treating weeds prior to entry) will address this issue and will reduce, but not eliminate the risk.

Environmental Consequences

Alternative 1

From a weed standpoint, the No Action alternative provides the most protection from invasive plant introductions to the project area, because heavy machinery and associated project vehicles would not be driving over the area, creating inviting spots for invasives to germinate and thrive.

However, the threat of weed establishment will remain with ongoing activities such as: road maintenance, gas line and powerline maintenance**,** visitors to recreation sites, and illegal use and creation of off-road trails. Current weed treatment in the form of manual hand pulling will resume which aids in the prevention of spreading seed but is not the most effective method for the control of weed sites. In May 2012, the Deschutes and Ochoco National Forests' Invasive Plant Treatment Environmental Impact Statement (EIS) was approved for use, allowing for the application of herbicide on approved sites. If the noxious weed sites within the project area are to be treated with herbicide, a prescription will be written and reviewed by an interdisciplinary team. Only after approval by the team will a site be treated with herbicide.

If documented weed sites within the project area are approved for spray, they could potentially be reduced more quickly and have less chance of maturing to the seed development and seed dispersal stages. In addition to existing weed sites, new sites that are found could be treated with herbicide through the "early detection/rapid response" (EDRR) feature within the EIS. The ultimate result is that the area's weed problem will have a control measure that is capable of reducing the weeds in a much more effective and efficient manner. Currently, the sites along Hwy. 97 are the only sites being treated by herbicide under the 2012 EIS.

The No Action alternative could increase the risk of wildfire in the area if current fuel loads remain, which would pose a serious threat to native habitat as invasive weeds readily establish post-fire. Invasion occurs as noxious weeds compete aggressively with native species for space and nutrients. Many native plants do survive and reestablish soon after a fire, but the ability of these plants to thrive in recently burned areas depends on the presence of noxious weeds. Unfortunately, noxious weed establishment is highly successful in recently burned areas where there is little competition, reduced shade and increased light, and depending upon the severity of the fire, a flush of nutrients. The post-fire conditions favor weeds and therefore could result in large scale infestations.

Although the No Action creates the least concern for invasive plants being introduced into the project area, existing recreational use of the area can introduce new populations, particularly from vehicles.

Alternatives 2, 3, and 4

Direct and Indirect Effects: All activities included in these alternatives, such as logging, pre-commercial thinning, and burning, increase the threat of invasive species spread or introductions, which tend to thrive on ground disturbing events. The mitigations requiring clean equipment in the project area and to inspect water intake sources for dust abatement are helpful in preventing weed establishment; despite this, the risk is not reduced to zero.

The three action alternatives contain risk of weed invasion, although the mitigations will reduce, but not eliminate, that risk. There is no discernible difference between the three action alternatives in terms of weed risk.

Cumulative Effects Alternatives 2, 3, and 4

The scale of analysis for this section is the project boundary, so chosen because it offers a landscape of reasonable size in which to determine effects.

The highway expansion project, which started in 2009 and is almost complete, has clearly resulted in noxious weed spread and even one new species, Medusahead (*Taeniatherum caput-medusae*) introduction has been documented. Any further ground disturbance or heavy equipment around Highway 97 could result in more noxious weed imports or exacerbate the current problem by moving though infested areas.

Recreation activity in the project area is concentrated at two developed sites, Lava River Cave and Lava Cast Forest; however there is also illegal construction and use of mountain bike and OHV trails dispersed throughout the forest stands. The moderate recreational use of the area will continue and the potential input of new weed seed and establishment will remain.

Previous ground disturbing activities have occurred in the Rocket project area. Weed sites have been documented as a result from road maintenance activity and general road use. Adding more ground disturbing events, as proposed in these alternatives, only makes the area more susceptible to non-native and invasive plant introductions.

There is moderate recreation use of the project area and environs, coupled with logging, burning activities, and road creation, as proposed in these alternatives, will create habitat that is conducive to more weed introductions.

Current weed mitigations are those discussed in Direct and Indirect Effects, which applies to the action alternatives. A combination of manual removal along with future herbicide application will help alleviate and control weed population growth.

Forest Plan Consistency

There are no Standards and Guidelines included in the 1990 Deschutes National Forest Land and Resource Management Plan addressing the weed issue. A Record of Decision for Preventing and Managing Invasive Plants was signed in October 2005, and incorporates its standards into the Forest Plan of the Deschutes National Forest. Three of those standards specifically address prevention of weed introductions into projects of the type that the Rocket project represents. These standards obligate the Forest Service to incorporate weed prevention into its planning documents and implementation phase. The resource protection measures listed on page 37 of this EA are the specific prevention strategy for the Rocket project.

The Rocket project meets the Forest Service Manual direction stating that for any project with a moderate to high risk of weed invasion, control measures must be in place. Rocket has a high risk, and control measures are required to address that concern.

Roads and Access

Introduction

Direction for the management of the road system is found in the 1990 Deschutes LRMP. According to the LRMP, the goal of the Forest's transportation system 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." (LRMP p. 4-71).

The Forest Service Manual (FSM 7730) covers road operations and maintenance and states that the goal is to "operate and maintain NFS roads in a manner that meets road management objectives and that provides for 1. Safe and efficient travel; 2. Access for the administration, utilization, and protection of NFS lands; and 3. Protection of the environment, adjacent resources, and public investment.

Affected Environment

The Rocket project area includes 6.7 miles of State and County jurisdiction roads in addition to 11.75 miles of Forest Service Highway Safety Act (HSA) routes. State Highway 97 (The Dalles-California Highway) provides the primary access to the area and mostly borders the western boundary of this planning area. FS collector roads that border portions of this planning area include 9701 (north), 9710 (east), 9720 (south). This area access is also supported via collectors 9711, 9714, 9721, and 9723. About 119 miles of open local roads traverse the area and contribute to a relatively high road density for the project area (3.5 miles per

square mile). Open road density is addressed on a watershed level and for Management Area 7 (Deer Habitat) in the big game section of this EA.

Roads that are deficient in deferred maintenance are listed in the Road Report, located in the project file, with the type of maintenance required. The condition of collector road system has a broad spectrum of maintenance needs from substantial resurfacing and drainage restoration to minimal blading and shaping of roadway. Over decades of use, aggregate, cinder, and native type surfacing on these roads has diminished, resulting in un-maintainable roads that are in need of surfacing, drainage restoration, light to heavy brushing, and felling of danger trees. Danger tree reductions would be in accordance with FSM 7733, and project specific guidelines listed with the description of the alternatives.

With the completion of project work, it is recommended that the open collector and local roads be restored to a self-maintaining condition to provide for years of service without maintenance.

Table 175: Road system before and after the Rocket project

Existing Condition		Alternatives 2, 3, and 4	
Open Miles	130.5	Open Miles	87
Currently Closed Miles (maint. Level 1)	12	Closed Miles (maint. Level 1)	50.7
Decommissioned roads	5.8	Decommissioned	11.2

Environmental Consequences

The existing system roads were analyzed within the Rocket project area, with a current open road density of 3.4 miles per square mile (Table 175). A transportation analysis was conducted in 2002. That analysis provided recommendations for the road system including closures and decommissioning. Additional review has been conducted by the Rocket ID Team in light of the newly widened Highway 97 and installation of the wildlife undercrossings. This project's purpose includes improving deer habitat conditions in the project area and maintaining viable migration corridors; therefore, additional road closures have been proposed. Approximately 38.6 miles of road would be moved to a maintenance category 1 (closed) under all action alternatives (see Figure 10).

Closed roads play a vital role in both the immediate and long term implementation and continuing support within this project area. When no longer needed for project support, the identified roads will be closed until needed for future management activities. Closed roads can be used for purposes such as permit administration, fire suppression, and management activities.

Temporary, un-inventoried, unauthorized user-created roads will be subject to full removal and restored to a condition suitable for a productive return to the land base. The preferred method for achieving this goal is by subsoiling these areas to reduce compaction and encourage new growth.

Direct and Indirect Effects Alternative 1 (No Action)

There would be no change from the existing condition in the project area. The mileage of open and closed roads and road density would remain at existing levels of 3.4 miles per square mile. No roads would be needed for project activities such as log hauling; therefore there would be no effects from log truck travel.

Direct and Indirect Effects Alternatives 2, 3, and 4

Alternatives 2, 3, and 4 would close approximately 38.6 miles of local system roads, putting them into a maintenance category 1. About 5.8 miles will be decommissioned. The decommissioned roads are short spurs that are located within the "peninsula" area of the project between the lava flows. Closures and decommissioning will prevent some people from accessing portions of the planning area. The main collector roads 9710, 9720, 9711, 9714, and 9723 and the local roads that would remain open provide access throughout the project area. One dispersed campsite in the northern part of the project area would no longer

have motorized access (see next section), but could still be accessed for non-motorized camping. Effects of the open road density in the project area is reduced from 3.5 miles per square mile to about 2.4 miles per square mile. Open road density is addressed on a watershed level and for Management Area 7 (Deer Habitat) in the big game section of this EA.

Project activities such as hauling timber with log trucks can create impacts to the road system. As a function of use during harvest activities, road maintenance activities would be conducted on roads designated for use. As a direct effect, some roads that do not receive recurring maintenance, primarily low standard roads in the Maintenance Level 2 category, would see some improvements in both safe drivability and in their ability to handle surface runoff. Dust can be an issue when native surface roads are used for haul. Dust abatement, primarily using water was the dust palliative, would be performed as necessary to maintain safe driving conditions. This would have a secondary effect of maintaining a relatively well-bonded road surface free of the highly erosive pulverized ash "flour" that can occur on native surface roads under heavy use conditions. The intensity of these effects are essentially the same for all alternatives.

Where ground-based yarding systems are used to remove logs to landings, temporary roads are customarily constructed to provide access to the landings that are not immediately adjacent to existing portions of the transportation system. Temporary roads in the Rocket project would be constructed primarily on flat ground (slopes < 10%) and excavation and construction of embankments would be negligible. Temporary roads would be built to low construction standards, with constraints of grade, curve radius, compaction, surfacing, and width being tailored to the minimum capabilities of the intended user vehicles. Impacts to soils from temp roads are addressed in the Soils section.

Cumulative Effects

Recent efforts to reduce open road density within and adjacent to the project area have been associated with the Sunriver HFRA project and the Highway 97 widening project. When the additional road closures from the Rocket project are implemented, the open road density will be reduced to within LRMP objectives for wildlife within one watershed and will move closer to LRMP objectives in the other two watersheds. This affects wildlife habitat effectiveness, as analyzed at the watershed scale and for Management Area 7 and disclosed in this EA under the MIS section.

The Travel Management Rule and the Forest's Motor Vehicle Use Map (MVUM) will make enforcement of road closures and off-road prohibitions more straightforward because forest users are responsible for using the MVUM and driving only on authorized routes. The rules and MVUM will result in a reduction in user-created roads and impacts from cross-country travel. The MVUM should also assist in public knowledge of OHV restrictions in the Newberry National Monument.

Recreation

Introduction

This section of the EA specifically addresses the effects of the proposed Rocket Vegetation Management Project and alternatives on the existing setting, visitor experience and activities for the area.

The public generally uses the Rocket planning area for dispersed camping, hunting, biking and OHV riding. One developed recreation site attracts the majority of public use within the planning area at Lava River Cave (see Figure 56). Visitors accessing Lava Cast Forest would travel FSR 9720 which forms a portion of the southern edge of the project area.

The various land management allocations of the Forest Plan and Monument Plan provides guidance on recreation management as well as guidance on protection of recreation resources during vegetation management. The goal of Deer Habitat (MA-7) is to "Manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality, and **recreation** opportunities." Standards and guidelines related to recreation state:

- M7-1. The area will provide various dispersed recreation opportunities primarily for the activities of viewing wildlife, hunting, gathering forest products, and roaded camping…
- M7-1. Closures and restrictions can be imposed on OHV activity where it threatens of damages other resource values.
- M7-1. Provisions will be made in the silvicultural and grazing prescriptions for maintaining amenities around areas where traditional concentrated recreation use occurs.
- M7-2. Providing the recreation setting, activity, and experience opportunities for the ROS category of Roaded Natural.

The goal for General Forest (MA-8) is to manage "in accordance with Roaded-Natural or Roaded-Modified classifications of the Recreation Opportunity Spectrum." See the Recreation and Special Uses Report for more information on ROS classifications. Standards and guidelines state:

- M8-1. Stands on these sites will be treated to retain the character that contributes to the value of the site for recreation.
- M8-2. Traditional informal campsites….will be recognized as being significant in producing dispersed recreation opportunities. Prescriptions for harvesting, cleanup, site preparation, and thinning will consider the environmental setting that contributes to the attraction of the sites for recreation purposes. The attempt will be made to retain this attractive character during and after treatment.
- M8-3. Recreation use can be discouraged or prohibited in areas where timber harvesting activities are occurring; where public safety is threatened; or where resource damage from recreation activity is occurring or may occur.
- M8-4. Generally, off-highway vehicle use is allowed. Closures and restrictions can be imposed on OHV activity where it threatens of damages other resource values. [Note: since the implementation of Travel Management Plan, off-road use is only allows on designated trails].

Scenic Views (MA-9) management area "will normally be managed in accordance with Roaded-Natural, but may include Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized and Semi-Primitive Motorized Winter-Only classifications."

The Old Growth management area (MA-15) also addresses recreation use in the following standards and guidelines:

- M 15-2. Vegetative manipulation to maintain the old growth character of some areas may conflict with recreation use, but such occurrences should be limited in size and number.
- M15-3. Concentrated use by off-highway vehicles and snowmobiles will not be permitted but incidental use of OHV's and snowmobiles will generally be permitted.

This project is within a portion of the Newberry National Volcanic Monument (see Figure 2), and the following standards and guidelines related to the recreation opportunity apply:

M-8 Intent: Overall, any projects to alter existing vegetation should respond to one or more of the following needs:

1.) protect existing large, old trees and provide for the perpetuation of the genetic heritage they represent,

2.) reestablish conditions that allow natural ecological succession of vegetation to the maximum extent practical,

3.) protect public health and safety (including the removal of hazard trees),

4.) enhance wildlife or sensitive plant habitat, scenic quality or recreational values,

5.) reduce serious threats from insects, fires or disease to resources outside the Monument,

6.) accommodate appropriate facility, trail or road construction or reconstruction consistent with this Plan.

M- 71. Recreational use of Class I, II, and II All-Terrain Vehicles within the Monument is not permitted. This restriction is promulgated in 36 CFR 261.54(e) and 36 CFR 261.55(a).

The desired condition for the road system is that it provides access to developed recreation sites and is minimal elsewhere; unneeded roads have been obliterated or closed; and expected levels of road closure/obliteration over the long term is approx.. 41 miles within the entire NNVM.

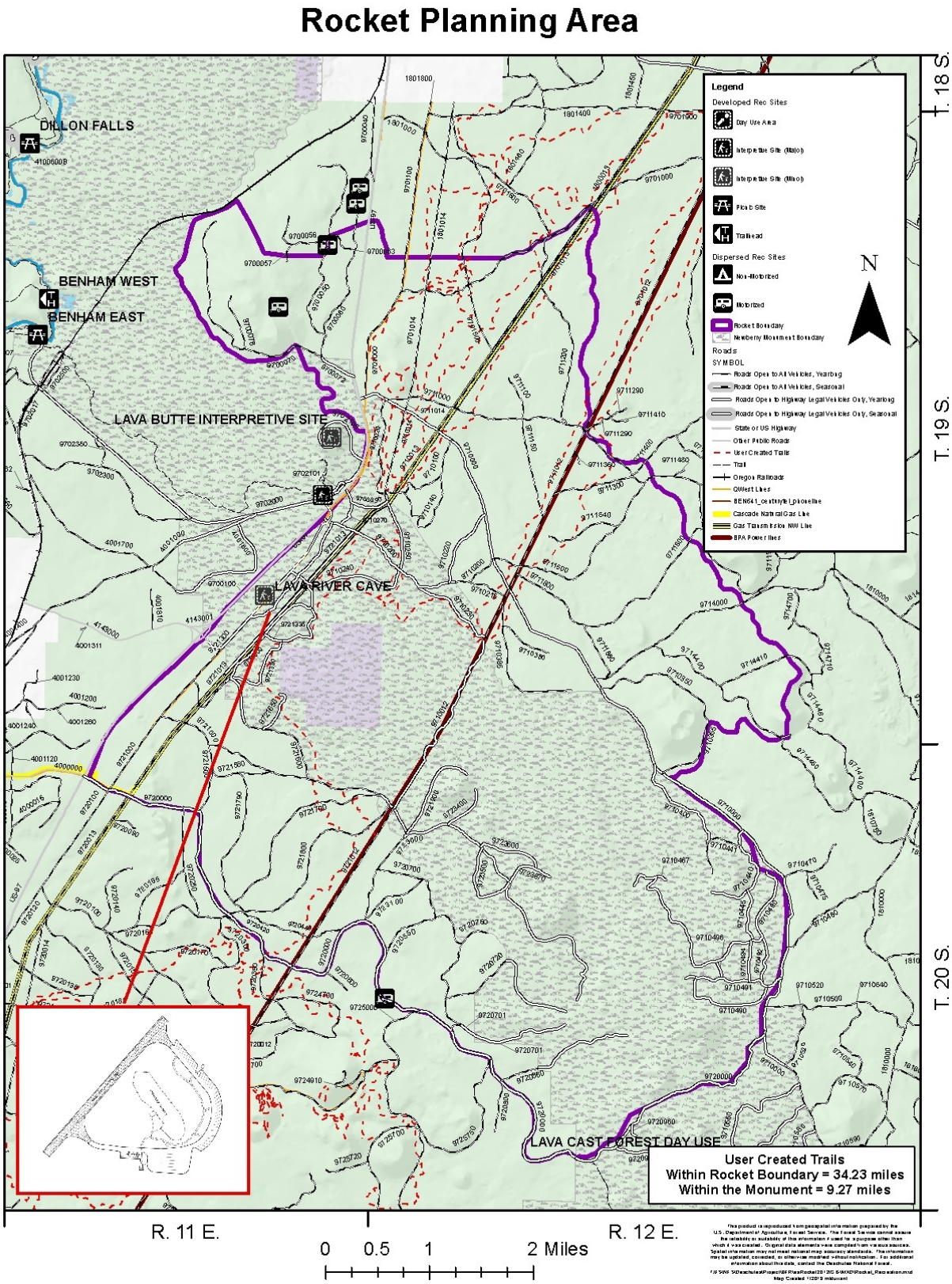


Figure 56: Developed and dispersed recreation sites, and user-created trails.

Developed Recreation Existing Condition

Lava River Cave (LRC) is the only developed recreation site within the project area. It is a high use Monument attraction open from May thru September and saw approximately 52,221 visitors in the 2012 season with average daily visitation of 358 persons/day. Although the focus of the site is the 1-mile underground cave trail, there are seven picnic sites and two double vault restrooms. The site is access controlled by two gates which are open from 9-4 during the operating season with the cave closing at 5 pm daily. Public is prohibited from entry into the cave during winter and other times when the recreation site is closed pursuant to 36 CFR 261.9(e) and 36 CFR 261.53(a). There are 44 single vehicle and six oversized vehicle parking spaces facilitating access to the welcome station, cave overlook plaza, and the cave itself. The site is operated in partnership with Discover Your Northwest doing-business-as Discover Your Forest (DYF). A recreation fee is required and lanterns are available to rent.

Lava Butte Interpretive Site hosts a large volume of visitors during the open season from May through September. Although not within the project area, visitors to Lava Butte would have a "birds-eye" view of the north portion of the project area.

Lava Cast Forest is another Monument attraction adjacent to the project area where the access road FSR 9720 serves as a project boundary on portions of the south edge.

Developed Recreation Environmental Consequences

Effects of the action alternatives are based on a number of resource protection measures for the proposed treatments for Scenic View corridors that are assumed to minimize how scenery is affected and are described starting on page 318. Effects of the action alternatives are also based on assumptions that recreational resource protection measures are adhered to.

Alternative 1

There are no direct or indirect effects from taking no action. The existing forest health and fuel loading conditions would be maintained in the LRC vicinity. The built environment may be less defensible over time should wildfire occur. Direct or indirect effects do not overlap in time or space, any residual effects from past projects, or expected effects from foreseeable projects; therefore there are no cumulative effects.

Alternatives 2, 3, and 4

Short-term, close range scenic views would be, in part, compromised by harvest and post-sale treatment effects such as slash, stumps, tracks and burning. Long term aesthetic qualities are expected to improve especially as results of this project expect more sustained, healthy forest in the project area. Following prescribed design features excluding project activities during periods when LRC is open would eliminate visitor exposure to harvest and fuel reduction activities. Visitors to Lava Butte and LRC would be able to view stages of project implementation and have the opportunity to engage with interpretive information describing real time activities.

The threat of wildfire advancing on the recreation facilities would be reduced from fuels treatments that are proposed to occur adjacent to LRC.

Project activities which open the canopy and promote growth of the shrub component between lava River Cave and Highway 97 would promote future screening of highway traffic from visitors. Absence of mowing or burning also affect continued development of shrub screening.

Cumulative Effects Alternatives 2, 3, and 4

The indirect / direct effects would overlap with the residual effects from the recent Highway 97 reconstruction project (2009-2012), Lava River Cave reconstruction activities (2010-2011) and past hazard tree removal actions to present.

Highway 97 reconstruction added two lanes of northbound traffic between the original highway alignment and Lava River Cave. The sights and sounds of highway traffic are immediately adjacent to Lava River

Cave parking area. Where continued vegetation manipulation prescribed by the Rocket planning effort is implemented, negative effects would occur to the visitor's experience and the sight setting. Openings created between the site and the highway would further expose views to highway traffic rather than a natural setting. Although it's anticipated that some visitors would look negatively upon increased highway exposure (especially picnicking visitors), the key attraction is underground and would not likely influence a visitor's decision to engage with the recreation opportunities at LRC.

A network of temporary roads between Highway 97 and FSR 9703 exist in part as a result of highway and wildlife fence construction activities. These existing and additional temporary roads constructed as a result of vegetation management activities, especially at the entry points from either roadway, need to be obliterated and naturalized to preclude continued unauthorized OHV use and to return appearance of an un-manipulated setting as described in the NNVM plan. Since LRC attraction is underground and the focus of a visit and temporary roads would be obliterated and naturalized in the FSR 9703 alignment, project activities would not likely influence a visitor's decision to engage with the recreation opportunities at LRC.

Recent reconstruction activities at Lava River Cave removed timber to facilitate construction of a new parking area. Since established as a recreation site, hazard tree management and removal has also been a contributing factor to the gradual reduction of stand density within the site boundary and adjacent to any element of the built environment at LRC.

Dispersed Recreation Existing Condition

Forest Service roads within the project area provide access for a variety of activities: driving for pleasure, 4-wheel driving, hunting, forest product gathering, caving and wildlife viewing. Motorized recreation in the area also includes OHV use on a network of unauthorized user created routes (Figure 56). This form of dispersed recreation is not permitted within the Monument (NNVM Standard/Guide M-71). Additionally, the Travel Management Plan only allows OHV use on designated trails. The network of unauthorized trails are also utilized for mountain biking. Tracks identified in 2010 show approximately 34 miles of user-created routes within the project boundary and about 9 miles solely within the Monument. Forest service personnel estimates suggest a 10% proliferation of routes since 2010; therefore there may be approximately 38 miles of user-created routes within the project area and 10 miles within the Monument. Dispersed camping occurs in some locations and is quite sparse in the project area. There were five mapped campsites in 2010 (Figure 56).

Dispersed Recreation Environmental Consequences

Alternative 1

The No Action alternative would have no direct or indirect effects on dispersed recreation occurring within the project area. The existing forest health and fuel loading conditions and trend would be maintained.

Direct or indirect effects do not overlap in time or space, any residual effects from past projects, or expected effects from foreseeable projects; therefore, there would be no cumulative effects.

Alternatives 2, 3, and 4

Other than short term visual quality effects, the proposed activities would have minimal effects on the dispersed campsites themselves, though some of the proposed vegetation management activities may occur within and/or adjacent to the sites themselves. Views would be opened for site-seeing traffic and dispersed campsite users adjacent to treatment units. This may increase the satisfaction for visitors where views are improved to buttes, rock outcroppings or other interesting geologic features.

Project implementation activities such as logging and burning operations around dispersed campsites would negatively affect the visitor's experience. Logging traffic, chainsaw and timber felling noise, and smoke would likely disrupt or displace recreation activities within or adjacent to the project area.

Opportunistic obliteration of travel routes and campsites not authorized by travel management regulations would incrementally further compliance with regulations and Monument Plan standards and guidelines. Visitors not understanding the illegal nature of the trails network that has been user-created may continue

creating alternate routes post project activities if not followed with field patrol education and information activities.

Closing 38.6 miles and decommissioning 5.8 miles of forest system roads would immediately reduce the current access to dispersed activities such as OHV recreation, hunting or forest product gathering in the areas proposed for closure. However, a number of the road segments proposed for closure are becoming overgrown with dense lodgepole pine and are likely not main motorized travel corridors for a majority of visitors. Furthermore, 20 miles of closure within the Monument move the landscape further toward the desired future condition described in the Monument Plan.

Cumulative Effects

The direct and indirect effects described above do not overlap in time or space with any residual effects from past projects or expected effects from foreseeable projects; therefore, there are no cumulative effects to dispersed recreation.

Special Uses Existing Condition

There are two major utility corridors aligned within the project area. One overhead Bonneville Power Administration transmission power line and a TransCanada Gas buried natural gas transmission line. In addition, there is a buried Century Link phone line running along FSR 9703 from Highway 97 to Lava River Cave. There is currently no recreation special use permit holders authorized to use or occupy the project area.

Special Uses Environmental Consequences

Alternative 1

There would be no direct, indirect, or cumulative effects on the utility corridors from taking no action. Line maintenance would continue as authorized under special use permits.

Alternatives 2, 3 and 4

Ensuring project managers are aware of all buried permitted facilities locations would eliminate effects of unearthing otherwise sound utility alignments. Coordination of hazard tree removal in association with vegetation management activities would provide analysis and implementation efficiencies.

Cumulative Effects – Alternatives 2, 3 and 4

Direct or indirect effects do not overlap in time or space, any residual effects from past projects, or expected effects from foreseeable projects; therefore there would be no cumulative effects to the special use utility lines.

Scenic Views

Introduction and Management Direction

This section of the EA addresses effects to scenery within the Scenic Views corridors of the Rocket project area. Scenic corridors occur along major routes such as Highway 97 and Forest Roads 9710 and 9720 (Figure 57). This section also addresses compliance with management direction for Scenic Views Management Areas classified as High Scenic Integrity in the Scenery Management System (SMS) (also known as Retention) and Medium Scenic Integrity (also known as Partial Retention) for areas both within and outside the boundaries of the Newberry National Volcanic Monument. Refer to the Scenic Resources Report for a description of these areas.

Newberry National Volcanic Monument Comprehensive Management Plan (1994)

The purpose of this plan is to guide all management and restoration activities within the Monument. It sets standards and guidelines for activities within five management zones for the Monument as well as outlines a monitoring program and identifies and prioritizes research opportunities. Monument Standard M-76 (pages 48-53) applies to this project and describes design projects to be, at a minimum, consistent with the Scenery Management System (SMS) or Visual Quality Objective (VMS) that applies to the site where the project is located, as shown on the map titles "Visual Quality Objectives – NNVM." Comply with the following definitions when applying Scenery Management System or Visual Quality Objectives which will be applied to the Transferal Corridor and Transferal Area, subject to valid geothermal lease rights.

In addition to being applied to Scenic Views Management Areas throughout the project area outside of the Monument boundaries, the Scenery Management System will also be applied to the areas within the Monument boundaries. These will be used in place of the interim standards described in the Monument Plan for the Summary Fire Character Rating System (SFCR) and Scenic Views Character Rating System (SVCR) for NNVM Monument Standard M-77 (See Scenic Views Map – page 3).

Deschutes LRMP

Standards and Guidelines in the Deschutes LRMP are specific to each forest type (i.e. ponderosa pine, lodgepole pine, mixed conifer). The majority of the Rocket project Scenic corridors are ponderosa pine. Refer to the LRMP or the Scenic Resources Report for a description of pertinent standards and guides.

Scenery Management System Methodology

The 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 (VQS)" which was 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.

In Scenic Views – Foreground Management areas classified in SMS as High Scenic Integrity (VQS - Retention), 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 in SMS as High Scenic Integrity (VQS - Retention).

This current and more holistic system includes the human element as an integral part of the ecosystem and has been the methodology used in place of the previous outdated Visual Quality System (VQS) of 1974 which continues to be referenced in Forest Plans that have not yet been updated to reference the current SMS instead. To facilitate this change in methodology, both systems have been referenced by applying SMS and including the VQS in parentheses such as High Scenic Integrity - SMS (Retention – VQS). 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 Level – SMS - Natural Appearing Landscape

(Retention – VMS) - MA 9, SV-1 Foreground, SV-3 Middleground

- Moderate Scenic Integrity Level - SMS - Slightly Altered Landscape
  (Partial Retention – VMS) - MA 9, SV-2 Foreground, SV-4 Middleground
- Low Scenic Integrity Level – 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

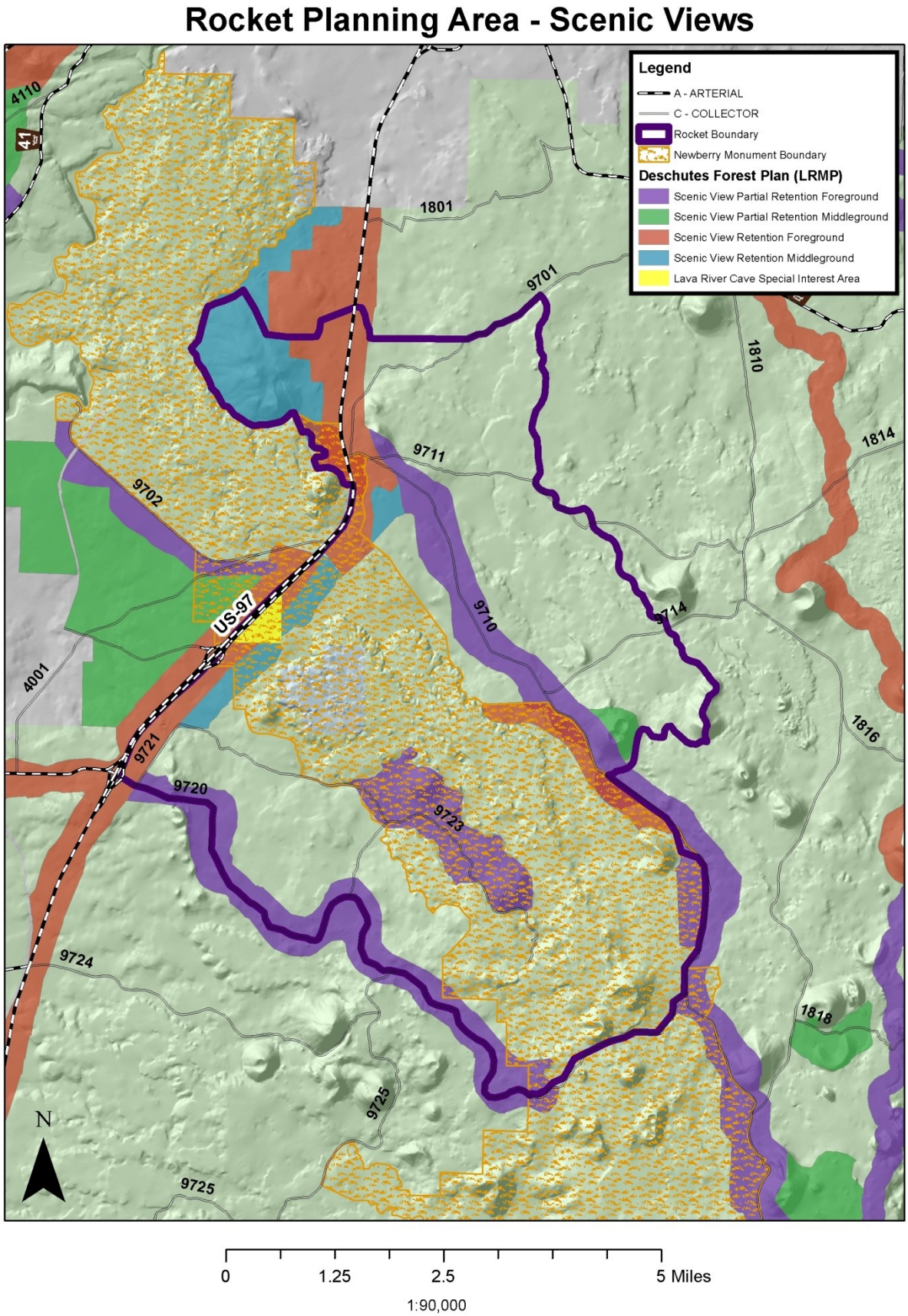


Figure 57: Scenic View Corridors in the Rocket Project Area

Existing Condition

The boundaries of the project area are mostly formed by scenic travel corridors of Highway 97 to the west and Forest Road 9720 to the south and east. Scenic travel corridors within or along the Newberry National Volcanic Monument are the Old Dalles-California Highway and Forest Roads 9721, 9723, and 9710. Another scenic travel route traveling through the project area is Forest Road 9711.

Within the project area, there are 970 acres of Scenic Views – Foreground Management Area classified as High Scenic Integrity – SMS (Retention – VMS), 1,102 acres of Scenic Views – Middleground Management Area classified as High Scenic Integrity – SMS (Retention –VMS). Most of these areas are found along the main scenic travel corridors of Highway 97, the Old Dalles-California Highway, and portions of Forest Roads 9710 and 9721. Within the Monument, this includes portions along the west side of Forest Road 9710. There is also views from the top of Lava Butte to the project area.

There are also 2,062 acres of Scenic Views – Foreground Management Area classified as Medium Scenic Integrity – SMS (Partial Retention – VMS) and 11 acres of Scenic View – Middleground classified as Medium Scenic Integrity – SMS (Partial Retention – VMS). Most of these areas are found along Forest Roads 9710, 9720, 9721, and 9723. Within the Monument, this includes Forest Road 9723.

Landscape Flows

Landscape flows throughout the area occur in south-north as well as southeast-northwest directions. The social connectivity corridor for visitors coming from other urban areas is along Highway 97 connecting California to Washington through Oregon. The lava flow as defined by Newberry National Volcanic Monument flows from the southeast to the northwest toward the Deschutes River. Migrations also occur in a southeast-northeast direction crossing the highway at nearby wildlife undercrossings. Other travel routes throughout the Monument and project area are in a southeast-northwest orientation.

Landscape Analysis Design

By applying a Landscape Analysis Design (Apostle/Diaz) process to the project area, a comprehensive view is provided with overlays comprised of ecosystem functions, landscape flows with physical, biological and social domains. The dynamics of the project area are defined by the lava flows and viewsheds of the Newberry National Volcanic Monument, vegetative stands throughout the area, and Highway 97 forming the northwest boundary of the site. Lava River Cave is the major recreation facility in the project area as well as the entry road to Lava Lands Visitor Center. Historic vegetation patterns, recent disturbance processes and changing climate conditions all combine to add other layers of how the project area is defined and then managed to a desired future condition (See Landscape Analysis Design Map in Appendix D).

Scenic View and Interpretive Opportunities

Scenic Views from Highway 97 and the Old Dalles-California Highway must continue to meet standards and guidelines for High Scenic Integrity (Retention–VMS). Screening of old and existing road scars along the Old Dalles-California Highway must be maintained and wild chokecherry along the entries to Lava River Cave must be protected. Opportunities for roadside or Visitor's Center interpretation of vegetation management exist and could be incorporated into sale area improvement projects.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects

The direct and indirect effects to the Scenic Views Management Areas for High Scenic Integrity (Retention) in Scenic Views – Foreground and Middleground landscapes as well as Medium Scenic Integrity (Partial Retention) in Scenic Views Foreground landscapes for Alternative 1 (No action) would be negative over time with no tree thinning, shrub mowing, or prescribed burning of surface fuels due to the overstocking of unmanaged stands, increased density, appearance of increased numbers of dead trees with brown needles,

fewer opportunities for healthy growth of large old ponderosa pine, and continued lack of visual diversity in species and size class.

These landscapes would be visible from scenic travel routes and scenic viewsheds throughout the project area that include Highway 97, the Old Dalles-California Highway, and Forest Roads 9710, 9720, 9721, and 9723.

The proposal to thin within Scenic View corridors to 40 sq. ft. BA was considered a key issue for potential impacts to scenic quality because some members of the public think it would be too visible and too unnatural appearing. Alternative 1 includes no thinning to 40 sq. ft. BA.

Past projects within and surrounding the project area have not provided large enough fuels treatments to maintain and enhance scenic views or to guarantee safe access during potential wildfire situations. The no action alternative would also increase the likelihood of heightened danger and risks to residents and visitors from potential wildfire affecting ingress and egress along scenic travel routes and main access roads throughout the project area. Opportunities for opening scenic views to vistas, lava features, and highlighting large old growth ponderosa pine would not be occurring over time so the desired future condition for scenic views would not be met.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

An amendment to Forest Plan M9-90 is proposed in order to allow prescribed fire to occur and to meet standards and guidelines for the project's Scenic Views Foreground Management Areas classified as having High Scenic Integrity (Retention) and Medium Scenic Integrity (Partial Retention). The amendment would allow treatment in areas greater than 5 acres and allow the visual effects of management activities to be visible for more than 1 year in High Scenic Integrity (Retention) areas and more than 2 years in Medium Scenic Integrity (Partial Retention) areas. First-order effects of prescribed fire will not be visible to the casual Forest visitor for 5 years after the action is completed.

Treatment units affected by this amendment are located along Highway 97, Old Dalles-California Highway, Forest Roads 9710, 9711, 99720, 9721, and 9723 both within and outside the Newberry National Volcanic Monument boundaries. The following treatment units included in these areas are: Units #11, 22.1, 22.4, 22.5, 22.6, 23.1, 36, 37, 41.1, 41.2, 42, 45, 48, 49.1, 49.2, 96, 97, 98, 99, 100, 129.1, 129.2, 209, 210, 213.1, 218, 247, 275, 277, 277.1, 277.2, 278, 307.1, 307.2, 338, 352, 801.1, 803, 804.1, 807.2, 812.1, 812.2, 812.5, 818, 821.1, 836, 842.1, 842.2, 876.1, 876.2, 885, 900, 911, 914, 922, 923, 924, 925, 941, 943, 944, 945, 946, 949, 958, 959, 960, 969, 972, 978, 980, 981, 982, 987, 988, 992, and 995

Chokecherry communities in mowing and underburning units that provide visual diversity in the pine forests located to the south of and adjacent to the Lava River Cave exit and along the Old Dalles-California Highway are to be protected. Other areas to be protected are developed recreation site signs along the Old Dalles-California Highway. A small triangular area (Unit #974) should also be protected because it currently provides vegetative screening to an existing old road scar that would be visible when driving south on the Old Dalles-California Highway toward Highway 97 when leaving Lava Lands Visitor Center and Lava River Cave. The units affected are: Units #96.1, 96.2, 96.3, 97, 98, 99, 100, 101, 278, 714, 809.1, 809.2, 832, 833, 834, 836, and 974

Locating landings, skid trails, slash piles or staging areas using existing openings and skid trails, minimizing bole damage to remaining vegetation along scenic travel corridors and access to developed recreation sites (Highway 97, Old Dalles-California Highway, Forest Roads 9710, 9711, 9720, 9721, and 9723), and flush cutting stumps (6 inches or less with angle cut away from line of sight) would need to happen to meet standards and guidelines for Scenic Views Management Areas in immediate Foreground areas (0-300 feet). The affected units are: Units #96, 97, 98, 99, 100, 117, 152.2, 220, 277.1, 277.2, 277.3, 278, 367.1, 367.2, 447, 715, 830.1, 831.1, 831.2, 831.5, 836, 840.1, 840.2, 905, 906, 907, 908, 960, and 973.

The proposal to thin within Scenic View corridors to 40 sq. ft. BA was considered a key issue for potential impacts to scenic quality because some members of the public think it would be too visible and too unnatural appearing. Alternative 2 includes the proposal to thin to 40 sq. ft. BA on 2,020 acres. The visual effects of thinning to this basal area would depend on the size of trees in the stand (lots of smaller trees make a stand appear more dense than a few larger trees would at the same basal area). A more open stand would increase the amount of time before it reaches a density above the upper management zone; therefore lengthening the time before needing to re-enter the stands again to reduce density.

Cumulative Effects

All units within Newberry National Volcanic Monument would meet Scenery Management System classifications through the design of underburning activities that minimize short-term visual effects by maintaining crown scorch at less than 30 percent and minimizing bole scorch up to 10 feet in height. The SMS classifications would also be met by minimizing the amount of leave-tree marking and blacking out tagging units with vertical orange paint on both sides of trees along scenic travel corridors and access to developed recreation sites after the sale closes.

With the footprint of this alternative being 43% of the forested acres, the amendments to the Forest Plan will allow underburning activities to occur with Scenic Views Management Areas as well as commercial thinning within late and old structure (LOS) stages of ponderosa pine that are below the historic range of variability (HRV). The more open character created by the proposed action would result in larger diameter trees in open pine areas which is described in the Monument Plan for Ponderosa Pine Forests (see page 57) as a desirable feature with small size groupings or groves of mature pine scattered throughout the foreground.

Alternatives 3

Direct and Indirect Effects

This alternative proposes 3,983 acres of fuels treatments and 5,580 acres of thinning and/or fuels treatments. There are fewer acres of fuels treatment but still considerable mowing and thinning in this alternative and within Scenic Views corridors visible from the main transportation routes and recreation access in the project area. Mowing only within Scenic Views corridors instead of mowing and burning and would not require Forest Plan amendments to the Scenic Views Management Area standards and guidelines. Fewer acres are being entered to retain more dense areas for wildlife. Also, by applying variable thinning prescriptions there would be more visual diversity. This alternative would meet standards and guidelines for the project's Scenic Views Foreground Management Areas classified as having High Scenic Integrity (Retention) and Medium Scenic Integrity (Partial Retention).

Cumulative Effects

The general appearance of the landscape within and around the Rocket Project area, especially as viewed from Scenic Views travel corridors and access Forest Roads throughout the area, does not currently represent the desired future condition of a natural appearing landscape. In the long-term, these proposed treatments will result in a more natural appearing landscape that has larger diameter "historic" ponderosa pine old growth trees with larger scale openings and more visual diversity in varied sizes, spacing, and species. The Scenic Views Management Area standards and guidelines will be met as a more natural ecological succession of vegetation occurs in the future through the proposed treatments.

Alternative 4

Direct and Indirect Effects

This alternative proposes 7,871 acres of fuels treatment and treats 9,541 acres with thinning and/or fuels treatments. Zero acres are thinned to an average of 40 sq. ft. basal area; the stands within Scenic Views corridors are thinned to mixed basal area which will provide variability in the stands. This alternative proposes 2,372 acres of fuels treatment in the Monument, which is more than the other alternatives. There are also more stands with thinning in this alternative than in the other alternatives. The fuels treatment areas would be accomplished in larger burn blocks and would be more visible from Scenic Views Management

Areas along main travel corridors. With Forest Plan amendments applied to this alternative, Scenic Views Management Area standards and guidelines would be met.

Cumulative Effects

The general appearance of the landscape within and around the Rocket Project area, especially as viewed from Scenic Views travel corridors and access Forest Roads throughout the area, does not currently represent the desired future condition of a natural appearing landscape. In the long-term, these proposed treatments will result in a more natural appearing landscape that has larger diameter "historic" ponderosa pine old growth trees with larger scale openings and more visual diversity in varied sizes, spacing, and species. The Scenic Views Management Area standards and guidelines will be met as a more natural ecological succession of vegetation occurs in the future through the proposed treatments.

Figure 58 is a series of photo points from the Fry Underburn (Wall, 2012). The pictures on the left were taken prior to the underburn and the pictures on the right were taken within a couple weeks after the underburn. The Fry underburn, located approximately 9 miles northwest of the Rocket planning area, was implemented in the spring of 2012 in a blackbark stand similar to the pine stands found in Rocket. The results shown within the Fry underburn would be somewhere in the middle of the range of effects that could be expected from the Rocket underburning. The actual effects would depend on numerous factors such as burn season, pre-burn fuel loading, fuel moisture conditions, and lighting techniques. Figure 59 displays the visual effects of underburning over a longer period of time. As shown in Figure 59, within a few seasons after the underburn the red needles drop and the visual effects of the underburn begin to fade.

Figure 58: Fry Underburn, before (left) and after (right).

Figure 59: Visual effects of prescribed underburn. Immediately following underburn (left) and a few seasons after an underburn (right) at the "Demo" project near the High Desert Museum in a similar stand to the black bark pine stands in the Rocket project area.

Scenic Views Forest Plan Amendments

The description of the alternatives in Chapter 2 includes two non-significant amendments to standards and guidelines of the Scenic Views management allocation (MA-9). These amendments deal with standards and guidelines that restrict the use of prescribed fire. The use of fire in the ponderosa pine forest type is key to restoring the area to historic conditions, including the promotion of late and old structure.

