United States Department of Agriculture

Forest Service

2017

Environmental Assessment

Hunter Integrated Resource Project

Clackamas River Ranger District, Mt. Hood National Forest
Clackamas and Marion Counties, Oregon
The project is located in T.6 S., R.6 E.; T.6 S., R.7 E.; T.6 S., R.8 E.; T.7 S., R.7 E.; T.7 S., R.8 E.; T.8 S., R.7 E.; T.8 S., R.8 E.; T.9 S., R.7 E.; T.9 S., R.8 E.; Willamette Meridian.

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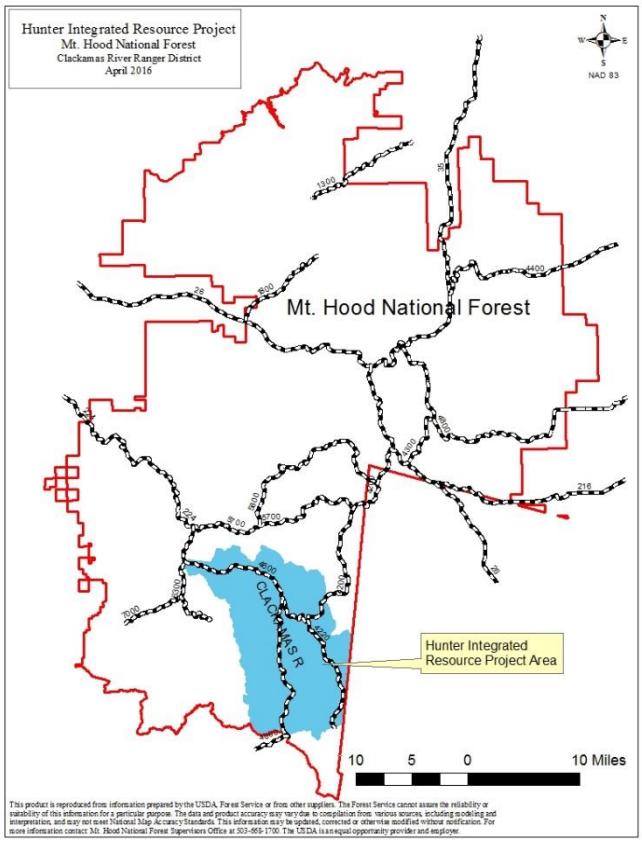


The project is located in the Clackamas River Ranger District, Mt. Hood National Forest, Oregon. The Mt. Hood National Forest is referred to as 'the Forest' in this document.

This proposal contains a suite of projects including vegetation management, transportation management and aquatic/riparian management actions. The purposes of these actions are to enhance forest health, growth and diversity; improve critical habitat for northern spotted owls; enhance Late-Successional Reserves and Riparian Reserves; provide early-seral habitats; provide an appropriate road system that is safe, affordable and minimizes impacts to resources; and to enhance or restore streams, aquatic habitats and riparian vegetation.

1.0 Introduction

1.1 Document Structure

The Forest Service has prepared this document in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This document discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. This document uses a section number system. This paragraph for example is in section 1.1 and may be referred to as s. 1.1. The document is organized into the following parts.

- *Summary*
- *Introduction:* This section includes the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section includes design criteria. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Alternatives:* This section provides a description of alternative methods for achieving the stated purpose. These alternatives are developed based on issues raised by the

public and other agencies. Finally, this section provides a comparison of the environmental consequences associated with each alternative.

- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource. Within each section, the existing situation is described first, followed by the effects of the alternatives. The no-action alternative provides a baseline for evaluation and comparison of the other alternatives.

- *Consultation and Coordination:* This section provides a list of preparers and agencies consulted during the development of this assessment.

- *References and Appendices:* The appendices provide more detailed information to support the analyses presented in the assessment.

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

1.2 Project Area Summary

The Hunter project area is located along the eastern edge of the Clackamas River Ranger District in the Upper Clackamas Watershed. Portions of the planning area border lands administered by the Willamette National Forest as well as the Confederated Tribes of Warm Springs. This watershed is approximately 101,000 acres in size and includes 5,585 acres of land owned by the Confederated Tribes of Warm Springs as well as 137 acres of private land at Austin Hot Springs. The project area is located in the southeast portion of Clackamas County, Oregon and the northeast portion of Marion County, Oregon. Maps can be found in Appendix A. The planning area was delineated and chosen because it encompasses a landscape with similar terrain features and a transportation system that provides logical access for management activities.

1.2.1 Management Direction

Management direction is derived from the following land management plans. This assessment is tiered to the Environmental Impact Statements and the listed plans are incorporated by reference.

- The Mt. Hood National Forest Land and Resource Management Plan Record of Decision and Final Environmental Impact Statement (USDA 1990a) and Standards and Guidelines (USDA 1990b), as amended, are referred to as the **Forest Plan**. The FEIS discusses environmental effects for Forest-wide programs and sets the stage for project level analysis. The Forest Plan contains standards and guidelines applicable to this project. Consistency is addressed in each resource topic of section 3.0.

- The Forest Plan was amended by the Northwest Forest Plan Record of Decision and Final Supplemental Environmental Impact Statement (USDA, USDI 1994a) and

Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. (USDA, USDI 1994b) (Hereafter referred to as the **Northwest Forest Plan** or NFP). The NFP contains standards and guidelines for Matrix, Riparian Reserves and Late-Successional Reserves. Consistency is addressed in certain resource topics of section 3.0.

- The Forest Plan was amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA, USDI 2001).

- The Forest Plan was amended by the 2005 Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, hereafter referred to as the R6 2005 FEIS. The R6 2005 FEIS culminated in a Record of Decision (USDA 2005). Standards and guidelines from the 2005 FEIS are addressed in section 3.13.

1.2.1.1 Land Allocations

There are several land allocations in the project area. The following tables show the acreage inside the planning area. Appendix A contains maps showing the proposed actions, land allocations and other details. Section 1.3 contains a description of how the proposed actions overlap these land allocations. These tables represent the entirety of the planning area; some have no proposed actions in them.

1.2.1.2 Northwest Forest Plan Land Allocations within the Hunter Project Area

Land Allocation	Acres	Management Theme
Congressionally Reserved	11,243	These lands are reserved by acts of Congress to be managed for specific objectives such as Wilderness and Wild and Scenic Rivers.
Late-Successional Reserves	24,759	Late-Successional Reserves are to be managed to protect and enhance old-growth forest conditions. Thinning or other silvicultural treatments inside these reserves may occur in stands up to 80 years of age if the treatments are beneficial to the creation and maintenance of late-successional forest conditions.
Administratively Withdrawn	1,827	These are areas where the Forest Plan land use allocation indicates vegetation management and timber harvest may occur if the treatments are beneficial to the resources highlighted for each area. Specific management direction for these areas is located in the Forest Plan and include the A allocations described below.
Riparian Reserves	8,712	Riparian Reserves are areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. The main purpose of the reserves is to protect the health of the aquatic system and its dependent species; the reserves also provide incidental benefits to upland species. These reserves will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat.

Land Allocation	Acres	Management Theme
Matrix	48,590	Matrix is the remaining area outside the above allocations and is the area where most timber harvest and other silvicultural activities are conducted. Management objectives for matrix lands are specified by Forest Plan land use allocation objectives.

1.2.1.3 Mt. Hood National Forest Land Allocations within the Hunter Project Area

Land Allocation*	Acres	Management Theme
A1 Wild and Scenic Rivers	7,386	Protect or enhance the outstandingly remarkable values of the Clackamas River. There are scenic and recreational segments. There is substantial overlap with Wilderness and Late-Successional Reserves.
A2 Wilderness	4,507	Preserve wildness. Two segments of the Clackamas Wilderness are in the project area: Big Bottom and Sisi Butte. There is substantial overlap with Wild and Scenic Rivers and Late-Successional Reserves.
A4 Special Interest Areas	8,013	Protect and, where appropriate, foster public recreational use and enjoyment. Includes parts of the Olallie Lake Scenic Area.
A5 Unroaded Recreation	200	Provide a variety of year-round unroaded recreational opportunities in a semi-primitive non-motorized setting and undeveloped forest environment.
A9 Key Site Riparian	2,845	Maintain or enhance habitat and hydrologic conditions.
B2 Scenic Viewshed	14,249	Provide attractive, visually appealing forest scenery with a wide variety of natural appearing landscape features. Utilize vegetation management activities to create and maintain a long term desired landscape character. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.
B3 Roaded Recreation	1,472	Provide a variety of year-round recreation opportunities in natural appearing roaded settings. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.
B8 Earthflow	569	Maintain hydrologic and physical balances to prevent reactivation or acceleration of large, slow moving earthflow areas. Allow for the management and utilization of forest resources through the use of special management practices.
B10 Deer & Elk Winter Range	43	Provide high quality deer and elk habitat for use during most winters. Provide for stable populations deer and elk. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.
B11 Deer & Elk Summer Range	6,756	Provide high quality summer rearing habitat for deer and elk. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.
B12 Back Country Lakes	167	Protect or enhance the recreation, fish and wildlife, or scenic values of designated lakes. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.
C1 Timber Emphasis	25,334	Provide lumber, wood fiber, and other forest products on a fully regulated basis, based on the capability and suitability of the land.

* Acreage for the B and C allocations includes the area in Matrix.

1.2.1.4 Other Land Delineations that are not Land Allocations

Category	Acres	Management Theme
Spotted Owl Critical Habitat	54,890	Where critical habitat overlaps the above land allocations, each land allocation would have an additional objective to enhance owl habitat. Approximately 30,633 acres of the Matrix land allocation overlap critical habitat.
Key Watershed	24,609	Key watersheds provide refugia for at-risk stocks of anadromous and resident fish. This delineation includes parts of the Upper Clackamas Watershed in a narrow band along the river. It is entirely overlapped by Late-Successional Reserve.
Inventoried Roadless Areas	3,893	This area is identified in the Forest Plan Appendix C and is in the Olallie Lake Scenic Area.