The goal of the Scenic Views Management Area is to provide Forest visitors with high quality scenery that represents the natural character of Central Oregon. The general objectives as stated in the Forest Plan include:

> "Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident or will be visually subordinate to the natural landscape.
>
> Landscapes will be enhanced by opening views to distant peaks, unique rock forms, unusual vegetation or other features of interest. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. 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 variations of stand densities and size classes. Large, old-growth pine will remain an important constituent, with trees achieving 30 inches dbh or larger and having deeply furrowed, yellowbark characteristics."

Amendment #1 allows visible effects of fuels reduction, specifically underburning, for approximately five years. Amendment #2 allows prescribed underburning to occur on in blocks larger than five acres. See page 29 for a description of these amendments.

Table 176: The units and number of acres proposed for underburning treatment within foreground areas (retention and partial retention) where scenic view standards and guidelines will be amended to the reintroduction of fire.

Alternative	Units	Total Unit Acres
2	11, 22.1, 22.4, 22.5, 22.6, 23.1, 36, 37, 41.1, 41.2, 42, 45, 48, 96.1, 96.2, 96.3, 97, 98, 99, 100, 209, 210, 213.1, 247, 275, 277.1, 277.2, 277.3, 278, 307.1, 307.2, 338, 801.1, 803, 804.1, 807.2, 812.1, 812.2, 812.5, 818, 821.3, 836, 842.1, 842.2, 876.1, 976.2, 900	1,509
3	96.2, 96.3, 99, 100, 275	77
4	11, 41.1, 42, 45, 48, 49.1, 49.2, 96.3, 97, 98, 99, 129.1, 129.2, 210, 213.1, 275, 277.1, 277.2, 307.1, 307.2, 803, 812.1, 812.2, 812.5, 821.1, 836, 842.1, 842.2, 976.1, 976.2, 922, 923, 924, 941, 943, 944, 945, 946, 949, 958, 959, 960, 969, 972, 978, 980, 982, 992, 995	1,374

Anticipated Effects to Scenic Views due to Amendments

The objective for providing high quality scenery (including open, park-like stands of ponderosa pine and enhancement of existing large pine trees) will be met in the long term. Overall, reducing the fuels within foreground scenery areas will help to feature the larger ponderosa pine with old-growth characteristics. It will also help to promote the development of larger trees where there are none. This is consistent with the overall goal of the scenery standards and guidelines. Scorching will likely remain below 30% crown scorch, although some mortality could occur to smaller trees. Larger trees that might experience mortality from burning would remain to provide snag habitat, except if they are hazard trees. Prescribed burning would occur during periods of cooler burning to keep burn intensity and scorch heights down.

About 1,509 acres are proposed under Alternative 2 (77 under Alternative 2 and 1,374 under Alternative 4) for prescribed underburning that at least partially overlap the scenic views allocations (Table 176). Ecologically, the reintroduction of fire is consistent with the restoration concept of more frequent low intensity fire on the landscape. This also improves ability to be consistent with the more recent Eastside Screens direction regarding the development of open park-like conditions with large trees.

In accordance with FSM 1926.51, the following items describe non-significant amendments with a discussion of how the actions address these items:

1. *Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;*

By reintroducing fire to this frequent fire regime, the consequence of the reduction of highly flammable shrubs and ladder fuels within scenic view areas will provide for long-term protection and resiliency to ponderosa pine. This also will allow the second-growth ponderosa pine to grow and eventually replace any existing old growth pine. Providing and maintaining the natural character of central Oregon is a central premise of and is consistent with the goals and objectives for scenic views.

2. *Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;*

Adjusting standards and guidelines allows for the long-term land and resource management by reducing the risk of high intensity wildfire that could result in widespread tree mortality, including the larger trees. Maintaining the larger ponderosa pine is essential to being consistent with the goals and objectives for scenic view.

3. *Minor changes in standards and guidelines; and/or*

On a landscape scale, this is a minor change to standards and guidelines. This change will contribute to the long-term protection, enhancement, and meeting the goals and objectives of scenic views. Scenic view allocations are present along all major highways as well as other areas. The Forest can only treat so many acres per year, so although there would be patches more than 5 acres underburned, the amount that does not get treated is far more.

4. *Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.*

By reintroducing fire at this time, fire can be used periodically to maintain the scenic views management allocation as needed. This is particularly important within the NNVM. The NNVM Plan acknowledges that fire (prescribed and natural) plays a key role in the ecological processes within the monument (NNVM Plan p. 8).

Potential Wilderness and Other Undeveloped Lands

Introduction and Existing Condition

There are no wilderness or inventoried roadless areas within the Rocket project boundary; therefore, there would be no effect to any wilderness or inventoried roadless area from any of the alternatives. This section of the EA addresses Potential Wilderness Areas and other undeveloped lands. Mapping was completed with Deschutes National Forest's Geographic Information System, using corporate data sources. Databases for the existing road system and past harvest were combined with examination of aerial photography to determine areas that might meet the inventory criteria for potential wilderness. According to FSH 1909.12, Chapter 71, the inventory criteria for potential wilderness is 1) More than 5,000 acres in size; 2) If less than 5,000 acres the area can meet one or more of the following: a) Area can be preserved due to physical terrain and natural conditions or is a self-contained ecosystem, such as an island, that can be managed as a separate unit of the National Wilderness Preservation System; b) Area is contiguous to existing wilderness, inventoried roadless area, primitive area, etc. regardless of size.

As described in previous sections of this EA, most land in the project was once owned by Shevlin-Hixon or Brooks Scanlon timber companies. Their management (until 1929 and 1944 respectively) involved associated road building and logging infrastructure such as landings. Through the mapping process, patches of forest that fall in between roads and harvest units were reviewed for potential wilderness criteria. Two polygons that meet the criteria were identified. They both consist primarily of the large lava flow, and are separated by the powerline corridor (see Figure 60). At less than 5,000 acres, these two polygons can most likely be preserved because of the physical terrain (lava flow). There have been utility corridors and even railroad lines built across these lava flows in the past, but they are now subject to the NNVM legislation which called for preserving and protecting the geologic landforms within the Monument. The polygons

coincide with the areas categories by Oregon Wild as “roadless” except that the Forest’s analysis selects for farther away from roads and management activities.

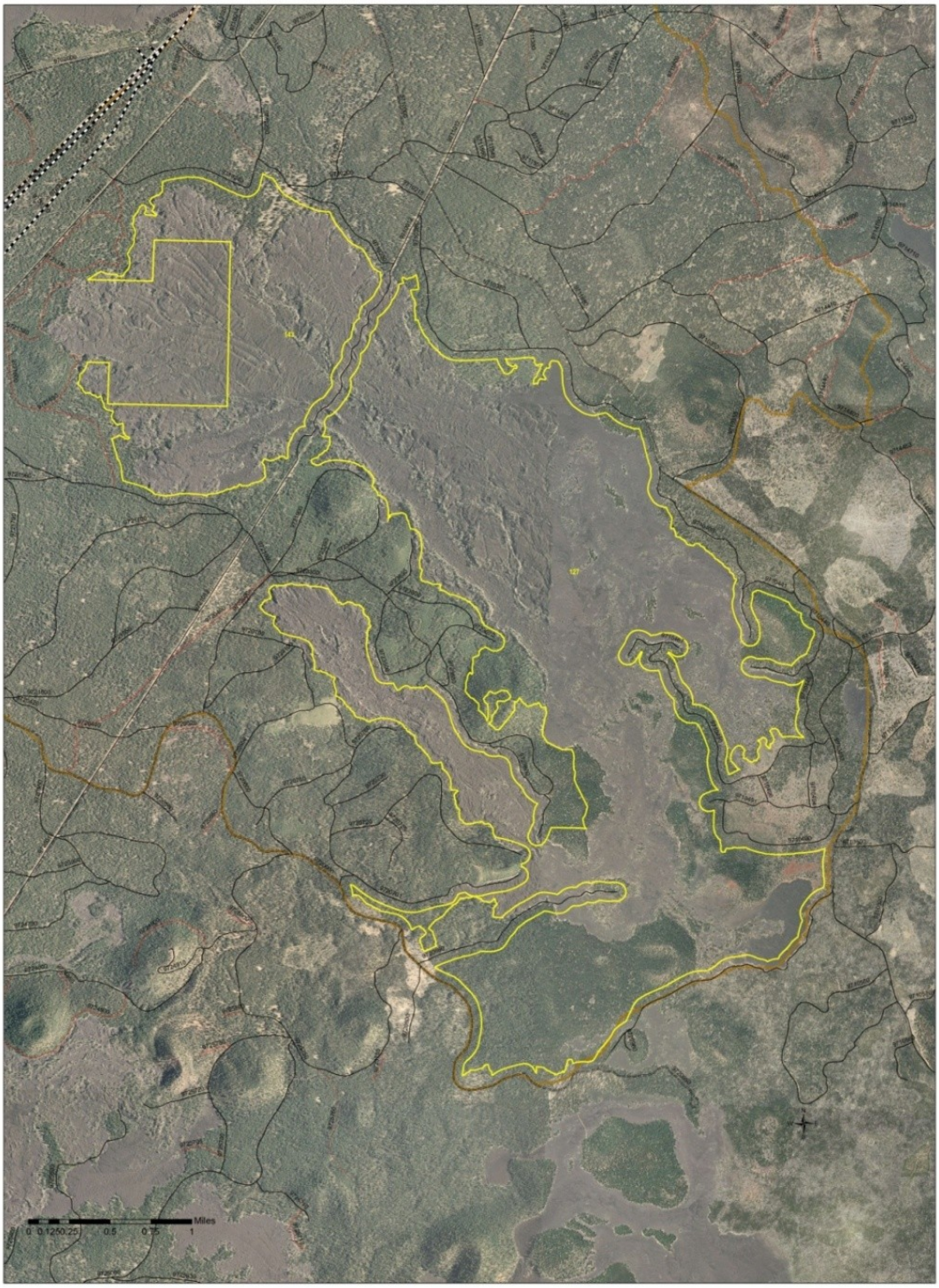


Figure 60: Aerial photo image of the Rocket project area with areas meeting the criteria for potential wilderness outlined in yellow.

Environmental Consequences

Alternative 1

There would be no direct, indirect, or cumulative effects to Potential Wilderness Areas (PWAs) or other undeveloped lands. No timber harvest or temporary road construction would take place, and the current condition of values associated with these areas would not change. Ecological trends would continue as described under No Action for all of the resources in this EA.

Alternatives 2, 3, and 4

The proposed activities in all action alternatives will not directly affect the lava flow area. Areas around the edges of the polygons may be entered for thinning, mowing, and underburning activities, but these areas have been actively managed for many years. The areas meeting potential wilderness criteria fall within the NNVM and are subject to complying with the legislation that established it. None of the action alternatives would substantially alter the undeveloped character of a potential wilderness area. The southern portion of the area that meets the criteria for potential wilderness overlaps the Mokst Butte Research Natural Area (RNA). This is the only largely forested portion of the PWA. No activities are proposed in this portion of the Rocket project area.

Cultural Resources

Introduction and Existing Condition

Management direction for cultural resources is found in several sources including: the Deschutes National Forest Resource Manage Plan, Forest Service Manual section 2360, federal regulations 36CFR64 and 36CFR800, and federal laws including the National Historic Preservation Act, National Environmental Policy Act, and the National Forest Management Act (all as amended) which all work in conjunction with the 2004 Programmatic Agreement among United States Forest Service Region 6 and the Oregon State Historic Preservation Officer (SHPO).

In general, the existing management direction notes the Forest must consider project's effects on cultural resources when those projects are within the bounds of the Forest's jurisdiction. In order to follow this direction the Forest has to determine if and where cultural resources occur, evaluate each resource for eligibility to the National Register of Historic Places (NRHP), and protect or mitigate effects to resources that are deemed eligible or potentially eligible.

Relevant Forest Plan Standards and guides include:

- CR-2 which states that historic properties located during inventory will be evaluated for eligibility to the NRHP.
- CR-3 states that in concert with inventories and evaluations the Forest Service will develop thematic National Register nominations and management plans for various classes of historic properties.
- CR-4 indicates that project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.

Desired Condition

The desired condition is not clearly stated in the Forest Plan but can be derived from the implied goals of the Standards and Guides and the Monitoring Plan. Those include knowing the location and extent of all cultural resources, evaluating each one for eligibility to the NRHP, and developing management plans for all eligible properties which entails protection or mitigation of effects.

Existing Condition

The project area has cultural resource surveys that date back more than 30 years. Areas surveyed according to current standards include 17,271 acres which totals 76% of the 22682 acre project area. Through these past surveys archaeologists located and recorded 61 cultural resources and one modern memorial cross. Of these cultural resources there are 49 sites and 12 isolated occurrences. In Oregon isolated occurrences consist of less than nine artifacts while a site consists of some combination of more than 10 artifacts.

Of those, there are nine historic sites, 40 prehistoric sites, four prehistoric isolated occurrences, and eight historic isolated occurrences. Isolated occurrences by their very nature are small scatters not eligible for inclusion on the NRHP. Of the cultural resource sites: 40 are eligible for inclusion on the NRHP, 4 are not eligible for inclusion on the NRHP, and 5 remain unevaluated for inclusion on the NRHP as there is currently not enough information available for evaluation.

Prehistoric site types currently identified in the project area include lithic scatters, lithic scatters with flaked stone tools, lithic scatters with ground stone tools, and those scatters with a combination of tool types. Historic era sites include railroad logging operations and early recreational use on the Forest as evidenced by the refuse dumps and railroad grade.

Environmental Consequences

Alternative 1 – No Action

No treatments would be implemented under this alternative. There would be no commercial or noncommercial fuel reductions which would result in no ladder or surface fuels being removed from the project, no road closures or decommissioning, and the objective of providing wood products would not be accomplished.

Direct, Indirect, and Cumulative Effects

The most likely indirect effect would result from a large scale unplanned wildfire event. These wildfire events would be exaggerated by a continual accumulation fuel. Fires have the ability to greatly impact cultural resources. Metal artifacts oxidize and become brittle, glass melts, and ceramics vitrify and decorative elements disappear. Organics like wood are completely consumed. Prehistoric elements like obsidian lose valuable dating information as the stone surface dehydrates or melts from the intense heat.

Other indirect impacts could be those resulting from activities associated with managing a wildfire event like control lines, staging areas, and ground disturbance from heavy machinery within site boundaries. Catastrophic fires can also increase the fragility of soils resulting in obscured or exposed sites due to erosion or aggradation.

Since there would be no treatment in the project area there would be no direct or cumulative effects.

Alternatives 2, 3, and 4

Direct and Indirect Effects

Direct effects from activities that could negatively affect those qualities of a site that contribute to its eligibility and that are proposed in the Rocket Vegetation Management project would consist of: the commercial harvesting of trees (using ground based equipment to fall and transport trees to the landing); the thinning of trees and creating openings for wildlife (also using ground based equipment); the creation of landings (one per ten to fifteen acres of harvest); the creation of new skid trails from the unit to the landing (trails would be located approximately every 100 feet apart); and the movement of harvesting equipment across the landscape (fellers, feller-bunchers, and processors would be allowed to travel cross-country and not be restricted to designated trails).

Other activities proposed that would adversely affect a ground-based archaeological site is mowing or mechanical shrub treatment (on flatter ground a rubber-tired tractor equipped with a rotary mower will be utilized for these treatments. Slopes over 20% will require a light tracked machine with a front mounted

mow deck in order to access the steeper slopes. Mechanized equipment will mow, cut, chop, grind, or otherwise reduce shrub or ground fuel vertical structure to a height of less than 8" and may occur on up to 70% to 80% of a unit).

Indirect effects from proposed activities, that could adversely affect an archaeological site, include grapple piling the slash left over from harvesting from the unit to the landing (using a track mounted excavator with hydraulic grapple); the dozer building of slash piles left from harvesting (completed pile dimensions will be approximately 12' long X 12' wide by 8' high, and would occur at a rate of 6 to 10 piles per acre); the hand building of slash piles (completed pile dimensions would be approximately 6' long by 6' wide by 5' high. The amount of piles per acre would fluctuate along with fuel loadings and are expected to occur at a rate of 18 to 24 piles per acre); and finally, the construction of firelines associated with prescribed underburning (fireline would be constructed using either a hand type fireline that would be approximately 20" in width or a skid-steerer that would be approximately 5 feet in width. Firelines would be rehabilitated following underburning activities by pulling displaced surface material back over them, including soil, rocks, and woody material; soil berms would be scattered back across the firelines). Finally, the building of temporary roads used to get trucks to the landings would adversely affect sites that are ground-based within the project area.

Although there are many activities that could adversely affect archaeological sites within the Rocket Vegetation Management project area, design criteria to avoid all eligible sites – the planning of activity unit boundaries to avoid sites; making site locations known to ID team members so their planned projects will avoid sites; requesting ATP designations on timber sale maps; and participating in the post-harvesting burn plans will all protect known eligible sites throughout the project area.

Cumulative Effects

If all design criteria are followed for this project, there should be no cumulative effects from proposed activities to known eligible archaeological sites.

Economic and Timber Sale Feasibility Analysis

Introduction

This section deals with three aspects of financial and social impacts: financial viability, impacts to local employment, and environmental justice. Financial viability is dependent on costs and revenues associated with a particular timber sale. Impacts to the forest sector employment are a reflection of District harvest levels and employment rates based on volume harvested. Timber sales, fuel treatments, and associated resource work can generate employment and stimulate the local economy. Environmental justice can be a concern if minorities or underserved groups are not granted equal opportunities to benefit from government programs and projects. The major opportunity for these groups are the small business set aside for timber sales and the opportunity for tree planting that may arise after timber harvest is complete.

Forest Service Handbooks (FSH) 1909.17, 2409.18, and Forest Service Manual (FSM) 2400-Timber Management, Chapter 2430 direct the evaluation of economic viability for timber sales and related costs and cost Efficiency for proposed projects and all related costs.

Executive Order 12898 (February 11, 1994) on Environmental Justice directs the agency to, "conduct its programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such programs, policies, and activities, because of their race, color, or national origin."

Analysis Methods

Alternatives for the Rocket Project on the Bend Fort Rock were compared based on timber sector employment, financial feasibility, and environmental justice. Timber sector employment considers the contribution of federal timber harvest in Deschutes County. The number of jobs created is compared among alternatives for the project.

Financial analysis consists of estimates for discounted costs, discounted revenue and net present value as a means of comparing the financial feasibility among alternatives for the project. The Transaction Evidence Appraisal method (TEA) estimates the fair market value of timber based on bid rates for past timber sales. This method is used to analyze timber value and draws on the most recent product values using a program developed for Forest Service timber appraisals (Reinberger 2010).

Environmental justice is a consideration for all agency run programs and activities. Portions of this project that may provide opportunities for minorities and underrepresented groups largely consist of contracted activities that may employ minority populations such as post sale planting.

Timber Sector Employment

Existing Condition

Oregon's forest products industry is an important part of Oregon's economy and a major player in the nation's wood products market (Gebert et al. 2002). Timber harvest has been important to Deschutes County for many years. Today both logging and related industries employ over 1,100 people in the County. The Rocket alternatives could produce between 18,300 and 43,000 CCF of timber and fiber products.

Historically timber harvesting has been a key use of forests in Deschutes County. The 1990 LRMP described mills in Deschutes County as "heavily dependent on timber supplied by the Forest" (LRMP 2-2). Production of timber in Deschutes County has fallen over the last two decades but has remained relatively steady on USFS land since 2005 (Table 177). In 1986 more than 117 million board feet were harvested, of which 86% were from Forest Service land. In 2011, 22 million board feet were harvested in Deschutes County, 75% from Forest Service land.

Table 177: Deschutes County Harvest Volume, Thousands of Board Feet (Oregon Department of Forestry, 2013).

Year	Forest Industry	Other Private	State	USFS	Other Public	Total
2005	2,019	41	0	26,235	0	28,295
2006	6,905	2,623	2	15,426	0	24,956
2007	10,864	660	0	10,924	16	22,464
2008	6,201	474	0	28,895	510	36,080
2009	66	29	0	14,040	540	14,675
2010	2,207	2,274	0	14,378	0	19,339
2011	5,570	9	0	17,335	0	22,851

The contribution of this project to timber sector jobs is based on the volume of wood harvested. Forest sector employment is more important in Deschutes County than in Oregon State as a whole. Since 2005 in Deschutes County, employment in the forestry and logging industry has hovered around 90 jobs. Associated sectors including wood products manufacturing (811 jobs) as well as agriculture and forestry supported activities (243 jobs) also contribute employment opportunities within the county (Oregon Employment Department, 2012). Over the last five years, the Bend Fort Rock Ranger District has produced an average of about 36 million board feet of timber and fiber products per year. This analysis estimates 16 jobs created for

each million feet of timber harvested (Brandt, et. al., 2006). The estimated volume for each alternative was used to calculate how many jobs each of the alternatives could provide or maintain.

Environmental Consequences

This alternative would not harvest any timber and would not support forest sector employment, contributions to local economies, or any other quantitative benefits from related projects.

Alternative 2

Alternative 2 would provide about 256 jobs. Alternative 2 produces more jobs than alternative 3 and fewer jobs than alternative 4. This alternative would produce roughly 16 million board feet of timber.

Alternative 3

Alternative 3 would provide about 136 jobs. Alternative 3 would produce fewer jobs than alternative 2 or alternative 4. This alternative would produce 8.5 million board feet of timber.

Alternative 4

Alternative 4 would provide about 320 jobs. Alternative 4 would produce more jobs than alternative 2 or alternative 3. This alternative would produce 20 million board feet of timber.

Cumulative Effects –Alternatives 2, 3, and 4

Timber Sector Employment was analyzed at the scale of Deschutes County. This scale was chosen as it coincides with other state employment data and provides a focused estimate of timber production that is largely driven by the Deschutes National Forest. The list of past, present and reasonably foreseeable future actions in Table 18 was consulted for this analysis. There are no projects that would contribute to cumulative effects related to timber sector employment. Other employment would continue to occur as a result of other timber sales in progress, recreation activities, and other special use receipts across the Forest. Commercial collection of non-timber forest products could continue to occur, although the quantity of harvest is unknown. Overall, none of the alternatives would result in economic-related cumulative effects.

Financial Viability

Existing Condition

Financial viability is analyzed based on net present revenue minus net present costs. Costs are analyzed for the timber sale and the project development separately. Projects on the Bend Fort Rock District often include many acres of low value small material that needs to be treated along with a timber sale. This low value material may be sold as biomass, or may be removed with fuel treatments paid for with congressionally appropriated fuels funding. In many cases a timber sale is viable but the project as a whole is in the red due to fuel treatments that occur after the sale is completed.

Financial costs are analyzed for both the timber sale and the project as a whole. Figure 61 shows the relationship between project costs and the subset of costs associated with the timber sale. Timber sale costs include stump to truck, haul costs, planting costs, road maintenance, and brush disposal costs. Project costs are analyzed more broadly and include NEPA planning, sale preparation, administrative costs, and additional project costs such as burning and slash treatment.

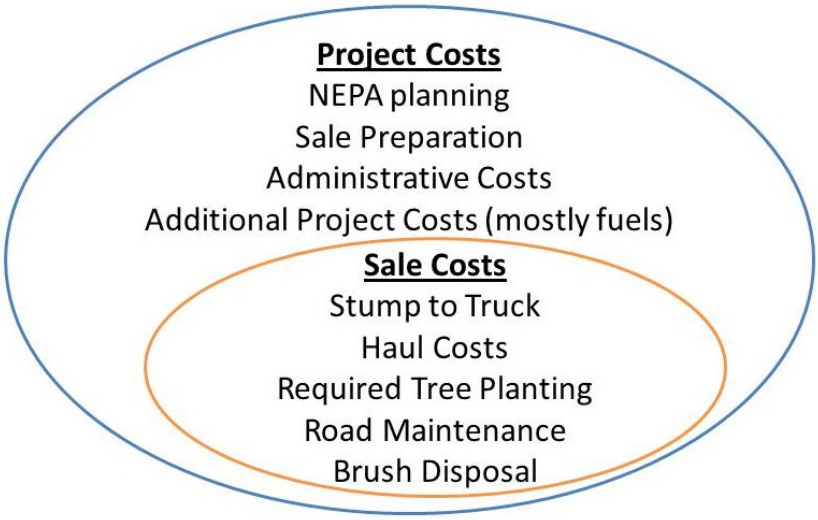


Figure 61: Project and Timber Sale Costs

Revenue generated by timber production is estimated based on species sold, whether trees are sold as timber products or biomass, and the fair market value of the material. The harvest volumes and species mix estimates come from the silvicultural prescriptions created for the Rocket area. Timber values were calculated using prices for logs delivered to the mill in eastern Oregon for March 2013. The Product Quality Adjustment Tables are built into the appraisal program and are provided by Northwest Forestry Services (NWFS. 2013). Stump to truck logging costs were estimated by Vickie Dunaway, Appraisal and Contract Specialists, at $162.49/mbf. Brush disposal and road maintenance and reconstruction costs were provided by district personnel and based on recent contract costs as well as site conditions for the Rocket project (brush disposal $2.80/mbf, road maintenance $7.55 /mbf). Haul costs were calculated using the Haul Cost Program ($56.28/mbf) (Barger, 2012).

This analysis does not place a monetary value (revenue) on benefits which may occur from actions other than the timber sale. These benefits include but are not limited to increased future yields resulting from reduced stocking and reduced risk of stand replacing wildfire. Benefits with other actions are described elsewhere in the EA.

Net present value and net present cost were calculated by subtracting costs from revenue using the economic analysis Transaction Evidence Appraisal Program (USFS, ECON 6.0 TEA-R6, 2013). The program uses the most recent product log values and appraisal costs to evaluate timber sale and project economics. A 4% discount rate is used to value all costs and benefits to present value. This analysis is appropriate for comparing among alternatives but should not be used as a predictor of individual sale costs or value. Prior to advertisement of any sale an appraisal will be conducted as part of contract development for each timber sale. Actual appraised value of individual sales may change over time and may depend on the design of timber sales, fuel prices, and regional lumber supply.

Table 178 shows costs used to estimate fuels related project costs. Both alternatives included mechanical shrub treatment, underburning, subsoiling of landings and skid roads after harvest, and various slash treatments. Reforestation surveys are conducted in regenerations harvest areas. Table 179 displays how the alternatives will differ in terms of the cost of implementing underburning.

Table 178: Related Project Treatment Costs 2013

Activity	Cost	Units
Precommercial thinning (SPC) & Ladder Fuel Reduction (LFR)	$75	acre
Prescribed Underburning	$200	acre
Hand Piling & Burning	$575	acre
Grapple Piling & Burning	$250	acre
Mastication	$250	acre
Mowing	$60 - 100	acre
Lop & Scatter	$90	acre
Reforestation surveys	$4	Each
Subsoiling	$45	acre

Table 179 displays the estimated cost and time required to complete the underburning in the Rocket planning area. This is displayed separately from the other treatments because the amount of underburning accomplished is highly dependent on burn unit design, a factor that was considered in alternative development. For example, a thousand acre burn unit surrounded by existing roads and lit by a helicopter would require an equal amount or less time and money to implement than a hundred acre hand ignition burn unit surrounded by hand or machine line. Roads are a more effective control line, they do not need to be constructed and they can be easily and quickly patrolled by engines. In general, hand and machine line is a less effective holding line, generally meaning that more ignition time will need to be spent during implementation to ensure that fire does not cross the hand line, hand lines are more labor intensive to patrol, and more time and money is required to build hand or machine line.

Table 179: Prescribed burn completion time and money for action alternatives

ALT	ACRES OF UNDER BURNING	MACHINE LINE (Feet)	ESTIMATED IGNITION DAYS	YEARS TO COMPLETE	UNDERBURN RX COST	COST/ACRE
2	**7,032**	**140,000**	**53**	**6-9**	**$905,800**	**$129**
3	**1,675**	**33,000**	**18**	**2-3**	**$250,500**	**$150**
4	**6,753**	**37,700**	**29**	**3-7**	**$660,600**	**$98**

This table was constructed with a combination of professional knowledge and past treatment costs and accomplishments. The intent of this table is to provide a comparison of alternatives from an implementation time and cost perspective. Greater detail would be considered during the actual implementation phase of the chosen alternative. The following assumptions were taken when creating the table:

- Fuels funding and organizational capacity remains similar to current levels.
- Ten days a year are spent on Rocket prescribed burn implementation, this assumes that Rocket is the priority for the east side of the District and receives approximately half of district resources during burn season
- Upper end of "years to complete" assumes that Rocket is competing with two other projects for underburn funding and that the district receives approximately $300k a year for underburning and $100k of this is allocated to Rocket.

- Implementation Costs: Hand Ignition = $150/acre, Hand Ignition in WUI = $200/acre, Aerial Ignition = $50/acre, Hand/Aerial Combination = $100/acre
- Lower end of "years to complete" is based upon available burn days. The number of ignition days is based on number of units, size of units and whether hand or aerial ignition techniques are used. For hand ignitions it is assumed that approximately 100 acres per day can be completed and 500-700 acres of aerial ignition can be completed in a day.
- Machine line was estimated using the ArcMap measurement tool and rounded to the nearest 1000'

Table 180 shows a summary of financial viability by alternative. These figures are drawn from the outputs in the Transaction Evidence Appraisal run for each alternative.

Table 180: Financial Viability Summary by Alternative

Item	Alt 1	Alt 2	Alt 3	Alt 4
Discounted Timber Sale Costs	$0	$367,124	$198,288	$466,964
Discounted non-Timber Projects	$0	$3,275,000	$1,924,226	$3,960,468
Total Discounted Costs	$0	$3,642,168	$12,122,514	$4,427,432
Discounted Revenues	$0	$947,538	$505,779	$1,192,416
Total Project Present Net Value	$0	-$2,694,631	-$1,616,736	-$3,235,016
Benefit/Cost Ratio (discounted benefits/discounted costs)	NA	0.26	0.24	0.27
Volume (MMBF)	0	16	8.5	20

Environmental Consequences

Direct and Indirect Effects—Alternative 1

Alternative one assumes the planning work is still completed but there would be no costs to prepare timber sales or other related projects. Planning costs for this project were estimated at $1,320,000. There would be no revenue generated as a result of the timber sale and there would be no volume produced. These costs would be born this fiscal year by the district and would not yield any products in the way of timber or biomass.

Direct and Indirect Effects—Alternative 2

Alternative 2 shows a discounted cost of $3,642,168 and discounted revenue of $947,538. The benefit cost ratio of this project is 0.26. Generally a ratio of 1 or better for the timber sale is preferred showing sale revenue at least equals sale costs.

Direct and Indirect Effects—Alternative 3

Alternative 3 shows a discounted cost of $1,924,226 and discounted revenue of $505,779. The benefit cost ratio of this project is 0.30. Generally a ratio of 1 or better for the timber sale is preferred showing sale revenue at least equals sale costs.

Direct and Indirect Effects – Alternative 4

Alternative 4 shows a discounted cost of $4,427,432 and discounted revenue of $1,192,416. The benefit cost ratio of this project is 0.30. Generally a ratio of 1 or better for the timber sale is preferred showing sale revenue at least equals sale costs.

Cumulative Effects –Alternatives 2, 3, and 4

Financial Viability was analyzed at the project scale. This scale was chosen as it is most useful to analyze on a project specific basis to highlight differences among alternatives. The table of ongoing and reasonably foreseeable future actions was consulted (Table 18). There are no activities listed which would contribute to cumulative effects of financial viability and there are no cumulative effects related to financial viability for either alternative 2 or 3.

Other Findings

Geothermal Consent to Lease Areas

Within the Rocket project area there are sections of land that have been leased to companies for the purpose of geothermal exploration and development. There are also sections of land near the project area that are proposed for leasing but for which the Forest Service has not yet given consent. An environmental assessment is currently being prepared for these "consent to lease" parcels. The nearest consent to lease parcel is about 3 miles to the south.

Concern regarding the geothermal exploration in the Newberry Volcano area in the 1980s led to the development of the NNVM. On November 5, 1990, NNVM Legislation became Public Law 101-522. By statute, the law withdraws all geothermal mineral rights from within the NNVM boundaries and gives the Secretary of Agriculture special and unusual authority over surface activities on geothermal compensation leases on the flanks outside of NNVM. The legislation also created several areas (Special Management Area, Transferal Area, Transferal Corridor, and Transferal Area Adjacent) which are adjacent to the NNVM boundary but have unique legal status related to mineral and geothermal uses. Guidance for the management of all of these lands is contained in the NNVM Comprehensive Management Plan (1994).

None of the lease areas within the Rocket project have been proposed for development; no ground-disturbing activities, such as for exploration, have been authorized. Implementation of the Rocket project would have no effect to the geothermal lease areas. If exploration activities were to be proposed, additional NEPA analysis would be required and coordination with those activities during Rocket implementation would occur as necessary.

Human Health and Safety

Under each action alternative, danger trees would be felled along all haul routes. The signing of project activity areas, in addition to notification of additional project-related traffic, would promote a safe environment for forest visitors during project implementation. Implementation of action alternatives would increase the potential for encounters on roadways between forest visitors and equipment associated with harvest. This elevated level of risk would be present for the short-term (approximately 5 years). Safety measures such as informational signing, flaggers, and road maintenance activities, such as brushing roads for increased visibility, would be enforced in the timber sale contract.

The work environment during all phases of logging operations would be physically demanding and potentially hazardous; effects to worker health and safety would be possible. Activities with the highest potential for serious injury would include tree felling and helicopter operations (helicopter may be used for prescribed fire ignition). All project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal Occupational Safety and Health Administration (OSHA) standards. All Forest Service project operations would be consistent with Forest Service Handbook 6709.11 (Health and Safety Code).

The Clean Air Act lists 189 hazardous air pollutants to be regulated. Some components of smoke, such as polycyclic aromic hydrocarbons (PAH) are known to be carcinogenic. Probably the most carcinogenic component is benzo-a-pyrene (BaP). Other components, such as aldehydes, are acute irritants. In 1994 and

1997[20], air toxins were assessed relative to the exposure of humans to smoke from prescribed and wildfires. The five toxins most commonly found in prescribed fire smoke were:

Particulate matter - Particulates are the most prevalent air pollutant from fires, and are of the most concern to regulators. Research indicates a correlation between hospitalizations for respiratory problems and high concentrations of fine particulates (PM2.5, fine particles that are 2.5 microns in diameter or less). Particulates can carry carcinogens and other toxic compounds. Overexposure to particulates can cause irritation of mucous membranes, decreased lung capacity, and impaired lung function. Particulate matter is analyzed for each alternative in the Air Quality section, page 75.

Acrolein - An aldehyde with a piercing, choking odor. Exposure severely irritates the eyes and upper respiratory tract.

Formaldehyde - Low-level exposure can cause irritation of the eyes, nose and throat. Long-term exposure is associated with nasal cancer.

Carbon Monoxide - CO reduces the oxygen carrying capacity of the blood, a reversible effect. Low exposures can cause loss of time awareness, motor skills, and mental acuity. Also, exposure can lead to heart attack, especially for persons with heart disease. High exposures can lead to death due to lack of oxygen.

Benzene - Benzene causes headache, dizziness, nausea and breathing difficulties, as well as being a potent carcinogen. Long-term exposure can cause anemia, liver and kidney damage, and cancer. The closest Smoke Sensitive Receptor Area (SSRA) to the analysis area is the city of Bend, Oregon; the communities of Sunriver and La Pine are also near the analysis area but are not as highly populated.

The greatest risk of exposure to airborne toxins from prescribed fires or wildfires would be to firefighters and forest workers implementing the prescribed burning. It is unlikely the general public would be exposed to toxin levels adverse to human health during implementation of prescribed burning operations in the Rocket analysis area because of the application of prescriptions designed to lessen the release of particulate matter. People who suffer from breathing ailments may experience some difficulty during periods of prescribed burning, especially during atmospheric conditions that do not favor dispersion of smoke. The Forest Service voluntarily follows the guidelines assigned by Oregon Smoke Management to limit state-wide exposure on a cumulative basis, in compliance with the Clean Air Act.

Forest workers and firefighters can face unhealthy levels of smoke when patrolling or holding fire lines on the downward edge of a wildfire or prescribed fire, or while mopping intense hot spots. In most cases, measures such as education on the effects of short and long term exposure, rotation out of the smoke, and the use of respirators can reduce exposure levels. OSHA regulates exposure to hazardous materials in the workplace. All project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal OSHA standards.

Water Quality and Fisheries

The project area contains no surface water. The nearest water is the Deschutes River about 2 miles to the northwest of the Rocket project boundary. Therefore, there would be no effect to water quality from any action alternative. Due to the lack of water, there are no fish in the project area and therefore there would be no effect to fish from any action alternative.

Wetlands and Floodplains

There would be no effects on either wetlands or floodplains under any alternative. There are no wetlands or floodplains within or adjacent to the project boundary.

[20] Results of an April 1997 conference to review the results of health studies and develop a risk management plan for the protection of fire crews were published by Missoula Technology Development Center in Health Hazards of Smoke, Technical Report 9751-2836-MTDC.

Prime Farmland, Rangeland, and Forestland

All alternatives are consistent with the Secretary of Agriculture memorandum 1827 for the management of prime farmland. The Rocket project area does not contain any prime farm land or rangelands. Prime Forestland, as defined in the memorandum, is not applicable to lands within the National Forest System.

Civil Rights and Environmental Justice

Civil rights legislation directs an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, people with disabilities, elderly and low-income groups. None of the alternatives would affect minority groups, women, or consumers differently than other groups. These groups may benefit from employment opportunities and by-products that proposed actions would provide. None of the alternatives adversely affect civil rights. All contracts that may be awarded as a result of implementation would meet equal employment opportunity requirements.

Data regarding minorities or people with disabilities employed in the region in the timber, mining, road construction, forestry services, and recreation sectors is unavailable. Some firms contracted by the Forest Service for reforestation work have traditionally hired Hispanic workers that comprise a minority workforce in the area. Asian and Pacific Islanders use of the area include commercial mushroom harvesting and camping associated with this activity. Some timber sale contracts on the forest are reserved for award to minority businesses under the USDA Office of Small and Disadvantaged Business Utilization and the Small Business Administration.

Under No Action, all current uses of the National Forest System lands would continue, including recreation, harvesting of non-timber forest products, special-use permits, subsistence uses, and spiritual/aesthetic uses. Effects to minority populations, disabled persons, and low-income groups would not be disproportionate with other users of the National Forest System lands. No jobs would be created that might provide opportunities to minorities.

All action alternatives would provide a variety of opportunities for potential contracts at various levels. Alternatives would have no impact on the contracting process or the USDA Small Business Administration program for reserving contracts for minority groups for tree planting, precommercial thinning, and road restoration. Employment and income would be available to all groups of people, subject to existing laws and regulations for set-asides, contract size, competition factors, skills and equipment, etc.

Set-asides for Small Business Administration Contracting opportunities would not be affected. Employment by firms that have hired Hispanic workers or other minority groups or low-income workers associated with reforestation or other potential contracting needs would not differ from those employed in the sectors as a whole. In the short-term (3-5 years), reforestation needs would potentially benefit this group.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are actions that disturb either a non-renewable resource (e.g. cultural resources) or other resources to the point that they can only be renewed over 100 years or not at all. The resource protection measures along with LRMP standards and guidelines are intended to reduce these commitments, but adverse effects cannot be completely eliminated. For example, the continued use of existing roads that access the forest is an irreversible commitment of the soil resource. An irretrievable commitment is the loss of opportunities for producing or using a renewable resource for a period of time. Almost all activities produce varying degrees of irretrievable resource commitments. They parallel the effects for each resource discussed earlier in the EA. They are not irreversible because they could be reversed by changing management direction. Irretrievable commitments associated with the action alternatives include loss of soil productivity due to temporary roads and landings and loss of vehicle access due to road closures.

Climate Change

The impacts on forests from climate change and the effects on climate change from forest management are complex and sometimes negated by the different factors involved. The most expected condition in Central Oregon is a warming trend and potentially less snowfall. The best comparison to the average condition is the drought cycles experienced in this area due to the pacific decadal oscillation (also known as El Nino and La Nina) (Hessl et al. 2004).

According to the Climate Impacts Group[21], based out of the University of Washington, climate modeling for the Pacific Northwest predicts a future rate of warming of approximately 0.5 degrees Fahrenheit per decade for the Pacific Northwest through at least 2050, relative to the 1970-1999 average temperature. Temperatures are projected to increase across all seasons, although most models project the largest temperature increases in summer (June – August), and the average temperatures could increase beyond the year-to-year variability observed in the Pacific Northwest during the 20th century as early as the 2020s.

With climate change, increases in drought, fires, and greater vulnerability to insects and diseases can be expected (Brown 2008). Thinning of stands to reduce competition for resources and favoring drought-tolerant species (such as ponderosa pine) will reduce the impacts of drought cycles on tree mortality, and increase resistance to insect and fire mortality (Ritchie 2008).

The Forest Service does not 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* (USFS 2009). This document outlines the basic considerations for assessing climate change in relation to project-level planning.

The trajectory of treated stands in the Rocket project area should lead to more resilience should the climate become warmer and drier as predicted. Thinning of stands under all alternatives will reduce competition for resources. Favoring drought-tolerant species such as ponderosa pine would reduce the impacts of future drought cycles on tree mortality, and increase resistance to insect and fire mortality (Ritchie 2008). Also, if a crown fire burns through a forest that was thinned to a low density, the fire may change from a crown fire to a surface fire, where many trees can often survive. In contrast, many or all of the trees in an unthinned stand would be killed by a crown fire.

The scope and degree of change from any action alternative is minor relative to the amount of forested land available as a whole. A project of this magnitude would have such minimal contributions of greenhouse gasses that its impact on global climate change would be infinitesimal. Therefore, at the global scale, the proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible, and therefore the project's cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fourth Assessment Report (IPCC 2007). The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion (56.6% of global total), deforestation (17.3%), and agriculture/waste/energy (14.3%). IPCC subdivides the deforestation category into land use conversions, and large scale deforestation. Deforestation is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

This vegetation management project does not fall within any of these main contributors of greenhouse gas emissions. Forested land will not be converted into a developed or agricultural condition. In fact, forest

[21] Intergovernmental Panel on Climate Change (IPCC). Their reports (2007) provide the authoritative scientific basis for subsequent Forest Service analysis of this phenomenon. Information specific to the Forest Service can be found in the latest Synthesis and Assessment Product 4.4.24.

stands are being retained and thinned to maintain a vigorous forested condition that can continue to support trees and sequester carbon long-term.

The net carbon balance is extremely difficult to quantify for a forest project. Adaptation and Mitigation can have positive and negative influences on each other's effectiveness (Klein et. al. 2007 in Joyce et. al. 2008). This project is also consistent with IPCC recommendations for land use to help mitigate climate change. The 2007 IPCC report summarizes sector-specific key mitigation "technologies." For the forestry sector, the report recommends forest management, including management to "improve tree species" and increase biomass. The three action alternatives are consistent with these recommendations.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The action alternatives fall into this category.

Interdisciplinary Team

Beth Peer	Team Leader
Barbara Schroeder	Forested Vegetation
Alex Enna	Fire/Fuels
Todd Reinwald	Soils
Julie S. York	Wildlife
Shelley Borchert	Wildlife
Steve Bigby	Transportation System
Marlo Fisher	Botany/Noxious Weeds
Kathleen T. Martin	Cultural Resources
Erin Woodard	Cultural Resources
Ryan Grim	Presale
Bob Heiden	Timber Sale Administration
Robin K. Gyorgyfalvy	Visuals
Scott E. McBride	Recreation

Agencies and Persons Consulted

State Historic Preservation Office

The Forest has completed necessary reporting for the State Historic Preservation Office (SHPO) following guidelines in the Regional Programmatic Agreement among USDA-Forest Service, the Advisory Council on Historic Preservation, and the Oregon SHPO. A cultural resource inventory and report have been completed. A determination of "Historic Properties Avoided" was made for this project and the SHPO concurred by letter on November 6, 2013.

Oregon Department of Fish and Wildlife

The Forest scoped with the Oregon Department of Fish and Wildlife (ODFW) when developing the proposed action. The focus of the discussions was how vegetation should be managed to facilitate the use of the Highway 97 undercrossings by big game, including a strategy for creating small openings to develop hiding cover.

Public and Tribal Mailing List

The following individuals, agencies, and Tribes have been included in direct mailings of project information including the scoping notice and notice of availability of the EA. Comment period information is provided in Appendix F.

Luann Danforth
Dave Lynn
Chuck Tolboe
Matt Mahoney
Vera Riser
Steven J. McNulty, Gas Transmission NW Corp.
Ken Roadman
Wally Buckman
Lee Fischer
Gary Pankey
Larry McGlocklin
Irene K. Jerome, AFRC Representative
Scott Odgers
Central Oregon Flyfishers
George Wuerthner
Craig Vaage, Bigfoot Guide Service
David Nissen, Wanderlust Tours
Larry Ulrich
Ed Duffy, Deschutes County 4-Wheelers
David H. Tjomsland
Robert Speik
Susan Jane Brown
Brad Chalfant, Deschutes Basin Land Trust
Jim King
Brent McGregor, President, Oregon High Desert Grotto
Nick Cady & Josh Laughlin, Cascadia Wildlands Project
Karen Coulter, Blue Mountains Biodiversity Project
Doug Heiken, Oregon Wild
Tim Lillebo, Oregon Wild
Marilyn Miller
Stuart Garrett
Scott Silver, Wild Wilderness
Matt Kern
Mike Morris
Libby Johnson, Bonneville Power Administration
Rod Adams, Bend Chapter of Oregon Hunters Assoc.
Senator Ron Wyden

Sunriver Owners Association
Dick Artley
John Pindar
Dennis Krakow, Woodside Ranch Owners Association
Arlie Holm
Fred Tanis
Chuck Burley, Interfor
Gerald Keck, D.R. Johnson Lumber Co.
John Morgan, Ochoco Lumber
Shawn Gerdes, Arnold Irrigation District
Bend Metro Parks & Recreation
Dylan Darling, The Bulletin
Billy Toman
Rick Bozarth, Bozarth's Offroad Service Specialties
Gordon Baker
Peggy Spieger, Oregon State Snowmobile Association
Glen Ardt, Oregon Department of Fish and Wildlife
Stuart Otto, Oregon Department of Forestry
John McKenzie, Sunriver Owners Association
Mark Dunaway, Pine Mountain Observatory, Univ. of Oregon
Bend/Burns Star Rte
Dyarle Sharkey
Patti Gentiluomo
Wade N. Foss
Bruce Cunningham, Moon Country Snowmobilers
Scott O'Neill
June Ramey
Mark Davis
Scott McCaulou, Deschutes River Conservancy
Ryan Houston, Upper Deschutes Watershed Council
Lynne Breese, Eastern Oregon Forest Protection Association
Greg McClarren
Rick Williams, Ore. Dept. of Transportation; Region 4
Kate Lighthall, Project Wildfire
SROA, Public Affairs Committee Chair
Northwest Environmental Defense Center
Vicki McConnell, Department of Geology and Mineral Industries
David Cox, The Equitable Center
Dean Richardson
Vic Russell
Ed Keith, Deschutes County
Patricia Moore
Pat Schatz, Crane Prairie Resort & Micky Finn Guide Service
Jim Wilson, JTS Animal Bedding
Chandra LaGue, Oregon Wild, Western Field Office
L. Ulven
Steve Johnson, Central Oregon Irrigation District
Jim Anderson
Loren Smith
Jim Larson, Upper Deschutes River Coalition
Stan Martineau, Deschutes River Woods Homeowners
Margie Gregory
David Pitts
Mike Riley, Central Oregon Climate Alliance
Kreg Lindberg
Peter Geiser
Senator Jeff Merkley
Larry Pennington, Oregon Chapter, Sierra Club
Judy Meredith, East Cascades Audubon Society
Paul Bannick, Conservation Northwest
Don Franks
Lowell Franks
Matt Bales, Mule Deer Foundation
Jeff Trant
Kenna Hoyser, Central Oregon Chapter, Oregon Equestrian Trails
John Zachem
Scott Walley
Lisa Clark, Central Oregon Fire Management Service
Flip Houston, Scott Logging Inc.
Pieter & Diane Van Gelderen
Christine Jacobe
Lillian Wetah, The Klamath Tribes
Gary Frost, Chairperson, The Klamath Tribes
Will Hatcher, The Klamath Tribes
Perry Chocktoot, The Klamath Tribes
Kenton Dick, Burns Paiute Tribe
100 Pasigo Street.
Charrisse Soucie, Chairperson, Burns Paiute Tribe
Amos Firstraised, Burns Paiute Tribe
Diane Teeman, Burns Paiute Tribe
Clay Penhollow, Confederated Tribes of the Warm Springs
Scott Turo, Confederated Tribes of the Warm Springs
Sally Bird, Confederated Tribes of the Warm Springs
Stanley Smith, Jr., Council Chairman, Confederated Tribes of the Warm Springs
Robert Brunoe, Confederated Tribes of the Warm Springs
Brigette M. Whipple, Confederated Tribes of the Warm Springs
Lonny Macy, Confederated Tribes of the Warm Springs
Jason Kesling, Director, Natural Resources, Burns Paiute Tribe
Adams, Cultural Preservation, Burns Paiute Tribe
Theresa Peck, Cultural Resources, Burns Paiute Tribe
Fenton, Environmental Program Manager, Burns Paiute Tribe
Ken Roadman
Paul Hammerquist
Central Oregon Running Club
Jon Cain
Larry Ulrich
Margie Gregory
Leonard Houston
Franklin Engel
Keith Nash
Stephen Roth
Sunset View Estates Homeowners Assoc.
David Scharfenberg
Ken Wienke, Boise Cascade
Stan Summers
Joani Dufourd, RecConnect LLC
Randy J. Zustiak
Terry Penhollow, Sunriver Utilities
John McKenzie, Sunriver Owners Association
Bergen Bull
Mike Supkis, La Pine Rural Fire Protection District
Darwin Thurston, Midstate Electric Cooperative, Inc.
Central Electric Cooperative Inc.
James Reeves, Century Tel
Kenneth Holmes
Donald Kerr
Charla Q. Ranch
Roger Prowell, City of Bend
Robert Ringering, North Unit Irrigation District
C. Gary Frazier, Woodside Ranch Homeowners Association

Steve Fitzgerald, Oregon State Universtity Extension Service
Davenport Newberry Holdings LLC
Charlie Larson, Oregon Grotto
Dennis Glasby, Willamette Valley Grotto
David Jones, East Lake Resort
Ken Copeland
John Emerson
Edward Kerber
Wes Pyne
Matt Kern
Rod Boozell
Linda Driskill, Grant County Conservationists
Frank Pennock
Michael Krochta
Rod Bjorvik
Chris Kerber
Alexander Reid Ross
Sandra Swanlund
Keith Cloudas
David Pitts
Larry Langston, City of Bend
Glenn Burleigh
Franz Miller
Nick F Lowen
Robert Ball
Keenen Howard
Marcy Monte
Herman A Meister III
Simon Wray, Conservation Biologist, Oregon Dept. of Fish & Wildlife
Paul Dewey, Attorney at Law
Richard Swoop
Neil Wrede
Tim Gezner
Neal Dunbar
Ron Paden, Woodland Rehab & Restoration
Art Uecker
Dan Varcoe, LaPine Chamber of Commerce

Claude H. Smith, III, Warm Springs Forest Products Industries
Chris Ketchum, Warm Springs Forest Products
Cathy Albrecht, Bonneville Power Administration
Larry Quackenbush, Oregon Dept. of State Lands
Shawn Zumwalt, Oregon Dept. of State Lands
Lynn Smith, Qwest
Terry Wolverton, Gas Transmission NW
Cascade Natural Gas
Nancy Gilbert, USFWS
Jennifer O'Reilly, USFWS

References

Abele, S.C., V.A. Saab, and E.O. Garton. 2004. Lewis's Woodpecker (*Melanerpes lewis*): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Agee, J.K. 1993. Forest ecology of Pacific Northwest forests. Washington, DC: Island Press. 493p.

Agee, J. K. (1998). The Landscape Ecology of Western Forest Fire Regimes. Northwest Science, 72(Special Issue).

Agee, J.K. 2002. Fire as a coarse filter for snags and logs. Gen. Tech. Report PSW-GTR-181. Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. Pp 359-367.

Agee, J. K., & Skinner, C. N. (2005). Basic principles of forest fuel reduction treatments. Forest Ecology and Management, 211, 83-96.

Ager, A. A., Vaillant, N. M., & Finney, M. A. (2011). Integrating fire behavior modesl and geospatial analysis for wildland fire risk assessment and fuel management planning. Journal of Combustion, 16.

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.

Altman, B. and A. Holmes. 2000. Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. Version 1.0. Oregon-Washington Partners in Flight. 136 pp.

Andrew, A. and Kutara K. 2005. Oregon's Timber Harvests 1849-2004. 2005. Oregon Department of Forestry.

Arno, S. F. (1996, June). The Concept: Restoring Ecological Structure and Process in Ponderosa Pine Forests. The Use of Fire in Fire Restoration, General Technical Report INT-GTR-341.

Aubry, K.L., K.S. McKelvey, and J.P. Copeland. 2007. Distribution and broadscale habitat associations of the wolverine in the contiguous United States. Journal of Wildlife Management 71:2147–2158.

Bagne, K.E., K.L. Purcell, J.T. Rotenberry. 2008. Prescribed fire, snag population dynamics, and avian nest site selection.

Barger, M. 2012. Haul Cost Appraisal Program. Version 8.0 for Microsoft Excel 2010 updated 3/19/2012. Retrieved From ftp://ftp2.fs.fed.us/incoming/r6/ro/toupin/Programs/

Barrett, J.W. 1979. Silviculture of ponderosa pine in the Pacific Northwest: the state of our knowledge. USDA Forest Service. Gen Tech. Report. PNW-97. 106p.

Beier, P. and M.F. Ingraldi. 2008. There Is No Evidence That the Forest Service's Goshawk Recommendations Improve Goshawk Nest Productivity. Wildlife Society Bulletin 36(1):153–154; 2012; DOI: 10.1002/wsb.122.

Black, S.H. 2005. Logging to control insects: the science and myths behind managing forest insect "pests". A synthesis of independently reviewed research. The Xerces Society for Invertebrate Conservation, Portland, OR. 82p.

Booser, J. and White, J. Undated. Calculating maximum stand density indexed (SDI) for Deschutes National Forest plant associations. 9p.

Borchert, S. and York. 2014. Biological Evaluation for the Rocket Vegetation Management Project. Deschutes National Forest, Bend-Ft. Rock Ranger District.

Bork, J. L. 1984. Fire history in three vegetation types on the eastern side of the Oregon Cascades, Ph D. Thesis. Oregon State University.

Brandt, J.P., 2006. Oregon's Forest Products Industry and Timber Harvest, 2003. General Technical Report. PNW-GTR-681.

Brown, James K., Elizabeth D. Reinhardt, and Kylie A. Kramer. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRSGTR-105. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Buchanan, J.B., R.E. Rogers, D.J. Pierce, and J.E. Jacobson. 2003. Nest-site habitat use by white-headed woodpeckers in the eastern Cascade Mountains, Washington.

Bull. E.L. 1980. Resource portioning among woodpeckers in northeastern Oregon. Ph.D. Dissertation, Univ. Idaho, Moscow. 109 pp.

Bull. E.L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. J. Wildl. Manage. 51(2):472-481.

Bull, E.L. and T.W. Heater. 2000. Resting and denning sites of American marten in northeastern Oregon. Northwest Science 74:179-185.

Bull, E.L. and T.W. Heater. 2001a. Home range and dispersal of the American marten in northeastern Oregon. Northwestern Naturalist 82:7-11.

Bull, E.L. and T.W. Heater. 2001b. Survival, causes of mortality, and reproduction in the American marten in northeastern Oregon. Northwestern Naturalist 82:1-6.

Bull, E.L. and R.S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. J. Wildl. Manage. 57(2):335-345.

Bull, E.L., A.D. Twombly, and T.M. Quigley. 1980. Perpetuating snags in managed mixed conifer forests of the Blue Mountains, Oregon. IN: Management of western forests and grasslands for non-game birds, Workshop Proceedings. USDA Forest Service Gen. Tech. Rep. INT-86, pp. 325-336.

Bull, E.L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. Research Note PNW-444, Pacific Northwest Research Station, U.S. Forest Service, Portland, Oregon.

Bull, E.L., C.G. Parks, and T.R. Torgersen. 1997. Trees and logs important to wildlife in the interior Columbia River basin. Gen. Tech. Rep. PNW-GTR-391. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55p.

Bull, E.L., N. Nielsen-Pincus, B.C. Wales, and J.L. Hayes. 2007. The influence of disturbance events on pileated woodpeckers in northeastern Oregon. Forest Ecol. and Manage. 243:320-329.

Burford, L.S. and M.J. Lacki. 1998. Moths consumed by *Corynorhinus townsendii virginianus* in Eastern Kentucky. American Midland Naturalist 129 (1):141-146.

Busse, M.; Riegel, G.; Johnson, W. 2006. Long-term effects of prescribed fire and thinning in central Oregon ponderosa pine forests. Proceedings of the Third International Fire Ecology and Management Congress, Nov. 13-17, 2006. San Diego, CA. http:www.emmps.wsu.edu/2006firecongressproceedings (Contributed Papers, Fuels Management Section).

Busse, M. D., & Riegel, G. M. (2009). Response of antelope bitterbrush to repeated prescribed burning in Central Oregon ponderosa pine forests. Forest Ecology and Management, 904-910.

Busse, M. D., Cochran, P. H., Hopkins, W. E., Johnson, W. H., Riegel, G. M., Fiddler, G. O., et al. (2009). Developing resilient ponderosa pine forests with mechanical thinning and prescribed fire in central Oregon's pumice region. Canadian Journal of Forest Restoration, pp. 1171-1185.

Caire, W., J. D. Tyler, B. P. Glass, and M. A. Mares. 1989. Mammals of Oklahoma. In NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http:www.natureserve.org/explorer

Clark, B.S., D.M. Leslie, Jr., and T.S. Carter. 1993. Foraging activity of adult female Ozark big-eared bats (*Plecotus townsendii ingens*) in summer. Journal of Mammalogy 74(2):422-427.

Clark, Roger N., and George H. Sankey. 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 Forest Service and National Park Service, Pacific Northwest Region.

Cochran, P.H.; Geist, J.M.; Clemens, D.L.; Clausnitzer, R.R.; Powell, D.C. 1994. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington. USDA Forest Service PNW-RN-513. 21p.

Cochran, P.H. and J.W. Barrett. 1999. Growth of Ponderosa Pine Thinned to Different Stocking Levels in Central Oregon: 30-Year Results. USDA Forest Service Pacific Northwest Research Station Research Paper PNW-RP-508.

Cochran P.H. and Barrett J.W. 1999. Thirty-five-year growth of ponderosa pine saplings in response to thinning and understory removal. USDA Forest Service. Research Paper PNW-RP-512. 28p.

Coe, F.C. and J. Woodward. 2013. Wildlife in Managed Forests: Deer and Elk. Oregon Forest Resources Institute. Portland, Oregon.

Copeland, J.P. 1996. Biology of the wolverine in Central Idaho. Masters Thesis. University of Idaho. 137 pp.

Copeland, J.P., J.M. Peek, C.R. Groves, W.E. Melquist, K.S. McKelvey, G.W. McDaniel, C.D. Long, and C.E. Harris. 2007. Seasonal habitat associations of the wolverine in central Idaho. Journal of Wildlife Management 71(7):2201-2212.

Core, J. E., & Peterson, L. J. (2001, December). Public Health and Exposure to Smoke. (C. C. Hardy, R. D. Ottmar, J. L. Peterson, J. E. Core, & P. Seamon, Eds.) Smoke Management Guide for Prescribed and Wildland Fire, pp. 27-33.

Corkran, C.C. and C.R. THoms, 1996. Amphibians of Oregon, Washington, and British Columbia: A field identification guide, Lone Pine Publishing, Edmonton, Alberta. 175 pp. *In* United States Department of Interior (USDI), USFWS Species Fact Sheet for the Oregon Spotted Frog, updated 2013.

Covert-Bratland, Kristin A, William M. Block, and Tad C. Theimer. 2006. Hairy woodpecker winter ecology in ponderosa pine forests representing different ages since wildfire. Journal of Wildlife Management. 70:1379-1392

Crocker-Bedford, B. C. and B. Chaney. 1988. Characteristics of goshawk nesting stands: proceedings of the southwest raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 12. Port City Press, Baltimore, Maryland, 395 pp.

Csuti, T.A. O'neil, M.M. Shaughnessy, E.P. Gaines E.P., and J.C. Hak. 2001. Atlas of Oregon Wildlife Distribution, Habitat, and Natural History. Oregon State University, Corvallis Oregon. 525 pp.

Curtis, R.O. 2010. Effect of diameter limits and stand structure on relative density indices: a case study. Western Journal of Applied Forestry. 25(4). 169-175.

Daily, G.C., P.R. Erhlich, and N.M. Haddad. 1993. Double keystone bird in a keystone species complex. Proc. Natl. Acad. Sci. USA 90:592-594.

Davis, L.S. and Johnson, K.N. 1987. Forest Management. McGraw-Hill, Inc. 790p.

Davis, R., D. McCorkle, and D. Ross. 2010. Survey protocol (v1.1) for Johnson's Hairstreak butterfly (*Callophrys johnsoni*) in Washington and Oregon. Unpublished report. On file with: Interagency Special Status Species Program, USDA Forest Service and USDI Bureau of Land Management, Portland, OR. http://www.fs.fed.us/r6/sfpnw/issssp/

Deppmeier, M. 2006. 18 Fire competing vegetation control E.A; Silviculture report, prescriptions and vegetation management plan. Bend/Fort Rock Ranger District. Deschutes National Forest. 55p and Appendix A – D.

Deschutes Collaborative Forest Project Steering Committee. 2012. Restoration recommendation framework by forest type [dry/wet second growth ponderosa pine]. 3p. (May 1).

DeStefano, S., M. T. McGrath, S. M. Desimone, and S. K. Daw. 2006. Ecology and habitat of breeding northern goshawks in the inland Pacific Northwest : a summary of research in the 1990s. Studies in Avian Biology 31:76-85.

Dickinson, M.B., M.J. Lacki, and D.R. Cox. 2009. Fire and the endangered Indiana bat. Proceedings of the 3rd Fire in Eastern Oak Forests Conference. GTR-NRS-P-46 51-75.

Dixon, R.D. 1995. Ecology of white-headed woodpeckers in the central Oregon Cascades. Masters Thesis. Univ. Idaho. 148 pp.

Duncan, Nancy. 2005. Conservation Assessment for *Derocerus Hesperium*, Evening Fieldslug. USDA Forest Service Region 6, USDI Bureau of Land Management, Oregon and Washington.

Edelman, F. and J. Copeland. 1999. Wolverine distribution in the northwestern United States and a survey in the Seven Devils mountains of Idaho. Northwest Science, Vol. 73, No. 4: 295-300.

Ehrlich, P. R., D. S. Dobkin, and Darryl Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Schuster Inc. New York, New York. 785 pp.

Elchuk, C.A., and K.L. Wiebe. 2002. Food and predation risk as factors related to foraging locations of Northern Flickers. Wilson Bulletin 114(3):349-357.

Ellison, L.E., T.J. O'Shea, M.A. Bogan, A.L. Everette, and D.M. Schnieider. 2003. Existing data on colonies of bats in the United States: Summary and analysis of the U.S. Geological Survey's bat population database. Pages 127-237 *In* O'Shea, T.J. and M.A. Bogan, eds. Monitoring Trends in bat populations of the United States and territories: problems and prospects. U.S. Geological Survey, Biological Resources Discipline, Information and Technology Report, USGS/BRD/1TR-2003-0003, 274 pp.

Endangered Species Act of 1973. 16 U.S.C. §§ 1531 et seq. (2002), available at <http://endangered.fws.gov/esa.html>

Enna, Alex. 2013. Rocket Vegetation Management Project Specialist Report: Fire and Fuels. Deschutes National Forest, Bend-Ft. Rock Ranger District.

Ernst, R.L. and Knapp, W.H. 1985. Forest stand density and stocking: concepts, terms, and the use of stocking guides. USDA Gen. Tech. Report WO-44. 8p.

Ewins, P. J. 1997. Osprey (*Pandion haliaetus*) populations in forested areas of North America: changes, their causes, and management recommendations. Journal of Raptor Research 31:138-150.

Federal Register. 2001. Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds. 66 FR 3853, January 17, 2001.

Fellers, G.M. and E.D. Pierson. 2002. Habitat use and foraging behavior of Townsend's big-eared bat (*Corynorhinus townsendii*) in coastal California.

Fettig, C.J., Klepzig, K.D., Billings, R.F., Munson, A.S., Nebeker, T.E., Jose F.N., Nowak, J.T. 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. Forest Ecology and Management. 238. 24-53.

Finney, M. A., Brittain, S., & Seli, R. (2006). FlamMap Version 3.0. Joint Fire Sciences Program. Rocky Mountain Research Station, US Bureau of Land Management, Systems for Environmental Management.

Fitzgerald, S. A. 2005. Fire Ecology of Ponderosa Pine adn the Rebuilding of Fire-Resilient Ponderosa Pine Ecosystems. USDA Forest Service. USDA Forest Service.

Frenzel, R.W. 2000. Nest-sites, nesting success, and turn-over rates of white-headed woodpeckers on the Winema and Deschutes National Forests, Oregon in 2000.

Frenzel, R.W. 2003. Nest-site occupancy, nesting success, and turn-over rates of white-headed woodpeckers on the Winema and Deschutes National Forests, Oregon in 2003. Unpubl. Report submitted to the Oregon Natural Heritage Program, The Nature Conservancy of Oregon. 49 pp.

Gargas, A, M.T. Trest, M. Christiensen, T.J. Volk, and D.S. Blehert. 2009. *Geomyces destructans* sp. nov. associated with bat white-nose syndrome. Mycotaxon 108:147–54.

Garrett, K.L., M.G. Raphael, and R.D. Dixon. 1996. White-headed Woodpecker (*Picoides albolarvartus*), The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America online: http://bna.birds.cornell.edu/bna/species/252

Gebert, K. et. al., 2002. Utilization of Oregon's Timber Harvest and Associated Direct Economic Effects, 1998. General Technical Report. PNW-GTR-532.

Geils, B.W.; Tovar, J.C.; Moody, B. (Tech. Coords.). 2002. Mistletoes of North American conifers. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-98. 123p.

Gellman, S.T. and W.J. Zielinski. 1996. Use by bats of old-growth redwood hollows on the north coast of California. Gowan, D. and T. E. Burke. 1999. Management Recommendations for *Pristiloma arcticum crateris* Crater Lake Tightcoil, reconfigured in 2004 by N. Duncan. Conservation Assessment for *Pristiloma arcticum crateris* Crater Lake Tightcoil. USDA Forest Service Region 6 and USDI Bureau of Land Management, Oregon and Washington. 17 pages.

Gibson, L. 2003. Return of Rhode Island Federal Register. 2001. Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds. 66 FR 3853, January 17, 2001.

Goggans, R., R. D. Dixon and L. C. Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Ore. Dept. Fish Wildl.- Nongame Wildl. Prog. USDA Deschutes Natl. For. Tech. Rep. 87-3-02. 43 pp.

Greenwald, D. N.; Crocker-Bedford, D. C.; Broberg, L.; Suckling, K. F.; Tibbitts, T. 2005. A review of northern goshawk habitat selection in the home range and implications for forest management in the western United States. Wildlife Society Bulletin 33: 120-129.

Gruver, J.C. and D.A. Keinath. 2006. Townsend's big-eared bat (*Corynorhinus townsendii*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf

Habeck, R.J. 1992. *Pinus ponderosa* var. ponderosa. In: Fire Effects Information System. USDA Forest Service. Rocky Mountain Research Station. Fire Sciences Laboratory. http://www.fs.fed.us/database/feis. (January 18, 2013)

Haggard, M. and W.L. Gaines. 2001. Effects of stand-replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades, Washington. Northwest Science. 75: 387–396.

Hall, F.C. 1987. Growth basal area handbook. USDA Forest Service. R6-Ecol-181b-1984. 84p.

Hardy, C. C. 2005. Wildland fire hazard and risk: Problems, definitions, and context. Forest Ecology and Management, 1-10.

Hardy, C., Schmidt, K., Manakis, J., & Samson, N. 2001. Spatial data for national fire planning and fuel management. International Journal of Wildland Fire, 10, 353-372.

Harrington, M. G. (1993). Predicting *Pinus ponderosa* Mortality from Dormant Season and Growing Season Fire Injury. International Journal of Wildland Fire, 3(2), 65-72.

Harrington, C.A. (Compiler). 2003. The 1930s survey of forest resources in Washington and Oregon. [CD-ROM]. Coversizecl shapefile. USDA Gen. Tech. Rep. PNW-GTR-584. http://www.fs.fed.us/pnw/publications/pnw_gtr584. [Date accessed unknown].

Harrod, R.J., W.L. Gaines, W.E. Hartl, and A. Camp. 1998. Estimating historical snag density in dry forests east of the Cascade Range. Gen. Tech. Rep. PNW-GTR-428. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 16 pp.

Hash, S. and T. Reinwald. 2013. Draft Soil Resources Specialist Report for the Rocket Vegetation Management Project. Deschutes National Forest, Bend-Ft. Rock Ranger District.

Hawksworth, F.G. and Johnson, D.W. 1989. Biology and management of dwarf mistletoe in lodgepole pine in the Rocky Mountains. USDA Forest Service. Gen. Tech. Rep. RM-169. 38p.

Hawksworth F.G. and Wiens, D. 1996. Dwarf mistletoes: biology, pathology, and systematics. USDA Forest Service. Ag. Hndbk. 709. 410 p.

Hayes, M.A., R.A. Schorr, and K.W. Navo. 2011. Hibernacula selection by Townsend's big-eared bat in southwestern Colorado. Journal of Wildlife Management 75(1):137–143.

Hayes, M.P. 1994. The spotted frog (Rana pretiosa) in western Oregon. Part I. Background. Part II, Current Status. Oregon Department of Fish and Wildlife Tech. Rept. #94-1-01. Unpublished Report. In United States Department of Interior, USFWS Species Fact Sheet for the Oregon Spotted Frog. Updated 2013.

Hejl, S. and M. McFadzen. 2000. Maintaining fire-associated bird species across forest landscapes in the northern Rockies. Summary Report. Missoula, MT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 14p.

Helms, J.A. (Editor). 1998. The dictionary of forestry. Bethesda, Maryland. The Society of American Foresters. 210p.

Hessburg, P.F.; Mitchell, R.G.; and Filip, G.M. 1994. Historical and current roles of insects and pathogens in Eastern Oregon and Washington forested landscapes. USDA Forest Service. PNW Gen. Tech. Rep. 327. 72p.

Hessburg, P.F.; Smith, B.G.; Kreiter, S.D.; Miller, C.A.; Salter, R.B.; McNicoll, C.H.; and Hann, W.J. 1999. Historical and current forest and range landscapes in the interior Columbia River basin and portions of the Klamath and Great Basins. Part 1. Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. USDA Forest Service. PNW Gen. Tech. Report 458. 357p. [Quigley, T.M. (editor) Columbia Basin ecosystem management project: scientific assessment].

Hessburg, P. F., & Agee, J. K. 2003. An environmental narrative of Inland Northwest United States forests, 1800-2000. Forest Ecology and Management, 179, 23-59.

Hessburg, P.F.; Agee, J.K.; and Franklin, J.F. 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.

Hiller, T. L. 2011. Oregon furbearer program report, 2010–2011. Oregon Department of Fish and Wildlife, Salem, Oregon, USA. http://www.dfw.state.or.us/resources/hunting/small_game/docs/2011_furbearer_report.pdf. Accessed 15 November 2011.

Hopkins, B.;Simon; Schafer, S; Lilybridge, T. 1992. Region 6 interim old growth definition for ponderosa pine series. In: USDA Forest Service. 1993. Region 6 interim old growth definition[s] for Douglas fir series, grand fir/white fir series, interior Douglas-fir series, lodgepole pine series, Pacific silver fir series, ponderosa pine series, Port Orford series, tanoak (redwood) series, western hemlock series. Portland, Oregon. USDA FS Pacific Northwest Region. [Irregular pagination].

Hornocker, M.G. and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Can. J. Zool. 59:1286-1301.

Horton, S.P. and R.W. Mannan. 1988. Effects of prescribed fire on snags and cavity-nesting birds in southeastern Arizona pine forests. Wildlife Society Bulletin 16(1): 37-44.

Hutto, R.L. and S.M. Gallo. 2006. The effects of postfire salvage logging on cavity-nesting birds. Condor 108:817-831.

Ingram, R. 1973. Wolverine, fisher, and marten in central Oregon. Oregon State Game Commission Report No. 73-2.

Johnsgard, P.A. 1990. Hawks, Eagles, & Falcons of North America. Pages.260-268. Washington and London: Smithsonian Institution Press.

Johnson, Bruce K., Michael J. Wisdom, and John G. Cook. 2005. Issues of elk productivity for research and management. Pp. 81-93 in Wisdom, M.J, tech. ed., The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources conference, Alliance Communications Group, Lawrence, KS. IN. Oregon Forest Resources Institute. 2007. Wildlife in Managed Forests. Elk. Portland, Oregon. USA.

Keen, F.P. 1929. How soon do yellow pine snags fall? Journal of Forestry 27:735-737.

Keinath, D.A. 2004, Odtober 29. Fringed Myotis (*Myotis thysanodes*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available : http://www.fs.fed.us/r2/scp/assessments/fringedmyotis.pdf.

Knapp, E. E., Estes, B. L., & Skinner, C. N. 2009, September. Ecological Effects of Prescribed Fire Season: A Literature Review and Synthesis for Managers. General Technical Report PSW-GTR-224.

Koonce, A.L. and Roth, L.F. 1980. The effects of prescribed burning on dwarf mistletoe in ponderosa pine. In: Proceedings, 6th conference on fire and forest meteorology, April 22-24, 1980. Seattle, WA. Washington, DC; Society of American Foresters: 197-203.

Kozma, J.M. 2009. Nest-site attributes and reproductive success of white-headed and hairy woodpeckers along the east-slope Cascades of Washington state. Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics. pp. 52-61.

Kozma, J.M. 2010. Characteristics of trees used by white-headed woodpeckers for sap feeding in Washington. Northwestern Naturalist 91:81-86.

Kozma, J.M. 2011. Composition of forest stands used by white-headed woodpeckers for nesting in Washington. Western North American Naturalist 71(1):1-9.

Kreisel, K.J., and S.J. Stein. 1999. Winter and Summer bird use of burned and unburned coniferous forests. Wilson Bulletin 111(2):243-250.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J.E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. .2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas. Washington, DC, U.S.A.

La Sorte, F.A., R.W. Mannan, R.T. Reynolds, and T.G. Grubb. 2004. Habitat associations of sympatric red-tailed hawks and northern goshawks on the Kaibab Plateau. Journal of Wildlife Management 68:307–317.

Larson, A.J. and Churchill, D. 2012. Tree spatial patterns in fire-frequent forests of western North America, including mechanisms of pattern formation and implications for designing fuel and restoration treatments. Forest Ecology and Management 267: 74-92.

Laudenslayer, W.F. Jr., Shea, P.J., Valentine, B.E., Weatherspoon, C.P., and Lisle, T.E., technical coordinators, 2002, Proceedings of the symposium on the ecology and management of dead wood in western forests: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-181, p. 949

Leonard, W>P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. In United States Department of Interior (USDI), USFWS Species Fact Sheet for the Oregon Spotted Frog, updated 2013.

Lehmkuhl, J.F.; Hessburg, P.F.; Everett, R.L.; Huff, M.H.; and Ottmar, R.D. 1994. Historical and current forest landscapes of eastern Oregon and Washington. Part I: Vegetation pattern and insect and disease hazards.

Lewis, S. E. 1994. Night roosting ecology of pallid bats (*Antrozous pallidus*) in Oregon. *In* NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http:www.natureserve.org/explorer

Lighthall, K. 2007. East & West Deschutes County Community Wildfire Protection Plan.

Linder, K.A. and S.H. Anderson. 1998. Reproductive habitat of Lewis' woodpeckers in southeastern Wyoming. Journal of Field Ornithology 69(1):109-116.

Lindstrand III, L. and M. Humes. 2009. White-headed woodpecker occurrences in Sun Pass State Forest, south-central Oregon. *In* USDA Forest Service, Deschutes National Forest. 2012B. White-headed Woodpecker Species Assessment.

Logan, R. 2002. Oregon's forest protection laws: an illustrated manual. Oregon Forest Resources Institute. Portland, OR. 160 p. http://www.oregonforests.org

Long, J.N. 2005. A density management diagram for even-aged ponderosa pine stands. West. J. Appl. For. 20(4): 205-215.

Magoun, A. J., P. Valkenburg, C.D. Long, and J.K. Long. 2013. Monitoring wolverines in northeast Oregon, January 2011–December 2012. Final report. The Wolverine Foundation, Inc., Kuna, Idaho, USA. http://www.dfw.state.or.us/conservationstrategy/docs/Wallowa%20Wolverine%20Final%20Report_2013_protected.pdf. Accessed 25 February 2013.

Marshall, D. B. 1996. Species at risk. *In* Birds of Oregon: A General Reference, Marshall, M. G. Hunter, and A. L. Contreras. Eds. 2003. Oregon State University Press, Corvallis, OR. 768 pp.

Marshall, D. B., M. G. Hunter, and A. L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, OR. 768 pp.

Mazurek, M.J. 2004. A maternity roost of Townsend's big-eared bats (*Corynorhinus townsendii*) in coast redwood basal hollows in northeastern California.

McCauley, P. 1993. Deschutes National Forest Fire History, 1908-1992. Internal Report.

McDonald, Philip M. and Abbott, Celeste S. 1994. Seedfall, regeneration, and seedling development in group-selection openings. Res. Paper PSW-RP-220. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 13 p.

McGrath, M. T., S. DeStephano, R. A. Riggs, L. L. Irwin, and G. L. Roloff. 2003. Spatially explicit influences on Northern Goshawk nesting habitat in the interior Pacific Northwest. Wildlife Monographs 154:1–63.

McHugh, C. W., & Kolb, T. E. 2003. Ponderosa pine mortality following fire in Northern Arizona. International Journal of Wildland Fire, 12, 7-22.

McHugh, C. W., Kolb, T. E., & Wilson, J. L. 2003. Bark beetle attacks on ponderosa pine following fire in northern Arizona. Environmental Entomology, 32, 511-522.

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2012. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.20. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/

Miller, Jeffrey C. and Paul C. Hammond. 2007. Butterflies and Moths of Pacific Northwest Forests and Woodlands: Rare, Endangered, and Management Sensitive Species. Forest Health Technology Team, Technology Transfer Species Identification. USDA Forest Service Publication FHTET-2006-07.

Moore, K. R., and C. J. Henny. 1984. Age-specific productivity and nest site characteristics of Cooper's hawks (*Accipiter cooperii*). Northwest Science 58:290-299.

Moser, B.W., and E.O. Garton. 2009. Short-term effects of timber harvest and weather on goshawk reproduction in northern Idaho. Journal of Raptor Research 43:1-10.

Munger, T. T. 1917. Western yellow pine in Oregon. US Department of Agriculture. Bulletin 418. 48 p.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http:www.natureserve.org/explorer

NWCG. 2012, July. Glossary of Wildland Fire Terminology. Retrieved from National Wildfire Coordinating Group: http://www.nwcg.gov/pms/pubs/glossary/index.htm

NWFS. 2013. Oregon Log Market Report. Northwest Forestry Services. Retrieved from http://www.nwforestryservices.com/logs.html

Ohmann, J. L. and K. L. Waddell. 2002. Regional patterns of dead wood in forested habitats of Oregon and Washington. U. S. Department of Agriculture Forest Service, Pacific Southwest Research Station. Gen. Tech. Rep. PSW-GTR-181. Pp 535-560.

Opler, Paul A., Harry Pavulaan, Ray E. Stanford, Michael Pogue, coordinators. 2006. Butterflies and Moths of North America. Bozeman, MT: Mountain Prairie Information Node.

Parmeter, J.R. 1978. Forest stand dynamics and ecological factors in relation to dwarf mistletoe spread, impact, and control. In: Proceedings of the symposium on dwarf mistletoe control through forest management. USDA Forest Service Gen. Tech. Rep. PSW-31. 190p.

Pollet, J., & Omi, P. N. 1999. Effect of Thinning and Prescribed Burning on Wildfire Severity in Ponderosa Pine Forests. The Joint Fire Science Conference and Workshop, (p. 5).

Powell, D.C. 1999. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington: an implementation guide for the Umatilla National Forest. USDA Forest Service. Tech. Pub. F14-SO-TP-03-99. 300p.

Powers, P.V. 2013. Historic condition and historic structure determination. In: West Bend forest vegetation silviculture report. Bend/Fort Rock Ranger District. Deschutes National Forest. [Irregular pagination].

Randall-Parker, T. and R.Miller. 2002. Effects of Prescribed Fire in Ponderosa Pine on Key Wildlife Habitat Components: Preliminary Results and a Method for Monitoring. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. 2002.

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 G. Proulx, H.N. Bryant, and P.M. Woodard, eds., Martes: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Alberta, Canada.

Raphael, M.G., M.L. Morrison, and M.P. Yoder-Williams. 1987. Breeding bird populations during twenty-five years of post-fire succession in the Sierra Nevada. Condor 89:614-626.

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), 139-148.

Reineke, L.H. 1933. Perfecting a stand density index for even-aged forests. Journal of Agricultural Research 46(7):627-638.

Reynolds, R. T. 1983. Management of western coniferous forest habitat for nesting Accipiter hawks. USDA Forest Service Gen. Tech. Rep. RM – 102.

Reynolds, R.T. 1989. Accipiters, Pages. 92-101 In B. G. Pendleton, G. E. Ruibal, D. L. Crahle, K. Steenhof, M. N. Kochert, M. N. LeFranc, Jr. [eds.]. Proceedings of the western raptor management symposium and workshop. Natl. Wildl. Fed. Sci. Tech. Ser. No. 12.

Reynolds, R.T. and H.M. Wight. 1978. Distribution, density, and productivity of accipiter hawks breeding in Oregon Wilson Bulletin 90: 182-196.

Reynolds, R.T. and E.C. Meslow. 1984. Partitioning of food and niche characteristics of coexisting Accipiters during breeding. Auk 101(4):761-779.

Reynolds, R.T., E.C. Meslow, and H.M. Wight. 1982. Nesting habits of coexisting Accipiters in Oregon. Journal of Wildlife Management 46:124-31.

Reynolds, R.T.; Graham, R.T.; Reiser, M.H.; Bassett, R.L.; Kennedy, P.L.; Boyce, D.A.; Goodwin, G.; Smith, R.; Fisher, E.L. 1992. Management recommendations for the northern goshawk in the southwestern United States. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, GTR-RM-217.

Reynolds, R.T., D.A. Boyce, and R.T. Graham. 2012. Ponderosa Pine Forest Structure and Northern Goshawk Reproduction: Response to Beier et al. (2008). Wildlife Society Bulletin 36(1):147–152; 2012; DOI: 10.1002/wsb.109.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).

Ritchie, M. W., Skinner, C. N., & Hamilton, T. A. 2007. Probability of tree survival after wildfire in an interior pine forest of northern California: Effects of thinning and prescribed fire. Forest Ecology and Management, 247, 200-208.

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, Managing directors, Wildlife-habitat relationships in Oregon and Washington: Corvallis, Oreg., Oregon State University Press, p 580-623.

Roth, L.F. and Barrett, J.W. Response of dwarf mistletoe-infested ponderosa pine to thinning: 2. Dwarf mistletoe propagation. USDA Forest Service. Research Paper PNW-RP-331. 20p.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, J.L. Lyon, and W.L. Zielinski, tech eds. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and range Experiment Station. 184pp.

Saab, V.A. and J.G. 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: USDA Forest Service, Rocky Mountain Research Station. 17 p.

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., R.E. Russell, and J.G. Dudley. 2007. Nest densities of cavity-nesting birds in relation to postfire salvage logging and time since wildfire. The Condor 109:97-108.

Saab, V.A., R.E. Russell, and J.G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257:151-159.

Sallabanks, R. 1995. Effects of wildfire on breeding bird communities in coniferous forests of northwestern Oregon. Unpublished annual report. Sustainable Ecosystems Institute, Meridian, ID, USA.

Sammon, S. and Logan, J., Tech. Eds. 2000. Assessment and response to bark beetle outbreaks in the Rocky Mountain area. Report to Congress from Forest Health Protection , Washington Office, Forest Service, U.S. Department of Agriculture. Gen. Tech. Rep. RMRS-GTR-62. 46p.

Sartwell, C. 1971. Thinning ponderosa pine to prevent outbreaks of mountain pine beetle. In: Baumgartner, D.M., editor. Proceedings of the short course on precommercial thinning of coastal and intermountain forests in the Pacific Northwest. Washington State University Cooperative Extension Service. Pullman, Washington. 41-52.

Sartwell, C. and Stevens, R.E. 1975. Mountain pine beetle in ponderosa pine: Prospects for silvicultural control in second-growth stands. J. Forestry 73(3): 136-140

Saveland, J. M., & Neuenschwander, L. F. 1990. A signal detection framework to evaluate models of tree mortality following fire damage. Forestry Science, 36, 66-76.

Schmid, J.M, S.A. Mata, and W.F. McCambridge, W.F. 1985. Natural falling of beetle-killed ponderosa pine. Res.Note RM-454. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 3 p.

Schmitt, Craig L. and Lia H. Spiegel. 2008. White paper on Johnson's Hairstreak butterfly and dwarf mistletoe in the Blue Mountains. USDA. Forest Service, Blue Mountains Pest Management Service Center, Wallowa-Whitman National Forest, La Grande, Oregon.

Schmid, J.M, S.A. Mata, and W.F. McCambridge, W.F. 1985. Natural falling of beetle-killed ponderosa pine. Res.Note RM-454. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 3 p.

Schmidt, K. M., Menakis, J. P., Hardy, C. C., Hann, W. J., & Bunnell, D. L. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rockt Mountain Research Station.

Schroeder, B. 2013. Rocket Vegetation Management Project Specialist Report: Silviculture. Deschutes National Forest, Bend-Ft. Rock Ranger District.

Siders, M. and P. Kennedy. 1996. Forest structural characteristics of accipiter reproductive habitat: Is there an allometric relationship? Condor 98:124-133.

Seidman, V.M. and C.J. Zabel. 2001. Bat activity along intermittent streams in northwestern California.

Siemers, J. 2002. A survey of Colorado's caves for bats. Colorado Division of Wildlife.

Simpson, M. 2007. Forested plant associations of the Oregon East Cascades. USDA Forest Service. Pacific Northwest Region. R6-NR-ECOL-TP-03-2007.

Stalmaster, Mark. 1987. The Bald Eagle. Universe Books, NY, NY. 227 pp.

Squires, J.R., and P. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation and management. Studies in Avian Biology 31:8-62.

Squires, J.R. and R.T. Reynolds. 1997. Northern Goshawk (*Accipiter gentilis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North

America Online: http://bna.birds.cornell.edu/bna/species/298

Stephens, S. L., & Finney, M. A. 2002, June. Prescribed fire mortality of Sierra Nevada mixed conifer tree species: effects of crown damage and forest floor combustion. Forest Ecology and Management, 162(2-3), 261-271.

Szewczak, J.M., S.M. Szewczak, M.L. Morrison, and L.S. Hall. 1998. Bats of the White and Inyo Mountains of California-Nevada. Great Basin Naturalist 58:66–75.

Tesky, Julie L. 1994. *Buteo jamaicensis*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, May 25].

Thies, W. G., Westlind, D. J., & Loewen, M. 2005. Season of prescribed burn in ponderosa pine forests in eastern Oregon: impact on pine mortality. International Journal of Wildland Fire, 14, 223-231.

Thomas, J. 1979. Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington, ed. USDA Forest Service. Agriculture Handbook 553. 512 pp.

Thomas, T.R. and L.R. Irby. 1990. Habitat use and movement patterns by migrating mule deer in southeastern Idaho. Northwest Sd., 64:19-27

Tobalske, B.W. 1997. Lewis's Woodpecker (*Melanerpes lewis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/284.

USDA Forest Service. 1985. National forest silvicultural practices handbook. FSH 2409.17. Washington, DC.

USDA Forest Service. 1990. Final Environmental Impact Statement. Land and Resource Management Plan. Deschutes National Forest. Pacific Northwest Region. Appendices A – I. (Table 7a, Managed yield table summary for the ponderosa pine working group, Appendix B-73).

USDA Forest Service. 1990a. Final Environmental Impact Statement. Land and Resource Management Plan. Deschutes National Forest. Pacific Northwest Region.

USDA Forest Service. 1990b. Land and Resource Management Plan. Deschutes National Forest. Pacific Northwest Region.

USDA Forest Service. 1993a. National forest silvicultural practices handbook. FSH 2409.17. R-6 Supplement 2. Portland, OR.

USDA Forest Service. 1993b. Region 6 Interim Old Growth Definitions.

USDA Forest Service. 1994. Deschutes National Forest Wildlife Tree and Log Implementation Strategy.

USDA Forest Service. 1994. Deschutes National Forest minimum stocking guidelines (94 Draft) for uneven-aged management. 2p.

USDA Forest Service. 1994. Newberry National Volcanic Monument Comprehensive Management Plan. Deschutes National Forest. Pacific Northwest Region.

USDA Forest Service, Region 6. 1995. Revised Environmental Assessment for the Continuation of Interim Management Direction Establishing Riparian Ecosystem and Wildlife Standards for Timber Sales.

USDA Forest Service. 1996. Landscape Aesthetics, A Handbook for Scenery Management.