1.2.2 Past Management

The planning area once contained large patches of mature Douglas-fir and hemlock in the lower elevations with other species mixing in at the higher elevations. It also contains large patches of younger stands that seeded in after fires. Now the planning area has areas of mature forest fragmented by plantations. The plantations in the watershed have a wide range of ages and densities (from age 10 to 60). Some plantations have already been thinned, while many others have not received treatment. Some of the fire-originated stands have also been thinned.

Approximately 30,533 acres or 32% of the analysis area was previously converted to plantations. Of these plantations, approximately 6% have already been thinned in the past 20 years. To put that in perspective, approximately 8% of the plantations are included for various treatments in the proposed action. Thinning has also occurred in approximately 1,234 acres of fire-origin stands in the project area.

The Forest has been making periodic decisions to decommission roads or change their maintenance status since the 1990s. Previous planning efforts that overlap the project area include: *Collawash and Upper Clackamas Restoration EA* (1996), *2007 Clackamas Restoration Projects EA* (2007), *Clackamas Road Decommissioning for Habitat Restoration EA* (2009) (sometimes referred to as Increment 1), and *Clackamas Road Decommissioning for Habitat Restoration, Increment 2* (2011). These projects resulted in decisions to close or decommission roads on the Forest's transportation system.

Two sets of power lines cross the project area from east to west; one in the southern portion of the project area, and one that crosses the northern portion of the project area.

There is a fire lookout tower and electronic facilities at the top of Sisi Butte.

1.2.3 Summary of Proposed Actions

The following briefly describes the proposed actions. Section 1.3 includes greater elaboration on the connections between the proposed action and the purpose and need. Section 2.2 contains detail on the proposed action including project design criteria (PDCs).

1.2.3.1 Summary of Vegetation Management Actions

Purpose & Need	Proposed Action	Acres	Notes
Improve Forest Health and Diversity in Plantations	Variable-density thinning with Skips and Gaps	1,880*	• 1,480 acres in Matrix • 400 acres in Late-Successional and Riparian Reserves
Improve Forest Health and Diversity in Fire-Originated Stands	Variable-density thinning with Skips and Gaps	260	• 240 acres in Matrix • 20 acres in Riparian Reserves • 16 stands ranging from 3 to 62 acres in size
Improve Forest Health and Diversity in Lodgepole Pine Plantations	• Shelterwood Harvest • Planting	116	• Matrix
Improve Forest Health and Diversity in Hemlock Stands Affected by Dwarf Mistletoe	• Site Preparation • Planting	81	• Matrix. Masticator machine would mulch shrubs and young hemlock trees.
Protect Western White Pine Stands from White Pine Blister Rust	Pruning	250	• Occurs on a variety of land allocations
Create Early-Seral Habitat for Deer and Elk	• Regeneration Harvest with Reserves • Seeding with Forage Species • Guzzler Installation	60	• Matrix
Maintain Forage Openings for Deer and Elk	• Control Invasive Plants • Seed with Native Forage Species • Prune/Cut Shrubs • Remove Encroaching Small Conifers	115	• 18 openings ranging from 2 to 16 acres in size
Enhance Forage for Deer and Elk	Prescribed Burning	11	• All within A9-Key Site Riparian land allocation
Utility Corridor Management	Tree Removal Under & Adjacent to Power Lines	66	• Linear corridors crossing a variety of land allocations • 23 separate areas to be managed ranging in size from less than half an acre to 12 acres in size
Roadside Hazard Management	Danger Tree Removal Along Forest Service Roads	296	• Occurs on a variety of land allocations

* This acreage figure represents the sum of all of the plantations considered for treatment at this time. There would actually be fewer acres treated after accounting for stream-protection buffers and other leave areas. It is estimated that approximately ¾ of these acres would actually be thinned.

1.2.3.2 Summary of Transportation System Management Actions

Purpose & Need	Proposed Action	Miles	Notes
Manage the Road System to Allow for Safe Timber Hauling	Maintain and Repair Forest Service System Roads	148	• The intensity of work varies based on location and the work recently accomplished by the Forest and other operators.
Provide Temporary Access for Vegetation Management	Construct and Reconstruct Temporary Roads and Existing Road Alignments. Rehabilitate and Close Following Use	13.9	• 2.5 miles of temporary road construction in locations where no road alignment previously existed. • 2.7 miles of existing road alignment reconstruction on road alignments that were once temporary roads. • 6.9 miles of existing road alignment reconstruction on road alignments that were once system roads. • 1.8 miles of existing road alignment reconstruction on road alignments that were once system roads. After use, return roads to the condition they are now with entrance management.(4200390, 4650170, 4660140, 4670130)
Reduce Resource Risks and Maintenance Costs Associated with Forest Service System Roads	Decommission and Close Forest Service System Roads	25.6	• 1.6 miles of active and passive decommissioning of roads no longer needed. • 24 miles of closure of roads that remain on the System.
Ensure Important Access Needs are Met	Return Former Forest Service System Road to the Road System	0.3	• Road 5731015 accesses powerlines managed by the Bonneville Power Administration. This access need was inadvertently overlooked during previous planning that authorized decommissioning.

1.2.3.3 Summary of Aquatic/Riparian Management Actions

Purpose & Need	Proposed Action	Notes
Restore and enhance streams and aquatic resources.	Culvert Replacement, Woody Debris, Dispersed Recreation Rehabilitation	• Replace/Repair culverts that impede fish passage. • Add woody debris in two streams. • Restore riparian areas impacted by user created routes related to dispersed camping.