USDA Forest Service. 2003. Memo regarding guidance for implementing eastside screens to Forest Supervisors of the Colville, Deschutes, Malheur, Ochoco, Umatilla, Wallowa-Whitman, Wenatchee-Okanogan, and Winema-Fremont National Forests. Signed by Mike Ash for Linda Goodman. 1p.

USDA Forest Service. 2004. Bald Eagle Species Assessment, San Juan National Forest.

USDA Forest Service. 2004. Fringed myotis (*Myotis thysanodes*): a technical conservation assessment. [Online]. Rocky Mountain Region.

USDA Forest Service. 2004a. National forest silvicultural practices manual. FSM 2479.01. Amend. 6. Washington, DC.

USDA Forest Service. 2004b. National forest silvicultural practices manual. FSM 2471.31. Amend. 6. Washington, DC.

USDA Forest Service. 2006a. National forest land management planning handbook. FSH 1909.12. Amend. 7. Washington, DC.

USDA Forest Service. 2006b [2005]. Review of Logging to Control Insects: The science and myths behind managing forest insect 'pests', a report by Scott H. Black, 2005, Xerces Society for Invertebrate Conservation, Portland, Oregon. Memo dated January 4, 2005 with enclosure dated November 2005 to Regional Foresters, Station Directors, Area Director, IITF Director, File Code 3400/4000 from Ann M. Bartuska, Deputy Chief for Research and Development.

USDA Forest Service. 2007. Spotted Bat (*Euderma maculatum*): a technical conservation assessment. [Online]. Rocky Mountain Region.

USDA Forest Service. 2010. Deschutes and Ochoco National Forests. Joint Aquatic and Terrestrial Programmatic Biological Assessment August 2010 – August 2013.

USDA Forest Service. 2011. Update of the Regional Forester's Sensitive Species Lists and Transmittal of Strategic Species List. December 1, 2011. Pacific Northwest Region. Portland, OR.

USDA Forest Service, Deschutes National Forest. 2012a. Red-tailed hawk species assessment.

USDA Forest Service, Deschutes National Forest. 2012b. Northern goshawk species assessment.

USDA Forest Service, Deschutes National Forest. 2012c. Cooper's hawk species assessment.

USDA Forest Service, Deschutes National Forest. 2012d. Sharp-shinned hawk species assessment.

USDA Forest Service, Deschutes National Forest. 2012e. Elk species assessment.

USDA Forest Service, Deschutes National Forest. 2012f. Mule deer species assessment.

USDA Forest Service, Deschutes National Forest. 2012g. American marten species assessment.

USDA Forest Service, Deschutes National Forest. 2012h. Black-backed woodpecker species assessment.

USDA Forest Service, Deschutes National Forest. 2012i. Three-toed woodpecker species assessment.

USDA Forest Service, Deschutes National Forest. 2012j. Pileated woodpecker species assessment.

USDA Forest Service, Deschutes National Forest. 2012k. Williamson's sapsucker species assessment.

USDA Forest Service, Deschutes National Forest. 2012l. Hairy woodpecker species assessment.

USDA Forest Service, Deschutes National Forest. 2012m. Northern flicker species assessment.

USDA Forest Service. 2011. National forest resource management manual. FSM 2020.5. Interim Directive 2020-2011-1. Washington, DC.

USDA Forest Service. PNW Gen. Tech. Rep. 328. 88p. [Everett, R.L. (team leader). Eastside forest ecosystem health assessment; Hessburg, P.F. (science team leader and tech. ed.) Volume III: assessment].

USDA Forest Service. 2006. National forest land management planning handbook. FSH 1909.12. Amend. 7. Washington, DC.

USDA Forest Service. 2011. An assessment of Geographical Priorities for Integration of Vegetation Management on Federal Lands in Central Oregon. Deschutes and Ochoco National Forests and Prineville District Bureau of Land Management.

USDA Forest Service. 2011. Update of the Regional Forester's Sensitive Species Lists and Transmittal of Strategic Species List. December 1, 2011. Pacific Northwest Region. Portland, OR.

USDA Forest Service. 2012. Unpublished map of plant associations (Volland 1985) of the Deschutes National [ArcInfo Coverage]. On electronic file with: USDA Forest Service, Region 6, Deschutes National Forest. T:\FS\Reference\GIS\r06_des\Data\pag. (April 18, 2011).

USDA Forest Service. 2013. *Financial Analysis Workbook TEA-R6 Econ 6.0 (Version 1331 TEA 07-13)* Retrieved from USFS R6 Land and Resource Management, Forest Products, Programs and Software Website http://www.fs.usda.gov/detail/r6/landmanagement/resourcemanagement/?cid=fsbdev2_027048.

USDA Forest Service. 2013a. Raster data with vegetation metrics [including potential vegetation, diameter size classifications, canopy cover, and stand density index] derived [in part] from Lidar data. On electronic file with USDA Forest Service, Deschutes National Forest, Bend-Fort Rock Ranger District. T:\FS\NFS\Deschutes\Project\BFR\eaRocket2012\GIS\Data\3_15_13.gdb\Combine5Copy.

USDA Forest Service. 2013b. Forest insect and disease aerial survey data [Oregon and Washington]. On electronic file with USDA Forest Service. Region 6. Deschutes National Forest. T:FS\Reference\GIS\r06_des\LayerFile_InsectDisease.lyr\FHP_Aerial Survey. (April 2013)

USDA NRCS (Natural Resources Conservation Service). 2008. Plant website at http://plants.usda.gov/java/profile

USDI Fish and Wildlife Service. 1986. Recovery Plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon. 160 pp.

USDI Fish and Wildlife Service (USFWS). 1987. Northern Rocky Mountain Wolf Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado, 119 pp.

USDI Fish and Wildlife Service. 2004. High Priority Shorebirds– 2004. U.S. Shorebird Conservation Plan. Unpublished Report, U.S. Fish and Wildlife Service, 4401 N. Fairfax Dr., MBSP 4107, Arlington, VA, 22203 U.S.A. 5 pp.

USDI Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pp. http://www.fws.gev/migratorybirds/

Vaillant, N. M., Ager, A. A., Anderson, J., & Miller, L. 2012. ArcFuels User Guide and Tutorial: for use with ArcGIS 10.0. Internal Report. Prineville: US Department of Agriculture, Forest Service, Pacific Northwest Research Station, Western Wildland Environmental Threat Assessment Center.

Volland, Leonard A. 1985. Plant associations of the central Oregon Pumice zone. USDA Forest Service. Pacific Northwest Region. R6-ECOL-104-1985. 138 p.

Wall, D. (2012). Fry Underburn, Fire Effects Report-5/10/2012. Bend, Oregon: Newberry Division - COFMS.

Walters, E.L., E.H. Miller, and P.E. Lowther. 2002. Red-naped Sapsucker (Sphyrapicus nuchalis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/663b.

Western Bat Working Group. 2005. Townsend's big-eared bat species assessment.

WDFW (Washington Dept. of Fish and Wildlife). 1999. Management Recommendations for Washington's Priority Species, Volume IV: Birds- Peregrine Falcon *Falco peregrinus.* Internet Source:

Wiebe, K.L. and W.S. Moore. 2008. Northern flicker (*Colaptes auratus*), The Birds of North America

Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/166a

Wightman, C.S., V.A. Saab, C. Forristal, K. Mellen-Mclean, and A. Markus. 2010. White-headed woodpecker nesting ecology after wildfire. Journal of Wildlife Management 74(5): 1098-1106.

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.

Wisdom, Michael J., and John G. Cook. 2000b. North American Elk. Chapter 32 in Denarais, Stephen, and Paul R. Krausman, Ecology and Management of Large Mammals in North America. Prentice Hall, Upper Saddle River, NJ. IN. Oregon Forest Resources Institute. 2007. Wildlife in Managed Forests. Elk. Portland, Oregon. USA.

Woodbridge, B. and C. D. Hargis. 2006. Northern Goshawk Inventory and Monitoring Technical Guide. USDA Forest Service General Technical Report WO-71. Washington, D.C.

York, J. 2013. Wildlife report for the Rocket Vegetation Management Project. Deschutes National Forest, Bend-Ft. Rock Ranger District.

Youngblood, A.; Max, T.; Coe, K. 2004. Stand structure in eastside old-growth ponderosa pine forests of Oregon and northern California. Forest Ecology and Management 199:191-217.

Youtz, J.A., R.T. Graham, R.T. Reynolds, and J.Simon. Implementing Northern Goshawk Habitat Management in Southwestern Forests: A Template for Restoring Fire-Adapted Forest Ecosystems Proceedings of the 2007 National Silviculture Workshop.

Zenerold, M. 1988. Modeling the yield and economic implications of a mountain pine beetle epidemic in second-growth ponderosa pine on the Deschutes National Forest. Prepared for: Stocking level control in second growth ponderosa pine environmental assessment. Bend/Fort Rock Ranger District. Deschutes National Forest.

Appendix A – Unit and Prescription Lists by Alternative

Table 181: Rocket Alternative 2 - Units and Proposed Activities

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
11.0	51	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
20.1	86	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
20.2	59	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
20.3	12	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
20.4	34	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
21.1	91	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
21.2	12	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
22.1	22	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
22.3	4	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
22.4	29	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
22.5	71	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
22.6	40	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
23.1	32	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
23.2	21	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
23.3	4	None	Mow/Underburn	
23.4	10	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
23.5	27	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
33.0	14	Ponderosa Restoration	Mow/Underburn	Grapple Pile
36.0	13	Ponderosa Restoration	Mow/Underburn	Grapple Pile
37.0	36	Ponderosa Restoration	Mow/Underburn	Grapple Pile
39.0	65	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
41.1	46	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
41.2	9	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
42.0	38	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
45.0	145	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
48.0	43	Plantation Thin	Mow	Grapple Pile / Masticate
53.0	3	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
55.0	6	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
57.0	17	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
59.0	22	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
61.1	20	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
61.2	13	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
61.3	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
62.1	11	Plantation Thin	Mow	Grapple Pile / Masticate
62.2	1	Plantation Thin	Mow	Grapple Pile / Masticate
63.0	10	Plantation Thin	Mow	Grapple Pile / Masticate
65.0	11	Ponderosa Restoration	Mow/Underburn	Grapple Pile
96.1	31	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
96.2	44	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
96.3	7	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
97.0	6	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
98.0	7	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
99.0	2	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
100.0	3	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
101.0	10	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
106.0	216	Plantation Thin	Mow	Grapple Pile / Masticate
123.1	181	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
123.2	5	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
123.3	63	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	71	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	65	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	16	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
125.0	8	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
126.1	26	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
126.2	4	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
152.2	20	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
209.0	43	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
210.0	31	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
211.0	79	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
213.1	19	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
213.2	20	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
220.0	45	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
234.1	23	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
234.2	15	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
239.1	39	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
239.2	24	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
240.0	15	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
241.0	50	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
242.0	68	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
244.1	40	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
244.2	22	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
245.0	99	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
246.0	56	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
247.0	62	Ponderosa Restoration	Mow/Underburn	Grapple Pile
248.1	37	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
248.2	6	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
275.0	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
277.1	76	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
277.2	10	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
277.3	8	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
278.0	3	Ladder Fuel Reduction	None	Pile / Lop & Scatter
307.1	39	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
307.2	40	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
308.1	2	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
308.2	12	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
308.3	13	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
308.4	8	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
308.5	7	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
312.0	102	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
313.1	190	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
313.2	27	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
325.1	61	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.2	5	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.3	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.4	11	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
335.0	19	Ponderosa Restoration	Mow/Underburn	Grapple Pile
338.0	17	Ponderosa Restoration	Mow/Underburn	Grapple Pile
340.0	22	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
346.0	21	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
347.1	51	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.2	42	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.3	53	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.4	72	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
354.0	4	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
356.0	71	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
366.0	26	Ponderosa Restoration	Mow/Underburn	Grapple Pile
367.1	28	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
367.2	10	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
367.3	14	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
367.4	19	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
367.5	12	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
447.0	37	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
451.1	98	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
451.2	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
451.3	5	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
451.4	48	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
716.0	5	Opening - Deer Hab.	Mow	Mix of Methods
800.0	33	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
801.1	110	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
801.2	56	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
802.1	96	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
802.2	285	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
802.3	103	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
802.4	5	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
803.0	20	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
804.1	62	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
804.2	11	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
804.3	5	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
806.1	44	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
806.2	16	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
807.1	46	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
807.2	44	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
808.0	54	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
809.1	38	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
809.2	23	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.1	2	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.2	7	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.3	8	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.4	3	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.5	8	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.6	26	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.7	8	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
810.8	3	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
811.1	27	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
811.2	21	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
811.3	3	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
811.4	14	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
812.1	11	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.2	48	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.3	20	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.4	25	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.5	30	Ponderosa Restoration	Mow/Underburn	Mix of Methods
813.0	71	Thin to 40 avg. BA	None	Mix of Methods
814.0	30	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
815.0	36	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.1	34	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.2	5	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.3	3	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.4	13	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.5	62	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.6	13	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
817.0	75	Ponderosa Restoration	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
818.0	16	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
820.0	176	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
821.3	40	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
822.5	30	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
823.1	81	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
823.2	44	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
828.0	14	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
830.1	96	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
830.2	9	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
831.1	57	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
831.2	45	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
831.3	24	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
831.4	7	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
831.5	32	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
832.0	39	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
833.0	2	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
834.0	14	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
836.0	8	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
837.1	7	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
837.2	12	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
839.2	4	Opening - Deer Hab.	Mow	Mix of Methods
840.1	28	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
840.2	11	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
842.1	13	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
842.2	10	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
843.0	15	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
844.0	13	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
845.0	11	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
846.1	11	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
846.2	3	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
847.0	20	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
848.0	12	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
849.0	4	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
850.0	8	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
851.0	16	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
852.0	6	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
853.0	15	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
854.0	31	None	Mow/Underburn	
855.0	51	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
856.2	20	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
856.3	11	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile

Unit Number	Acres	Alt. 2 Tree Prescription	Alt. 2 Fuels Prescription	Alt. 2 Slash Treatment
857.0	21	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
859.1	8	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
859.2	3	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
860.1	20	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
861.0	3	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
862.0	9	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
863.0	6	Ponderosa Restoration	Mow/Underburn	Grapple Pile
864.0	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
865.1	49	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
865.2	17	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
866.0	6	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
867.0	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
868.0	53	Ponderosa Restoration	Mow/Underburn	Grapple Pile
869.0	9	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
870.0	27	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
871.0	10	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
872.1	27	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
872.2	24	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
873.1	52	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
873.2	6	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
873.3	4	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
873.4	16	Thin to 40 avg. BA	Mow/Underburn	Mix of Methods
874.1	15	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
874.2	19	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
874.3	19	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
874.4	30	Thin to 40 avg. BA	Mow/Underburn	Grapple Pile
875.0	63	Ponderosa Restoration	Mow/Underburn	Grapple Pile
876.1	89	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
876.2	9	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
900.0	4	Aspen Enhancement	None	Pile / Lop & Scatter
901.0	1	Aspen Enhancement	None	Pile / Lop & Scatter
903.0	4	Opening - Deer Hab.	Mow	Grapple Pile

Table 182: Alternative 3 – Units and Proposed Activities

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
9.0	46	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
11.0	51	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
21.2	12	Thin to 60 avg. BA	None	Mix of Methods
22.3	4	Opening - Deer Hab.	Mow	Mix of Methods
22.4	29	Thin to mixed BA (40-80)	None	Mix of Methods

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
23.2	21	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
23.5	27	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
33.0	14	Ponderosa Restoration	None	Grapple Pile
36.0	13	Ponderosa Restoration	None	Grapple Pile
37.0	36	Ponderosa Restoration	None	Grapple Pile
39.0	65	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
41.1	46	Thin to mixed BA (40-80)	Mow	Mix of Methods
41.2	9	Thin to mixed BA (40-80)	None	Mix of Methods
42.0	38	Thin to mixed BA (40-80)	Mow	Mix of Methods
45.0	145	Thin to mixed BA (40-80)	Mow	Mix of Methods
48.0	43	Plantation Thin	Mow	Grapple Pile / Masticate
53.0	3	Plantation Thin	Mow	Grapple Pile / Masticate
55.0	6	Plantation Thin	Mow	Grapple Pile / Masticate
57.0	17	Plantation Thin	Mow	Grapple Pile / Masticate
58.1	35	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
58.2	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
59.0	22	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
62.1	11	Plantation Thin	Mow	Grapple Pile / Masticate
62.2	1	Plantation Thin	Mow	Grapple Pile / Masticate
63.0	10	Plantation Thin	Mow	Grapple Pile / Masticate
96.2	44	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
96.3	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
97.0	6	Ladder Fuel Reduction	None	Pile / Lop & Scatter
98.0	7	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
99.0	2	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
100.0	3	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
101.0	10	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
102.1	71	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
102.2	8	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
106.0	216	Plantation Thin	Mow	Grapple Pile / Masticate
109.0	55	Plantation Thin	Mow	Grapple Pile / Masticate
110.0	16	Plantation Thin	Mow	Grapple Pile / Masticate
117.0	33	Thin to mixed BA (40-80)	Mow	Grapple Pile
123.1	181	Thin to 60 avg. BA	None	Mix of Methods
123.2	5	Opening - Deer Hab.	Mow	Mix of Methods
123.3	71	Ladder Fuel Reduction	None	Pile / Lop & Scatter
125.0	8	Thin to 60 avg. BA	None	Mix of Methods
126.1	26	Thin to 60 avg. BA	None	Mix of Methods
129.1	47	Thin to mixed BA (40-80)	Mow	Grapple Pile
129.2	7	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
152.2	20	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
218.0	30	Thin to mixed BA (40-80)	None	Grapple Pile

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
220.0	45	Thin to mixed BA (40-80)	Mow	Mix of Methods
229.0	20	Thin to mixed BA (40-80)	Mow	Grapple Pile
230.0	10	Thin to mixed BA (40-80)	Mow	Grapple Pile
231.0	9	Thin to mixed BA (40-80)	Mow	Grapple Pile
239.2	24	Thin to mixed BA (40-80)	None	Mix of Methods
240.0	15	Thin to mixed BA (40-80)	None	Mix of Methods
241.0	50	Thin to mixed BA (40-80)	None	Mix of Methods
242.0	68	Thin to mixed BA (40-80)	None	Mix of Methods
245.0	99	Thin to mixed BA (40-80)	Mow	Mix of Methods
246.0	56	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
247.0	62	Ponderosa Restoration	None	Grapple Pile
248.1	37	Thin to mixed BA (40-80)	None	Mix of Methods
275.0	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
277.1	76	Thin to mixed BA (40-80)	Mow	Mix of Methods
277.2	10	Thin to mixed BA (40-80)	Mow	Mix of Methods
277.3	8	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
278.0	3	Ladder Fuel Reduction	None	Pile / Lop & Scatter
308.1	2	Thin to 60 avg. BA	None	Mix of Methods
308.2	12	Opening - Mistletoe	Mow	Mix of Methods
308.4	8	Opening - Mistletoe	Mow	Grapple Pile
308.5	7	Thin to 60 avg. BA	None	Mix of Methods
313.1	190	Thin to 60 avg. BA	None	Mix of Methods
335.0	19	Ponderosa Restoration	None	Grapple Pile
340.0	22	Plantation Thin	Mow	Grapple Pile / Masticate
346.0	21	Plantation Thin	Mow	Grapple Pile / Masticate
347.1	51	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.2	42	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
347.3	53	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
347.4	72	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
352.0	1	Thin to mixed BA (40-80)	None	Mix of Methods
354.0	4	Thin to mixed BA (40-80)	None	Mix of Methods
356.0	71	Thin to mixed BA (40-80)	None	Mix of Methods
360.0	8	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
367.1	28	Thin to mixed BA (40-80)	Mow	Mix of Methods
367.2	10	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
367.3	14	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
367.4	19	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
367.5	12	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
447.0	37	Thin to mixed BA (40-80)	Mow	Mix of Methods
709.0	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
712.0	10	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
715.0	1	Thin to mixed BA (40-80)	Mow	Mix of Methods

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
716.0	5	Opening - Deer Hab.	Mow	Mix of Methods
717.0	1	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
720.0	3	Thin to mixed BA (40-80)	None	Grapple Pile
800.0	33	Thin to mixed BA (40-80)	None	Mix of Methods
801.1	110	Thin to mixed BA (40-80)	None	Mix of Methods
801.2	56	Thin to mixed BA (40-80)	None	Mix of Methods
802.2	285	Thin to 60 avg. BA	None	Mix of Methods
803.0	20	Thin to mixed BA (40-80)	Mow	Mix of Methods
809.1	38	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
809.2	23	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.1	2	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.2	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.5	8	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
811.2	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
811.3	3	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
814.0	30	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
815.0	36	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
816.1	34	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
816.2	5	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
816.3	3	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
816.5	62	Thin to mixed BA (40-80)	None	Mix of Methods
828.0	14	Thin to 60 avg. BA	None	Mix of Methods
829.0	31	Thin to mixed BA (40-80)	Mow	Grapple Pile
830.1	96	Thin to mixed BA (40-80)	Mow	Mix of Methods
830.2	9	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
831.1	57	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
831.2	45	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
831.3	24	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
831.4	7	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
831.5	32	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
832.0	39	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
833.0	2	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
836.0	8	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
838.1	11	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
839.1	41	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
839.2	4	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
839.4	12	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
840.1	28	Thin to mixed BA (40-80)	Mow	Grapple Pile
840.2	11	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
842.2	10	Thin to mixed BA (40-80)	Mow	Mix of Methods
844.0	13	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
845.0	11	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
846.2	3	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
847.0	20	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
849.0	4	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
850.0	8	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
853.0	15	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
854.0	31	None	Mow/Underburn	
855.0	51	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
856.3	11	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
857.0	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
865.2	17	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
866.0	6	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
869.0	9	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
872.1	27	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
872.2	24	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
873.1	52	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
873.2	6	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
873.3	4	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
873.4	16	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
876.1	89	Thin to mixed BA (40-80)	Mow	Mix of Methods
876.2	9	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
877.0	14	Plantation Thin	Mow	Grapple Pile / Masticate
900.0	4	Aspen Enhancement	None	Pile / Lop & Scatter
901.0	1	Aspen Enhancement	None	Pile / Lop & Scatter
903.0	4	Opening - Deer Hab.	Mow	Grapple Pile
905.0	14	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
906.0	75	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
907.0	55	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
908.0	27	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
911.0	18	Plantation Thin	Mow	Grapple Pile / Masticate
913.0	10	Plantation Thin	Mow	Grapple Pile / Masticate
914.0	27	Thin to mixed BA (40-80)	None	Mix of Methods
915.0	2	Plantation Thin	Mow	Grapple Pile / Masticate
916.0	1	Plantation Thin	Mow	Grapple Pile / Masticate
917.0	2	Plantation Thin	Mow	Grapple Pile / Masticate
919.0	34	Plantation Thin	Mow	Grapple Pile / Masticate
921.0	75	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
922.0	12	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
923.0	55	Thin to mixed BA (40-80)	Mow	Mix of Methods
924.0	9	Thin to mixed BA (40-80)	Mow	Mix of Methods
925.0	4	Thin to mixed BA (40-80)	None	Mix of Methods
926.0	22	Thin to 60 avg. BA	None	Mix of Methods
927.0	3	Thin to 60 avg. BA	None	Mix of Methods

Unit Number	Acres	Alt. 3 Tree Prescription	Alt. 3 Fuels Prescription	Alt. 3 Slash Treatment
934.0	13	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
935.0	14	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
939.0	17	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
940.0	14	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
942.0	18	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
947.0	46	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
950.0	10	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
951.0	20	Plantation Thin	Mow	Grapple Pile / Masticate
958.0	29	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
959.0	20	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
960.0	23	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
963.0	13	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
967.0	35	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
970.0	3	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
972.0	12	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
973.0	8	Thin to mixed BA (40-80)	Mow	Mix of Methods
976.0	4	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
977.1	60	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
979.0	31	Thin to mixed BA (40-80)	None	Mix of Methods
980.0	3	Thin to mixed BA (40-80)	Mow	Mix of Methods
981.0	32	Plantation Thin	Mow	Grapple Pile / Masticate
982.0	25	Ladder Fuel Reduction	Mow	Pile / Lop & Scatter
983.0	66	Thin to mixed BA (40-80)	Mow	Grapple Pile
986.0	2	Thin to 60 avg. BA	None	Grapple Pile
987.0	5	Thin to mixed BA (40-80)	None	Mix of Methods
988.0	22	Thin to mixed BA (40-80)	None	Grapple Pile
989.0	3	Plantation Thin	Mow	Grapple Pile / Masticate
990.0	7	Thin for Mistletoe	None	Mix of Methods
991.0	8	Plantation Thin	Mow	Grapple Pile / Masticate
993.0	14	Thin to mixed BA (40-80)	None	Mix of Methods

Table 183: Alternative 4 – Units and Proposed Activities

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
9.0	46	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter
11.0	51	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
20.1	86	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
20.4	34	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
21.1	91	Thin to 60 avg. BA	None	Mix of Methods
21.2	12	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
22.1	22	Thin to mixed BA (40-80)	None	Mix of Methods
22.3	4	Opening - Deer Hab.	Mow	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
22.4	29	Thin to mixed BA (40-80)	None	Mix of Methods
22.5	71	Thin to mixed BA (40-80)	None	Mix of Methods
23.1	32	Thin to mixed BA (40-80)	None	Mix of Methods
23.2	21	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
23.5	27	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
33.0	14	Ponderosa Restoration	None	Grapple Pile
36.0	13	Ponderosa Restoration	None	Mix of Methods
37.0	36	Ponderosa Restoration	None	Grapple Pile
39.0	65	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
41.1	46	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
41.2	9	Thin to 60 avg. BA	Mow	Mix of Methods
42.0	38	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
45.0	145	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
48.0	43	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
49.1	5	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
49.2	4	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
53.0	3	Plantation Thin	Mow	Grapple Pile / Masticate
55.0	6	Plantation Thin	Mow	Grapple Pile / Masticate
57.0	17	Plantation Thin	Mow	Grapple Pile / Masticate
58.1	35	Plantation Thin	Mow/Underburn	Mix of Methods
58.2	7	Plantation Thin	Mow/Underburn	Mix of Methods
59.0	22	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
61.1	20	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
61.2	13	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
61.3	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
62.1	11	Plantation Thin	Mow	Grapple Pile / Masticate
62.2	1	Plantation Thin	Mow	Grapple Pile / Masticate
63.0	10	Plantation Thin	Mow	Grapple Pile / Masticate
65.0	11	Ponderosa Restoration	None	Grapple Pile
96.1	31	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
96.2	44	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
96.3	7	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
97.0	6	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
98.0	7	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
99.0	2	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
100.0	3	Ladder Fuel Reduction	Handpile/Burn	Pile / Lop & Scatter
101.0	10	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
102.1	71	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
102.2	8	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
102.3	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
102.4	42	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
106.0	216	Plantation Thin	Mow	Grapple Pile / Masticate
109.0	55	Plantation Thin	Mow	Grapple Pile / Masticate
110.0	16	Plantation Thin	Mow	Grapple Pile / Masticate
117.0	33	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
123.1	181	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
123.2	5	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
123.3	63	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	71	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	65	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
123.3	16	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
125.0	8	Thin to mixed BA (40-80)	None	Mix of Methods
126.1	26	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
126.2	4	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
129.1	47	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
129.2	7	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
152.2	20	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
209.0	43	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter
210.0	31	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
213.1	19	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
213.2	20	Thin to mixed BA (40-80)	None	Mix of Methods
218.0	30	Thin to mixed BA (40-80)	None	Grapple Pile
220.0	45	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
229.0	20	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
230.0	10	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
231.0	9	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
234.1	23	Thin to mixed BA (40-80)	None	Mix of Methods
234.2	15	Thin to mixed BA (40-80)	None	Mix of Methods
239.1	39	Thin to mixed BA (40-80)	None	Mix of Methods
239.2	24	Thin to 60 avg. BA	None	Mix of Methods
240.0	15	Thin to 60 avg. BA	Mow	Mix of Methods
241.0	50	Thin to 60 avg. BA	Mow	Mix of Methods
242.0	68	Thin to 60 avg. BA	Mow	Mix of Methods
243.2	3	Thin to mixed BA (40-80)	None	Grapple Pile
244.1	40	Thin to mixed BA (40-80)	None	Mix of Methods
244.2	22	Thin to 60 avg. BA	None	Mix of Methods
245.0	99	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
246.0	56	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
247.0	62	Ponderosa Restoration	None	Grapple Pile
248.1	37	Thin to 60 avg. BA	None	Mix of Methods
248.2	6	Thin to mixed BA (40-80)	None	Grapple Pile
275.0	21	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
277.1	76	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
277.2	10	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
277.3	8	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
278.0	3	Ladder Fuel Reduction	None	Pile / Lop & Scatter
307.1	39	Thin for Mistletoe	Mow/Underburn	Mix of Methods
307.2	40	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
308.1	2	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
308.2	12	Opening - Mistletoe	Mow/Underburn	Mix of Methods
308.3	13	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter
308.4	8	Opening - Mistletoe	Mow/Underburn	Grapple Pile
308.5	7	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
312.0	102	Thin to 60 avg. BA	None	Mix of Methods
313.1	190	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
313.2	27	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
325.1	61	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.2	5	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.3	7	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
325.4	11	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
335.0	19	Ponderosa Restoration	None	Grapple Pile
338.0	17	Ponderosa Restoration	None	Grapple Pile
340.0	22	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
346.0	21	Plantation Thin	Mow	Grapple Pile / Masticate
347.1	51	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.2	42	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.3	53	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
347.4	72	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
352.0	1	Thin to mixed BA (40-80)	Mow	Mix of Methods
354.0	4	Opening - Mistletoe	Mow	Mix of Methods
356.0	71	Thin to 60 avg. BA	Mow	Mix of Methods
360.0	8	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
366.0	26	Ponderosa Restoration	None	Grapple Pile
367.1	28	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
367.2	10	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
367.3	14	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
367.4	19	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
367.5	12	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
447.0	37	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
451.1	98	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
451.2	7	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
451.3	5	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
451.4	48	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
700.0	8	Thin to mixed BA (40-80)	Mow	Mix of Methods
701.0	9	Thin to mixed BA (40-80)	Mow	Mix of Methods
702.0	23	Thin to mixed BA (40-80)	Mow	Mix of Methods
703.0	12	Thin to mixed BA (40-80)	Mow	Mix of Methods
704.0	11	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
705.0	12	Ponderosa Restoration	None	Grapple Pile
706.0	18	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
707.0	76	Ponderosa Restoration	None	Grapple Pile
708.0	9	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
709.0	7	Thin for Mistletoe	Mow/Underburn	Grapple Pile
711.0	6	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
712.0	10	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
714.0	14	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
715.0	1	Thin to mixed BA (40-80)	Mow	Mix of Methods
716.0	5	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
717.0	1	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
720.0	3	Thin to mixed BA (40-80)	None	Grapple Pile
721.0	2	Thin to mixed BA (40-80)	None	Mix of Methods
722.0	18	Thin to mixed BA (40-80)	None	Mix of Methods
800.0	33	Thin to mixed BA (40-80)	None	Mix of Methods
801.1	110	Thin to mixed BA (40-80)	None	Mix of Methods
801.2	56	Thin to mixed BA (40-80)	None	Mix of Methods
802.1	96	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
802.2	285	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
802.3	103	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
802.4	5	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
803.0	20	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
804.1	62	Thin to mixed BA (40-80)	None	Mix of Methods
804.2	11	Thin to mixed BA (40-80)	None	Mix of Methods
804.3	5	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
806.1	44	Thin to 60 avg. BA	None	Mix of Methods
807.2	44	Thin to mixed BA (40-80)	None	Mix of Methods
808.0	54	Thin to mixed BA (40-80)	None	Mix of Methods
809.1	38	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
809.2	23	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.1	2	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
810.2	7	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
810.3	8	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.4	3	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
810.5	8	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
811.2	21	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
811.3	3	Opening - Deer Hab.	Mow/Underburn	Mix of Methods
812.1	11	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.2	48	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.3	20	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.4	25	Ponderosa Restoration	Mow/Underburn	Mix of Methods
812.5	30	Ponderosa Restoration	Mow/Underburn	Mix of Methods
813.0	71	Thin to mixed BA (40-80)	Mow	Mix of Methods
814.0	30	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
815.0	36	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.1	34	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.2	5	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
816.3	3	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
816.4	13	Thin to mixed BA (40-80)	None	Mix of Methods
816.5	62	Thin to 60 avg. BA	None	Mix of Methods
816.6	13	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
817.0	75	Ponderosa Restoration	None	Mix of Methods
818.0	16	Thin to mixed BA (40-80)	None	Mix of Methods
820.0	176	Thin to 60 avg. BA	None	Grapple Pile
821.1	18	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
821.3	10	Thin to mixed BA (40-80)	None	Mix of Methods
822.1	13	Thin to mixed BA (40-80)	None	Grapple Pile
822.3	11	Thin to 60 avg. BA	None	Mix of Methods
822.4	67	Thin to 60 avg. BA	None	Grapple Pile
822.5	30	Thin to 60 avg. BA	None	Mix of Methods
828.0	14	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
829.0	31	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
830.1	96	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
830.2	9	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
831.1	57	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
831.2	45	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
831.3	24	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
831.4	7	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
831.5	32	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
832.0	39	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
833.0	2	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
834.0	14	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
836.0	8	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
838.1	11	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
838.2	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
839.1	41	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
839.2	4	Opening - Deer Hab.	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
839.3	23	Thin to mixed BA (40-80)	None	Mix of Methods
839.4	12	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
840.1	28	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
840.2	11	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
842.1	13	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
842.2	10	Thin to mixed BA (40-80)	Mow/Underburn	Pile / Lop & Scatter
843.0	15	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
844.0	13	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
845.0	11	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
846.1	11	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
846.2	3	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
847.0	20	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
848.0	12	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
849.0	4	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
850.0	8	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
851.0	16	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
852.0	6	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
853.0	15	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
854.0	31	None	Mow/Underburn	None
855.0	51	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
856.2	20	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
856.3	11	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
857.0	21	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
859.1	8	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
859.2	3	Thin for Mistletoe	Mow/Underburn	Grapple Pile
860.1	20	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
861.0	3	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
862.0	9	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
863.0	6	Ponderosa Restoration	Mow/Underburn	Grapple Pile
864.0	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
865.1	49	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
865.2	17	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
866.0	6	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
867.0	10	Ponderosa Restoration	Mow/Underburn	Grapple Pile
868.0	53	Ponderosa Restoration	Mow/Underburn	Grapple Pile
869.0	9	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
870.0	27	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
871.0	10	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
872.1	27	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
872.2	24	Thin for Mistletoe	Mow/Underburn	Mix of Methods
873.1	52	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
873.2	6	Thin for Mistletoe	Mow/Underburn	Mix of Methods
873.3	4	Thin for Mistletoe	Mow/Underburn	Mix of Methods
873.4	16	Thin for Mistletoe	Mow/Underburn	Mix of Methods
874.1	15	Thin for Mistletoe	Mow/Underburn	Grapple Pile
874.2	19	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
874.3	19	Thin for Mistletoe	Mow/Underburn	Grapple Pile
874.4	30	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
876.1	89	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
876.2	9	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
877.0	14	Plantation Thin	Mow	Grapple Pile / Masticate
878.0	17	Thin to mixed BA (40-80)	None	Mix of Methods
879.0	9	Thin to mixed BA (40-80)	None	Grapple Pile
880.0	6	Thin to mixed BA (40-80)	None	Mix of Methods
881.0	18	Ponderosa Restoration	None	Mix of Methods
882.0	2	Ponderosa Restoration	None	Grapple Pile
883.0	2	Thin to 60 avg. BA	Mow	Grapple Pile
884.0	2	Thin to 60 avg. BA	Mow	Grapple Pile
885.0	40	Thin to 60 avg. BA	Mow	Mix of Methods
886.0	6	Thin to 60 avg. BA	Mow	Mix of Methods
887.0	8	Ponderosa Restoration	None	Grapple Pile
900.0	4	Aspen Enhancement	None	Pile / Lop & Scatter
901.0	1	Aspen Enhancement	None	Pile / Lop & Scatter
902.0	54	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
903.0	4	Opening - Deer Hab.	Mow	Grapple Pile
905.0	14	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
906.0	75	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
907.0	55	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter
908.0	27	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
909.0	26	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
910.0	104	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
911.0	18	Plantation Thin	Mow	Grapple Pile / Masticate
912.0	11	Thin to mixed BA (40-80)	None	Grapple Pile
913.0	10	Plantation Thin	Mow	Grapple Pile / Masticate
914.0	27	Thin to mixed BA (40-80)	None	Mix of Methods
915.0	2	Plantation Thin	Mow	Grapple Pile / Masticate
916.0	1	Plantation Thin	Mow	Grapple Pile / Masticate
917.0	2	Plantation Thin	Mow	Grapple Pile / Masticate
918.0	20	Plantation Thin	Mow	Grapple Pile / Masticate
919.0	34	Plantation Thin	Mow	Grapple Pile / Masticate
920.0	19	Plantation Thin	Mow	Grapple Pile / Masticate
921.0	75	Ladder Fuel Reduction	Mow/Underburn	Pile / Lop & Scatter

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
922.0	12	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
923.0	55	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
924.0	9	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
925.0	4	Thin to mixed BA (40-80)	None	Mix of Methods
926.0	22	Thin to 60 avg. BA	Mow	Mix of Methods
927.0	3	Thin to 60 avg. BA	Mow	Mix of Methods
928.0	7	Thin to mixed BA (40-80)	None	Mix of Methods
930.0	26	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
931.0	13	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
932.0	24	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
933.0	27	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
934.0	13	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
935.0	14	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
936.0	26	Thin to mixed BA (40-80)	None	Grapple Pile
937.0	19	Thin to mixed BA (40-80)	None	Mix of Methods
938.0	38	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
939.0	17	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
940.0	14	Thin to 60 avg. BA	Mow/Underburn	Mix of Methods
941.0	36	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter
942.0	18	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
943.0	36	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
944.0	23	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
945.0	5	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
946.0	71	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
947.0	46	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
948.0	3	Thin for Mistletoe	Mow/Underburn	Mix of Methods
949.0	6	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
950.0	10	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
951.0	20	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
952.0	13	Thin to mixed BA (40-80)	Mow	Mix of Methods
953.0	8	Thin to mixed BA (40-80)	Mow	Mix of Methods
954.0	11	Thin to mixed BA (40-80)	Mow	Mix of Methods
955.0	11	Thin to mixed BA (40-80)	Mow	Mix of Methods
956.0	6	Thin to mixed BA (40-80)	Mow	Mix of Methods
957.0	14	Thin to mixed BA (40-80)	Mow	Mix of Methods
958.0	29	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
959.0	20	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
960.0	23	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
962.0	10	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
963.0	13	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
964.0	8	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods

Unit Number	Acres	Alt. 4 Tree Prescription	Alt. 4 Fuels Prescription	Alt. 4 Slash Treatment
965.0	57	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
966.0	45	Thin to mixed BA (40-80)	None	Grapple Pile
967.0	35	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
968.0	18	Thin to 60 avg. BA	Mow/Underburn	Grapple Pile
969.0	11	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
970.0	3	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
971.0	30	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
972.0	12	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
973.0	8	Thin to mixed BA (40-80)	Mow	Mix of Methods
975.0	16	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
976.0	4	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
977.1	60	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
977.2	2	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
978.0	4	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
979.0	31	Thin to mixed BA (40-80)	None	Mix of Methods
980.0	3	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
981.0	32	Plantation Thin	Mow	Grapple Pile / Masticate
982.0	25	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
983.0	66	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
985.0	29	Thin to mixed BA (40-80)	None	Grapple Pile
986.0	2	Thin to 60 avg. BA	Mow	Grapple Pile
987.0	5	Thin to mixed BA (40-80)	Mow	Mix of Methods
988.0	22	Thin to mixed BA (40-80)	Mow	Grapple Pile
989.0	3	Plantation Thin	Mow	Grapple Pile / Masticate
990.0	7	Thin for Mistletoe	Mow/Underburn	Mix of Methods
991.0	8	Plantation Thin	Mow/Underburn	Grapple Pile / Masticate
992.0	32	Thin to mixed BA (40-80)	Mow/Underburn	Grapple Pile
993.0	14	Thin to mixed BA (40-80)	Mow/Underburn	Mix of Methods
994.0	22	Thin for Mistletoe	Mow/Underburn	Pile / Lop & Scatter
995.0	19	Ponderosa Restoration	Mow/Underburn	Grapple Pile
996.0	7	Ponderosa Restoration	Mow/Underburn	Grapple Pile
997.0	36	Thin to mixed BA (40-80)	Mow	Grapple Pile
998.0	34	Thin to mixed BA (40-80)	Mow	Grapple Pile
999.0	11	Thin to mixed BA (40-80)	Mow	Grapple Pile

Appendix B –Stands with Large Tree Structure Treated by Alternative

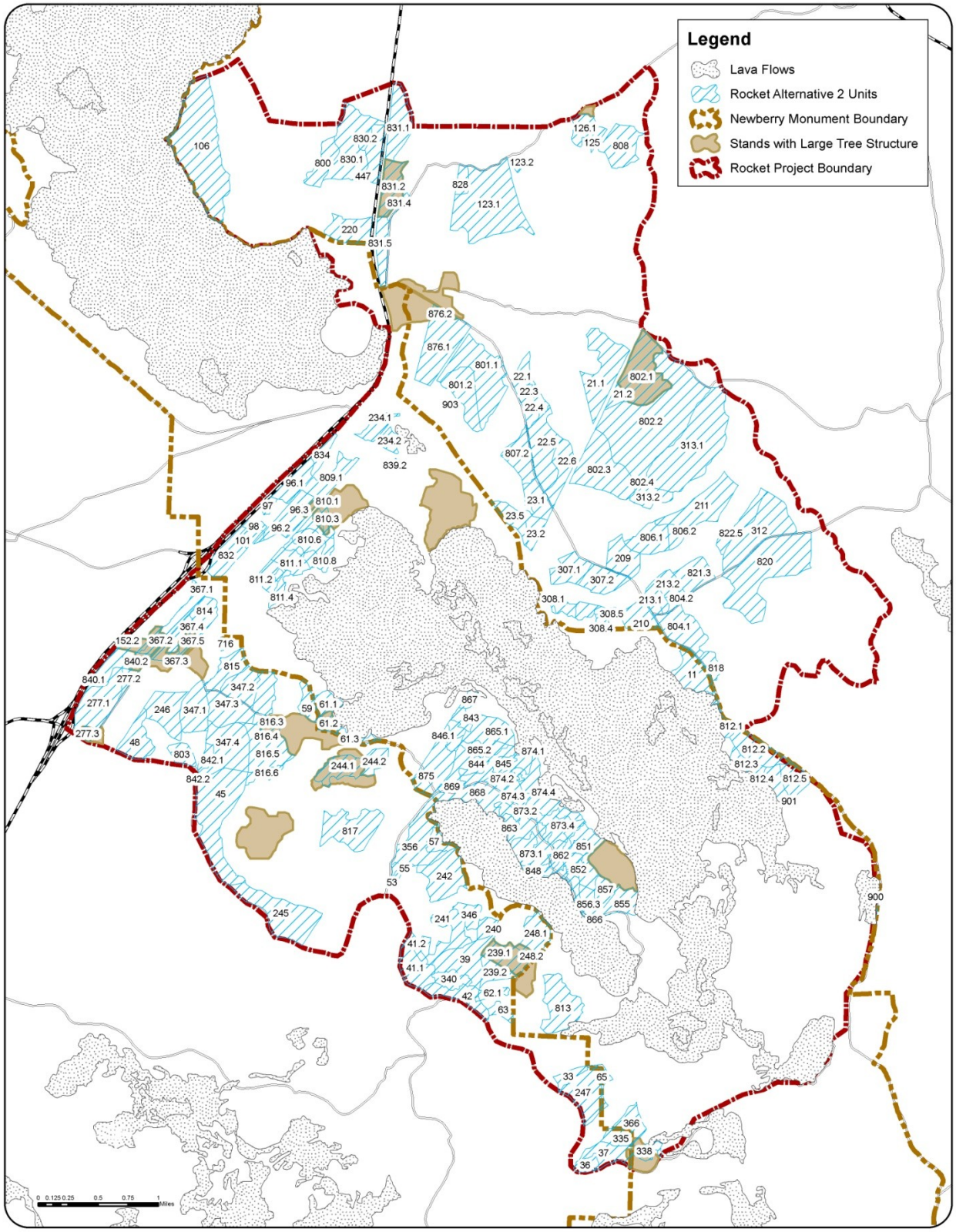


Figure 62: Alternative 2 commercial harvest units overlapping stands where large trees are common.

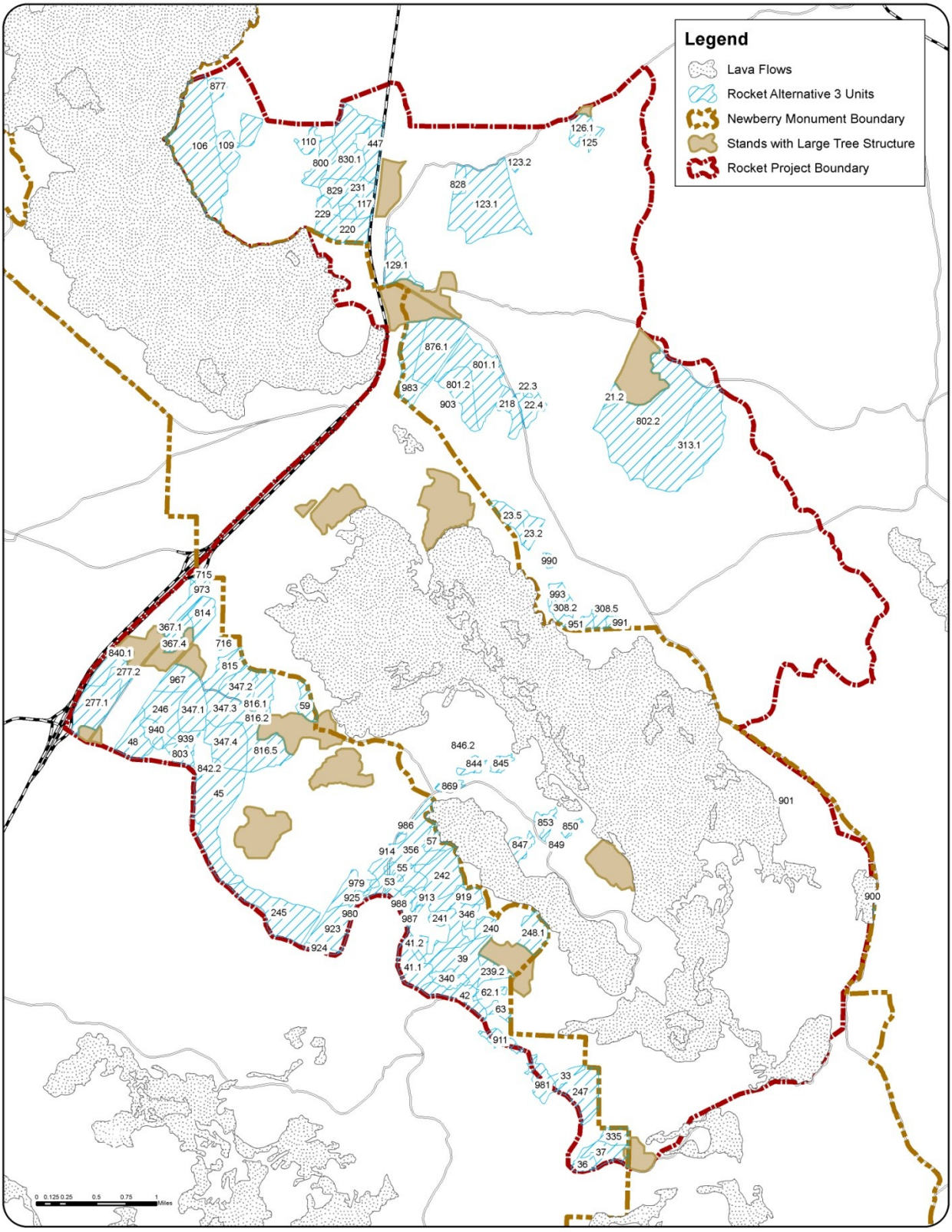


Figure 63: Under Alternative 3, no commercial harvest units overlap stands where large trees are common.

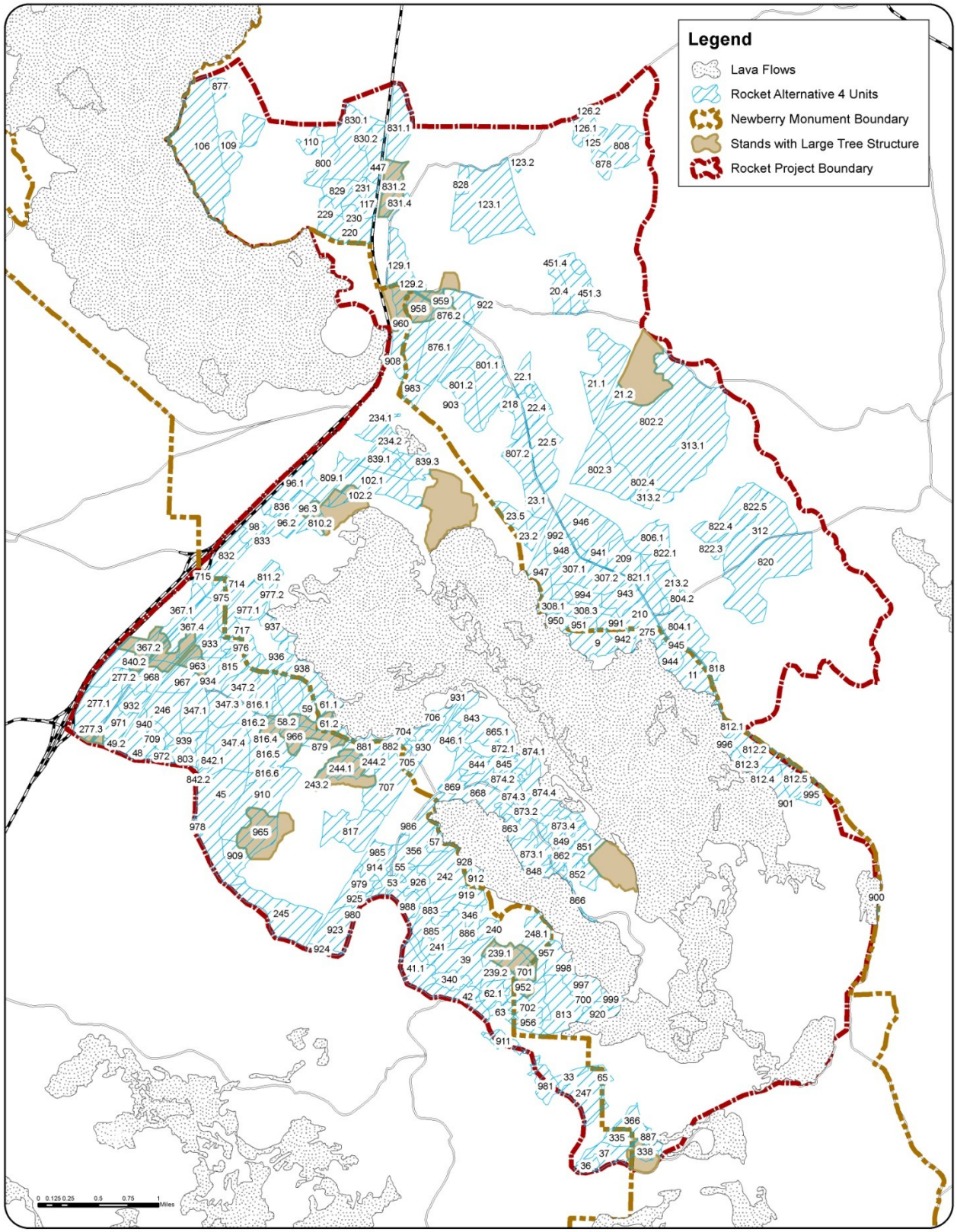


Figure 64: Alternative 4 commercial harvest units overlapping stands where large trees are common.

Appendix C – Soils Estimated Detrimental Conditions by Unit and Alternative

Table 184: Soils with Soil Condition Class 2 or 3 (subsoiling units if mechanical treatment)

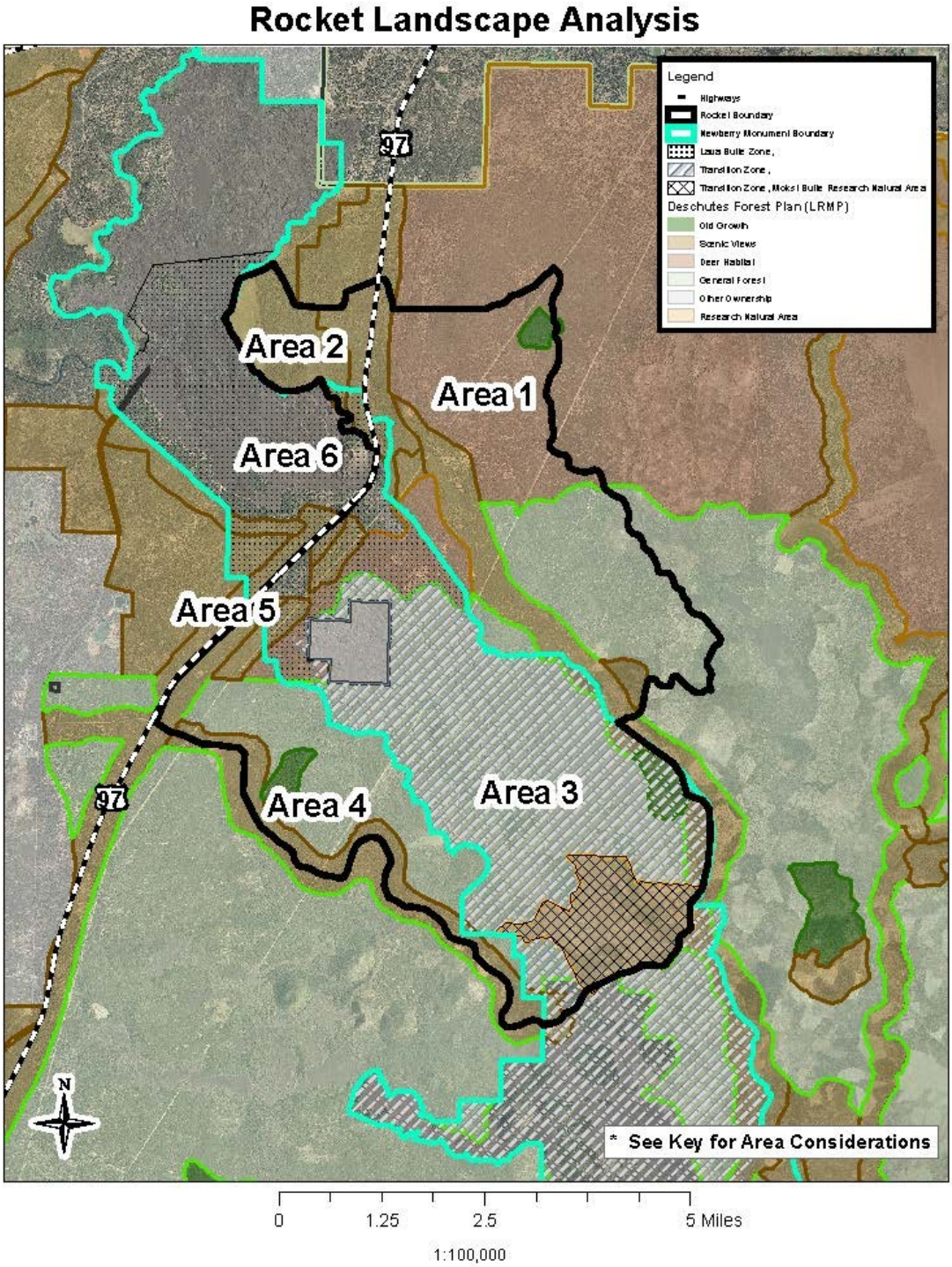
Unit Number	Acres	Soil Condition Class	Alt. 2	Alt. 3	Alt. 4
20.1	85.99	15-20	Yes	No	Yes
20.3	11.77	10-15	Yes	No	No
20.4	33.71	15-20	Yes	No	Yes
21.1	91.22	10-15	Yes	No	Yes
21.2	11.70	15-20	Yes	Yes	Yes
22.1	22.16	10-15	Yes	No	Yes
22.4	28.58	10-15	Yes	Yes	Yes
22.5	71.49	15-20	Yes	No	Yes
22.6	39.80	15-20	Yes	No	No
23.1	32.18	15-20	Yes	No	Yes
23.3	3.67	10-15	Yes	No	No
23.4	10.23	15-20	Yes	No	No
39	65.26	>20	Yes	Yes	Yes
41.1	45.60	>20	Yes	Yes	Yes
41.2	9.22	15-20	Yes	Yes	Yes
42	37.72	10-15	Yes	Yes	Yes
45	145.04	15-20	Yes	Yes	Yes
48	42.69	>20	Yes	Yes	Yes
55	5.90	10-15	Yes	Yes	Yes
57	16.91	15-20	Yes	Yes	Yes
58.1	35.04	>20	No	Yes	Yes
58.2	7.038	>20	No	Yes	Yes
106	216.45	>20	Yes	Yes	Yes
109	55.06	>20	No	Yes	Yes
110	15.63	>20	No	Yes	Yes
123.1	180.96	10-15	Yes	Yes	Yes
123.3	215	>20	Yes	No	Yes
125	8.29	15-20	Yes	Yes	Yes
126.2	4.19	10-15	Yes	No	Yes
218	29.90	15-20	No	Yes	Yes
220	44.86	15-20	Yes	Yes	Yes
239.1	39.23	10-15	Yes	No	Yes
239.2	23.58	10-15	Yes	Yes	Yes
240	14.72	10-15	Yes	Yes	Yes
241	49.62	10-15	Yes	Yes	Yes
242	67.79	10-15	Yes	Yes	Yes
244.1	40.43	10-15	Yes	No	Yes

Unit Number	Acres	Soil Condition Class	Alt. 2	Alt. 3	Alt. 4
244.2	22.28	10-15	Yes	No	Yes
245	98.67	15-20	Yes	Yes	Yes
247	61.60	10-15	Yes	Yes	Yes
248.1	36.95	>20	Yes	Yes	Yes
248.2	6.278	10-15	Yes	No	Yes
325.1	61.37	15-20	Yes	No	Yes
325.2	4.88	>20	Yes	No	Yes
340	22.10	10-15	Yes	Yes	Yes
346	20.98	15-20	Yes	Yes	Yes
347.1	51.07	15-20	Yes	Yes	Yes
347.3	53.43	15-20	Yes	Yes	Yes
347.4	71.84	15-20	Yes	Yes	Yes
356	70.60	15-20	Yes	Yes	Yes
367.1	28.05	10-15	Yes	Yes	Yes
447	36.65	10-15	Yes	Yes	Yes
451.1	98.05	10-15	Yes	No	Yes
703	12.14	10-15	No	No	Yes
709	6.55	>20	No	Yes	Yes
802.2	284.61	10-15	Yes	Yes	Yes
803	19.70	15-20	Yes	Yes	Yes
804.1	61.74	15-20	Yes	No	Yes
807.1	45.71	15-20	Yes	No	No
807.2	43.52	15-20	Yes	No	Yes
810.3	7.71	10-15	Yes	No	Yes
812.1	10.52	15-20	Yes	No	Yes
812.3	20.33	10-15	Yes	No	Yes
813	71.01	15-20	Yes	No	Yes
816.2	5.398	10-15	Yes	Yes	Yes
816.3	3.16	15-20	Yes	Yes	Yes
818	15.58	15-20	Yes	No	Yes
823.1	81.25	10-15	Yes	No	No
823.2	43.93	>20	Yes	No	No
828	14.20	10-15	Yes	Yes	Yes
830.1	95.60	10-15	Yes	Yes	Yes
830.2	8.70	>20	Yes	Yes	Yes
831.1	57.36	>20	Yes	Yes	Yes
839.4	11.62	10-15	No	Yes	Yes
840.2	10.65	10-15	Yes	Yes	Yes
842.1	12.74	15-20	Yes	No	Yes
843	15.17	15-20	Yes	No	Yes
844	12.63	10-15	Yes	Yes	Yes

Unit Number	Acres	Soil Condition Class	Alt. 2	Alt. 3	Alt. 4
845	10.88	15-20	Yes	Yes	Yes
846.2	2.85	10-15	Yes	Yes	Yes
847	19.66	10-15	Yes	Yes	Yes
848	12.05	10-15	Yes	No	Yes
849	4.37	15-20	Yes	Yes	Yes
854	31.06	15-20	Yes	Yes	Yes
855	50.86	15-20	Yes	Yes	Yes
856.2	19.79	10-15	Yes	No	Yes
856.3	11.06	10-15	Yes	Yes	Yes
857	20.62	10-15	Yes	Yes	Yes
859.1	8.45	10-15	Yes	No	Yes
859.2	3.34	15-20	Yes	No	Yes
860.1	20.33	10-15	Yes	No	Yes
861	2.81	10-15	Yes	No	Yes
863	6.42	10-15	Yes	No	Yes
865.1	49.32	15-20	Yes	No	Yes
865.2	16.68	10-15	Yes	Yes	Yes
866	5.61	15-20	Yes	Yes	Yes
868	52.95	10-15	Yes	No	Yes
870	27.00	10-15	Yes	No	Yes
872.1	27.12	15-20	Yes	Yes	Yes
872.2	24.09	15-20	Yes	Yes	Yes
873.4	16.09	15-20	Yes	Yes	Yes
874.1	15.07	10-15	Yes	No	Yes
874.2	18.63	10-15	Yes	No	Yes
874.3	18.86	10-15	Yes	No	Yes
874.4	30.43	10-15	Yes	No	Yes
875	62.81	10-15	Yes	No	No
876.1	89.41	10-15	Yes	Yes	Yes
880	6.34	10-15	No	No	Yes
881	17.61	15-20	No	No	Yes
883	1.77	10-15	No	No	Yes
885	40.20	15-20	No	No	Yes
886	5.64	15-20	No	No	Yes
900	3.68	10-15	Yes	Yes	Yes
906	75.16	10-15	No	Yes	Yes
909	26.16	15-20	No	No	Yes
910	103.59	15-20	No	No	Yes
912	10.62	10-15	No	No	Yes
914	27.48	10-15	No	Yes	Yes
915	1.68	10-15	No	Yes	Yes

Unit Number	Acres	Soil Condition Class	Alt. 2	Alt. 3	Alt. 4
916	0.91	15-20	No	Yes	Yes
917	2.32	15-20	No	Yes	Yes
919	33.53	>20	No	Yes	Yes
920	19.27	10-15	No	No	Yes
921	74.59	10-15	No	Yes	Yes
923	55.14	15-20	No	Yes	Yes
926	22.08	15-20	No	Yes	Yes
928	7.17	10-15	No	No	Yes
939	17.47	10-15	No	Yes	Yes
942	18.30	15-20	No	Yes	Yes
950	9.72	>20	No	Yes	Yes
951	20.43	>20	No	Yes	Yes
952	13.33	10-15	No	No	Yes
953	7.97	10-15	No	No	Yes
959	19.57	10-15	No	Yes	Yes
966	44.77	>20	No	No	Yes
969	11.11	10-15	No	No	Yes
977.2	2.44	15-20	No	No	Yes
980	3.02	15-20	No	Yes	Yes
981	31.6	10-15	No	Yes	Yes
982	24.6	10-15	No	Yes	Yes
987	5.38	10-15	No	Yes	Yes
991	7.77	>20	No	Yes	Yes
997	35.79	10-15	No	No	Yes
998	33.92	10-15	No	No	Yes
999	11.21	10-15	No	No	Yes

Appendix D – Landscape Analysis



See table on following page for list of considerations associated with each area.

Landscape Consideration	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
Deschutes NF LRMP Management Allocation(s)	General Forest, Deer Winter Range, OGMA, Scenic views	Scenic views, 1.5 miles outside of the wildland urban interface	NNVM, Research Natural Areas, other ownership	General Forest, Deer Winter Range, OGMA, Scenic viewshed	Scenic views, NNVM,	NNVM
Existing LRMP Amendments	East-Side Screens	East-Side Screens	NNVM	East-Side Screens	ODOT, NNVM, East-side screens	NNVM
Newberry Nat. Volcanic Mon. (NNVM) Allocation	Adjacent to Transition and Lava Butte zones	Adjacent to Lava Butte zone	Transition Zone	Adjacent to Transition and Lava Butte zones	Adjacent to Transition and Lava Butte zones	Lava Butte zone
Other Important Designations and Agency Coordination	East-West Deschutes Co. Community Wildfire Protection Plan	Greater Bend Community Wildfire Protection Plan	East-West Deschutes Co. Community Wildfire Protection Plan	East-West Deschutes Co. Community Wildfire Protection Plan	East-West Deschutes Co. Community Wildfire Protection Plan	East-West Deschutes Co. Community Wildfire Protection Plan
Current Forest Condition	Extensive past management, mostly mid-aged black-bark ponderosa pine, also some LP and mixed conifer, thinned and dense stands, some older forest structure	Extensive past management, mosaic of variable-age ponderosa pine plantations, thinned and dense stands, some older forest structure	Most of area is lava flow. Minimal mgt. since NNVM Plan, variable-aged ponderosa pine plantations, LP pockets, and mixed conifer, thinned and dense stands, some older forest structure, and some un-managed stands on buttes	Extensive past mgt., mostly young and mid-aged black-bark ponderosa pine, mixed pine transition, mixed conifer, thinned and dense stands, single and multi-storied structure and some old growth	Extensively modified highway corridor, dominantly mid-aged black-bark ponderosa pine, mostly, thinned with leave patches, some older forest structure	Extensive past management, dominantly mid-aged black-bark ponderosa pine, mostly thinned with leave patches, some older forest structure
Infrastructure Values	FR 9710 ingress/egress, natural gas and powerline utility corridors	Railroad ROW	Powerline utility corridor	FR 9720 ingress/egress, natural gas and powerline utility corridors, Lava Cast Forest access	Hwy 97, Lava Lands visitor center, Lava River Cave	FR 9702 ingress/egress, Lava Lands and Benham Falls access
Wildlife Values	Deer migration corridors, deer thermal cover connectivity,		Kipukas	Deer migration corridors, goshawks	Hwy 97 wildlife underpass, wildlife fencing, important deer migration	Deer migration corridor, important east-west link, bat hibernaculum

Landscape Consideration	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
	goshawks				connectivity	
Geologic/Landforms	Klawhop Butte, Lava Butte ash over Mazama ash	Green Mountain	Northwest rift zone, large lava flow with Kipukas, Mokst and Ikt Bu., other un-named buttes	Big lava flow peninsula	Hwy 97, Lava Butte lava flow	Lava Butte, Lava River Cave, spatter cones, large lava flow, several other caves
Recreation	User-created motorcycle trails	User-created motorcycle and Mtn. bike trails		Lava Cast Forest Access, user-created motorcycle trails	Lava Lands, Lava River Cave, user-created motorcycle trails	Lava Lands, Lava River Cave, Benham Falls access
Scenic	Hwy 97 scenic views, FR 9710 Scenic viewshed, visible from Lava Butte	Visible from Cascade Lakes Scenic Byway and Lava Butte	Scenic viewshed from Lava Butte, Mokst Butte	Visible from Cascade Lakes Scenic Byway and Lava Butte, FR 9720 viewshed	Hwy 97 scenic views, visible from Cascade Lakes Scenic Byway and Lava Butte	Hwy 97 scenic views, visible from Cascade Lakes Scenic Byway, Lava Butte L.O., Lava Lands visitor center
Hydrologic	No water,	No water	No water	No water	No water	No water
Other	Adjacent to 18 fire of 2003, Utility corridor weeds, abundant heritage resources	Garbage dumping, abundant heritage resources	State land in-holding	Several ongoing research studies	Utility corridor weeds, abundant heritage resources	Abundant heritage resources, outside of Rocket project area boundary

Appendix E – Fire Regime and Condition Class Descriptions

Fire Regime Description

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; mesic sagebrush communities with typical return intervals 25-35 years and occasionally up to 50 years and mountain shrub communities (bitterbrush, snowberry, ninebark, ceanothus, Oregon chaparral; etc.), with typical return intervals of 10-25 years. Fire severity is generally high to moderate. Grasslands and mountain shrub communities are not completely killed, but usually only top-killed and re-sprout.

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. Sites tend to be very cold, very hot, very wet, very dry or some combination of these conditions.

Condition Class Properties

Condition Class	Attributes	Example Management Options
Condition Class 1	▪ Fire regimes are within or near an historical range. ▪ The risk of losing key ecosystem components is low. ▪ Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. ▪ Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	▪ Fire regimes have been moderately altered from their historical range. ▪ The risk of losing key ecosystem components has increased to moderate. ▪ Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been moderately altered from their historical ranges.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	▪ Fire regimes have been significantly altered from their historical range. ▪ The risk of losing key ecosystem components is high. ▪ Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been significantly altered from their historical ranges.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

Appendix F – Consideration of Comments Submitted during the 30-day Public Comment Period

Consideration of Public Comment

During the public comment period (October 23, 2013 – November 22, 2013), 16 responses were received from individuals, agencies or organizations listed in the table below. Full text of the comment letters are on file at the Bend/Ft. Rock Ranger District.

Individuals, agencies, and organizations that submitted comments during the 30-day comment period:

Gail Carbiener	Nick Cady, Cascadia Wildlands
Jim Anderson	Doug Heiken, Oregon Wild
Loren Irving	George Wuerthner, Alliance for the Wild Rockies
Russ Mitchell	Irene K. Jerome, American Forest Resource Council
Stu Garrett	Meriel Darzen, Oregon Chapter Sierra Club
Dick Artley	Karen Coulter, Blue Mountains Biodiversity Project
Maya Jarrad	Stephanie O'Brien, Burns Paiute Tribe
Ella Deck	Chuck Burley, Interfor

All comments have been considered during the decision-making process for the Rocket Vegetation Management Project. Although not a requirement for environmental assessments, the responses provided here are intended to briefly discuss all major points of view and to document if comments resulted in any changes to the environmental assessment. Similar comments are grouped together by topic or resource. Statements may have been summarized or paraphrased to reduce paperwork.

Treatment: Forest Openings / Deer Cover

Comment: *Early travelers (Fremont, others) note only large, regularly spaced trees. They were not reporting large clearings. Early settlers also comment on the regular structure of the forest. Early photos show no evidence of openings as large as being proposed (up to 15 acres). Most openings were probably as small as one acre or less, which represented the loss of one or a few trees. The proposed openings should be reduced in size (0.5 to 1.5 acres) and number within the NNVM in the current Rocket proposal. It would be appropriate to have different sized openings in the areas considered General Forest. (S. Garrett)*

Comment: *There's already plenty of openings and 4-12 acres is larger than natural openings would usually be. (K. Coulter)*

Comment: *Sierra Club does not support openings this large. A 12-acre spatial opening is a glorified clearcut. We would be supportive of openings up to but not exceeding 5 acres. (M. Darzen)*

Consideration: Two types of openings are proposed in this project, those for initiating deer cover and those for addressing sites heavily-infected with mistletoe. The largest of these (12 acres) is a mistletoe treatment within General Forest (see Figures 6 and 8 for location). The number of openings proposed varies by alternative (EA p. 106). The size of openings also varies by alternative, with Alternatives 3 and 4 each including one opening of 12 acres.

The Rocket EA provides a brief review of the best available science concerning opening size and distribution in historic ponderosa pine forests (EA p. 107), including studies on the historic patch size. In sum, it is difficult to determine appropriate patch size reference conditions for openings created by disturbance events in historic ponderosa pine forests. Also, the Rocket EA has been updated to include information from the NNVM Management Plan describing conditions found in historic, fire-based ponderosa pine old growth. Conditions can include small gaps from 0.5 to several acres in size, and gaps or openings may also be occupied by smaller-sized trees.

The Rocket EA cumulative effects analysis for openings has also been updated, documenting that less than one percent of the HRV analysis area is currently in openings and this would not change with the additional openings proposed with the Rocket and West Bend projects (EA pp. 108-109).

Comment: *Both Alternative 2 and 3 still include these prescriptions for deer cover. In our scoping comments, we criticized these prescriptions because we felt any thinning down to 40 square feet basal area would provide these wildlife values. Cascadia can support such prescriptions that would result in some gap creation, if the Forest Service would attempt to work these gaps into existing gaps that would be created or currently exist. Also, Cascadia would really like to see these gaps being part of more built-in diversity into the logging prescriptions. (N. Cady)*

Consideration: In response to comments received during scoping, the one opening proposed with Alternative 2 (the Proposed Action) within NNVM was not included in Alternative 3. Also in response to comments received during scoping, two additional openings were proposed within General Forest with Alternative 3, meeting dual objectives of initiating development of deer foraging and hiding cover and reducing dwarf mistletoe infection. As a result, Alternative 3 proposes to create one additional opening compared to Alternative 2 (EA, p. 106).

With the proposed thinning treatments in ponderosa pine, including the 40 sq. foot basal area thinning treatment, removal of ponderosa pine with heavy dwarf mistletoe infection will influence where gaps are created or existing gaps are enlarged. Landings created to facilitate harvest operations would also function as gaps. Additional gaps could be created during underburning. Gaps created during thinning and burning, however, would not provide the same kind of cover development as would be provided with proposed group openings due to less than optimal location of gaps, the unpredictable nature of gaps being regenerated with ponderosa pine, and competitive effects of residual overstory ponderosa pine. Where openings are created and replanted with ponderosa pine seedlings, the regeneration would provide quality foraging habitat in the short-term and quality hiding cover and eventually thermal cover over the long term.

Comment: *It's Orwellian and ridiculous to imply that logging increases deer hiding cover or somehow helps deer when the EA admits that the project area already has sufficient hiding cover available as recommended. (K. Coulter)*

Comment: *We question the purpose and need of the Forest Service arranging the hiding cover and forage areas by logging while reducing or preventing natural disturbances that would otherwise naturally "arrange" hiding cover and forage. (K. Coulter)*

Comment: *You're already creating plenty of openings with other planned logging (fir, mistletoe, etc). (K. Coulter)*

Comment: *Let insects and fire create openings naturally. This is over-manipulation of the ecosystem. (K. Coulter)*

Comment: *Deer need more cover, not more openings in this area. We oppose planting of trees at the expense of natural regeneration disturbances. (K. Coulter)*

Comment: *Within openings created for big game, we urge the FS to focus on areas with mostly small trees, retain significant structure of live and dead trees (not mini-clearcuts), avoid or minimize replanting. (D. Heiken)*

Comment: *I would like ask you to drop The Rocket Timber sale, or to select a modified version of alternative 3 [not creating mini-clearcuts "for deer cover"]. (E. Deck)*

Comment: *In the big game land allocations, the FS should leave adequate untreated areas to achieve "optimal" cover values. The untreated areas should be well-distributed, with special attention to migration corridors and safe crossing of Hwy 97. (D. Heiken)*

Consideration: One purpose of the project is to improve the arrangement of forage, cover, and thermal habitat. The distribution of cover is important for deer movement, particularly in proximity to Highway 97 and the wildlife undercrossings. Standard and Guideline M7-3 pertains to deer habitat and states "Generally, programmed timber harvest is appropriate when required to regenerate new cover stands, maintain tree vigor for resistance to stand-threatening insect damage, or encourage desirable forage in deficient areas." Standard M-37 of the NNVM Plan states "In migration corridors, design vegetation management to provide for viable migration corridors over time. "In areas undertaken to reestablish historic fire-based ponderosa pine old growth may not be feasible to maintain entire corridor. In these areas, provide for pockets of higher-density tree clumps."

Hiding cover is limited in the western portion of the project area in deer winter range, particularly in and near the north/south connectivity corridor that leads between the southern and northern Highway 97 undercrossings. Openings were designed to initiate development of hiding cover patches and eventually thermal cover that will facilitate movement between these undercrossings and in the deer winter range habitat in the northeastern portion of the project area (EA p. 218).

The development of hiding and thermal cover by creating openings has been supported by the Oregon Department of Fish and Wildlife, who commented during scoping they would encourage additional openings be created across the project area to meet the historic range of approximately 25% of the dry ponderosa pine plant association group occurring in an early seral condition on the Deschutes NF (based on a 2007 assessment done by The Nature Conservancy and Fire Learning Network).

Planting of trees will assure a sufficient number of trees become established. Experience with openings in the Rocket area shows there is not reasonable assurance that natural regeneration would adequately restock an opening within five years (EA p. 106).

Leave areas and wildlife corridors are incorporated into the design of the alternatives. At a project scale, this is illustrated with maps of density classes, displayed in EA Figures 30 through 33. At a finer scale, spatial diversity is not estimated well, but can be observed in a recent thinning within the Rocket area (EA Figure 26, p. 96).

A large component of the strategy to improve conditions for mule deer is reducing open road density. Both the LRMP and the NNVM Plan encourage a reduction in open road density to reduce disturbance to deer. All action alternatives of the Rocket project would close 38 miles of road and decommission 5.4 miles of road (EA pp. 30, 34). In addition, user-created motorized trails will be obliterated and restored to benefit habitat security and further reduce disturbance.

Comment: *We are opposed to girdling pine > 21" dbh with mistletoe. (K. Coulter)*

Comment: *We are opposed to gopher control through indiscriminate poison baiting. (K. Coulter)*

Consideration: Where ponderosa pine seedlings are planted within openings, measures such as mistletoe control and gopher control are used to assure adequate restocking with the intent of accelerating development of hiding cover (EA p. 33). Seedlings would also be protected with plastic tubing.

Comment: *The Deschutes National Forest really needs to do a fine-scale analysis that documents where deer and elk habitat is and where summer and "winter" recreation use is occurring in determining basal area limits. Recent developments in the area of the Rocket Project have not been analyzed, nor has the Forest Service made educated estimates on winter use by the public.*

a. No hard data is presented on the utilization of the two Highway 97 undercrossings by elk or deer.

b. New planting of trees near the south undercrossing would indicate that there is not enough cover for the animals on the previously thinned west side. Sections 277, 840, 152, 367, and 814 should be thinned to not less than 120 Basal Area.

c. New Forest Service Road 9703 will encourage the public to ski and hike in the winter, no estimates of use is presented and how that will affect deer and elk.

d. The Lava Lands Visitor Center parking lot is to remain open all year. This will create 100% new public use in this area for skiing and hiking during the winter. The Sunriver to Lava Lands paved path will encourage winter use. The Forest Service has not determined what affect this will have on habitat or deer and elk migration and winter areas. (G. Carbiener)

Consideration: As discussed previously, recent developments such as the widening of Highway 97 and installation of fences along the highway were considered during project development. Data on the use of the area by deer is collected by the Oregon Department of Fish and Wildlife. Monitoring of the undercrossings indicates that both crossing structures are seeing steady use by mule deer.

During planning for the Rocket project, project-scale information was gathered to determine where thermal cover and hiding cover habitat currently exists. This information was used in project design in order to address the LRMP management goals to "provide optimum habitat conditions on deer winter and transition ranges" and NNVM direction to maintain migration routes for deer and provide some high-quality winter forage, hiding cover, and thermal cover where feasible throughout the Lava Butte and Transition Zones.

Vegetation around the northern and southern undercrossing as well as the northern and southern jump-off areas will not be treated under any alternative.

The analysis in the EA for the Sunriver to Lava Lands Visitor's Center concluded that the proposed paved trail project would impact a small amount of suitable elk and deer habitat (less than 1% at the watershed scale). Effects were anticipated to be primarily potential disturbance; road density reduction and signage were anticipated to partially mitigate this disturbance.

Comment: *In order to insure that large trees, nearly 21" dbh, are not cut within the five areas recommended to be clear cut, the Forest Service should clearly mark each area and indicate the boundary for the public to observe. I have no objection to the openings for the reasons stated in the EA. However, during the field trip to show members of the Central Oregon Intergovernmental Council and others, the clear cutting of all trees under 21" dbh included at least two trees that were 19" dbh. This makes no sense as one of the main objects is to restore the forest to historic old growth status. The five areas of clear cut should be located where smaller trees are present. (G. Carbiener)*

Consideration: Boundaries of all treatment areas would be clearly marked according to Forest Service protocols. Most units in the project area have been previously thinned and can be characterized as dense stands of ponderosa pine ranging in size from 5 to 21 inches dbh, mostly 70-90 years of age. The benefit of openings is not realized if too many overstory trees are retained or if gap size is too small because ponderosa pine seedling growth at the edges of gaps tends to be less successful due to lessened water and light availability and effectiveness of hiding cover patch. The focus of the specifically-referenced field trip discussion was the guidelines used to determine in the field whether or not trees are old (> 150 years of age) and therefore should be retained as part of a project-wide design feature. The trees viewed in the field were used to demonstrate how the guidelines would be applied in situation.

Treatment: Dwarf Mistletoe Control

Comment: *There are relatively small acreages with significant mistletoe present in the Newberry Monument within the Rocket Project. Mistletoe control is not needed in the Monument and goes against the Congressional direction to "allow natural ecological succession of vegetation to continue to the maximum extent practical" within the NNVM. Mistletoe has been shown to provide important ecosystem benefits for hiding cover, nesting areas, food production, and foraging areas for numerous rodents, birds, and other wildlife. In fact, it is considered a "keystone species" in some habitats. Although considered a threat to commercial logging, mistletoe can have a positive effect on biodiversity by providing non-commercial benefits for a broad range of animals.*[22] *Outside the NNVM and in General Forest mistletoe control activities should be done only where necessary and should be designed to have minimal impact on larger, fire-proof trees. (S. Garrett)*

Consideration: The EA (pp. 138-139) describes the role of dwarf mistletoe as a disturbance agent. Historically, ponderosa pine stands had a modest amount of mistletoe, but mistletoe severity was continuously reduced under the influence of fire (Hessburg et. al. 1994). Suppression of fires has contributed greatly to the increase in dwarf mistletoe levels. Mistletoe is present throughout the project area. Within the NNVM, and only under Alternative 4, a treatment that would reduce tree density by using level of mistletoe infection as a criterion for selecting trees to remove is proposed on 154 acres (called "sanitation harvest"). No openings are proposed within the NNVM for mistletoe control.

The NNVM Plan Standard M-12 recognizes that insects and disease play an important role in ecosystem function but that high levels of insect and disease activity or the location of such activity could preclude accomplishment of important goals of the Monument legislation. The objectives in the NNVM include creating conditions that will promote old growth ponderosa pine, allow the reintroduction of fire, and allow fire to play a key role in the future.

The three action alternatives provide a range of approaches to treating mistletoe in the NNVM, with none of the treatments (Table 45, EA p. 138) eliminating dwarf mistletoe (EA, p.140). Alternative 2 would thin 87 acres to an average basal area of 40 sq. feet. Alternative 3 would not thin, but would instead cut ladder fuels and underburn 117 acres of high dwarf mistletoe infection. Alternative 4 would treat the most acres of high dwarf mistletoe infection within the NNVM, treating 154 acres with a treatment focused on removing trees with moderate to heavy mistletoe infection (sanitation harvest). The discussion on pp. 140-141 describes that 40 BA thin best reduces the potential for lateral spread. Sanitation harvest, with its focus on removing the more heavily infected ponderosa pine less than 21 inches dbh, would create variability in tree spacing and thus variable potential for lateral spread of mistletoe by creating gaps, increasing size of existing gaps and by retaining individual or clumps of ponderosa pine with little or no dwarf mistletoe. The discussion also describes that the ladder fuels reduction/underburn treatment would have the least effect on dwarf mistletoe.

The Rocket EA has been updated to address consistency of the 40 BA thinning and the sanitation harvest, mechanical treatments that would reduce tree density and dwarf mistletoe infection levels, with direction from the NNVM Management Plan. Both treatments would protect existing large, old trees and would leave stands in a condition where it would be possible for stands to be maintained and perpetuated solely with prescribed fire. Both treatments would reduce but not eliminate trees infected with mistletoe, allowing mistletoe to continue to play a role in ecosystem function.

Comment*: Mistletoe is a native species that provides important wildlife benefits. Mistletoe is not removed though partial logging. Mistletoe will eventually be controlled via stand-replacing fire that kills hosts across large areas. We do not object to thinning young trees with mistletoe, but all large and old trees with mistletoe should be retained.*

[22] David M. Watson, "Mistletoe – A Keystone Resource in Forests and Woodlands Worldwide" Annual Review of Ecology and Systematics 32 (2001:219-249).

We urge the FS to reconsider two specific aspects of the proposed mistletoe treatments: First, the proposal to remove all heavily infected trees <21" dbh regardless of residual basal area. Since these trees have ecological value, both alive and dead, and since thinning within infected stands will improve the vigor and persistence of these benefits, we urge the FS to retain appropriate numbers of medium-sized trees even if they are infected.

Second, we urge the FS to reconsider the proposal to "Within openings, [and up to 40 feet beyond opening edge] mistletoe infected ponderosa pine ≥ 21" dbh would be made into snags by topping or girdling;" in order to prevent infection of the newly planted pine stands within openings. This problem can be partially avoided by not creating a new understory cohort that is so susceptible to infection. If the interest is in creating deer cover, the FS should recognize that deer cover can be provided over the long term by dense tree boles, while dense pine reprod provides only transient cover. OR, consider this: if the FS would allow the planted pine to get infected with mistletoe they will be stunted and provide deer cover longer. That way, we can retain the ecological benefits of both the large trees and the mistletoe with the longer lasting deer cover it provides. Removing large trees infected with mistletoe actually works against large tree habitat as well as the FS' stated interest in deer cover. This may run counter to traditional forestry, but it's ecologically appropriate. (D. Heiken)

Consideration: Effects of thinning on the presence of mistletoe infected trees within treatment units is described in the EA (p. 140-141). Thinning will not eliminate mistletoe from these areas, with all severity levels of mistletoe likely remaining. Within thinning units, all trees greater than or equal to 21 inches dbh would be retained, including heavily infected trees. Removal of all heavily infected trees less than 21 inches dbh could create or expand gaps in the forest, creating desired diversity. Dwarf mistletoe infected trees of all sizes and levels of mistletoe infection will remain throughout the project area.

The EA (p. 108) describes with the no action alternative (Alternative 1) shrubs could eventually provide deer hiding cover where natural disturbances create openings. Shrubs, however, would not achieve a height tall enough to provide deer thermal cover.

Within openings for deer habitat, the goal is to provide foraging habitat in the short term and the development of hiding (shrub) cover and eventually thermal cover over the long term.

***Comment**: In the discussion of Dwarf Mistletoe, I find that the referenced study material is old (1978, 1996, 1980) with Geils at 2002. Also the EA gives no hard data, estimated percentages or acres, of infection only states that stand density is high and favors spread of mistletoe. This analysis favors Alternative #3. Please explain how large ponderosa pine are made into snags. For trees over 21" dbh is this within the management guidelines? Is topping the procedure? (G. Carbiener)*

Consideration: The EA states that mistletoe is present throughout the project area with patches of infection varying in size and level of severity (EA p. 140). The qualitative analysis focuses on areas proposed for treatment known from field review to have relatively high levels of dwarf mistletoe infection. How treatments proposed in these areas affect resilience is measured by how many acres are treated by alternative to effectively reduce mistletoe infection and spread. Alternative 4 treats the most acres effectively (EA p. 141). Snag creation could be done by topping or girdling the tree (EA p. 33). Examples of these kinds of snags occur within the Oz project openings; some of which occur within Rocket and were visited on the collaborative field trip commenter attended.

Treatment: Prescribed Fire

***Comment:** Given the burning goals set forward in the Management Plan for the NNVM, the Deschutes National Forest is significantly behind the Congressional direction to re-introduce fire in the NNVM. Every opportunity should be taken to make this happen over large acreages. The Peninsula is an area where prescribed burns could be performed safely and the opportunity to introduce fire maximized. (S. Garrett)*

Consideration: The EA acknowledges the importance of working towards meeting the goals of the NNVM Plan's (EA p. 7). The NNVM Plan estimated an implementation schedule for different activities in the short (first decade) and long-term. The Record of Decision for the Plan acknowledges a conservative approach of 120 to 400 acres of ponderosa pine restoration activities in the first decade (1994 to 2004) but overall 3,700 acres of ponderosa pine restoration.

The Rocket project proposes to underburn between 799 acres (Alternative 3) and 2,090 acres (Alternative 4) within the NNVM. The "Peninsula" area will have some underburning associated with it under each alternative, with Alternative 3 having the fewest because it is limited to those acres that can be underburned without a mechanical tree treatment first. Under Alternatives 2 and 4 the vast majority of the Peninsula would be underburned (EA Figure 5, p. 23 and Figure 9, p. 30). The District's burn program includes burning other large areas on the District, such as the West Bend project area. Challenges associated with implementation schedule such as weather constraints and work capacity will mean that implementation of prescribed burning in the Rocket project could take several years to complete. The EA estimates that Alternative 2, with the most burning proposed, could take 6 to 9 years (EA p. 348).

***Comment**: The Newberry Monument Plan emphasizes prescribed fire as a tool for restoration. The FS should strive to accomplish as much restoration as possible with fire and non-commercial pre-treatment, especially within the monument. (D. Heiken)*

Consideration: The Forest identified stands within the Monument where the use of prescribed fire would be feasible without first conducting a commercial thinning. Alternative 3 calls for prescribed burning in these units and foregoing commercial size treatment followed by burning elsewhere in the Monument (EA pp. 15, 24-27). Under Alternative 3, 799 acres of prescribed fire would occur within the Monument, usually preceded by mowing or ladder fuel reduction (EA Table 27, p. 74). The trade-off is leaving a greater proportion of the NNVM acres at higher risk of loss to insects and disease, as well as introducing fire into a smaller proportion of the NNVM (EA Table 15, p. 50).