1.3 Purpose and Need for Action

Since this proposal contains a suite of projects that each have different purposes and address various needs, this section is organized by project type. Each project type heading has subsections that discuss the purpose and need, the proposed actions, the land allocations and some background information. Greater detail on the proposed action including Project Design Criteria can be found in section 2.2.

1.3.1 Thinning

1.3.1.1 Purpose and Need

A primary purpose of this project is to **improve the health and increase diversity** of densely stocked forested areas. *The desired condition is to have stands that are relatively healthy with growth rates commensurate with site capability. This desired condition is discussed in the Forest Plan on pages Four-3, Four-5, Four-26, Four-91 & Four-289.* The accomplishment of this objective is measured by acres treated and the change in average tree diameter in 50 years. Section 3.1 has more detail on stand growth and health dynamics.

While thinning, there is an opportunity to gain greater variability of vertical and horizontal stand structure by the inclusion of skips, gaps and other adjustments to the thinning prescriptions. There is an opportunity to make some of these changes in Riparian Reserves and Late-Successional Reserves to promote desired conditions in these land allocations and in northern spotted owl critical habitat. *The desired condition is a multi-layer canopy with large diameter trees, well-developed understory, more than one age class, and sufficient quantities of snags and down woody debris. These desired conditions are described in the Forest Plan on page Four-67 and in the Northwest Forest Plan on pages B-5, B-6 and C-32. The desired condition for spotted owl critical habitat is to have stands that contribute to dispersal and suitable habitat. These desired conditions are described in the owl recovery plan (USDI 2011) at III-19.* The accomplishment of this is measured by acres treated, the change in tree species composition, the change in the abundance of other desired plants, the change in vertical canopy layers, the change in horizontal structure with skips and gaps, and the changes to snags and down logs. For more information on diversity, see sections 2.4, 3.1, 3.2 & 3.8.

Another primary purpose is to keep forests productive to sustainably provide **forest products** now and in the future. *The desired condition for the matrix component of the landscape is to have live productive forest stands that can provide wood products now and in the future. This need is described in the Northwest Forest Plan on page 26 and Forest Plan on pages Four-3 & Four-26.* The accomplishment of this objective is measured by volume of timber removed and the acres treated in the matrix for long-term forest productivity. For more information, see sections 2.4, 3.1, & 3.16.

Variable-density thinning is proposed on approximately 1,880 acres of plantations and about 260 acres of forested land that seeded in following a fire approximately 100 years ago.

While the project area contains many thousands of acres of mid-aged stands of various ages, approximately 2,140 acres are currently in a condition where variable-density thinning treatments are appropriate to move stands toward desired conditions (s. 2.2.1). If some of this work were to be deferred, there would be a backlog of mid-aged stands that would begin to develop as described for the No-Action Alternative (s. 3.1.3, & s. 3.2.2). An important element of this purpose and need is to avoid this backlog by treating

as many mid-aged stands as possible within the parameters of the Forest Plan to move them toward desired conditions in an operationally efficient manner.

1.3.1.2 Tree Growth and Health

The stands included in this project have been examined and those proposed for thinning have been found to be overstocked. When trees are too closely spaced, as the plantation pictured at right, they experience a slowing of growth due to competition for sunlight, moisture and nutrients. Suppressed, slow-growing trees have begun to die and have become susceptible to diseases and wind damage.

When stands reach density levels at which individual trees are competing with each other for growing space it can take a long time for individuals to express dominance. If trees are not thinned, competition would increase, stems would continue to grow in height, but diameter growth would drastically slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner, they are more likely to blow down in large groups or be more susceptible to disturbance agents.

Failure to provide trees sufficient spacing while they are young can have consequences lasting the life of the stand (Oliver 1996). The overstocked condition of current stands in the planning area would continue to result in stands with reduced vigor, small size, and increased susceptibility to stressors such as insects, diseases and weather.

Some fire-origin stands have legacy trees like the one pictured at left, while others do not. The term, 'legacy tree' is often used to describe large trees that survived a fire or large snags that were killed by the fire but remain. The presence or absence of live legacy trees may have been dependent on fire intensity.

Management direction provided by the Forest Plan as amended, indicates the desire for productive healthy forest stands, and where the existing stands are overstocked, thinning

is a technique that can be used to reduce tree density to achieve their growth potential and maintain their health (s. 3.1).

1.3.1.3 Diversity

Diversity is the distribution and abundance of different native plant and animal communities and species. There are many ways to look at diversity and several scales to consider. Diversity in forests can be categorized by variations in genetics, structure and species composition. At the landscape scale, a mix of forest types and ages can provide habitat for a wide range of plants and animals. At the stand scale, other elements become more relevant such as species composition, snag abundance or the number of canopy layers.

Plantations sometimes lack certain elements of diversity and complexity. They often do not contain the mix of tree species that were present in the original stand and they are relatively uniform in terms of size and spacing. When the original clearcut harvesting occurred within the project area, all of the large trees and snags were removed. The plantations have minimal variability of vertical and horizontal stand structure and little sunlight reaches the forest floor resulting in low levels of diversity of ground vegetation.