Treatment: Ponderosa Pine Restoration

***Comment:** I would like ask you to drop The Rocket Timber sale, or to select a modified version of alternative 3 [not converting mixed conifer stands through "ponderosa pine restoration" logging out of lodgepole pine and grand fir]. (E. Deck)*

***Comment:** We are opposed to the ponderosa pine restoration treatment. Lodgepole and grand fir are growing in these areas because they are moister areas. Ponderosa pine is still largely dominant in these areas. (K. Coulter)*

Consideration: Ponderosa pine restoration prescription is applied in all three action alternatives in varying amounts (see Table 14 of EA, p. 49). The areas proposed for this treatment were historically dominated by ponderosa pine, but fire exclusion has allowed lodgepole pine and true fir to grow in. The results would be similar to a variable density thin (40-80 sq. feet basal area), where lodgepole pine or fir would be retained if needed to keep stocking above minimum levels; and any species that is over 21" would be retained. This treatment will allow the reintroduction of fire into the stands, which would have historically kept the lodgepole pine and fir from growing in. The most fire resilient trees in these stands are ponderosa pine that because of the current high density are at risk of loss. Alternative 3 includes the least amount of this treatment type (144 acres) primarily due to dropping mechanical harvest in the NNVM.

Treatment: Aspen Restoration

***Comment:** The aspen groves should be preserved in all areas and fire introduced to promote their health. (S. Garrett)*

Consideration: Aspen is not common on the east side of the Bend/Ft. Rock Ranger District. Only two small patches of aspen have been located within the Rocket project area, together covering about 5 acres. These areas are incorporated into each action alternative for restoration (Figures 4, 6, and 8). The restoration will involve removing lodgepole pine and poor vigor ponderosa pine. The slash would be hand piled and burned or lopped and scattered (EA p. 34). The objective at this stage is to maintain the existing aspen trees so they continue to mature and to encourage more sprouting to occur. Because of the small number of aspen trees present and their small size and relative immaturity, introducing fire at this point could result in a high percentage of mortality and is therefore not included in the restoration treatment, but would be considered for future entries (EA p. 48).

Road and Trail Closures

Comment: *All non-essential, user-created roads and trails should be obliterated. Signage and enforcement are badly needed. The proposed closures should be considered a minimal amount and further closures instituted as projects and time allows. (S. Garrett)*

The Forest Service acknowledges that approximately 35 miles of user-created OHV trails exist within the project, much of it within the National Monument where they are not allowed. Rocket with thinning and underburning will create more open conditions which will lead to more illegal off-road activity. Closing access roads will discourage ORV users. (G. Carbiener)

Consideration: The interdisciplinary team reviewed the current road system in the project area. Changes that have occurred recently include widening of Highway 97 and associated road decommissioning and closures reflected in Figure 10, p. 31. The team reviewed the latest transportation analysis for the area and recommended closure of 38.6 miles and decommissioning of 5.4 miles of road, retaining roads that will likely be needed for implementation of this project. A District-wide minimum road system analysis will be undertaken in the near future which may show that more closures could be implemented.

Thinning and fuels reduction can have the unintended effect of making it easier for off-road vehicles to travel cross-country. This project is giving the Forest an opportunity to restore user-created trails which will help implementation of the Travel Management Rule. The Forest is also considering signing, especially at the Monument boundary to help the public know where off-road use is prohibited.

Comment: *The Deschutes National Forest really needs to analyze road closings. It is obvious that closed roads are continuing to be used, even metal gates remain open. The primary mitigating procedure to loss of deer and elk habitat has been to close or decommission forest roads. This was done with Highway 97 expansion, and the Sunriver to Lava Lands Visitor Center paved path. It is now proposed for the Rocket Project. No hard data exists to show if this is effective! No apparent effort has been made to keep road closed. What is the Rocket project going to do differently? The Rocket Project should be stopped until these facts can be determined. (G. Carbiener)*

Consideration: While no research data is available on previous road closings to determine road closing effectiveness on the Forest, literature indicates that open roads can cause deer and elk to exhibit higher stress levels and increase movement rates near open roads, thus expending energy reserves to avoid noise and human disturbance, particularly during winter (Wisdom et al. 2005; Johnson et al. 2005). The Oregon Department of Wildlife officials have expressed a desire to see more roads closed on the Forest. Closing roads will move the area towards Forest Plan standards and guides for open road density and will limit motor vehicle disturbance to deer and other wildlife. Road closure maintenance is included in the list of post-sale projects and could be implemented under stewardship contracting. Road closures, once implemented, will be reflected on the Motor Vehicle Use Maps (MVUMs) and will not be designated for motorized travel; therefore if use is occurring after closure, then it would be an illegal activity.

Newberry National Volcanic Monument

Comment: *The boundary of the NNVM should be prominently placed on all Forest maps that include portions of the Monument. Many USFS employees and the public don't realize when they are on the Monument and it is unrealistic to expect the public to respect conditions and allowed activities in the NNVM unless they realize where the boundaries are. (S. Garrett)*

Consideration: The boundary of the NNVM is displayed on the Motor Vehicle Use maps, the Deschutes National Forest Visitor maps and the Volcanic Vistas guide to NNVM. The Forest recognizes that prominent symbology of the NNVM boundary is a shortcoming in the 2013 edition of the Motor Vehicle Use map and is adequate in the latter two mentioned publications. Annual edits to the Motor Vehicle Use map will incorporate a more prominent boundary symbol.

Comment: *Which Forest Plan standards and guidelines apply in the Monument and which don't? (K. Coulter)*

Consideration: The NNVM Plan states on p. 18 that some existing Deschutes LRMP standards and guides will be used to manage the Monument. Those standards and guides are listed in the NNVM Plan on p. 77 without their full text. A copy of the Deschutes LRMP and NNVM Plan are available on the central Oregon Forest Service web site and copies have also been posted to the Rocket web page (http://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=38282).

Comment: *Within the NNVM it would be more prudent to aim for a Basal Area (BA) of 60 to 80 rather than the 40 being proposed. The lower basal areas don't provide a future cushion to mitigate for unforeseen occurrences like fires, wind, disease, et cetera if management doesn't go as desired and planned. USFS Old Growth definitions put forward BAs of over 110 for Old Growth ponderosa stands in our area. Thinning to a BA of 40 will also increase the amount of shrubs, saplings, etc, which were rare in the pre-contact forests and will require more future entries to control. (S. Garrett)*

Consideration: In response to scoping comments, Alternatives 3 and 4 propose within the NNVM, and elsewhere, to use a thinning treatment that would retain varying levels of basal area (EA, p. 90, Table 37). The highest basal area (60 to 80) would be retained where trees are greater than or equal to 16 inches dbh and the lowest basal area (40 to 60) where trees are less than 16 inches dbh (EA p. 32). The EA describes that the 40 BA thin would not leave much of a buffer for absorbing future mortality (p. 91) and that the mixed BA thinning treatment would leave a buffer, at least in the short term (p. 93).

The NNVM Management Plan (pp. 23-28) includes descriptions of ponderosa pine old growth, one for historic fire-based and one for ecological (fire-excluded). The plan states the descriptions are provided as a useful reference in considering management options and tools and what conditions to approximate. The plan explicitly states descriptions are not standards. In the describing the characteristics of ponderosa pine old growth, the management plan gives no basal area reference. The Plan does, however, reference the Region 6 – Interim Old Growth Definition for ponderosa pine (Hopkins et al 1992) and this definition includes basal area conditions characteristic of old growth ponderosa pine. According to the interim old growth definition, the typical range of basal areas is 43 to 96 square feet where site productivity is moderate to high and where dominant trees are greater than 21 inches dbh and at least 150 years in age. Basal areas of 110 sq. ft. and greater are described as the highest values associated with ponderosa pine old growth. The interim definition shows when dominant trees grow to more than 31 inches dbh and mature to an age of at least 200 years, there is a decrease in basal areas, with 26 to 37 sq. ft. the typical range and 40 plus sq. ft. the highest value.

The EA (p. 88, Table 35) illustrates that stands with tree densities as low as 13 to 14 trees per acre can attain basal areas typical of ponderosa pine old growth conditions (when dominant trees >21" dbh), reaching the lower end of the range (approximately 40 BA) when trees are 24 inches dbh and

approaching the upper end of the range (80 BA approaching 96 BA) when trees are 34 inches dbh. Based on size alone, however, when trees exceed 31 inches dbh the typical basal area range characteristic of old growth is lower (26 – 37 sq. ft.) than that when trees are greater than 21 inches. Table 35 (EA, p. 88) also illustrates stands can exceed this lower typical range with 7 trees per acre that are 32 inches dbh. The basal area associated with this condition (40 BA) would be at the low end of the range defining highest BA values (40 plus sq. ft.) characteristic of ponderosa pine old growth (when dominant trees >31" dbh).

The EA describes the range of residual trees per acre associated with three of the proposed thinning treatments (p. 92, Figure 24). With the 40 BA thinning treatment, residual tree density ranges from 17 to 40 trees per acre. The lowest tree density would generally left where larger trees are present, a condition not commonly found. Depending on future mortality, at the lowest tree density there could be potential for basal areas typical of old growth conditions to develop.

Comment: *Drop commercial mechanical thinning in the NNVM. (K. Coulter)*

Comment: *We urge the Forest Service to adopt Alternative 3 because we are concerned that logging within the monument boundaries is in violation of the NNVM plan. It appears that numerous areas to be logged are in violation of the Visual Quality Objectives in those areas which prioritize or provide only for ecological change. The logging also has the potential to affect goshawk habitat and nesting activity, and therefore surveys must be conducted (within any area to be logged with the NNVM, not just the two PFAs) to determine if goshawks are present and may be affected by the project, and manage these sites to promote successful production of young. (N. Cady)*

Consideration: Alternative 3 has no commercial thinning within the NNVM except for 5 acres of aspen restoration where conifers would be removed. The tradeoffs for foregoing density reduction in the NNVM are discussed in the EA pp. 84-141. Approximately 36% of the forested area of the NNVM within the Rocket project would be left in a density class above the upper management zone compared to 22% under Alternative 4.

Surveys for goshawks were conducted in 2012 and 2013 across the entire project area including the existing PFAs. No detections occurred in the PFAs in the project area. A goshawk was detected in 2012 in the eastern area of the project outside of the proposed treatment units. There are no proposed treatments in the 30-acre nest cores under any of the alternatives. The alternatives include monitoring to occur within the PFAs.

Comment*: With nearly half the Rocket project within the National Monument, a separate Environmental Assessment is warranted. The intent of the NNVM Management Plan was certainly not to be included with the general Forest in determining these activities. Deschutes NF continues to manage NNVM just like any other part of the Forest.*

EA page 105, paragraph Creation of openings within NNVM is an example of broad brush application of the Monument Management Plan to Rocket activities.

LZ-1 Maintain some migration routes for deer through this Zone. Provide for some high-quality winter forage, hiding cover, and thermal cover where feasible within the context of objectives to reintroduce fire and foster development and preservation of historic, fire-based ponderosa pine old growth. Within transition/winter range, maintain hiding and thermal cover on at least 30% of suitable range in the Zone. Provide for 900 acres of bitterbrush within transition/winter range, preferably located away from roads and facilities.

The EA on page 105 states: Within the NNVM Lava Butte Zone, opening will provide some hiding cover within a landscape in which fire will be reintroduced and the development of historic, fire-based ponderosa pine old growth will be fostered.

The two are similar but certainly the NNVM description is more complete and should require additional analysis of the requirement. (G. Carbiener)

Consideration: A complete analysis of the size and number of openings for each alternative is provided on pp. 106-110 of the EA. The EA addresses the consistency of creating openings with the NNVM Plan (EA p. 109). A complete analysis for deer is provided on pp. 205-222. Consistency with the direction for deer in the LMRP and the NNVM plans is provided in the EA pp. 221.

The Lava Butte Zone is particularly important for deer movement because of its location along Highway 97. Since the Highway 97 widening and installation of undercrossings, there have been numerous road closures in this portion of the Monument. In addition to hiding cover and thermal cover arrangement, additional road closures under the Rocket project contribute to the overall strategy for improving habitat conditions for deer and maintaining viable migration corridors through the NNVM.

Comment: *It is important that the direction for the LRMP and NNVM plans be applied to the appropriate areas. This is an important point because not only are the goals and objectives of the two plans different, the standards and guidelines that dictate how to manage are also different.*

The EA says "The Forest Plan ...provides guidance and direction for management activities on all lands managed by the Deschutes National Forest" this is not correct. The Eastside Screens did not include the Monument Plan. Therefore to take the Eastside Screens and apply them to the Monument is counter to the Monument Plan. Indeed the Monument Plan states on p. 78 "Unless otherwise indicated in standards and guidelines direction for Management Zones, no other standard and guideline from the 1990 Forest Plan apply to Newberry National Volcanic Monument or the Newberry Special Management Area..." Clearly this would apply to the Eastside Screens. (C. Burley)

No doubt the agency would point out that the Monument Plan's purpose in part is to promote old growth ponderosa pine and that the Eastside Screens are designed to do that. Perhaps. But what is important is that the Monument Plan does not include the Eastside Screens. Thus applying diameter limits and LOS designations and its associated HRV analysis within the Monument would not be consistent with the Monument Plan.

Consideration: An overview of management direction is provided in the EA pp. 9-11. The quoted statement has been updated to clarify that LRMP direction does not apply within the Monument, except where noted within the Monument Plan.

Analysis of the HRV must be conducted on a landscape scale. The Screens direct that the watershed be characterized for patterns of stand structure by biophysical environment (EA p. 110-115). The analysis covers all allocations, including the forest within the Monument and only excludes non-National Forest System lands and non-forest such as lava flows (EA p. 11). The resulting information is useful for comparing the existing condition against conditions that may have occurred historically prior to extensive logging of the large trees and fire suppression. The HRV analysis shows that some structural stages are overrepresented on the landscape and some are underrepresented on the landscape relative to HRV. The amount of the 113,350- acre HRV analysis area that falls within the Monument is 25,660 acres (about 23% although not all of it is forested). This information has been added to the EA (EA p. 111).

Thinning objectives within the Monument can be met by thinning from below up to 21" dbh. Because large trees are not prevalent across the project area, including within the Monument, there is not a compelling need to thin in the larger size classes. Retention of larger trees in the Monument is supported by direction in the NNVM Plan.

It was useful to know where stands occur within the NNVM where large trees are common. However, the final EA points out that an amendment to the Eastside Screens in order to conduct timber harvest

within LOS stands in stages that are below HRV does not apply to thinning within the NNVM (EA p. 38).

Large Tree Structure

Comment: *If the goal is to maintain and enhance large tree structure, there should be no logging over 15" dbh due to the shortage of trees over this size. (K. Coulter)*

Comment: *It's contradictory to say the objective is to accelerate the development of larger trees and then log 15-21" dbh trees – the biggest trees in the stands. The lack of large trees is why a lower dbh limit for logging is appropriate – the largest trees are usually < 21" dbh in these stands. (K. Coulter)*

Consideration: The stands in the Rocket project area are generally 70 to 90 years old. These stands have regrown since being clearcut in the 1930s and 1940s. The trees are therefore generally below 21" dbh and larger trees are uncommon (where larger trees do occur, they are retained). Existing tree density makes these stands susceptible to mountain pine beetle and slows tree growth. The EA (p. 32) describes proposed thinning would be from below, with the smallest diameter trees in the stand and/or the shortest trees generally priority for removal, and when exceptions would occur. The EA also describes if thinning from the lower crown classes will not reduce stocking to desired levels, trees from the dominant and codominant crown classes will be removed to favor the best trees of those same crown classes. This could mean trees 15 to 20.9 inches dbh will be cut to favor retaining other, potentially better trees greater than or equal to 15 inches dbh.

By thinning from below (starting smallest diameter trees in the stand), increased growth, health, and vigor will help ensure an increase in resilience on 25% of the area under Alternative 2, 16% of the area under Alternative 3 and 33% of the area under Alternative 4. This will lead to development of large tree structure in the long term.

Late and Old Structure (LOS) and Old Growth

Comment: *page 10 of the EA states that the Eastside Screens forest plan amendment "was the result of a large-scale planning effort to determine the best approach for maintaining future options concerning wildlife habitat…"*

This is a patently false statement and the final EA needs to reflect the truth. The Screens were a politically expedient means to avoid a threatened lawsuit by the Natural Resources Defense Council. The only reason any NEPA was even prepared for the Screens was because the forest products industry sued the Forest Service for failure to do NEPA. When the EA came out and the 80% reduction in timber outputs became evident, the industry asked the court to order an EIS be prepared. But the agency argued that the Interior Columbia Basin Ecosystem Management Project (ICBEMP) would replace the 18-month interim Eastside Screen policy and the judge said to wait until ICBEMP was completed. Of course ICBEMP never resulted in a final decision so we are now stuck with the Screens until something else comes along. The point is that to suggest that the Eastside Screens were the result of an extensive and rigorous analysis is simply not true.

Page 31 of the EA provides activities common to all action alternatives. In the Commercial Harvest Operations paragraph, it says the harvesting of trees will be limited to those under 21" in diameter at breast height. Please clarify that this diameter limit comes from the Eastside Screens and thus is not applicable to the Monument. If you wish to employ this arbitrary standard to the Monument then you will need to provide some analysis and present alternatives to this standard.

Page 36 of the EA mentions an analysis with lidar data to identify stands that would qualify as Late and Old Structure (LOS) under the Eastside Screens. Given the sensitivity to how stands are designated LOS and the fact that much of the Rocket planning area is second growth forest, we are very interested in how this was done. The EA does not provide much detail on this analysis and how stands were classified LOS using lidar. In fact on page 86 the EA states "Structure classifications from this [lidar] data set, which describe five

diameter classes and two canopy cover classes, were used to compare how alternatives would move Rocket's associated watershed closer to HRV. These structure classifications differ in a number of ways from those described in the Eastside Screens, but both classification methods use the same definition for classifying conditions where 'large trees are common'."

To compound the uncertainty of how stands were designated LOS the EA on page 81 states that the Region 6 interim old growth definitions were employed for this purpose because the "large trees are common" definition of LOS is ambiguous.

This is the same issue the industry raised with the West Bend Project. It is no secret the industry does not like the screens. But given the fact the Eastside Screens are current direction we expect the agency to apply them properly and in accordance with the current direction including its definition of LOS. To employ other, non-applicable definitions is not consistent with the forest plan direction. If the Deschutes National Forest believes the Eastside Screens as written are not workable, we suggest that the Forest Plan be amended or revised to adopt an alternative to the Eastside Screens—and not on a project by project basis.

Consideration: The EA has been modified to quote the purpose of the Eastside Screens directly from that environmental assessment: "The primary purpose is to conserve those components of the landscape – old forest abundance, wildlife habitat in late and old structural stages – in relation to larger ecosystem management to protect habitat for certain species of wildlife and to promote the vigor and health of the forests (Revised Environmental Assessment for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, p. 5). Although intended to be interim direction, the Screens are still in effect for timber sale planning on the Deschutes National Forest east of the range of the spotted owl.

The Forest's assessment of structural stages as called for in the Interim Ecosystem Standard of the Eastside Screens was done correctly because it implements the direction to "identify stands where large trees are common." Neither the Screens nor the Rocket analysis attempt to define LOS (in the context of the HRV analysis) as anything other than stands "where large trees are common." (Decision Notice Regional Forester's Amendment #2, Appendix B pp. 3-4; Rocket EA p. 84). The EA describes (p. 119) how stands where large trees are common were identified using Lidar technology, with 13 large trees being the minimum to be considered common. This has been standard practice for HRV analysis across central Oregon Forests. The Rocket project will harvest within these LOS stands in order to reduce density and maintain and enhance large tree structure under all alternatives (see Table 11 in the EA).

Comment: *The purpose and need states that for some stands, the purpose is to hasten the development of LOS by reducing stand densities to LOS stocking levels. This makes no sense. (K. Coulter)*

Comment: *We are opposed to proposed logging in LOS stands below HRV. (K. Coulter)*

Consideration: Within those stands where large trees are "common" (more than 13 per acre) and thinning is proposed, it is because stand density is above the upper management zone (where density-related mortality could become serious (EA pp. 6, 86). This is displayed in Figure 30 (EA p. 100). The purpose and need states that the purpose would be to reduce stand densities to LOS stocking level (from reference conditions) now, and reintroducing fire to maintain those conditions over time. That was the intent of Alternative 2, with the lower basal area in Scenic Views and NNVM. The EA (pp. 85-86) explains how the reference conditions for ponderosa pine LOS were derived using both a historic reference (Munger 1917) and a retrospective study of current conditions (Youngblood 2004). Achieving or getting closer to historic stocking levels is important because in these stands large trees are at risk from fire or insects and disease, and future development of large trees is impeded. Thinning in Alternatives 3 and 4 would retain higher residual basal areas. Thinning will improve conditions for development and/or maintenance of large trees, thus retaining or enhancing existing LOS acreage in the long-term (EA pp. 37-38, 123-124, 131).

Rationale for Forest Plan Amendment #3, thinning in LOS stand below HRV, is discussed on pages 36-37 of the EA. While this amendment proposes timber harvest in LOS below HRV, there would be no net loss of LOS and closed canopy is generally thinned to become open canopy. The objective of treatments in LOS would be to improve conditions for the development and/or maintenance of large trees.

Comment: *Leave stands that have already been commercially thinned alone. They're already wide open, well-spaced, etc. Logging them again now would gut essential forest structure, setting them back from attaining LOS status, not maintaining or accelerating that trajectory and would remove needed mortality diversification (natural creation of snags and down logs). (K. Coulter)*

Comment: *There are plenty of proposed sale units for commercial logging that are already open to the extent that tree stocking levels are not high enough to need thinning at this time, yet are proposed for more logging. (K. Coulter)*

Consideration: Past thinning may have been either precommercial size small tree thinning or commercial thinning. Stands proposed for thinning that have been thinned previously have reached a density where they are above the upper management zone. Treatment alternatives were determined based on existing stand conditions rather than previous treatments. Pages 97-98 of the EA describe the existing conditions as being mostly densely forested (69 percent of the Rocket project area and 71 percent of the NNVM). Alternatives 2, 3, and 4 aim to reduce dense forest conditions by varying degrees (p. 98) and leave dense forest conditions in the following amounts respectively: 44%, 53%, and 36%. Alternative 1 does not thin within stands that have been previously thinned as the commenter recommends and leaves dense forest conditions on the majority of the landscape (EA p. 98).

Comment: *We support the prescription to retain all ponderosa pine with old tree characteristics but would warn that it is critical that the people marking the sales are knowledgeable, well-trained, and neutral so that the marking for retention of trees with old characteristics is done accurately. (M. Darzen).*

Comment: *Retain all old growth of all sizes and species. Retain all large pine trees, whether they are live or dead or infected with mistletoe. Retain all old trees, large or small, whether they are live or dead or infected with mistletoe. Use external characteristics to identify old trees, e.g. Van Pelt guidelines. Below, we explain how the Resource Protection Measures for small old trees in the EA could be improved. (D. Heiken)*

The Resource Protection Measures for small old trees in the EA could be improved. They say "Retain ponderosa pine trees less than 21" dbh with old tree characteristics (from Van Pelt 2008) except where they are either: 1) ladder fuels which pose a threat to larger diameter trees or 2) dwarf mistletoe infected and contribute to infection potential of desired understory trees." We think it should be explicitly stated that these exceptions should be used very rarely. First, old trees should not be viewed as ladder fuels but as valuable habitat. The EA says that ladder fuels are generally smaller than 4"-6" dbh. Trees 150 years old are very unlikely to be that small. These small old trees rarely have branches close to the ground.

It is not necessary to remove 100% of the ladder fuels. Clearing non-old-growth trees nearby should accomplish the fuel reduction purpose. Second, we disagree that mistletoe infection justifies removal of small old trees. Mistletoe is a native species that provides ecological benefits. Not something that needs to be removed. Partial treatments are not even very effective. The EA also says "Ponderosa pine old tree characteristics include all of the following: 1) orange bark with plates generally more than three times wider than the darker fissures that separate them, 2) rounded crown, and 3) below the main crown, few if any dead branches present and knots not noticeable." This should be clarified, so that the small old trees do not have to have ALL of these characteristics. The evaluation should be based on the preponderance of evidence.

Consideration: Trees of any species greater than or equal to 21 inches dbh will generally be retained regardless of dwarf mistletoe infection, with the exception being mistletoe-infected ponderosa pine trees growing within or adjacent to proposed openings. These would be converted to snags and not harvested. Old trees less than 21 inches dbh will also be retained, except where: 1) they could serve as a ladder fuel into the crown of a larger diameter tree, or 2) where they are dwarf mistletoe infected and serve as a

source of inoculum to nearby trees in a lower canopy level. This proposed treatment of small, old trees recognizes they may have a variety of values but also recognizes they may have lower potential than neighboring trees to develop into large, old trees. The exceptions allow for retaining trees with best potential to mature into large, old trees.

The resource protection measure addressing the identification of old trees less than 21 inches dbh uses characteristics described by Van Pelt. Rather than using the scoring system described by Van Pelt, the protection measure simplifies and expedites the identification of old trees by requiring all old tree characteristics scoring highest with the Van Pelt's rating system to be present. These are the characteristics described in the resource protection measure. Allowing one of the three old tree characteristics to be relaxed would increase the complexity of identifying small, old trees but could result in additional small trees being identified as old.

Van Pelt (2008) describes a rating system to determine the general age of ponderosa pine trees. This rating system consists of scoring the lower trunk bark condition (Score 0 – 5), the knot indicators on the main trunk below the crown (Score 0 – 3), and the crown form (Score 0 – 5). Using the Van Pelt rating system to determine the developmental stage of a given tree, a score is assigned for category and then scores are summed. For a tree to be considered old (defined by Van Pelt and greater than or equal to 250 years) its total score must be greater than 10. Using the Van Pelt rating system, a tree meeting all of the requirements described in the EA, would score as follows: (A) Orange bark plates generally more than three times wider than the darker fissures that separate them (Lower trunk condition), 5 points; (B) Below the main crown, few if any dead branches present and knots not noticeable (Knot indicators on main trunk below the crown), 3 points; and (C) Rounded crown (Crown form), 5 points. The total score (13) of the required conditions exceeds the minimum score needed (11) to meet Van Pelt's criteria for identifying and old tree.

A relaxing of one tree condition could still result in scoring a tree high enough (Total score of 11) to be considered "old" provided the other two conditions remain unchanged. Even though maximum plate width is well correlated with tree age, the lower trunk condition could be relaxed to allow trees with bark plate widths between 6 and 10 inches (Score 3), provided the current requirement for knot indicators (Score 3) and crown form (Score 5) remain the same. The knot indicator condition could be relaxed to allow trees with old knot/whorl indicators below the main crown but no dead branches (Score 1) provided the current requirements for lower trunk condition (Score 5) and crown form (Score 5) remain the same. The crown form condition could be relaxed to allow trees whose tops are usually pyramidal or rounded, sometimes pointed (Score 3), provided current requirements for lower trunk condition (Score 5) and knot indicators (Score 3) remain the same.

Comment: *EA page 125 makes a case for harvesting within LOS stage below HRV by saying the amendment is "minor" and will contribute to achieving long range goals. The recommended alternative #2 would 232 acres or 40% of the total 574 acres are thinned. This does not seem to be minor. Alternative #3 would have the least effect and is recommended. (G. Carbiener)*

Consideration: The amount of large tree structure on the landscape is limited. Figure 40 displays the successional stages within the HRV analysis area and Figure 41 displays the proportion of those stages compared to HRV. Ponderosa pine late open stage is far below HRV as a result of historic harvest practices removing all of the large trees when the area was in private timber company holdings. The three alternatives thin 32, 0, or 42 acres of the late open stage (30%, 0%, or 40%), so at best 40% of existing stands with large tree structure can be maintained or enhanced, which is consistent with Eastside Screens direction. On the landscape, the proportion of late open ponderosa pine structural stage would be unchanged (all late open structural stage would still be late open structural stage) and that stage would remain below HRV.

Thinning Rx / Stocking Level

Comment: *40 sq. feet of basal area is a virtual clearcut. 60 sq. feet of basal area is not a high enough canopy cover. (K. Coulter)*

Consideration: Table 35 (EA p. 88) presents the number of trees per acre that would be present at various levels of basal area. If trees were very large at a particular basal area, there would be very few of them present; however, if trees are smaller, the basal area is represented by more trees. Table 35 also presents the stocking levels in relation to minimum stocking, lower management zone, and upper management zone. Depending on the average DBH of the stand, thinning to lower basal areas, such as 40 or 60 BA, will put the resulting stands between minimum stocking and the LMZ or between the LMZ and the UMZ (found on page 87 of the EA). In a stand with lower average DBHs, thinning to lower a lower BA is appropriate to achieve desired SDIs for optimal tree growth, while still maintaining trees per acre and canopy cover greater than minimum stocking. Stand with larger trees would be thinned to higher Bas (60-80), in order to maintain the appropriate stocking level and remaining trees per acre.

Comment: *I would like to see the thinning to an average basal area of 40 square feet of basal area be added to Alternative 4 as it was designed in Alternative 2. Although thinning to this level may seem too aggressive to many it would provide numerous advantages including accelerating the trajectory toward large structure, minimizing the spread of dwarf mistletoe, and creating vertical diversity within the stands. (I. Jerome).*

Consideration: Alternatives 3 and 4 were developed to address the key issue that was raised with thinning to 40 BA (EA p. 15). The advantages stated by commenter are acknowledged in the EA. The mixed basal area thinning described for Alternative 3 and 4, would leave some areas at an average of 40 sq. feet, but there would be a higher average residual basal area where the stand could support it.

Comment: *We support variable retention thinning as proposed in Alt. 3. Cutting to 40 BA as a uniform prescription does not allow for the variability of diameter within stands because it will result in some stands with large diameter trees to be cut to very low number of tree per acre and it is likely that at least some of the trees removed will be large diameter. In other words, in a stand with many large diameter trees, a universal prescription of 40 BA will cause many large trees to be cut, even if that stand is supporting those large trees. Variable retention would allow for a stand with many larger trees to have a higher BA and thus save more of the larger trees. This is highly preferable in the Old Growth Management Areas, NNVM, and Scenic View areas, where there should be an emphasis on naturally evolved old-growth forest ecosystems and removal of larger trees just to achieve 40 BA will be contrary to these indications. (M. Darzen)*

Consideration: Thinning to a 40 BA would not necessarily result in a uniform spacing because it is considered an average across the stand, and the proposal to thin to 40 BA under Alternative 2 was intended to create stocking conditions that would take more time before stands need to be thinned again, and to provide an opportunity to maintain the lower density while residual trees grow larger with fire rather than additional thinning. Table 35 in the EA displays the average number of trees per acre that would occur with 40 sq. feet of basal area, which ranges widely depending on tree size. A stand with average tree size of 22" dbh would have 15 trees per acre at 40 sq. feet of basal area, which would be within reference conditions for old growth ponderosa pine.

Comment: *We are in favor of a range of basal areas for all commercially logged units with the LOW end at 60 or 80 and the resulting density being higher where the forest would naturally be denser – e.g. N/NE slopes, riparian areas, moist hollows, mixed conifer, etc. (K. Coulter)*

Consideration: The mixed basal area thinning proposed in Alternatives 3 and 4 provides the ability to account for naturally more dense areas. Additionally, thinning will avoid sensitive areas such as riparian, steep slopes, and cover patches.

Comment: *We oppose the stated exceptions to thinning from below. Removing larger trees is contrary to the purported purpose of the project of developing larger trees and LOS. Artificial "stocking" level goals should not be used to justify removal of dominant and co-dominant crown classes of trees. (K. Coulter)*

Consideration: Stocking level goals are based on the Stand Density Index concept described in the EA p. 86. The exceptions described for thinning from below would favor the more fire-resistant ponderosa pine over lodgepole pine or true fir, increasing resiliency.

Comment: *I am strongly opposed to making diameter limits a part of the thinning protocols. Shooting for a residual stand composed of predominantly larger trees is a worthy goal and can be achieved by thinning from below. Diameter limits will mean, though, that residual stands will have groups of trees growing too close to each other. The goal of a thinning, especially in young pine, should be good spacing among trees. Good spacing means every tree can practice photosynthesis with minimal competition from its neighboring trees. And that means improved growth for trees for decades in the future. And the twin results of good vigor and wider spacing among trees means resistance to attack by the mountain pine beetle. (R. Mitchell)*

Consideration: The Eastside Screens impose a diameter limit of 21" dbh. As a standard and guideline, the diameter limit can be amended if necessary for ecological purposes. The IDT expects thinning objectives to be met without thinning trees over 20.9" dbh, therefore an amendment to the standard and guideline has not been proposed.

Old Growth Management Areas (OGMAs)

Comment: *We encouraged you to remove these areas from the commercial thinning prescription because the Deschutes RMP dictates that the goal of these Old Growth Management Areas is "[t]o provide naturally evolved old growth forest ecosystems . . ." While we recognize that bark beetles do pose a risk to a small number of trees, bark beetles are naturally occurring and native to these forest stands, and their presence helps ensure that these stands are naturally evolved. The loss of trees to bark beetles helps creates snags that are vital to biological diversity and cavity nesting birds. Snags are a priority within these Old Growth Managements Areas.*

Additionally, the Deschutes LRMP generally forbids programmed harvest in this allocation unless necessary to perpetuate or enhance old growth characteristics. You state that the need for this intensive thinning is to reduce the risk of beetle attack. Until there is a recognizable risk of a beetle epidemic that has the potential to eliminate old growth characteristics from the area, beyond what naturally occurs in these stands, there is no need for thinning. Please adopt Alternative 3 which excludes these areas from commercial harvest. (N. Cady)

Comment: *We would support Alt. 3 but with some thinning in the OGMAs of trees up to but not exceeding 16 inches in diameter and no thinning of trees with old growth characteristics. For that type of treatment in the OGMAs we would support something like what is proposed in Alternative 4 (variable retention thinning in order to retain more larger diameter trees). The EA acknowledges that thinning in the OGMA could come at the expense of providing larger trees. Alternative 3 could be tweaked to include some variable retention thinning with a focus on small diameter trees to reduce stand density. (M. Darzen)*

Comment: *OGMAs need natural disturbances for snag and log creation. (K. Coulter)*

Consideration: Treatment within OGMAs was considered a key issue in the EA (EA p. 15). Alternative 2 proposes to thin only in the portions of the OGMAs that have been previously thinned (total of 55 acres) ; Alternative 3 includes no commercial harvest treatment in the OGMAs; and Alternative 4 thins additional acres that are overly dense (total 211 acres). The existing condition of the OGMAs is described in the EA p. 104 and the density classes displayed in Figure 34. The stands are

relatively young ponderosa pine, so there isn't a large number of snags, similar to the rest of the project area. Although Alternatives 1 and 3 would contribute towards meeting an OGMA objective of providing abundant standing and downed dead trees, Alternatives 2 and 4 would enhance old growth characteristics by increasing potential for live, large tree structure to develop in 20 to 40 years. Where large trees are present in the southern OGMA, thinning at the mixed BA under Alternative 4 would provide some buffer against bark beetle risk but would retain more of the existing larger diameter trees (EA p. 105).

Comment: *Why are more acres within the OGMAs proposed for logging in Alt. 4? OGMAs are supposed to be prioritized for wildlife habitat and not be scheduled for logging. UMZ is an artificial concept, not a natural imperative. (K. Coulter)*

Consideration: The UMZ is based on the stand density index concept, explained in the EA pp. 6, and 86-87. The four alternatives provide various ways to address the key issue of treatment within the OGMAs, Alternative 4 treats the most acres and thereby leaves the least amount of the OGMAs in dense forest conditions.

Thinning within OGMAs in Alternatives 2 and 4 would enhance or create old growth characteristics by increasing the potential for live, large tree structure to further develop (discussed further on page 105 of the EA). Thinning would also reduce beetle risk, serving to maintain or enhance old trees. This goal is consistence with management direction for OGMAs.

Comment: *Drop all logging in OGMAs. There's very little old and large structure left in the project area. We don't think these areas need logging or ponderosa pine conversion. (K. Coulter)*

Consideration: The OGMAs do not currently exhibit old growth characteristics, although a portion of the southern OGMA has some large tree structure as displayed in Figure 30, p. 100. The OGMAs are ponderosa pine stands, therefore, the existing density puts them at risk of bark beetles.

Wildlife: Caves and Bat Habitat

Comment: *I would like to see disturbance as little as possible because the Rocket sale impacts to sensitive bat species by removing large trees that could be used for roosting. (E. Deck)*

Consideration: Large trees are not to be removed in any Rocket alternative. Specific provisions are included in the action alternatives to protect bats and other cave resources (EA p. 46).

Comment: *Units in LOS must be dropped to protect sensitive and MIS bat roosting habitat. There is very limited tree roosting habitat in the project area. (K. Coulter)*

Consideration: Effects to bat species that may be using the project area are disclosed in the EA pp. 152-158. There would be no loss of LOS under any alternative, and large trees will not be removed. Thinning is expected to be beneficial to the Townsend's big-eared bat (EA p. 156), although there is potential for negative impacts from prescribed fire and temporary roads (EA pp. 156-157).

Comment: *There is a lack of baseline population data and known viability thresholds in the area for the Townsend's big-eared, pallid, and fringed myotis bat species. Concerned with cumulative effect from visitors to Lava River Cavg. (K. Coulter)*

Consideration: Analysis in the EA for the Townsend's big-eared bat is based on information in the 2012 Species Assessments. The pallid bat and fringed myotis were added to the Region 6 Sensitive Species list in December 2011. Forest data for bat species is predominantly from cave surveys that have

been occurring on the Forest in various caves since the 1980s. Species are normally identified as either Townsend's or non-Townsend's. Cumulative effects to bat species are discussed within the EA page 157-158.

Comment: *EA p. 149 indicates several reasons for concerns about the impacts to fringed myotis bats: removal of existing and future larger diameter trees that could provide roosts, modification of forest structure around roost trees, selective removal of dead and dying trees, and homogenization of the landscape at the scale of typical bat foraging areas. (K. Coulter)*

Consideration: Large diameter trees and snags will not be removed, and the activities proposed in the Rocket alternatives will not serve to homogenize the landscape due to the variety of treatments proposed with each alternative across the project area and project design (EA pages 20-46).

Comment: *We are opposed to the mini-clearcuts due to potential impacts to Townsend big-eared bats. (K. Coulter)*

Consideration: The EA describes potential impacts from created openings to how the areas would serve as foraging for Townsend's big-eared bats (EA p. 156). The openings would provide foraging in the short-term, but not for long. Other tree treatments are expected to be beneficial to the species because proposed treatments would provide diversity across the project area by opening up stands to provide for more shrub growth within the denser stands (for prey species) and providing for better maneuverability for the bats to forage. Tree growth would be accelerated towards LOS, thereby providing potential quality roosting habitat in the long-term.

Comment: *Based on reading the Rocket EA, it is not clear to us that the project would be consistent with standards for caves and bats in the Forest Plan.*

Bats need the prey species when they're not hibernating.

Re: cumulative effects, There is no quantifying analysis to show that this much habitat removal for bats would have only "minor" effects to bats. (K. Coulter)

Why wouldn't the Rocket project contribute to a negative change in viability for Townsend's big-eared bat?

There is no quantified analysis supporting the assumption that bat species presence would be maintained with any of the proposed alternatives.

These bat species are already sensitive listed and were chosen as a management indicator species in the case of Townsend's big-eared bat. The EA recognizes that few Townsend's big-eared bats are known to exist in the project area.

Consideration: Project standards and guides for caves are listed on page 149 of the EA. Each one describes what measures will be taken to meet the standard and guide.

Pages 155-157 of the EA discuss current foraging conditions and those that would be available while the bats are not hibernating. Potential numbers of acres of foraging habitat impacted is listed in the EA (p. 157). As stated on the same page, habitat acres and home range acres for each of these bat species is unknown within the watershed and across the Deschutes National Forest.

Any change in viability is based on impacts to caves (MIS Species Assessment 2012). Any potential impacts to caves would be mitigated through Resource Protection Measures (EA pp. 39-40 and 46).

Analysis for bat species occurs on pages 150-152 of the EA (including Table 51). Information on page 157 specifically discusses numbers of acres treated and acres not treated.

All three bat species discussed are Region 6 Sensitive species. The Townsend's big-eared bat is a management indicator species for our cave habitat. Lava River Cave is the only known cave within the project area with a population of hibernating Townsend's big-eared bats (EA page 153).

Comment: *I am aware that the proposed Rocket Sale impacts sensitive bat species by removing large trees that could be used for roosting. I am concerned that this sale will remove valuable habitat for these species in the area. Bats are an important predator of mosquitos, which will be increasingly important as the West Nile Virus proliferates to this region of the country in the coming years. (M. Jarrad)*

Consideration: Large trees (>21" dbh) will not be removed. See previous responses.

Comment: *EA page 150 states that to protect Lava River Cave and other caves found within the project area, trees would not be harvested with 150 to 200 feet. The NNVM Management Plan M-5 requires 200 feet.*

1. The EA recognizes that illegal entrance is done and is a problem for bats at Lava River Cave when the cave is closed for the season. A mitigation should be considered as Alternatives 2 ,3, 4 all reduce habitat. Installation of a gate at the entrance of the cave will protect hibernating bats and offset some of the negative impact of habitat loss. (G. Carbiener)

Comment*: I recommend that the Forest Service as mitigation of the Rocket Project install a bat pass-through gate at the cave entrance.*

Consideration: Width of protection around caves within the NNVM has been corrected to 200 feet within the NNVM and 150 feet outside NNVM. Although gating the cave would be outside of the scope of this project, this is an option that has been discussed for several years, including potential other means of preventing entrance into the cave while bats are hibernating.

The existing cable barriers at Lava River Cave are being improved upon in early 2014 in the vicinity of the welcome station building. This will deter illegal entry by placing a more substantial physical barrier en route to the cave entrance. Illegal entries unfortunately may continue where violators climb over the chain link fence or gate and walk past notices. Large steel lockable entrance gate structures are cave entrances are very expensive to both install and repair after damage by vandals who are intent on illegal entry at any cost or effort. The Lava River Cave is also monitored by law enforcement and forest protection officers.

Wildlife: Birds

Comment: *I would like to see disturbance as little as possible because fire reduction logging not allowing for wildfire creation of habitat for fire-dependent species such as Lewis' woodpecker. (E. Deck)*

Consideration: There are still many acres of habitat that will be untreated (See EA page 20 for alt. 2, page 24 for alt. 3, and page 28 for alt. 4).

Comment: *We question the finding of MI/BI for Lewis' and White-headed woodpecker species, as the Rocket project would remove existing and future large diameter snags and also impairs habitat by seeking to prevent wildfire or reduce its occurrence. (K. Coulter)*

Consideration: The project would not remove existing large diameter snags. The action alternatives will address the biological objectives for these species identified in the *Conservation Strategy for Landbirds of the East-Slope Cascades Mountains in Oregon and Washington* (Altman 2000) thereby increasing reproductive habitat suitability. Specifically, the action alternatives would aid in maintenance of large trees, reduction in canopy cover, and acceleration of diameter growth of smaller ponderosa pine. Snag retention and creation will also benefit these species (EA p. 174-176, 180-182).

Comment: *Drop burning during the spring reproductive season. (K. Coulter)*

Consideration: Because of moister conditions than summer or fall, the spring season is typically when the District is most successful with prescribed fire implementation. Limiting burning to summer and fall would significantly decrease the likelihood of completing the proposed burning acreage in any of the action alternatives. The amount of acres to be burned within the project area would be spread throughout several years both during the spring and fall. Some areas are preferred for spring through fall burning such as units around caves and units within deer winter range. The ultimate impact on bird populations requires a longer-term view and consideration of the habitat enhancement to the overall landscape. Additionally, burning does not impact 100% of an area being burned, leaving a mosaic condition after the burn.

Comment: *Re: cumulative effects – Removal of existing large snags through OSHA hazard tree removal, firewood cutting, and reduction in stand replacement fire through fuel removal are impacts to these species. This is inadequate cumulative effects analysis. (K. Coulter)*

Consideration: This project does not propose removing any ponderosa pine snags except hazard trees. The area has not been open to firewood cutting, and firewood cutting is in fact not allowed in the NNVM. Stand replacement fire is not the natural fire regime for this type of ponderosa pine forest, but snags will continue to be created due to natural disturbance agents and potentially through prescribed burning. Some larger snags will also be created within and adjacent to the small openings where they post a risk of infecting seedlings with mistletoe.

Comment: *Concerned about impacts on white-headed woodpeckers through removal of OSHA hazard trees in units, reduction in wildfire, and removal of potential future snags ≥ 10" dbh. (K. Coulter)*

Consideration: While harvest operations associated with timber sales may require limited snag felling for safety considerations during temporary road construction and placement of log landings, overall snag removal would be minor in scope and occur randomly throughout the project area, averaging one to two percent based on monitoring by district timber sale administrators. Resource protection measures have been incorporated to limit snag felling and the loss of snags during prescribed burning operations (EA page 175).

While the focus of much of the project acres is to increase forest resiliency to wildfire, during prescribed fire treatments, live trees can succumb to fire and converted to snags from these operations (EA page 175), which could occur more easily in stands treated with a higher basal area.