At a landscape scale, the logging that created the plantations fragmented mature forest stands. Prior to the 1950s, the forests in the project area were relatively uniform mature forest that became fragmented by clearcuts as plantations were established. This likely benefited certain species such as elk because of the temporary levels of forage created, but likely harmed species such as spotted owls that require large blocks of contiguous mature habitat.

In the past, thinning focused primarily on tree growth and productivity and resulted in continued uniformity. There are opportunities while designing a thinning project to both enhance growth and provide for greater diversity. The science behind the concepts of variable-density thinning has been evolving in recent years (Carey 2003) (Chan 2006) (Tappeiner 1999) (RIEC 2013). Diversity can be enhanced by using techniques such as retaining minor species, retaining down wood and non-hazardous snags, and creating snags, skips and gaps.

Gaps are small areas where most or all trees are removed in patches scattered through a thinned stand. Gaps can provide breaks in an otherwise uniform canopy allowing sunlight to reach the ground. Where gaps are created, seedlings and ground vegetation would regenerate resulting in a multi-storied canopy with both vertical and horizontal diversity.

Skips are small areas where no trees are cut in patches scattered through a thinned stand. Skips provide dense shade and a place to optimize quantities of snag development, although in the short term, snags would be relatively small.

Thinning that incorporates these features can change a uniform stand into one with more variable vertical and horizontal structure and greater species diversity. These changes are beneficial to a wide range of plants and animals. Enhanced diversity is particularly

important in LSRs and Riparian Reserves to restore them to the desired conditions for the key species that rely on unfragmented mature forest conditions.

1.3.1.4 Forest Products

Wood is used to make many important products needed by society. The value of wood drives rural economies as logs are removed from the forest and processed into a myriad of eventual products. Much of the wood from this project would be used to make houses. Every 10 million board feet of timber is sufficient build several thousand houses. Other products that would come from the removed trees include chips for paper manufacturing and firewood.

Even though timber harvest from Federal lands has declined in the past two decades, the forest products industry in Oregon remains an important component of rural economies and provides approximately 25,000 living wage jobs in forest management and manufacturing. Locally, approximately 4,400 of these jobs are in Clackamas County. The annual incremental contribution of each 10 million board feet of timber is approximately 83 jobs (Oregon 2012). Jobs include woods workers who cut and remove the timber, equipment operators who repair and maintain roads, mechanics who service equipment, mill workers who process the raw materials, and craftsmen who assemble wood products into their final usable form. The Northwest Forest Plan (p. 3&4-297) contains an in-depth analysis of employment in the timber industry and the ripple effect that wood products have throughout local and regional economies.

The project has the potential to generate more than half of the Forest's goal for one year, though it is likely that the timber from this project would be harvested over multiple years. For the State of Oregon, the project represents 0.5% of the State's annual timber production (Oregon 2012). In terms of one local sawmill in rural Clackamas County, this volume represents a fraction of their annual needs.

In addition to covering the cost of logging, the value of the wood also covers the cost of road repair, road maintenance, road rehabilitation and road decommissioning. The value of the wood also provides a source of funding for other elements of the proposed action such as disease treatments and replacing culvert that block fish passage.

1.3.2 Lodgepole Pine Plantations

1.3.2.1 Purpose and Need

A primary purpose of this project is to convert **off-site lodgepole pine** plantations to other conifer species more appropriate to the site. *The desired condition for spotted owl critical habitat is to have stands that contribute to dispersal and suitable habitat. These desired conditions are described in the owl recovery plan (USDI 2011) at III-19.* The accomplishment of this is measured by acres treated and the change in tree species composition to those that are capable of contributing to the needs of owls.

Another primary purpose of this project is to keep forests productive to sustainably provide **forest products** now and in the future. *The desired condition for the matrix*

component of the landscape is to have live productive forest stands that can provide wood products now and in the future. This need is described in the Northwest Forest Plan on page 26 and Forest Plan on pages Four-3 & Four-26. The accomplishment of this objective is measured by volume of timber removed and the acres treated in the matrix for long-term forest productivity. For more information, see sections 1.3.1.4, 2.4, 3.1, & 3.16.

The project area contains approximately 116 acres of lodgepole plantations in the Matrix land allocation in areas to be managed for timber emphasis (C1) and deer and elk summer range (B11). These plantations are also within northern spotted owl critical habitat. The plantations have off-site lodgepole pine trees growing in areas that originally had other species.

Instead of using the clearcut method 50 years ago, it is now known that the shelterwood method should have been used to ameliorate harsh site conditions. When attempts to plant other species failed, lodgepole pine was planted to use as a 'nurse' crop to eventually provide shelter trees. There is a need to re-establish other conifer species more appropriate to the site.

The proposed action involves harvesting some of the lodgepole pine trees while retaining a sufficient number to provide the desired shelter. Trees would be planted that are more appropriate for the site. Without this action, the lodgepole pine trees would eventually be killed by mountain pine beetles and the stands would not be productive parts of the Matrix land allocation. Without this intervention, it is likely that the stands would not grow to become suitable northern spotted owl habitat, which is the desired condition in critical habitat areas.

1.3.3 Mistletoe Infected Stands

1.3.3.1 Purpose and Need

A primary purpose of this project is to convert stands with substantial dwarf mistletoe infection to species that are not affected by this parasite. *The desired condition for spotted owl critical habitat is to have stands that contribute to dispersal and suitable habitat. These desired conditions are described in the owl recovery plan (USDI 2011) at III-19.* The accomplishment of this is measured by acres treated and the change in tree species composition to those that are capable of contributing to the needs of owls.

Another primary purpose of this project is to keep forests productive to sustainably provide **forest products** in the future. *The desired condition for the matrix component of the landscape is to have live productive forest stands that can provide wood products. This need is described in the Northwest Forest Plan on page 26 and Forest Plan on pages Four-3 & Four-26.* The accomplishment of this objective is measured by the acres treated in the matrix for long-term forest productivity. For more information, see sections 2.4, 3.1, & 3.16.

The proposed action is to treat approximately 81 acres with a masticating machine to chip rhododendron shrubs and small hemlock trees to prepare the site for planting.

These stands are located in the Matrix and in critical habitat for the northern spotted owl. This treatment is appropriate in this land allocation and in spotted owl critical habitat to move the stands toward late-successional conditions. These severely infected stands are not capable of growing into late-successional stands without this intervention. These photos show the parasite and a contorted small tree that is approximately 50 years old.

Vast portions of the project area are infected with hemlock dwarf mistletoe, a parasite specific to hemlock trees. Many stands are almost exclusively comprised of hemlock with very few other tree species present. The parasite is causing the older hemlock trees to die and fall over and the young trees to grow very slowly and in a contorted fashion. This condition has resulted in relatively open stands with dense rhododendron brush inhibiting other species from seeding in. Without active management, these stands are unlikely to change. While many stands are infected, there is limited funding available treat these stands and only 81 acres in two stands have been proposed at this time.

1.3.4 Blister Rust Infected Stands

1.3.4.1 Purpose and Need

A primary purpose of this project is to provide some protection to young western white pine trees from the potentially lethal effects of blister rust. This treatment would provide for enhanced species diversity across the landscape and would keep forests productive to sustainably provide forest products in the future. *The desired condition for the landscape is to have live productive forest stands with a western white pine component that can provide both the element of native species diversity and provide future wood products. This need is described in the Northwest Forest Plan on page 26 and Forest Plan on pages Four-3 & Four-26.* The accomplishment of this objective is measured by the acres treated to enhance the longevity of western white pine trees.

For more information, see sections 2.4, 3.1, & 3.16.

The proposed action is to prune the lower branches from western white pine trees on approximately 250 acres.

White pine blister rust is a non-native disease that has caused a dramatic decline in western white pine populations on the Forest. Infections that begin on branches can grow toward the trunk and when it girdles the trunk, the trees die.

This photo shows a typical infection in a sapling. There are few mature trees remaining of this species that was once common and provided important ecological functions. Pruning the lower branches is a technique that has been successful in reducing the likelihood of trees dying.

1.3.5 Deer and Elk Habitat Enhancement Projects

1.3.5.1 Purpose and Need

A primary purpose of these projects is to enhance forage for deer and elk because forage is declining across the landscape. *The desired condition is to have forest stands across the landscape with a mix of ages and densities sufficient to provide all of the habitat needs for deer and elk including adequate forage. At this time, the primary lacking element is forage. This desired condition is discussed in the Forest Plan on pages Four-22 & Four-71.* The accomplishment of this is measured by acres treated for forage enhancement. For more information, see sections 2.2.5, 2.4, & 3.8.3. These sections describe the change over time in the scientific literature and in local forest structure from an emphasis on cover years ago, to a current-day need for quality forage.

In recent years, early-seral habitats have declined across the planning area. Deer and elk are management indicator species that require a mix of habitat types including early-seral habitats that provide forage.

While other projects listed above may provide some incidental forage as a temporary byproduct, there are three project types specifically designed to enhance forage for deer and elk. The proposed action includes: 1) a regeneration harvest on 60 acres in a mid-age plantation; 2) enhancement of existing forage openings on 115 acres; and 3) burning 11 acres in a meadow.

Changes in forest management direction and practices over time have resulted in practices that favor the development of late-successional features over large areas of the forest. In the Hunter project area, for instance, nearly 55,000 acres are designated critical habitat for spotted owl. Additional areas are managed for wilderness characteristics, riparian values, and habitat for species dependent on late-successional forest. These changes make it prudent to consider the forage needs of deer and elk and to seek out opportunities to create and enhance forage opportunities where appropriate.

Recent research has indicated that elk do not rely as much on cover as was once thought; research indicates that forage is much more critical (Cook 2010). Telemetry data

indicated that elk were negatively associated with cover. Cook indicated that openings (early-seral habitats) are far more valuable for elk than cover.

Fire has been the dominant stand-replacing event that created early-seral habitats prior to more active management. Beginning approximately 70 years ago, with fire suppression and increasing regeneration harvest, the pattern and quantities of early-seral habitat has changed in quantity and distribution.