Levels of live tree retention in all treatments will provide adequate numbers of green tree replacements to provide future snag and down log levels (EA page 175). Each action alternative leaves a proportion of the project area in dense forest conditions, as well as an additional 10% retention patches, where snags creation is likely to continue at a higher rate.

Comment: *Logging would take canopy closure well below the level in which white-headed woodpeckers roost. Group selection cuts and shelterwood logging are not appropriate neither are the proposed mini-clearcuts appropriate to meet desired conditions for white-headed woodpecker habitat. We want sale units with ≥ 15" dbh tree average dropped. The Rocket project should retain all trees > 17" dbh to meet requirements for the white-headed woodpecker. (K. Coulter)*

Consideration: Commenter is referring to a section of the EA that lists relevant conservation strategies for the white-headed woodpecker from Altman (2000). Altman (2000) has stated that one of the biological objectives for white-headed woodpecker is to provide a mean canopy closure of 10-40% (p. 174).

Conservation strategies including thinning, partial cuts, group selection cuts and shelterwood harvests can be utilized to meet desired conditions (EA page 170). The objective for creating small openings is not for white-headed woodpeckers (EA p. 33).

Although Altman (2000) does state as a conservation strategy to "retain all ponderosa pine >17" dbh," he also states that "these management actions are intended to stimulate conservation actions, but are not regulatory nor do they represent the policies of any agency or organization," (Altman 2000, page iv).

Comment: *DecAID tolerance levels for snags are low compared to natural numbers of snags per acre and do not imply species viability at these levels (draft EA p. 165). (K. Coulter)*

Consideration: Information from DecAid is based on the best available science for these species and is not meant to imply species viability but the percentage of the population that would utilize habitat based on snag levels. DecAID is compared to other research in the EA p. 165.

Comment: *White-headed woodpecker viability is precarious in the Rocket area and the Forest as a whole (re: snag habitat availability, draft EA p. 166). (K. Coulter)*

Consideration: Information for the projects analysis is taken from the Forest MIS Species Analysis 2012. The species prefers open forests with large diameter trees and an open understory. This type of habitat is not common because of historic logging that removed large trees when the area was in private logging company ownership. In Rocket there is no habitat at the snag density preferred for nesting by a majority of individuals (3.8 snags >= 20 inches dbh). Alternative 1, the No Action Alternative, would allow this species' habitat to decline. All action alternatives would increase habitat in the project area (EA p. 174)

Comment*: We are disturbed by intent to cumulatively log most or all goshawk habitat, especially PFAs and other foraging areas, leading to the extirpation of this species that requires denser forest habitat. (K. Coulter)*

Comment: We do not support logging in goshawk post-fledging area. (M. Darzen)

Comment: *How long have the PFAs been unoccupied? If these have been used within the last 5 years, they should still be considered active and not be logged. (K. Coulter)*

Comment: *If PFAs were active in the last 5 years, then they are active. We are opposed to logging active and recently used goshawk PFAs. (K. Coulter)*

Comment: *re: p. 185 information on goshawk surveys: This does not mean that the 3 PFAs are not active by Eastside Screens definition. The Forest Service doesn't know if these nests were active during the last five years due to lack of surveying. Therefore we oppose logging of these potentially active PFAs. Drop all sale unit within PFAs and in adjacent suitable foraging habitat. (K. Coulter)*

Consideration: Occupancy of goshawks in the PFAs or elsewhere in the project area in the five years prior to the 2012 is not known due to a lack of surveys. Surveys for goshawks were conducted in 2012 and 2013 across the entire project area including the existing PFAs. No detections occurred in the PFAs. A goshawk was detected in 2012 in the eastern area of the project outside of proposed treatment units. There are no proposed treatments in the 30-acre nest cores under any of the alternatives and monitoring of the area will continue.

Comment: *re: Youtz et al (2007) (EA P. 184) this does not match other goshawk science recommendations. (K. Coulter)*

Consideration: Differing research is disclosed in the EA pp. 190-191.

Comment: *Cooper's hawk and sharp-shinned hawk will be negatively affected by the Rocket project, which would greatly decrease canopy cover and tree density. (K. Coulter)*
Drop logging of mistletoe-infected trees >= 14-16" dbh. No Action or Alternative 3 would reduce negative effects to the MIS accipiter hawks. Inadequate cumulative effects analysis.

Consideration: The MIS analysis in the EA determined that none of the alternatives would result in a negative trend towards viability for the Cooper's or sharp-shinned hawks. Cumulative effects analysis (p. 204-205) considered all ongoing and reasonably foreseeable projects.

Comment: *The EA does not discuss how the timber sale's harvest and slash/Rx burning activities will affect protected bird species or if there will be adverse effects how they will be eliminated. (D. Artley)*

Consideration: Seasonal restrictions are included in the action alternatives for underburning and other disturbance such as slash piling (EA p. 44-45). Effects to numerous bird species are located in the EA between pages 142 and 291.

Wildlife: Deer Habitat - Thermal Cover

Comment*: I would like ask you to drop The Rocket Timber sale, or to select a modified version of alternative 3 [not using a Forest Plan amendment (violation) to further reduce thermal cover for deer, which offers them protection from winter storms and summer heat]. (E. Deck)*

Comment: *We are opposed to proposed logging within deer thermal cover within MA-7.*

This further reduction of thermal cover further below Forest Plan standards is unacceptable. If the area has a lot of low productivity sites then what thermal cover exists is that much more important to retain (K. Coulter)

Comment: *I do not want the Forest Service to be able to use a Forest Plan amendment to further reduce thermal cover for deer, as this is critical for their protection from winter storms and summer heat. (M. Jarrad)*

Consideration: In studies conducted from 1991-1995 at the Starkey Experimental Forest and Range in northeastern Oregon, no measurable benefits of thermal cover in either winter or summer were found. Instead, biologists found that elk held in dense cover stands during the winter lost more weight than elk held in clearcuts. Also, biologists found that during the summer there was no difference in growth of yearling elk among the different thermal cover treatments. Similar studies were conducted for mule deer and white-tailed deer in Maine and Colorado. These studies also found that thermal cover has little influence over animal energy balance and performance. Cover for both deer and elk is important however because it provides security and protection from predators (Wisdom and Cook 2000). Management implications are that thermal cover may be important under certain conditions, but its value depends on other habitat attributes such as the availability of forage. Food enables animals to grow and animals must grow and survive before cover becomes important.

Treatments proposed in the Rocket project are anticipated to improve foraging habitat across the project area and enhance hiding cover. Although some treatments will occur in thermal cover, foraging and hiding cover will be improved in the project area and sufficient thermal cover will remain. The recommended ratio of thermal cover will existing within the Rocket project after project implementation, even though it is below recommended ratio at the MA-7 scale.

Comment: *Deer habitat in MA-7 as stated in the EA show deer populations declining, hiding cover at or slightly above minimums, Thermal cover less than required, and road densities exceeding those required in the forest plan. If the same standard was applied to the National Monument land within the Rocket project thermal cover would be significantly below requirements.*

1. Deer analysis continues to obtain no data for highway 97 under crossings to determine success of deer routes.

2. EA continues to rely on road closures to offset habitat loss. Past road closures have not been successful, no information is provide to indicate that additional closures will be different.

3. Impact of winter use of the FR 9703 and expanded Lava Lands parking lot and paved trail has not been determined.

4. EA page 213 states; "Implementation of the Rocket project is not consistent with the Forest Plan standard and guideline for deer thermal cover." The proposed Forest Plan Amendment will allow this action based in part on long range improvement. The EA then states that Rocket project will not contribute to a negative trend in viability for the mule deer. This is contrary to all the data presented and trend to date. (G. Carbiener)

Consideration: Numeric data is not yet available on deer or elk utilization of the Highway 97 undercrossings; however, the Oregon Department of Fish and Wildlife has reported through emails that both undercrossings have received steady use by mule deer. While no research data is available on previous road closings to determine road closing effectiveness on the Forest, literature indicates that open roads can cause deer and elk to exhibit higher stress levels and increase movement rates near open roads, thus expending needed energy during winter to avoid noise and human disturbances.

While the Rocket project will reduce thermal cover in the proposed alternatives, the treatments are anticipated to improve the distribution of foraging and hiding cover for deer which are the most important components of deer habitat in the Rocket project area. In addition, the 44 miles of road closures and decommissionings will reduce noise and human disturbance to deer and elk. Therefore, the EA determined that the Rocket project will not contribute to a negative trend in viability for mule deer.

Wildlife: Johnson's Hairstreak Butterfly

***Comment**: We recommend dropping sale units where the average tree size is 15" dbh or greater which is congruent with our survey sheet recommendations. (K. Coulter)*

Comment: How much mistletoe does the butterfly need over what size of an area and with what degree of proximity? (K. Coulter)

There is no basis for the assumption that the Rocket project (along with the West Bend project and other projects across the Forest) would not contribute to a trend toward federal listing for the Johnson's hairstreak butterfly- more research on the ground would be needed to establish viability thresholds.

Consideration: The stands in the Rocket project area are generally 70 to 90 years old. These stands have regrown since being logged in the 1930s and 1940s by private timber companies. The trees are therefore generally below 21" dbh and larger trees are uncommon. Existing tree density makes these trees susceptible to mountain pine beetle and slows growth. The EA (p. 32) describes proposed thinning would be from below, with the smallest diameter trees in the stand and/or the shortest trees generally priority for removal, and when exceptions would occur. The EA also describes if thinning from the lower crown classes will not reduce stocking to desired levels, trees from the dominant and codominant crown classes will be removed to favor the best trees of those same crown classes. This could mean trees 15 to 20.9 inches dbh will be cut to favor retaining other, potentially better trees greater than or equal to 15 inches dbh.

This species is believed to utilize mistletoe from a variety of tree species and a variety of age classes across the Forest (see EA pages 158-159). Since population numbers are lacking for this species across its range due to difficulties in determining presence (difficult to inventory) determination of impacts is based on habitat presence (see EA pages 159-160). As stated in the EA, a survey occurred on the Forest in 2010 (Crescent Ranger District), but no Johnson's hairstreak larvae were found. Additional surveys

may be conducted in the future, but these surveys would be used to determine presence, not viability thresholds, which could be based more on habitat presence.

Fire suppression has resulted in more mistletoe spread that would have occurred naturally under a frequent fire regime (EA p. 139-140). Thinning treatments that favor mistletoe-free trees will not result in the removal of mistletoe from the forest but depending on the amount and intensity of thinning would limit its lateral spread. Each alternative leaves a proportion of the area untreated, and consequently leaves areas of heavier mistletoe.

Comment: *The cumulative effects analysis for wildlife species tend to be biased, inadequate, and not based on professional integrity or scientific accuracy, especially for Townsend's big-eared bat, Johnson's hairstreak butterfly, and the western bumblebee. (K. Coulter)*

Consideration: The commenter does not provide specifics to respond to. Some updates to the analysis presented in the EA have been made, including in the wildlife section.

Forest Plan Amendments

Comment: *We are opposed to all the proposed Forest Plan Amendments, which we see as violations of the only existing Forest Plan and as cumulatively significant with multiple timber sales across the Forest adopting such Forest Plan amendments. We see this as contrary to the original intent behind allowing for Forest Plan amendments. (K. Coulter)*

Each of these amendments is significant in themselves and if not part of the much larger Rocket project would obtain public attention. In reviewing the list below, it is obvious that this type of amendment has been done before several times. (G. Carbiener)

NFMA contains direction for amending the plan. This does not include language to amend the plan to produce volume or additional volume. No FP amendments. (D. Artley)

I would like to see rejection of the use of Forest Plan amendments to violate the existing Forest Plan. (E. Deck)

There is an insufficient range of alternatives when all alternatives except No Action are designed to violate the Forest Plan. (K. Coulter)

Fuels could be reduced in scenic views without violating the Forest plan if done more conservatively. (K. Coulter)

Consideration: The Forest Service authority to amend National Forest Land Management Plans is codified at 36 CFR 219.17. The Rocket EA includes an analysis of the no-action alternative (Alternative a), which does not include any Forest Plan amendments. Other alternatives vary the area where amendments would be necessary. All amendments proposed for action alternatives have been developed to help achieve the purpose and need of the project, to increase resilience to disturbance agents, reduce stand density, and improve forest health. As disclosed on pp. 131, 221, and 338-340, these amendments to the Eastside Screens and the Deschutes Land and Resource Management Plan standards and guidelines would not change the desired future condition for land and resources from that contemplated by the existing management direction in the Land and Resource Management Plan.

Comment: *The Forest Service could do non-commercial thinning and keep burns to less than 5 acres with scorching limited to the lower 1/3 of the canopy, as prescribed fires are supposed to be a mosaic anyway. (K. Coulter)*

An amendment wants to allow visible effects for five years. Certainly in 1990 this would have been considered and one and two year time period was determined to be appropriate and manageable. I object to

this amendment for Units 277.1, 277.2, 277.3 if alternative 2 or 3 is chosen. Eliminate fire in these units and move slash piles to comply with current Forest Plan. (G. Carbiener)

Consideration: The type of fire prescribed is low intensity underburning. It does not intend to cover 100% of units. Underburning is designed to maintain crown scorch at less than 30% and to retain about 25% of existing shrub cover, which would create a mosaic type burn. Where feasible, burning is preceded by ladder fuel reduction and mowing rather than commercial thinning. In order to reintroduce fire into the landscape while avoiding substantial mortality, pretreatment is usually necessary. Alternative 1 includes no amendment to the Scenic View standards and Alternative 3 includes far fewer acres for Scenic View amendment than Alternatives 2 or 4. Units 277.1, 277.2, and 277.3 are not underburned with Alternative 1 or Alternative 3.

Comment: *Drop the units that would generate the use of Amendment #3. There's not many large trees left in the project area – logging up to 21" dbh in these areas will increase the deficit in large trees.*
Drop commercial logging units in ponderosa pine late closed seral stage. These areas would be degraded and have fewer mature trees to become old growth. (K. Coulter)

Consideration: Amendment #3 does not allow for the removal of larger trees; rather it allows for maintenance and enhancement of existing large tree structure by thinning and fuels reduction in those stands where large trees exist. Treatments are designed to move the structural stages on the landscape closer to the historic range of variability where open stands of large ponderosa pine are currently far below the HRV (EA pp. 37-38).

Recreation

Comment: *I would like to see as little disturbance as possible because of the long-term impacts of extensive logging to recreation in the area. (E. Deck)*

We are very concerned that the proposed action alternative, Alternative 2, is too intensive of management for an area with a recreational focus and a focus upon maintaining scenic views. While we recognize that fire risk exists in some areas, this area has already been thinned within the past 20-30 years and there is no immediate risk of fire or extensive beetle loss. (N. Cady)

As an avid hiker, and also someone who studies the Oregon state economy, I am concerned that the long-term impacts of extensive logging will decrease recreation in the area.

Consideration: Action alternatives are designed to minimize impacts to recreation and improve long-term forest resilience. Effects to recreation are discussed in the EA pp. 323-329. Impacts to recreation would primarily be short-term first order visual effects and noise during operations. Long-term, the health and resilience of the forest will contribute to a positive experience for forest visitors.

Natural Processes / Snags / Wildfire

Comment: *Snag density in the lower-elevation black bark areas in the project area is deficient. Whenever mechanical entry is proposed it should include snag creation at the level of 3-5 snags per acre. (S. Garrett)*

Comment*: There is a serious deficiency in snags ≥ 10" and ≥ 20" in the watersheds. (K. Coulter)*

Consideration: Snags are proposed for creation within and immediately adjacent to proposed openings. There is also the potential for snags to be created as a result of prescribed fire. Dense stands retained outside project treatments and in 10% retention areas are also areas where more snags are likely

to occur. Also, thinning will allow trees to grow over 21" dbh and in the future, these will be larger snags.

Comment: *Forest Plan standards provide for less snags in ponderosa pine forests than is thought to have existed historically. This corresponds with our field experience in unlogged dry ponderosa pine sites. (K. Coulter)*

Consideration: Snag levels prior to European settlement are estimated by Harrod et al (1998) and Agee (2002). These levels are within the range reported in DecAID for ponderosa pine/Douglas-fir and eastside mixed conifer times for small and medium trees (EA p. 166). The Eastside Screens require 2.25 snags per acre in ponderosa pine, which is lower than the referenced studies estimated to have been present historically. The Rocket project does not propose the removal of any ponderosa pine snags except hazard trees and will therefore maintain the current level of ponderosa pine snags, while some may be created during prescribed burning operations and some may be lost during prescribed burning operations (EA p. 175).

Comment: *Showing Forestwide level of snags and changing the scale of analysis to make the snag availability look better is not appropriate. (K. Coulter)*

Consideration: Analysis is done at project, watershed, and Forest levels in order to address environmental effects at the project and landscape levels, and then make determinations about Forest-wide impacts.

Comment: *Concerns about capturing mortality and precluding recruitment of enough snags in the future. It is important not to confuse tree health with forest health. Healthy forests require abundant dead wood. The FS must carefully consider retention of adequate green trees for continuous recruitment of biologically optimal snag levels. Trees should be retained in clumps where competition and other mortality processes can continue to operate and create snags over time. The EA (p 16) says "Thinning would also increase individual tree size thus increasing potential snag sizes in the future." This is an incomplete and misleading statement because thinning not only increase the size of trees that may be recruited as snags it also significantly reduces the number of trees available for recruitment. This trade-off is significant. The significant reduction of snag numbers may far outweigh the marginal gain in snag sizes. Failure to acknowledge this is misleading. (D. Heiken)*

EA Table 55 suggests that 4 snags per acre can be provided over time with just 8 green trees per acre. This seems to fly in the face of stand dynamics. Snags are ephemeral. As snags fall down, the green tree replacement population will be rapidly depleted. Many more green trees are needed to provide continuous recruitment of adequate snag levels. We also disagree that 4 snags per acre is enough to meet the needs of wildlife associate with snags. New science indicates that the old potential population methodology is outdated. Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001)
http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf

Consideration: The EA (p. 137) describes that mortality processes will continue to operate within thinned stands resulting in scattered, incidental mortality. Bark beetles, lightning strikes, high levels of dwarf mistletoe in trees greater than 21 inches dbh, and proposed underburns will continue to function through time as mortality-causing disturbance agents in thinned stands. The EA (pp. 92-94) describes that resilience to bark beetle attack will diminish through time, with the period of resilience varying by thinning treatment and site productivity (EA, Table 38, p. 93). Once stocking levels exceed the upper management zone, larger scale beetles outbreaks could begin to occur within thinned stands. The three

action alternatives would retain varying amounts of dense forest conditions across the landscape (EA, Figures 28 - 33, pp. 98, 100-103). Within denser forests, conditions would continue to be favorable for larger scale beetle outbreaks, but the purpose of the project is to increase resilience. The table in the EA page 164 is based on the creation of openings and the discussion of this table occurs in greater depth on page 21 of the silviculturists report for Rocket.

Comment: *I have found Red-napped Sapsuckers and Flammulated owls using lodgepole snags as a nesting substrate all around the Lava-top, Bessie Butte areas. Unfortunately, some forest managers have it in their minds that ONLY large, ponderosa snags are the substrate woodpeckers use. However, even green, punky lodgepole are used by cavity-nesters, sometimes even if they are wind-thrown.*

When I was conducting snag-marking projects for the Ft. Rock District, (you were just a gleam in your daddy's eye back then:-) I carried out tree-by-tree inventories to select which "Wildlife Trees" (and replacements) to save and what could be harvested. It's the only way to be sure. It may be possible to round up a bunch of birders to help do an inventory to save valuable wildlife trees... (J. Anderson)

The Rocket Vegetation Management Project will take place in a sensitive area for nesting Flammulated Owls, Great Grey Owls, a variety of native woodpeckers, several other cavity nesting species and both resident and migrating bat species. It is therefore vital that special attention be paid to present snag (dead tree) numbers and methods for establishing replacement trees and habitat. (J. Anderson)

Consideration: The majority of the project area is ponderosa pine forest type which was historically dominated by open stands of large ponderosa pine. Restoration treatments will still leave between 36 and 53% of the area in dense forest conditions, including areas where lodgepole pine have grown in and become snags. Red-naped sapsuckers, flammulated owls, great grey owls and cavity nesting species are all addressed in the wildlife section of the EA.

Comment: *The forest is infinitely more than conifer trees. A properly functioning forest is dependent on decadent, dying, unhealthy trees. A harvested forest differs dramatically from a natural forest. A healthy, natural forest has an abundance of dead trees. All healthy groups have unhealthy and dying individuals. Removing certain trees from the forest to increase vigor and diameter growth harms the biodiversity of the area. Taking action to increase vigor and diameter growth is the goal of private industrial tree farm managers … not national forest managers. (D. Artley)*

Consideration: The Deschutes LRMP (pp. 4-5) describes the desired future condition of forest health as being in an overall state of health, vigor, and diversity where-by it can fulfill the full complement of resource management goals both in the long and short-term. The LRMP further describes that forest pest impacts are still present in the Forest but as desirable agents of a healthy functioning ecosystem. Resistance to devastating epidemics is high. The EA provides the management goals for the various allocations in the project area as well as for the NNVM (EA pp. 9-10). The EA acknowledges the importance of snags in the forest and mortality is expected to continue due to lightening, prescribed fire, and from beetles as individuals or in groups especially in unthinned areas.

Comment: *Wildfire does not destroy wildlife habitat. Fire is a natural disturbance in these forests. The forest is more concerned with not losing green trees <u>to be logged</u>. (K. Coulter)*

Comment: *I am aware that fire reduction logging will not allow for wildfires that are essential to certain fire-dependent species such as Lewis' woodpecker. Without the proper wildfires, the habitat for these species doesn't meet their needs.*

Consideration: Ponderosa pine forests in the project area have departed from the natural fire regime that was characterized by frequent low-intensity surface fires. Wildfires occurring with the current forest

condition of dense second-growth ponderosa pine trees do not create the kinds of wildlife habitat that would have occurred naturally. By promoting a condition that allows the use of fire, that disturbance process can be reintroduced.

Comment: *When will the Forest Service allow wildfires to burn. So far, they prefer to over-manage endlessly. (K. Coulter)*

Comment: *We favor more of the project area being allowed to be guided by natural processes. (K. Coulter)*

Comment: *There is a compelling need to allow natural disturbances play their roles and not to maintain the forest in a sterile, homogenous plantation condition. The FS should not be in the business of wildfire prevention. (K. Coulter)*

It's very important that natural disturbance events be allowed to occur in the forest if the events do not occur close to the WUI where the risk of fire severity might be increased which would put homes at risk. (D. Artley) (see Franklin, Jerry F. Ph.D. and James K. Agee Ph.D. "Forging a Science-Based National Forest Fire Plicy." Issues in Science and Technology Fall 2003.

Comment: *There seems to be a philosophical and pejorative bias against natural processes like wildfire, beetles, mistletoe and so forth that can achieve many of the goals without timber cutting. The goal should be the restoration of natural processes, not just some concept of structure that may or may not have existed. Restoration of natural processes, including large wildfires which always burn with varying intensities, along with the acceptance of beetle and mistletoe as natural thinning agents should be given priority. (G. Wuerthner)*

Comment: *A major fire in this area would "reset" the ecological parameters and create exactly the mixed age, and stand densities that the Forest Service suggests is the main goal of the Rocket project, but without the negative impacts associated with logging, nor cost to the taxpayer. (And I do not accept that comparing firefighting costs to the losses associated with below cost timber sales is legitimate. Most firefighting is unnecessary and a knee jerk reaction of the agency and costs could be significantly reduced by allowing most fires to burn unimpeded, with only limited suppression near communities). (G. Wuerthner)*

Consideration: The Forest Plan provides an emphasis on "natural processes" within Research Natural Areas (RNA). The Rocket project includes a 1,310 -acre RNA where forest management does not occur (EA p. 10). In other allocations timber production is usually a primary or secondary goal of the Forest Plan. See management direction pp. 9-10.

Improving resilience to insects, such as bark beetles, is another identified purpose of the Rocket project. The EA (p. 132) describes the LRMP management direction concerning forest pests. The LRMP describes a desired future condition where forest pest impacts are present and act as desirable agents of a healthy functioning ecosystem. The goal of silvicultural techniques should be to increase resistance to devastating epidemics.

Regarding wildfire as a natural disturbance even, under current Federal Wildfire Management Policy, (see Guidance for Implementation of Federal Wildland Fire Management Policy, February 13th 2009), a wildland fire may be concurrently managed for one or more objectives. One of these objectives may "allow a wildfire to burn" within a specified area. However, given current fuel conditions and the close proximity of the Rocket project area to the city of Bend and Highway 97, this is not currently an objective that could be widely used for fire starts in and near the Rocket planning area. The current vegetative conditions in much of the Rocket Planning area result from landscape scale clearcut logging and decades of fire suppression. The large number of fire starts, the current fuel loading, and the recent history of large fires near the project area provide evidence that the project area could experience a large fire resulting in large scale mortality to the overstory. The fuels reduction through thinning, mowing and prescribed burning proposed in the alternatives will increase the opportunities for fire personnel to implement a management strategy that would "allow a wildfire to burn" on a larger scale.

Comment: *You don't get re-establishment of fire-based ponderosa pine old growth by greatly limiting or preventing wildfire. (K. Coulter)*

Consideration: The germination and establishment of ponderosa pine is not *dependent* on fire. Re-establishment of ponderosa pine does not require fire, as the cones are not serotinous. Rather, ponderosa pine is *adapted* to fire, meaning that trees are somewhat resilient to fire under natural fire regimes. However, existing conditions, described in pages 62-66 of the EA, are departed from historic fire regimes. Also see previous responses concerning fire as a disturbance in the Rocket project area.

Comment: *One may presume that a fire in the Rocket area, which is lower and dominated more by ponderosa pine would likely have a lower percentage of high severity fire [than Pole Creek fire] if it were to occur. (G. Wuerthner)*

Consideration: Fire severity describes the immediate effects of fire on vegetation, litter, or soils. It is most commonly used to describe fire's effects on the primary tree cover. The severity of a fire depends on both the vegetation and site characteristics in which a fire is burning and the fire intensity. Much of the Pole Creek fire burned in vegetation types that are classified as having a historically mixed severity and high severity fire regimes. The Rocket area is dominated by ponderosa pine and the majority of the forested project area is classified as historically being a low severity fire regime (EA p. 62-66). Currently, most of the project area is departed from its historic fire regime because of fire exclusion. The effects analysis does not specifically measure fire severity but it does use "fire hazard" as a metric to compare alternatives (EA p. 62). High severity fire effects could be expected from a wildfire occurring under typical summer wildfire weather conditions in the extreme, high, and in some of the moderate fire hazard rating areas.

Comment: *The EA says that dense forest stands creates slow growing trees—as if that is some kind of "bad" thing. Slow growth is only a problem for timber production, an economic concern, not a biological one. In reality slow growing trees are more resistant to rot when they die, hence last longer in the ecosystem. Dead trees/wood serves many important services to the forest ecosystem, and longer lasting dead trees are a positive contribution to the ecosystem. Attempting to reduce or eliminate slow growing trees demonstrates once again the substitution of economic concerns for ecological values. (G. Wuerthner)*

Consideration: The EA describes the need to improve vegetative resilience in the Purpose and Need section (pp. 7-8). Stand density reduction will help improve health and growth of trees, causing more resilience to bark beetles. The Forest Vegetation and Silviculture section of the EA explains that current research correlates factors such as stand density, tree diameter, and host density with bark beetle infestations (EA p. 132). Fettig et al. (2007) describe the mechanism by which over-stocked trees have diminished growing space and allocate photosynthate to insect and disease resistance as a last priority. Thus insect resilience may be compromised when growing space becomes limited. Additionally, thinning should create fire resilience. Two definitions of fire resilience are referenced on page 8 of the EA: Agee and Skinner (2005) define resiliency as maintenance of substantial live basal area after being burned by wild fire and Fitzgerald defines it as the ability of ponderosa pine to survive after wildfire. Thinning treatments serve to create favorable conditions in terms of fire resilience. Thinning also serves to meet the goals and objectives for land allocations where timber production is a primary or secondary goal.

Comment: *The EA suggests that the "Nearly all of the project area is departed from its historic fire regime and is at risk of being lost during a wildfire event. Particular concern for fuels hazard is public and firefighter safety during a wildfire event…" First of all the only forest type that "may" have departed from historic condition is the ponderosa pine component. Fire intervals in all other forest types tend to be much longer than fire suppression has been successful.*

Furthermore, this ignores how climatic conditions have affected fire regimes. Most fires are episodic—that is they occur in drought years at infrequent intervals. A good overview of this is found in Daniele Colombaroli and Daniel G. Gavin 2010 accessed here awww.pnas.org/cgi/doi/10.1073/pnas.1007692107 PNAS Early Edition. To quote from their study. "Our results indicate that over millennia fire was more episodic than revealed by nearby shorter tree-ring records and that recent severe fires have precedents during earlier drought episodes but also that sediment loads resulting from logging and road building have no precedent in earlier fire events."

The use of "averages" distorts this view for people. For instance, when one says that fires averaged less than 30 years in the ponderosa pine forests, that give the impression that every 30 years or less there is a fire. However, over a hundred year period, you could have 4 fires, all within a single decade, and 90 years without a single fire, yet still "average" a fire every 30 years or less. Long fire free intervals are actually quite normal—and within the "historic" variability. (G. Wuerthner)

Consideration: Nearly all, 85%, of the forested vegetation acres within the planning area is a ponderosa pine vegetation type, characterized by a historically low severity fire regime (EA p.62-63) The team acknowledges that fire return intervals can be highly variable. In the EA, a range of years is provided when discussing fire return intervals and a widely used nationally accepted classification system (Hardy et al. 2001) is used to classify the fire regimes. It is difficult to make inferences about the fire return interval in the Rocket planning area by using Colombaroli and Gavin's study. Their study took place in the Klamath mountains of southwest, Oregon. The site conditions and vegetation types of their study site are different than the Rocket planning area (Klamath Mountain - mixed conifer with 43" annual mean precipitation, Rocket Planning area-ponderosa pine with 12" annual mean precipitation.) To best describe fire regimes specific to the Rocket planning area, local information, including fire history studies pertinent to ponderosa pine fuel types on the Bend-Ft. Rock Ranger District (e.g. Bork 1984) are used.

Comment: *In addition, without getting into too much detail, the EA should acknowledge there is some debate about the occurrence of fire even in ponderosa pine forests. Stand replacement blazes are not unknown in other regions of the country where ponderosa pine occurs, and at least several analysis of Oregon eastside forests have questioned the assumption that large blazes were unusual and that ponderosa pine forests were uniformly open and park like. (G. Wuerthner)*

Comment: *There is also controversy about using scar data for management purposes. 2013 Can. J. For. Res. 43: 951–962 (2013) dx.doi.org/10.1139/cjfr-2013-0176 Published at www.nrcresearchpress.com/cjfr on 17 July 2013. And Baker and Elhe 2003 Uncertainty in fire history and restoration in ponderosa pine forest sin the Western US USDA Forest Service Proceedings RMRS-P-29. 2003), yet this is not acknowledged in the EA. Building drastic management alternatives based upon controversial methods is questionable. (G. Wuerthner)*

Comment: *Fire scar methods for determining fire history are flawed and result in a shorter fire rotation bias; fire rotations are longer and therefore current conditions may be normal and healthy and therefore not in need of restoration. (G. Wuerthner)*

Comment: *It may also be an exaggeration to suggest that fire suppression has resulted in significantly larger fires if a long term perspective is taken. Periodic large fires have always been "normal" even in ponderosa pine ecosystems under certain climatic conditions of warmer, drier weather. For instance, research done primarily in the ponderosa pine belt of southern Idaho found episodic occurrences of large fires (Jennifer L. Pierce1, Grant A. Meyer1 & A. J. Timothy Jull 2004 NATURE |VOL 432 | 4 NOVEMBER 2004 | www.nature.com/nature). "The pre-settlement period between about AD 1500 and AD 1900 was also generally colder than present, raising the possibility that rapid twentieth-century warming promoted recent catastrophic fires." (G. Wuerthner)*

Comment: *On page 8 the FS references Fitzgerald who defines fire-resiliency as the ability of ponderosa pine forests to survive wildfires relatively intact, as typically occurred during pre-settlement times (2005). However, there is no acknowledgement that new research at least calls in question the conclusions of Fitzgerald and others about pre-settlement conditions, even in ponderosa pine forests. Not only research done in Oregon, but in other parts of the West are starting to call into question the generalization that dry forests were typically open and parklike and/or stand replacement fires were not a part of the ecological fabric. (See Hessburg, Piece and Meyers, Williams and Baker, Heyedral, Velben and others for some of these reviews—reference can be provided upon request). It behooves the FS to consider that it might be alternating the natural processes and reducing resilience rather than increasing it. (G. Wuerthner)*

Comment: *The scientific basis for "restoration" is dependent on fire scar studies. These studies suggest that the drier forests composed of lower elevation ponderosa pine and Douglas fir burned frequently and thus kept density low with "park-like" open stands of mostly larger trees. Keep in mind the discussion is focused on lower elevation forests since higher elevation forests like lodgepole pine, fir and spruce are characterized by much longer fire intervals and definitely were not affected to any significant degree by fire suppression. So we often hear how such low elevation dry forests burned regularly at frequent intervals in "light, "cool" blazes that removed the litter and killed the small trees, but did little harm to the larger trees.*

Like a lot of myths, there is some truth to this generalization, and no doubt in some areas this characterization is accurate. But more recent studies using different methods have started to question this well-established story-line. These alternative interpretations are finding that the intervals between fires is much longer than previously suspected, and that stand replacement blazes (where most of the trees are killed) were likely more common even among lower elevation dry forests than previously thought. (G. Wuerthner)

Consideration: The above comments are related to historic fire return intervals and fire regimes. To build a vision of historic conditions within the project area, the EA provides a general discussion of fire history and fire regimes. A primary purpose of the project is to increase resiliency in vegetation conditions resulting from past clearcut logging and decades of fire suppression. The need for increased resiliency remains the same no matter what the attributes of the historical fire regime were. The current conditions of the forest did not develop naturally. There is potential for disturbance to occur at an unnatural scale and intensity because of tree density and fire hazard. Thinning and low intensity prescribed fire are proposed in order to reintroduce natural disturbance.

Some of the comments are in reference to Baker and Dugan 2013 paper and, presumptively, Williams & Baker 2012 (Global Ecology and Biogeography, 21, 1042-1052). The general discussion of the fire history and fire regimes provided in the EA is based upon what the project fuels specialist concluded to be the best available and relevant science. Baker and Dugan's paper is relatively new and there are currently few published research papers supporting their conclusions whereas there are volumes of literature supporting using scar data to reconstruct fire history. As for Williams and Baker's paper on variable-severity fire in western dry forests, a number of fire ecologists had concerns about the methods used to come to Williams and Baker's conclusions (Fule et al. 2013).

Comment: *Dr. Barry concludes from his research on Insects that: "Forests change. Disturbance including insects and fires are frequently part of the regenerative process. Rarely is it possible or desirable to maintain a forest at some seemingly idyllic stage of succession. Forest health - including services provided such as water - require managing to maintain natural processes. In the overgrown western U.S., fires and insects are resetting the system in response to years of fire suppression and changing climate. They are doing so in a way that will lead to adaptive and renewed forests, with far improved outcomes than logging could ever hope to achieve. Bush's "Forest Health" initiative will only exacerbate the negative situation. These forests are still extensive and large enough that letting them be is the best forest health prescription."*

Source: Barry, Glen Ph.D. "Insect Attacks May Benefit Colorado Forests" Forests.org, January 29, 2004. http://forests.org/blog/2004/01/insect-attacks-may-benefit-col.asp (D. Artley)

Consideration: Management of the Rocket project area is guided by direction in the LRMP, Eastside Screens, and the NNVM Plan. The purpose and need for action addresses goals and objectives of those plans. The EA does acknowledge that insects will remain on the landscape as disturbance agents (EA p. 137).

Comment: *Failing to tell the public that many natural resources not only benefit from tree mortality caused by natural disturbance events, but depend on these natural disturbance events occurring to function properly is a lie by omission. (D. Artley)*

Consideration: The current conditions of the forest did not develop naturally. There is potential for disturbance to occur at an unnatural scale and intensity because of tree density and fire hazard. Thinning and low intensity prescribed fire are proposed in order to reintroduce natural disturbance.

Fuel Treatments

Comment: *Fuel treatments should be effective—and many are not due to a lack of follow up maintenance—i.e. continued fuel treatments. Without effective follow up it is a waste of tax dollars to do any treatments in the first place.*

Most effective treatments include prescribed burning as a component, often combined with some mechanical thinning. (G. Wuerthner)

Comment: *Fuel treatments must be maintained or they lose effectiveness due to regrowth of forest. (G. Wuerthner)*

Comment: *Fuel treatments require multiple entries or disturbance – at least if they are going to maintain their effectiveness. Each entry can disturb and displace wildlife, be a vector for weed invasion, remove biomass, impact scenic values, reduce genetic diversity and increase access if roads are built.*

Consideration: Use of prescribed burning in the Rocket project is preceded by some form of ladder reduction thinning and/or mowing. Maintenance of the fuel profile is expected but is contingent on additional NEPA analysis.

Comment: *Treatments that open the forest to sunlight and wind can enhance fire spread by drying fuels faster, and permitting greater wind penetration which can spread flames and embers. (G. Wuerthner)*

Consideration: Principles of fire resistance for dry forests is provided in Table 19 of the EA. By increasing height to live crown, there is a concern that opening the understory may allow surface wind to increase and surface fuels may be drier. 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 (EA p. 57).

Comment: *The biggest problem with fuel reductions is that one can't predict where and when fires will occur. The limited research that has so far been done on the probability issues has found that the likelihood of a wildfire actually encountering a treated forest in the time scale when fuel reduction are effective is very small--1-2%. As the authors point out most studies of fuel treatment effectiveness start out with the unrealistic assumption that there will be a 100% overlap in the area treated and wildfire occurrence.*

However, in reality most fuel reductions will not actually do what they are designed to do--reduce wildfires--because fires are not likely to encounter them. A huge amount of forest must be treated to have even minimal effects on fire impacts. (G. Wuerthner)

Comment: *Forest and the forests that are of any interest to the public in stopping or controlling-- wildfires can and do burn through treated areas and/or simply jump over them (as a result of blowing embers) and thus tend to ultimately have limited value (G. Wuerthner)*

Consideration: Current research supports the idea that fuels reduction treatments in ponderosa pine forests are effective at reducing fire intensity and severity (Agee and Skinner 2005, Fule et al. 2001, Pollet and Omi 2002, Omi and Martinson 2009). On the Deschutes National Forest, fuels reduction treatments have proven effective at slowing the spread of fire on recent incidents such as the 2012 Pole Creek fire.

Forest Resilience

Comment: *Resilience should also include biodiversity, ecological integrity, natural forest structures. Logging would not maintain the same basic structure and ways of functioning, as logging is planned with the intent of preventing natural disturbances from contribute to forest functioning. There won't be substantial live basal area left after logging down to only 40-50 sq. ft. of basal area.*

Consideration: Thinning prescriptions were planned with the intent of increasing resilience to insects, disease, and fire, not to prevent these natural disturbances from functioning in the ecosystem. This purpose and need for action is described on page 7 of the EA. The current forest structure in most stands is a product of high density and overcrowding of trees. Post thinning stocking levels relative to the upper and lower management zones is displayed in Table 38, p. 93.

Comment: *Random removal of trees by foresters who have no insights into the genetics of individual trees may further reduce allele diversity by removing critical and important genetic alleles. For instance, one study done in Ontario found that timber harvest removed 50% of the genetic diversity in the stands that were logged (Buchert, G. P., O. P. Rajora, J. V. Hood, and B. P. Dancik. 1997. Effects of harvesting on genetic diversity in old-growth eastern white pine in Ontario, Canada. Conservation Biology 11:747–758.). More importantly these alleles were the rarest and yet it is exactly the rarest alleles that are most important for resistant to future challenges to the forest. Whether that would be a problem here is unknown, but it appears the FS gives little consideration to the effects of logging on forest gene pools. (G. Wuerthner)*

Consideration: Ponderosa pine is a relatively highly genetically diverse species (amongst conifers). Generally, conifers from mid to late successional stages, with open cones, tend to have higher levels of genetic variation. Early successional species (such as closed cone species) have adapted to relatively homogenous environmental conditions for colonization (such as lodgepole after stand replacing fire). Uniform colonizing habitat leads to uniform selection pressures which lead to reduction in genetic variation. Later successional species tend to colonize in more complex habitats under more variable conditions leading to increased genetic variation. In addition to ecological characteristics, such as cone type and successional type, life history also plays a significant role in population genetic diversity. Longevity of populations and existence of multiple cohorts helps to ensure maintenance of different genotype representation. Since different cohorts develop over time, each cohort is more likely to be produced from different individuals. Thus moving stands towards later successional stages may do more to preserve genetic diversity than keeping dense homogenous stands intact (J. L. Hamrick, J. B. Mitton, and Y.B. Linhart 1981).

Comment: *The increased extent of treatment under Alt 4 concerns us. The EA makes it seem like "resilience" is all good, so the more the better. This oversimplifies the situation. "Resilience" is not a synonym for ecological restoration. In this project, resilience is achieved almost entirely through forest*

density reduction, which is fine, within limits. The EA does not clearly recognize the limits of resilience - that it can be taken too far, leaving too little forest cover, carbon, and dead wood. These are all essential for ecological function, species viability, forest health, so resilience must be balanced with other important objectives. (D. Heiken)

Consideration: Desired conditions as well as limits on forest management activities are found in Forest-wide goals, objectives, and standards & guidelines. The range of alternatives provides a comparison of trade-offs where desired conditions are met at the expense of some other conditions. Alternative 4 offers the most treatment of the alternatives (and therefore meets the purpose and need relatively more than the other alternatives), but still foregoes meeting the desired condition on over one-third of the project area in order to continue to provide for other objectives. HRV analysis shows that the structural stages being thinned are above what would have occurred historically, and the amount of change on the landscape from this project, even when combined with other projects in the watershed, is a moderate movement towards the HRV (see Figure 49 for example which shows the ponderosa pine mid-closed structural stage being reduced from 46% of the biophysical environment to 30%, but remaining far above the HRV level).

CWPPs / WUI

Comment: *Funny how the CWPPs are designed to cover all the National Forest lands. If that's all WUI, where's the wild lands? (K. Coulter)*

Consideration: The CWPPs address large areas and define the wildland-urban interface within each plan. In the Rocket area, priority areas are Lava Lands Visitor's Center, Lava River Cave, Lava Butte, and critical transportation routes. The remainder of the project area is not considered WUI, but is included in a CWPP (EA pp. 12, 56).

Comment: *Who were the "private entities" involved in preparing the CWPPs? The timber industry? (K. Coulter)*

Consideration: CWPPs are available on the internet: (http://www.projectwildfire.org/images/uploads/2012_E__W_CWPP_final_July_2012.pdf). CWPPs are developed by a collaborative group of representatives of federal, state, and local governments and private entities (EA p. 12).

Comment: *The CWPP standards cannot supplant Forest Service legal requirements. (K. Coulter)*

Consideration: The CWPPs are prepared under the authority of the Hazardous Fuels Reduction Act (HFRA) which requires identifying WUI areas for hazardous fuels reduction. The standards provided for WUI do not supplant Forest Service legal requirements.

Comment: *Priority for fuels management should be the wilderness-urban interface.*

Please analyze an alternative using Dr. Cohen's fire damage to structures risk reduction methods in the final EA. (D. Artley)

Consideration: The Rocket project area does not involve WUI adjacent to any homes. The CWPP identifies important interface areas in the Rocket project (Lava Lands Visitor center, Lava River Cave, and critical transportation routes). Public and firefighter safety are the priority. The

ability to prevent flames from reaching homes is not within the scope of the Rocket project, therefore, Dr. Cohen's methods are not applicable.

Roads

Comment: *We are supportive of 44 miles of road being closed or decommissioned and favor decommissioning. (K. Coulter)*

Consideration: The IDT identified which roads may be needed for access for completing project activities and future maintenance. Those roads are proposed for closure.

Comment: *We are opposed to the building of "temporary" road mileage as there's already too many roads and temporary and re-opened closed roads open access by livestock, fur trappers, ATVs, and invasive exotic plants, as well as increasing human disturbance in wildlife habitat. (K. Coulter)*

I do object to use of any temporary roads. Temporary roads have many of the same impacts as permanent roads. Plus they often are taken over by ORVs and mountain bikers and thus converted into travel corridors anyway and become vectors for the spread of weeds. (G. Wuerthner)

Comment: *I would like ask you to drop The Rocket Timber sale, or to select a modified version of alternative 3 [avoiding "temporary" road construction (such roads are often re-used for logging and create access points for ATV damage and invasive plants)]. (E. Deck)*

Comment: *Temporary roads must be obliterated after use. (D. Artley)*

Consideration: Temporary roads are necessary to access treatment units. The EA describes how they are created and states that they will be restored following activities (EA p. 35).