With the reduction in regeneration timber harvest on the Forest in the past two decades and continued tree growth, cover habitats are common but early-seral habitats are becoming scarce. Currently less than 3% of the planning area is in early-seral habitat and that figure is declining each year. Once tree canopy closes the stands are considered mid seral, and forage and other early-seral attributes are lost.

One of the purposes of the proposed action is to add some early-seral habitat to the landscape and to enhance some existing forage opportunities. While the project addresses some of the need for early-seral habitat it does not attempt to provide all of the early-seral habitat needed across the landscape. Management direction provided by the Forest Plan as amended, identified the need to create a sustainable level of forage through regeneration harvest in mature stands. While regeneration harvest in mature stands is not proposed in this area at this time, there are opportunities to provide forage in other ways (s. 2.2.5 & 3.8.3).

The following aerial photographs show a before-and-after example of forage created inside a thinning unit. This area was visited on a field trip sponsored by the collaborative group, Clackamas Stewardship Partners; the discussion centered around the many palatable plant species that are being heavily used by deer and elk, and the potential to replicate this treatment on a larger scale.

1.3.6 Utility Corridor Management

The project area contains power lines managed by Bonneville Power Administration (BPA).

1.3.6.1 Purpose and Need

A primary purpose of this project is to provide for safety along power lines as trees grow. Because the areas below and directly adjacent to power lines cannot be managed in the long term to grow large trees, another objective for this project is to harvest and utilize the wood in a safe and cost effective manor and to reduce maintenance costs that would otherwise be borne by another agency. *The desired condition is to have a power transmission facility that is safe and unencumbered by encroaching vegetation. The goal is to remove trees before the hazard becomes imminent. This need is described in the Northwest Forest Plan on page C-39 and Forest Plan on pages Four-5 & Four-26.* The accomplishment of this objective is measured by acres treated along power lines. For more information, see sections 2.4 & 3.16.

The proposed action is to remove the trees on approximately 66 acres that are either directly underneath or within 50 feet of the currently cleared corridor.

While two power line corridors cross the planning area, only the northern most route has management actions proposed. When the power lines were built in the 1960s, they crossed a landscape with some existing plantations. Where there was mature timber, the right-of-way was cleared to approximately 700 feet in width. Since then trees have seeded in from the edge. BPA has maintained a swath of ground approximately 250 feet wide where the lines were close to the ground and left the trees to grow in some areas where the lines were higher. The photos below show the original right-of-way clearing on the left (1967) and how it looks today on the right.

As trees grow taller and get too close to the line, either underneath or to the side, they become hazardous to the safe operation of the power lines. The risks include trees falling and striking the wires and electric discharge, which is similar to lightning, where electricity can arc between the wires and vegetation starting fires. As the trees under and adjacent to the lines grow, BPA cuts them down when the hazard becomes great enough to meet their maintenance thresholds. There are trees in areas underneath and adjacent

to the power line that pose a safety hazard. There is a need to provide for safety along power lines as trees grow. The goal is to remove trees before the hazard becomes imminent. This photo shows where trees would be removed in a 50-foot wide strip adjacent to the existing clearing.

1.3.7 Roadside Danger Tree Management

1.3.7.1 Purpose and Need

A primary purpose of this project is to provide for safety along roads. *The desired condition is to have a landscape accessed by a network of roads that provide for safe access. These desired conditions are described in the Forest Plan on pages Four-3 & Four-34 and the Northwest Forest Plan on page C-32.* The accomplishment of this is measured by miles of roads treated. For more information, see sections 2.2.8, 2.4 & 3.11.

The proposed action is to remove danger trees on approximately 296 acres along primary Forest roads. The trees may be removed and utilized as a wood product or used for fish logs or left on site depending on site-specific circumstances.

1.3.8 Transportation System Management

1.3.8.1 Purpose and Need

A primary purpose of road management is to provide access to the other proposed projects, and to reduce resource risks and maintenance costs while providing appropriate and safe access to the Forest. *The desired condition is to have a landscape accessed by an appropriate network of roads that provide for management access and visitor safety while minimizing risk to aquatic resources. These desired conditions are described in the Forest Plan on pages Four-3, Four-5 & Four-34 and the Northwest Forest Plan on page C-32.* The accomplishment of this is measured by miles of roads treated. For more information, see sections 2.2.8, 2.4 & 3.11.

A mix of road treatments is considered, including culvert replacement to enhance fish passage, temporary road construction, road repair, maintenance, stormproofing, closure and decommissioning.

The photographs below show examples of road decommissioning.

The photographs below show examples of existing old road alignments. The photo at left below shows an old alignment that was built as a temporary road that is blocked with boulders and logs. Some other old road alignments have no closure. The photo below right shows an example of a road closed with a berm that has vegetation including small trees growing in the road surface. Roads like these that access harvest units have been examined for reuse.

1.3.8.2 Background

In order to better manage the Forest's transportation system, the Forest has embarked on several planning processes that address travel and access management. The Forest-wide

Roads Analysis (2003) examined the transportation system and the risk it poses to aquatic habitat. The Roads Analysis, which addressed both the access benefits and ecological impacts of roads, highlighted the fact that Forest Service budgets have not kept pace with what it costs to maintain all roads so they are functioning properly. If the Forest is not able to adequately keep up with road maintenance needs, then the Forest's backlog of

roads needing maintenance could impact hydrologic function. In response, the Roads Analysis recommends decommissioning road segments having high environmental risk factors coupled with low access needs. It also recommended keeping roads on the Forest's system, but closing and stormproofing them where they present lower risk and higher levels of future need.