Comment: *Minimize soil impacts, such as from road construction. We are concerned about the increased road construction under Alt 4. Whole tree yarding and the huge landings often seen in projects like this may not be appropriate in and near the National Monument and scenic areas. To avoid the large landings and sacrifice zones, more emphasis should be placed on non-commercial treatments.*

Consideration: There is no system road construction with Alternative 4. Temporary roads are constructed to the lowest possible standard capable of supporting log haul (EA p. 35) Landings are to be located to minimize visual impacts (EA p. 40).

Comment: *The EA does not analyze an alternative in detail that does not construct any new roads (temp or system).*

A no new roads alternative stands out among the infinite number of alternatives because it reduces the adverse environmental effects of the proposed action while still meeting the purpose and need for the project. New road construction causes damage to some important natural resources in the sale area. This activity is particularly detrimental to aquatic and wildlife resources. This is a valid reason to analyze a no new temporary or system road alternative in detail. (D. Artley)

Consideration: All alternatives have a modest amount of temporary road development. Alternative 3 has the least amount of commercial thinning proposed at 2.8 miles. As such, there are 3 fewer miles of temporary road access necessary than for Alternative 4. The No Action alternative provides for no new temporary roads. Also, a non-commercial thinning only alternative was considered, (which would be the same as a no temp road alternative) and was not analyzed in detail because it would not meet the purpose and need (EA p. 48). As no aquatic resources are present, there would be no effect to them from this project. Wildlife resources are

temporarily impacted by operations, including the use of temporary roads. Temporary roads are obliterated after use, so the effect is short term. None of the action alternatives would require new system roads, and they all would substantially reduce the amount of open roads in the project area by closing or decommissioning 44 miles.

Comment: *re: sediment input to water from roads and clearcuts... Furniss et al. 1991; Cederholm et al. 1991. In the final EA please tell the public why such natural resource damage will not occur or why it would be an acceptable trade off. (D. Artley)*

Consideration: There is no surface water within the Rocket project area; therefore, temporary roads have no potential to cause sediment input to water (EA p. 10).

Comment: *Roads that have been closed in the past have not been effective as public travel occurs on most unabated. Sub-soiling is not effective without additional closures. Better obstacles, signage, and increased patrol is necessary. (G. Carbiener)*

Consideration: Travel management rules make public travel off of designated routes illegal which will make enforcement easier than in the past. Any road closures resulting from this project would be reflected in the Motor Vehicle Use Map (MVUM). Road closure methods should be the most economical that is effective in meeting management objectives, and may require maintenance over time.

Diversity and Heterogeneity

Comment: *We are concerned by the intent to further homogenize an already fairly sterile forest area by selectively eliminating other tree species, including larger fir. Tree species diversity contributes to wildlife and plant diversity and should be allowed and encouraged, not suppressed. (K. Coulter)*

Consideration: The EA (p. 6) describes the project area as being dominated by relatively young ponderosa pine stands except in the southeastern portion of the project area where stands can have a mix of ponderosa pine, lodgepole pine, and occasionally white fir. While thinning and underburning will favor ponderosa pine for retention, the intent of the treatments is not to eliminate lodgepole pine and white fir within treatment units. Within treatment units, these species occurrence will be reduced, but not likely eliminated. Outside of treatment units lodgepole pine and white fir will remain on the landscape, serving as seed sources for the natural regeneration of these species. All alternatives propose a treatment intended to encourage the spread and maturation of aspen, a species of value to wildlife and not commonly found within the Rocket project area. Treatment would occur within two small patches where aspen is growing in the understory beneath an overstory of lodgepole and ponderosa pine.

Comment: *Thinning from both above and below will enhance structural diversity –both horizontally and vertically – and I encourage you to utilize that tool. (I. Jerome)*

Comment: *Use the Glaze Restoration Concepts, ICO Method, Oregon Wild's Eastside Restoration Handbook, or something similar, to achieve a "gappy, patchy, clumpy" distribution of trees. We want to make sure that the diversity concepts are clearly described in the Decision Notice, the prescriptions, and the marking guides. Please work with Oregon Wild's Tim Lillebo to identify prescriptions and marking guides that are effective to achieve heterogeneity. We look forward to continued cooperative efforts like the Glaze Project and West Bend. (D. Heiken)*

Consideration: Proposed thinning and burning treatments will achieve “gappy, patchy, clumpy” distribution of trees at both the treatment unit and landscape scale. Management allocations,

wildlife habitat considerations, and stand conditions, including tree size and vigor, drive where denser or more open conditions occur and the extent to which they occur.

At the treatment unit scale, retaining the best, most dominant trees, regardless of spacing, and favoring ponderosa pine for retention will leave trees at variable spacing, with some occurring as widely-spaced single trees and others occurring in clumps. Dwarf mistletoe and species composition will drive where gaps are created or existing gaps are expanded. Within ponderosa pine dominated stands, removal of trees with heavy dwarf mistletoe infection could create gaps or expand existing gaps. Removal of lodgepole pine to favor ponderosa pine, particularly with the ponderosa pine restoration treatment, could also create gaps or expand existing gaps. Landings created to facilitate harvest operations would also function as small gaps within the treatment units. Underburning, particularly in areas proposed for ponderosa pine restoration, could also create or expand gaps. Tree diameters will drive where higher basal areas occur, contributing to "patch, clumpy" conditions. With all harvest treatments, retention of trees greater than 21 inches dbh could result in patches or clumps of higher basal areas. The mixed BA treatment, proposed with Alternatives 3 and 4, would retain higher basal area where trees are greater than 16 inches dbh and lower basal area where trees are smaller; there also will be retention patches left untreated across about 10% of treated acres.

At the landscape scale, the alternatives retain varying tree densities in varying patch sizes (EA, pp. 95-103), with management allocation and wildlife habitat considerations driving where on the landscape denser or more open forest conditions are retained or created. The EA (p. 90, Table 37) shows how the use of the 40 BA, 60 BA, and Mix BA thinning treatments vary by alternative and management allocation. Dense forest conditions are retained and openings are proposed where considered beneficial for maintaining or improving deer usage within the project area. With Alternative 3, historic goshawk nest sites are also used to direct where additional areas of dense forest would be retained within the project area.

Comment: *We urge the FS to retain well-distributed wildlife leave patches of 1/4 - 5+ acres, retain clumps of 2-15 trees, 3-4 clumps per acre minimum.*

We urge the FS to retain all non-hazard snags. Avoid safety conflicts by keeping workers out of snag clumps so they can be conserved.

We urge the FS to prescribe variable density thin ranging from 40 - 60 - 80 - 100 sq. ft. basal area. (D. Heiken)

Comment: *We would like to see the following concepts in the prescriptions to achieve diversity. Retain all old growth of all sizes and species, retain wildlife leave patches of ¼-5+ acres, retain clumps of 2-15 trees, 3-4 clumps per acre minimum, and retain all non-hazard snags. We like the mixed prescription within Alternative 3 in order to diversify retention across the landscape. (N. Cady)*

Consideration: Wildlife leave patches of existing hiding cover will be distributed across treatment units to total about 10% of treatment acres. In addition, for each historic PFA (there are no currently active nest sites), about 30 acres will be delineated out of the treatment units and left unthinned to maintain a higher density patch. All alternatives also include the provision to retain non-hazard snags, and trees with old characteristics. Gaps and clumps are expected to occur through variable density thinning prescriptions, particularly under alternatives 3 and 4 which call for the mixed basal area thinning (ranging from 40 to 800 sq. ft.).

Monitoring on the Bend/Fort Rock Ranger District, specifically monitoring done in the vicinity of the Rocket project area, has found following thinning, patches remain where basal areas are above and below the target basal area for a given unit. Spatial distribution of trees is variable, including widely-spaced single trees and clumps of trees. Monitoring has also shown the number of clumps and the number of trees in a clump varies depending on the method used to designate trees for thinning (Powers

2013). Table F-2 summarizes these spatial distribution monitoring results. As would be expected, a thinning designation method using a specified spacing distance from the largest tree (Designation by Description) retained the fewest clumps (approximately 2 to 3 clumps per acre, based on 2 sample units). The most clumping occurred when thinning designation used tree characteristics such as vigor and crown dominance (approximately 6 to 8 clumps per acre, based on 3 sample units). Additionally, with what's referred to here as the tree characteristic method, a higher number of trees per clump were retained compared to the designation by description method, which retained no clumps with 10 or more trees.

Table F-2. Spatial distribution monitoring results from Powers (2013).

Spatial Arrangement	Percent of Residual Trees*		Equivalent Clump Density**	
	Designation by Description Method	Tree characteristic Method	Designation by Description Method	Tree characteristic Method
Single tree	73 – 87%	43 - 44%	N/A	N/A
2 to 4 tree clump	12 – 23%	44 – 48%	1.7 - 2.9 per acre	6.0 – 7.4 per acre
5 to 9 tree clump	1 – 4%	7 – 9%	1 clump/ 5 acres to 1 clump/25 acres	1 clump/2.5 ac to 1 clump/1.7 acres
10 to 15 tree clump	0%	1 – 2%	0	1 clump/12.5 ac to 1 clump/25 acres
16 plus tree clump	0%	0 – 2%	0	0 clumps to 1 clump/25 acres

* From Powers 2013

** Calculated from Powers 2013

Local sampling has not been done to reconstruct how trees were spatially distributed historically, including how frequently larger clumps (10 plus trees per clump) occurred. Where reconstruction has been done in ponderosa pine and Douglas-fir plant associations in the Eastern Washington Cascades (Churchill et al. 2013), larger clumps were either absent (0% of residual trees in clumps of 10 to 15 or 16 to 20 trees) or were a relatively small proportion of the residual trees (3-5% of residual trees in clumps with 10 to 15 trees and 2-5% in clumps with 16 to 20 trees). Youngblood et al. (2004) describe the historic spatial pattern of upper canopy trees in eastside old-growth ponderosa pine forests as either aggregated; clumped distribution, with clumps greater than 22 meters (72 feet) in diameter; or random distribution. Based on this description and drawing inferences from reconstruction work in Eastern Washington, it is assumed monitoring results from the 3 areas thinned using tree characteristics approximate historic patterns, with larger clumps perhaps under represented.

Clumps with more than 10 trees will remain following the implementation of proposed thinning treatments both across the landscape and within thinning units where clumps are retained to protect resource features such as rock outcrops and cultural resource sites. The addition of a resource design criteria could be considered to provide even more representation of these larger clumps, particularly in larger thinning units. Table F-3 displays large clump density needed for 1 to 5 percent of tree density to be in clumps of 10 or 16 trees. For simplicity, calculations assume a density following thinning of 40 trees per acre, assumed to be a reasonable approximation for proposed thinning based on ranges displayed in the EA (p. 92, Figure 24).

Table F-3. Large clump density needed to retain 1 to 5 percent of residual trees in large clumps.

Clump Size	Proportion of 40 trees per acre (density assumed for all thinning treatments)				
	1%	2%	3%	4%	5%
10 tree clump	1 clump/25 ac	1 clump/13 ac	1 clump/ 9 ac	1 clump/ 7 ac	1 clump/ 5 ac
16 tree clump	1 clump/40 ac	1 clump/20 ac	1 clump/14 ac	1 clump/10 ac	1 clump/ 8 ac

Range of Alternatives

Comment: *We generally support Alt. 3 or No Action but would like Alt. 3 to be modified not to reduce thermal cover for deer, to keep ladder fuel reduction to trees only up to 10" dbh or less, drop the "ponderosa pine restoration treatments" drop the proposed temporary roads, and only non-commercially thin or burn previously commercially-thinned sale units and OGMAs. (K. Coulter)*

Consideration: Alternative 3 presents the least amount of active treatment in order to address concerns raised during scoping. There is no commercial thinning in OGMAs or NNVM, less burning occurs, and there is no treatment within historic PFAs (EA p. 24).

Comment: *We are very opposed to alternative 4 as logging too large a percentage of the forest in this area too heavily at the expense of the majority of the public, wildlife, and other ecological values, all for a small minority's private profit. We also oppose Alt. 2 for the same reasons. (K. Coulter)*

Consideration: Alternative 4 provides the most benefit on the landscape in terms of meeting the purpose and need, but also leaves dense patches, connectivity corridors, stands of potential goshawk nest habitat, and a level of deer hiding and thermal cover that address site-specific issues and needs. The comparison of Alternatives on pp. 49-52 summarizes this.

Comment: *The main objection has to do with the means of getting to those ends – namely all proposals except the No Action alternative recommend some degree of logging. (G. Wuerthner)*

Consideration: To reduce stand density trees need to be removed. The most practical means is through a timber harvest described in the EA p. 32. Timber harvest is also an activity that is not prohibited in any of the areas proposed; timber production is actually an objective for much of the project area.

Comment: *Our scoping comments urge recognition of the ecological value of untreated areas and the need to identify the optimal mix of treated and untreated areas. We appreciate the acknowledgement of this comment on page 16 of the EA, and the consideration of the ratio of treated/untreated as a "key issue" (EA pp 92-96) but our concern has not been fully addressed because the EA does not disclose the differing ecological consequences of alternatives with different mixes of treated/untreated, e.g., what are the biological consequences of the treated/untreated ratios in Figure 29? For instance, how many snags and how much dead wood will be recruited over time in each density class? Are the areas being retained in a dense condition similar to the areas being treated or are they dominated by small trees with less ecological value? Which wildlife species are benefited by less dense forests with fewer snags versus more dense forest with more snags?*

It would be helpful to see the DecAID tolerance levels for different species (not just estimated HRV) for the different forest density classes resulting from various levels of treatment/non-treatment. We are unclear why the FS chose to analyze woodpeckers known to be associated with less dense forest with widely scattered snags (white-headed woodpecker) and post-fire habitat (Lewis woodpecker), and not other species known to be associated with more dense forest and abundant snags. It would be helpful to see snag habitat projections over time comparing treated/untreated conditions, like this:

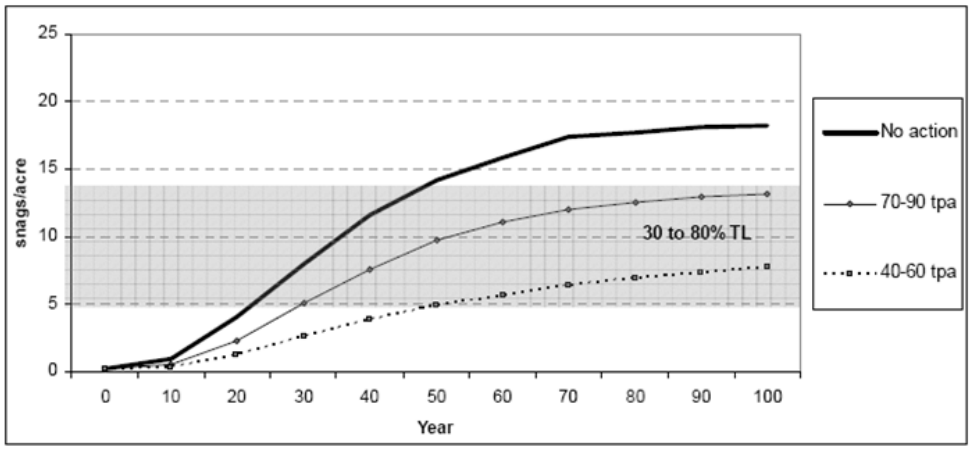


Figure 15. Short and long-term changes to ≥20" dbh snags.

Concern about the mix of treated/untreated is based in part on the fact that there is no surface water in the project area and therefore no RHCAs where management is focused on retention of shade and large wood. There is a risk that the FS will treat too large of a fraction of the landscape. The FS should establish purposeful "skips" (both within units and across the landscape) to serve non-aquatic side-benefits of riparian protection, such as wildlife cover, landscape diversity, and dead wood recruitment.

Consideration: The effects of the various treated/untreated ratios are disclosed and compared throughout the EA. There will likely be more snag development in areas left at high density areas and the areas that are left untreated under each alternative are similar to those being treated because most of the project area has similar conditions of black-bark ponderosa pine with few larger trees. With the mixed basal area thinning prescription, there will be more density remaining where the trees are over 16" but that is a within-stand scenario.

Snag removal is not a focus of this project, so snag recruitment projects over time were not part of the analysis. The effects of this project, including the effects of creating a less dense forest with less recruitment of snags in the short-term (as opposed to areas not to be treated, are more dense, that may have more snag recruitment in the short-term) are discussed in the wildlife section of the EA on pp. 142-291. The EA analyzes a variety of woodpeckers, such as the Region 6 Sensitive species white-headed woodpecker and Lewis' woodpecker (EA pp. 163-183) and Management Indicator Species including the black-backed woodpecker, three-toed woodpecker, pileated woodpecker, Williamson's sapsucker, hairy woodpecker, northern flicker, red-naped sapsucker, and downy woodpecker (EA pp. 243-257, 285-291).

The alternatives are designed to retain important habitat components in an untreated condition as well as to maintain and enhance other important habitat conditions through treatment. Specific habitat components retained untreated (skips) include hiding cover patches, thermal cover stands, connectivity corridors, and nest core stands within PFAs. The RNA in the south end of the project area is a large area of over one thousand acres that will not be treated that currently exhibits very high stand density. During implementation, additional skips will occur within units where rock outcrops, steep slopes, or areas to protect such as cultural resources will be delineated out of units. Previous responses have also addressed the proportion of treated to untreated and pointed out that between 36 and 56% of the project area would remain untreated with this project.

Purpose and Need for Action

Comment: *I am solidly in support of your project. In general we need to be thinning out this whole area on the Deschutes National Forest. It makes sense to let some selective commercial logging take place and generate some revenue for the FS to help pay for all the thinning that is needing to take place. (L. Irving)*

Consideration: Thank you for the comment.

Comment: *The Forest Service has not adequately determined a need for the project at this time. The project should be delayed until hard data is obtained and presented. The Environmental Assessment is incomplete. The Forest Service must provide some numeric data such as acres for the public to make a determination of the impact in the project boundary.*

The EA states: "Many of the stands in the project area, including previously thinned stands, have stocking levels high enough to slow diameter growth and increase the risk of mortality from bark beetle attack." How many stands and what is the amount of acres in relation to project? (G. Carbiener)

Consideration: The EA describes the purpose and need for the project on pp. 6-9. Acres of treatment for each alternative are provided on pp. 20, 24, and 28. Most of the effects analyses are measured in acres as disclosed throughout the EA (pp. 57-354).

The project area was classified into five stand density index classes. Figure 28 shows that 69% of the forested portion of the project area falls within SDI classes above the upper management zone. This is also displayed spatially in Figure 30, EA p. 100.

Comment: *The EA states: "Across the project area, fuel loading and ladder fuels increase the risk of a high intensity and/or stand-replacing wildfire event." Your data on page 52 of the EA does not support that a fire event has occurred. Since 1911 four fires described as large have occurred, and from 1986 to 2009 there were 67 fires all suppressed at less than 5 acres. The threat of a large wildfire in the project area has not been supported with any data. An aerial survey of the Deschutes National Forest, surrounding the project shows significant thinned and logged sections of land. The EA should identify these areas and indicate the amount of acreage and potential for slowing or stopping fires. (G. Carbiener)*

Consideration: Effectiveness of other thinning projects is discussed on p. 79. Because of the current conditions, most fire starts are aggressively suppressed. Near the project area and in similar conditions, the 18 Fire (2003) and Skeleton Fire (1996) provide evidence that any fires that escape initial attack would likely result in large scale mortality to the overstory (EA p. 70).

Comment: *The EA states the need to improve deer habitat conditions in the project area, including the arrangement of forage, cover and thermal habitat. The EA does not provide any numeric data on deer or elk utilization of the Highway 97 under-crossings. There is no data presented on previous road closings to determine road closing effectiveness. (G. Carbiener)*

Consideration: Numeric data is not yet available on deer or elk utilization of the Highway 97 undercrossings; however, ODFW has reported through emails that both undercrossings have received steady use by mule deer. While no research data is available on previous road closings to determine road closing effectiveness on the Forest, literature indicates that open roads can cause deer and elk to exhibit higher stress levels and increase movement rates near open roads, thus expending needed energy during winter to avoid noise and human disturbances.

Comment: *The EA starts with the assumption that dense forest stands will likely be killed by beetles, that beetle kill will increase fire risk, and that both dead trees and wildfires are somehow undesirable.*

Beetle numbers and vulnerability to beetle kills only occurs under specific conditions, usually associated with drought. Therefore, the mere fact that forests are dense, does not automatically mean there will be a significant beetle kill. Beetle outbreaks tend to be decades apart, and usually require a "perfect storm" of

conditions for beetles numbers to rise to the point where they have serious effects on tree density. Thus any treatment will over time be negated to some degree.

Can the FS explain to me why it needs to log (kill the trees) so they will not be killed by pine beetles? Pine beetles will, if they attack the area, automatically thin the stands to the density that is most resistant to beetle attacks. This is due to the ecology of beetles and trees. Trees are not hapless victims; rather they can expel beetles when they have sufficient moisture to thwart beetle attacks. Furthermore, because beetles typically do not kill all trees in a stand, rather attack those most vulnerable—typically those suffering due to drought stress—the density of trees is reduced, leaving behind a multi age stand of trees. After a percentage of the trees are killed, drought stress is relieved, and the remaining trees are able to fend off beetles. Reduction in competition for moisture and light releases the remaining trees allowing rapid growth.

A similar response could be made about the concern about mistletoe. So what if mistletoe makes trees more susceptible to beetles? Beetles thin the density of the trees—isn't that the ultimate goal of the FS? The same argument could be made about large wildfires. Even the most severe fires driven by extreme fire weather does not kill the bulk of trees. Rather a mosaic results of severe burn, mixed severity and low/to no burning. For instance, the recent Pole Creek Fire near Sisters had a fire composition of 24% under burned, 35% mixed mortality and 40% stand replacement. (G. Wuerthner)

Consideration: The scientific basis for the thinning is provided in the EA. Research shows that stands like those in Rocket will be responsive to thinning and thinning reduces the amount of ponderosa pine mortality caused by mountain pine beetles; tree growth increases following thinning; and thinning is an important first step in restoring fire-resilient ponderosa pine forests (EA pp. 6-7, 86). Because of the current conditions, most fire starts are aggressively suppressed. Near the project area and in similar conditions, the 18 Fire (2003) and Skeleton Fire (1996) provide evidence that any fires that escape initial attack would likely result in large scale mortality to the overstory (EA p. 70).

Comment: *On page 8 the EA says another purpose is to provide for local and regional employment. But there is no analysis if timber cutting is the best way to provide for such employment. Since all logging operations are money losing enterprises in the region, the question naturally arises whether there are other ways to spend federal dollars that might provide employment both in the short and long term without the negative impacts associated with logging. For instance, wildlife surveys, prescribed burning, road closures, weed removal, trail maintenance, and many other needed actions that could provide both employment without the negative impacts of logging. NEPA requires consideration of alternatives, but this EA appears predicated on the notion that logging is the only option for providing local employment. (G. Wuerthner)*

Consideration: Timber sector jobs are a measureable indicator of the employment that results from the proposed activities. Other activities are ongoing, such as wildlife surveys, weed treatment, and trail maintenance. The project area also supports a limited amount of developed recreation. The EA does not consider alternative forms of local employment, because the purpose and need is focused on forest management needs which is directly tied to the wood products industry.

Comment: *Rocket planning area fire regimes (page 61) indicate that 85% of the area is characterized by Fire Regime 1 and none in Fire Regime 3. This is classed as "low" and is supported by few fires in the past. This contradicts the need for the Rocket project.*

1. The statement on page 61 that says; "Most of the forested portion of the project area (17,399 acres or 96%) is moderately departed from historic fire regimes and the hazard ratings indicate that many of the stands are at risk of being lost during a wildfire event. The last 80 years does not support this conclusion. (G. Carbiener)

Consideration: The fire regime refers to what would have occurred naturally without fire exclusion. Typically the ponderosa pine forest would have frequent low or moderate severity fires occurring. The

existing condition, however, is the result of dense second-growth ponderosa pine regenerating after clearcut logging in the 20th century, as well as fire suppression. The existing hazard rating reflects (EA Figure 13) reflects what flame length would occur and the potential for surface, passive, or crown fire (EA p. 65). Forested areas with conditions similar to Rocket have burned at high severity over the last several years, most recently the 18 Fire. Recent fire history is an indication that a wildfire in the Rocket project area could result in large scale mortality to the overstory.

Comment: *The EA page 106 says an identified purpose and need for this project is to move the proportion of structural stages on the landscape closer to the historic range of variability (HRV). There is no data that supports this objective for the National Monument.*

1. NNVM is surrounded by activities that do not support historic range landscape. Historically, the population of the surrounding area especially Sunriver and Bend were not present at historic times. The use of the National Monument by development of Lava Lands Visitor Center, Lava River Cave, Lava Cast Forest and the caldera do not support historic times.

2. The public needs the opportunity to provide management input to these treatments of the National Monument. (G. Carbiener)

Consideration: The EA states that within the NNVM the purpose is to create conditions that will promote old growth ponderosa pine, allow the reintroduction of fire, and allow fire to play a key role in the future (EA p. 7). A goal of the NNVM is to promote old growth ponderosa pine (which is a stated purpose of the project EA p. 7). This goal can be met by increasing resilience and moving structural stages closer to the HRV, which shows that open stands of large ponderosa pine were much more common on the landscape (EA pp. 119-122).

Comment: *Interfor supports the purpose and need for this project and Alternative 4 because it treats the greatest amount of Condition Class 2 acres. It only makes sense that you should implement the alternative that treats the greatest amount of acres after having spent the resources to analyze the project area. (C. Burley)*

Consideration: The benefits and trade-offs are described in the EA. Alternative 4 treats 9.541 acres of FRCC 2 compared to Alternative 3 at 5,580 acres and Alternative 2 at 7,049 acres.

Economics

Comment: *There is absolutely no analysis verifying that the "local and regional economies" will improve when the sale is logged. In some cases the opposite is true. To justify the need, the Responsible Official must analyze the entire local and regional economies in question here. This should include: names of cities or towns where increased logging might benefit the economy and if these cities or towns have lumber mills; the basis for the claim that the economy of these cities or towns is in poor condition; the number of unemployed loggers and millworkers who live near these cities or towns who will have a job again; the mill capacity of the mills in these towns, the volume currently being stored at the mill for processing, and volume under contract. (D. Artley)*

There is no shortage of raw materials for paper and wood products in the United States otherwise the owners of private timberland would not be exporting their lumber. (D. Artley)

Consideration: The EA does not include a purpose of improving the economy. Rather, there is a purpose to contribute to the local and regional economies by providing timber, and other wood products (EA p. 8). The Deschutes LRMP specifies that in General Forest timber production is to be emphasized. Outside of the General Forest allocation, timber and other wood products are an important byproduct of

forest management such as thinning where that activity is not prohibited. For example Scenic Views and Deer Habitat allocations have programmable timber harvest components (LRMP p. 4-113, 4-121). Both logging and related industries employ over 1,100 people in Deschutes County; and it is estimated that between 136 and 320 jobs would be created (EA p. 346). Scoping input confirmed this purpose and need.

Comment: *Most economic literature (as well as USFS literature) indicates that recreation revenues to the community far exceed timber revenues. It is well known that recreationists avoid logged over areas. Supervisor Allen, you have chosen to ignore the recreation generated revenue to other business in the local communities (motels, sporting goods stores, restaurants, gas stations, grocery stores etc.) Harvesting timber in and near national forest locations that might be used for recreation will cause recreationists to recreate (and spend their money) elsewhere. This NEPA analysis must discuss this tradeoff. (D. Artley)*

Comment: *Please include a market analysis for small communities near the timber sale showing the income derived from recreation and income derived from logging and milling in the final EA. (D. Artley)*

Consideration: The forested areas close to Bend where some of the highest density of recreation occurs, as well as the Rocket project area, were clearcut logged in the 20th century. The thinning that has occurred since that time has not deterred recreationists from the Deschutes National Forest.

Direct effects to recreation sites and user experience in the Rocket project area are fully disclosed in the EA (pp. 323-329). Creating a more resilient forest and reducing the risk of widespread mortality contributes to a desirable recreation experience. The recreation and tourism economy is tied to the health of the forest. The action alternatives are expected to maintain the natural setting and environment that is the primary attraction for outdoor recreation.

Comment: *The EA analysis and disclosure arbitrarily excludes post-project costs. (D. Artley)*

The cost-benefit analysis needs to reflect agency and public costs. The cost disclosures of this project should reflect post-project costs likely to be incurred to mitigate damage from timber harvest and road construction. As pointed out in a recent study, "taxpayers are essentially asked to pay several times to subsidize the degradation of our natural resources; initially to create the damage by logging, then to mitigate those damages, and last, to repair the damages from logging." (D. Artley)

Consideration: The EA provides information on costs associated with project activities (Tables 178 and 179). Mitigation is included in the calculation of cost per acre. It is not clear what post-project costs the commenter is referring to.

Comment: *On page 49 of the EA in Table 15, Alternative B is shown as creating or maintaining 2556 forest sector jobs." Since Alternatives C and D show 136 and 320 jobs created respectively I assume that the number under Alternative B is a typographical error. (I. Jerome)*

Consideration: Table 15 should show Alternative 1 – 0 jobs; Alt. 2 – 256 jobs; Alt. 3 – 136 jobs; and Alt. 4 – 320 jobs.

Opposing Views

Comment: *Attachments to comments contain statements about natural resource degradation that results from timber harvest and road construction activities. The responsible official's response to each of these opposing views is governed by 40 CFR 1502.9(a) and 1502.9(b) which mandate a response to each opposing view. (D. Artley)*

Consideration: NEPA's implementing regulations at 40 CFR 1502.9, which commenter references, provide the requirements for draft, final, and supplemental *Environmental Impact Statements*. The requirement is to "make every effort to disclose and discuss at appropriate points in the draft statement all major points of view on the environmental impacts of the alternatives including the proposed action." And to "discuss at appropriate points in the final statement any responsible opposing view which was not adequately discussed in the draft statement and shall indicate the agency's response to the issues raised."

The definition of an *environmental assessment* is at 40 CFR 1508.9: A concise public document for which a federal agency is responsible. It shall include brief discussions of the need for the proposal, of alternatives, of the environmental impacts, and a listing of agencies and persons consulted. Forest Service NEPA regulations at 36 CFR 220.7(c) require that a decision notice describe "how comments were considered." Additionally, project-level Predecisional Administrative Review Process regulations state "The responsible official shall consider all written comments submitted in compliance with paragraph (a) of this section. All written comments shall be placed in the project file and become a matter of public record."

The Responsible Official and the Interdisciplinary Team have considered the comments submitted as well as the attachments provided. The major points of view expressed in the comments have been responded to in this appendix to the final EA.

Miscellaneous

Comment: *The map legends are not consistent. Some maps show "West Bend" and some show the "Rocket" project area. Perhaps I missed the detail when I was reading the EA and there is sound rationale for this nomenclature however I found it very confusing. (I. Jerome)*

Consideration: Maps that display the West Bend project area are for the purpose of disclosing cumulative effects where the cumulative effects analysis boundary includes the 5th field watershed.

Comment: *There should be no logging within the Research Natural Area (RNA). (K. Coulter)*

Consideration: The project does not propose any activities within the RNA.

Comment: *A project should never proceed if it might or could adversely affect T&E and sensitive species individuals and their habitat... not even a little bit. (D. Artley)*

Consideration: Effects to threatened, endangered, and sensitive species are provided in the EA and documented in a biological evaluation (EA pp. 143-182).

Comment: *Resource specialists make unsubstantiated statements that the resource harm is "short term" to justify the impacts to their resource. (D. Artley)*

Consideration: The commenter does not provide any specific examples of how the use of "short term" is unsubstantiated. Where effects are defined as either short or long-term, the EA provides information on what that means for the particular resource.

Comment: *You refer to the West Bend Vegetation Management Project when describing the effects of the Rocket project on wildlife at pages 152, 156, 170, 176, 189, 192, 198, 216, 226, 232, 245, 251, 258, 266, 273, and 278. The public does not want cut & paste effects analysis as has been done here. (D. Artley)*

Consideration: Where the West Bend project was referred to in the analysis it was because that project shares a watershed with the Rocket project and cumulative effects were being discussed at the watershed

level. Information was provided on the amount of effects from West Bend, followed by how the Rocket project would combine with those effects at the watershed scale.

Comment: *If it is not possible to post the Responsible Official's responses to public comments online, then consider this a FOIA (per 36 CFR 200.6) for these responses to be mailed to me hardcopy before the day when the 30-day appeal period on the final EA begins. (D. Artley)*

Consideration: All substantive public comments are considered as required by NEPA regulations. Written responses to comments on environmental assessments are not required by NEPA, but are prepared for the Rocket project as documented in this appendix to the final EA. This project will not be subject to a 30-day appeal period. Rather, it will be subject to the predecisional administrative review process as described at 36 CFR 218. The final EA, including these comment responses will be available to the public on the Forest Service web site prior to the initiation of the objection period. Direct notification of the objection period will be provided to those who submitted comments during the 30-day comment period.

Comment: *Tell the public why natural resource damage if it should occur is an acceptable tradeoff for the economic purpose and need statement. The EA contains no information indicating the local and regional economies (which includes all businesses) will improve when this timber sale is logged. (D. Artley)*

Consideration: The EA provides a comparison of the effects of each alternative, including no action, summarized in Tables 14, 15, and 16. Pages 50-354 provide detail on the trade-offs involved. The responsible official for this project will determine through his selection of an alternative what the actual trade-offs will be (EA p. 19). The scope of the impacts to local employment is limited to timber sector jobs in Deschutes County.

Comment: *The EA does not evaluate the fisheries values of these areas. None of your maps show the location and names of these streams. (D. Artley)*

A meaningful analysis of fisheries and watershed values specific to watersheds and subwatersheds would have covered the significance of foreseeable effects on a site-specific level, with reference to both the intensity of the cumulative watershed effects (i.e. sedimentation, LWD deficiencies, problems with channel erosion, etc.), as well as the importance of the affected reaches for fisheries. (D. Artley)

The EA entirely fails to consider the effects of landings, skid-trails and temporary roads that have not been obliterated on watersheds and aquatic habitat. Past landings and skid trails were not accounted for. (D. Artley)

The EA fails to consider the road-stream connectivity. (D. Artley)

Consideration: Page 10 of the EA states that there is no surface water and no fisheries in the Rocket project area. Effects at the watershed scale are disclosed for a number of resources; however, there is no potential for cumulative effects to stream values such as sedimentation or instream large woody debris due to the lack of streams, rivers, lakes, or reservoirs.

Comment: *BMP effectiveness is overstated and misapplied....Non-implementation of BMPs by sale administrators must be considered reasonably foreseeable and the cumulative impacts analysis must address this issue. (D. Artley)*

Consideration: The resource protection measures, including Best Management Practices (BMPs) as listed in the EA are included in each action alternative. The effects analysis assumes implementation of all resource protection measures (EA pp. 39-46).

Comment: *The organizational form and content of the EA is more geared to preventing successful citizen challenge of the Decision, than to the public of the nature of the Decision. Profound and difficult issues of socio-economics, wildlife, and fisheries habitat, silviculture, covering a large physical area, are addressed in small pieces. No effort has been made to put the pieces together. For instance, the public cannot discern the big picture when interacting adverse effects of the bits of information are individually described. (D. Artley)*

Consideration: NEPA regulations state that an EA may be prepared in any format useful to facilitate planning, decisionmaking, and public disclosure as long as certain requirements are met (36 CFR 200.7(a)). Public involvement on this EA indicates that the public has been able to read and provide substantive comments on the specifics of the project. A summary comparison of the alternatives is presented in the EA pp. 49-52 which provides a simple means of reviewing the relative benefits of each alternative.

Comment: *The EA should analyze adverse effects of noise and dust caused by timber harvest activities and provide mitigation. (D. Artley)*

Consideration: The EA provides information on the potential for dust and noise from operations. EA p. 323. Dust abatement will occur as necessary, usually through watering roads.

Comment: *Herbicides containing glyphosate must never be used on public land for any reason. (D. Artley)*

Consideration: Herbicide use is not proposed in the Rocket project.

Comment: *The Forest Service fails to explain how the pre-decisional EA complies with the 1982 NFMA Planning Regulations on species viability, which are incorporated into the Deschutes National Forest Land Management Plan. [Provide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species and provide that habitat for species chosen under Sec. 219.19 is maintained and improved to the degree consistent with multiple-use objectives established in the plan.] (D. Artley)*

Consideration: Population viability determinations are made for all Management Indicator Species. See EA pp. 183-291.

Consideration of Additional References Offered with Comments (if not already responded to in EA or Response to Comments).

Attached to comments by Dick Artley are 18 attachments that each contain numerous excerpts meant to support his statements. These attachments were reviewed by the IDT for applicability to the Rocket project. The contents of the attachments are primarily quotes or excerpts that do not report original and empirical research that has been subjected to an impartial review through the peer review or refereeing process; instead many are opinion pieces from newspapers, court documents, and presentations by individuals or organizations.

"Opposing Views Attachment #1 – Respected Scientists Reveal the Certainty that Natural Resources in the Forest are Harmed (and some destroyed) by Timber Harvest Activities." This document included 74 "opposing views quotes" with links to documents supporting the quotes. Some of the sources constitute scientific research and some are opinion pieces, comment letters to other projects, newspaper articles, or blogs. These references generally deal with the ecological effects of timber harvesting on wildlife habitat, water quality, dead wood, and wildfire. Some also address public opinion, recreation, roadless areas, and other natural resource policy issues that concern National Forests.

Environmental effects of the commercial timber harvest proposed in the Rocket action alternatives are analyzed and disclosed throughout the EA (pp. 57-354). Effects analysis are based on best available science as referenced in the EA. In some instances, the analysis has disclosed effects that are not inconsistent with the potential effects of timber harvesting discussed in the cited sources. For most of the quotes, they are not directly related specifically to the Rocket project (for example – some of the sources concern impacts to aquatic habitat, grizzly bears, but there are no such resources in Rocket). What science is provided does not present any new or additional information that is inconsistent with or that refutes science used in the preparation of the Rocket EA.

"Opposing Views Attachment #3 – Harvesting Trees to Reduce Fuels is not only Ineffective at Reducing the Risk of Fire Damage to Human Structures but Harms the Forest Ecosystem." This attachment includes 57 excerpts of mostly opinion pieces, some research, some congressional reports and testimony, and publications by special interest groups. The commenter asserts that harvesting trees to reduce fuels in ineffective at reducing risk of fire damage to human structures. The Rocket project does not claim to reduce risk of fire damage to human structures. The commenter also asserts that harvesting trees harms the forest ecosystem. This is similar to the "Opposing Views Attachment #1" comment that states forests are harmed (and some destroyed) by timber harvest activities. Impacts to forest resources are provides in the EA (pp. 57-382). Principles of fire resistance in dry forests is provided in Table 19, p. 57 of the EA. Implementing fuels treatments across the project area follows these principles and will reduce surface fuels, increase height to live crown, decrease crown density, and keep large trees of resistant species.

Previous responses to comment in this appendix have discussed efficacy of fuels reduction. For example, 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 (EA p. 55). Also, Current research supports the idea that fuels reduction treatments in ponderosa pine forests are effective at reducing fire intensity and severity (Agee and Skinner 2005, Fule et al. 2001, Pollet and Omi 2002, Omi and Martinson 2009). On the Deschutes National Forest, fuels reduction treatments have proven effective at slowing the spread of fire on recent incidents such as the 2012 Pole Creek fire.

"Opposing Views Attachment #4 – Roads Damage the Proper Ecological Functioning of the Natural Resources in a Forest." The Rocket project does not propose the construction of any new forest roads. Rather, between 2.5 and 5.8 miles of temporary roads built to the lower standard that are restored following activities. The project incorporates Best Management Practices to reduce unwanted impacts to soils, and as stated before aquatic resources will not be impacted by project activities because none are present. Due to road closures, the Rocket project will reduce open road density to a level within LRMP standards and guides on the largest portion of the project area.

"Opposing Views Attachment #5 – Insect Activity is a Beneficial Natural Disturbance Event in the Forest." Several of the comments submitted on the EA stress the importance of natural disturbance, including insect activity. These comments have been considered and responded to. The attachments submitted by Dick Artley include newspaper articles, opinion pieces, comments on other projects, and some scientific research. Some of it concerns whether or not existing widespread insect mortality in lodgepole pine increases fire severity. Generally these sources suggest that insects are part of a healthy forest ecosystem, that insect epidemics are an indicator that forest ecosystem is unhealthy, and that forest management is appropriate to maintain a healthy forest ecosystem. The Rocket EA acknowledges the importance of insects and does not propose to eradicate insects from the forest. Thinning is proposed to reduce density-related stress and the risk of serious mortality from insects. As stated previously in this appendix, at least 30% of the project area would remain at elevated risk from dense forest conditions but the purpose of the project is to increase resilience and reduce the amount of forest at risk. The excerpts presented in the attachment do not provide new or additional information that is inconsistent with or that refutes the science used in the preparation of the Rocket EA.

"Opposing Views Attachment #9a – Herbicides Containing Glyphosate should Never be Applied to Areas where Mammals (including humans), Fish, or Birds Might Visit." The Rocket Project does not involve the use of any herbicides. This comment and associated references in the attachment are outside the scope of this project.

"Opposing Views Attachment #11 – Any NEPA Document that Analyzes Treatments to Reduce the Risk of Fire Damage to Homes Located in the WUI must Analyze a Dr. Jack Cohen Alternative in Detail." The Rocket Project does not propose treatments to reduce risk of fire damage to homes located in the WUI. This comment and associated references in the attachment are outside the scope of this project.

"Opposing Views Attachment #14 – Dead and Dying Trees are Important to the Survival of many Natural Resources in the Forest and should not be Removed to Provide Opportunities for Corporate Profit or to Produce a Private Industrial Tree-Farm." Removal of dead and dying trees in the Rocket project is a minor component of the project and is limited to hazard trees, and lodgepole pine in ponderosa pine restoration units; and the EA recognizes the importance of snags to certain wildlife. The views expressed in these attachments do not offer any additional specific comments beyond what has already been responded to.

"Opposing Views Attachment #15 – Forest Service Leaders Stress that Independent, Unbiased Science Conclusions should Always form the Basis for Proposed Public Land Treatments." This attachment presents excerpted statements from Forest Service officials about the importance of science. These statements do not contradict anything in the Rocket EA or offer any additional specific comments on the project that have not already been responded to.

"Opposing Views Attachment #17 – Mountain Pine Beetle Activity in Lodgepole Pine does not Increase the Fire Risk." These attachments deal with the question of whether or not mortality from mountain pine beetles in lodgepole pine forests increase fire risk or is responsible for large fires. The vast majority of the Rocket project area is ponderosa pine forest (EA Figures 36, 37, and 38). Lodgepole pine forests with large scale mortality from mountain pine beetles is not a condition present in the Rocket project area. Scientific information on bark beetles as a disturbance agent and thinning to improve resilience to beetle disturbance is summarized in the EA pp. 131-134. The purpose and need for thinning to increase resilience in the second-growth ponderosa pine is analyzed in the EA pp. 135-140. Increased fire risk in lodgepole pine forests affected by mountain pine beetles is outside this cope of this project.

"Opposing Views Attachment #18 - *Following Label Directions on Approved Herbicides Containers does not Assure Safety.*" The Rocket Project does not involve the use of any herbicides. This comment and associated references in the attachment are outside the scope of this project.

References Cited in Responses to Public Comment

Churchill, D.J.; Dalhgreen, M.C.; Larson, A.J.; Franklin, J.F. 2013. The ICO approach to restoring spatial pattern in dry forests: Implementation guide. Version 1.0. Stewardship Forestry, Vashon, Washington, USA. 24p.

Fulé, P. Z, C. McHugh, T. A. Heinlin, W. W. Covington. 2001. Potential Fire Behavior is Reduced Following Forest Restoration Treatments. USDA Forest Service Proceedings RMRS-P-22.

Fulé, P. Z., Swetnam, T. W., Brown, P. M., Falk, D. A., Peterson, D. L., Allen, C. D., Aplet, G. H., Battaglia, M. A., Binkley, D., Farris, C., Keane, R. E., Margolis, E. Q., Grissino-Mayer, H., Miller, C., Sieg, C. H., Skinner, C., Stephens, S. L. and Taylor, A. 2013. Unsupported inferences of high-severity fire in historical dry forests of the western United States: response to Williams and Baker. Global Ecology and Biogeography.

Hamrick, J.L., J. B. Mitton, and Y. B. Linhart. 1981. "Levels of genetic variation in trees: influence of life history characteristics," in *Proceedings of the symposium on isozymes of North American forest trees and forest insects*, pp. 35–41.

Omi, P. N. and E. J. Martinson. 2009. Effectiveness of Fuel Treatments for Mitigating Wildfire Severity: A Manager-Focused Review and Synthesis. Final Report, JFSP Project Number 08-2-1-09

Pollet, J. and P. N. Omi. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. International Journal of Wildland Fire, 11: 1-10.

Powers, P.V. 2013. Monitoring of spatial distribution of recent thinning on the Bend/Fort Rock Ranger District. 9 pg.

Williams, M. A. and W. L. Baker. 2013. Spatially extensive reconstructions show variable-severity fire and heterogeneous structure in historical western United States dry forests. Canadian Journal of Forest Research, 43(10): 951-962.