In 2015, the Forest completed a Travel Analysis Report (TAR), which was a synthesis of previous efforts and set the stage for project-level decisions about whether to retain roads, close or decommission them, and what level of maintenance they should receive. This project-level analysis takes the general information in the TAR and looks at the local roads with proposals that may differ from what was listed in the TAR based on better site-specific information and field reconnaissance. For example, some roads were identified as 'not likely needed' that were found to be needed at least in the near future, and other roads that were thought to be needed are not actually needed even for long-term management and are being proposed for decommissioning.

The Forest has been making periodic decisions to decommission roads or change their maintenance status since the 1990s. Previous project-level planning efforts that overlap the Hunter project area include: *Collawash and Upper Clackamas Restoration EA* (1996), *2007 Clackamas Restoration Projects EA* (2007), *Clackamas Road Decommissioning for Habitat Restoration EA* (2009) (sometimes referred to as Increment 1), and *Clackamas Road Decommissioning for Habitat Restoration, Increment 2* (2011). These projects resulted in decisions to close or decommission roads on the Forest's transportation system.

The Forest Transportation System within the Hunter Project Area

Forest Road Status	Approximate Miles
National Forest System Roads Prior to the 1990s Road Decommissioning Efforts	489
Current National Forest System Roads	300
Decommissioned National Forest System Roads (no longer part of the Forest's Transportation system)	189
National Forest System Roads Authorized to be Decommissioned (not yet completed)	16
National Forest System Roads Currently Closed	55

1.3.9 Aquatic/Riparian Habitat Management

1.3.9.1 Purpose and Need

The primary purpose of these projects is to restore and enhance streams and aquatic resources. *The desired condition is to have streams with complex structure, unimpeded species mobility, and functional riparian habitat as described in the Northwest Forest Plan on page B-9 and Forest Plan on pages Four-17.* The accomplishment of this is measured by stream miles enhanced. For more information, see section 2.2.1.1.

The Forest has accomplished numerous aquatic and riparian habitat management projects in the recent past, including replacing undersized culverts and culverts that do not allow full passage by fish and other aquatic organisms, constructing side channels,

introducing large woody debris in streams to enhance habitat, restoring areas affected by unauthorized off-highway vehicle (OHV) use, decommissioning roads, and planting in riparian areas. While much has been done, there are additional opportunities within the Hunter project area to improve aquatic and riparian habitat. There is a need to accomplish restoration activities to improve water quality and habitat for fish and other organisms. This is particularly important because some of the area's streams provide habitat for threatened fish species.

The proposed action would replace three culverts that impede fish passage, place woody debris in two streams, and rehabilitate dispersed camping areas that impact riparian vegetation.

1.3.9.2 Aquatic Habitat Enhancement - Culverts

Culverts that are not the correct size can serve as a barrier to fish passage, effectively shrinking the amount of habitat available for fish as well as other aquatic species. Improperly functioning culverts can also lead to erosion and sedimentation into streams. There are culverts within the planning area that are known to be too small to accommodate flood flows and to allow for adequate fish passage. Some culverts have already been addressed in section 1.3.8 above. The Pot Creek culvert on Road 4600 and the Lowe Creek culvert on Road 4672, and culverts on road 4691120 would be replaced with culverts that would accommodate higher flows and allow for passage of aquatic organisms.

There is another culvert on Lowe Creek at Road 4671. This is a very large open-arch culvert that is being undermined by the creek. There are signs of erosion immediately upstream of the culvert. The proposed action is to stabilize this stream crossing through reinforcement of the culvert to prevent additional damage and erosion.

1.3.9.3 Stream Habitat Enhancement - Large Woody Debris

Large woody debris within streams enhances the habitat available for fish and other aquatic species. The Hunter project area contains stream reaches that lack a desirable amount of woody debris. There are areas along Lowe Creek and Pot Creek that were clearcut and burned in the past. There has been no recruitment of large trees into these streams in these particular locations since those vegetation management activities occurred.

The proposed action includes felling trees into these creeks or bring logs in from off-site and place them in the creek. This would occur in the area where a proposed thinning unit (Unit 48a) borders Lowe Creek and along an eighth of a mile stretch of Pot Creek just downstream of the Forest Service Road 4660 creek crossing. In these areas, 20 to 30 trees would be introduced into the creeks at each site.

1.3.9.4 Riparian Habitat Enhancement - Dispersed Camping Areas

Dispersed camping is a popular recreation activity that involves camping outside of developed campgrounds. Many dispersed campers prefer to camp both close to their vehicles and close to water sources such as streams or lakes. When enough dispersed use occurs at a particular location, unauthorized user-created access routes are created. These access routes can compact soils, produce erosion, and damage vegetation. This is particularly undesirable in riparian areas close to rivers, streams and lakes.

The proposed action includes enhancing riparian habitat by restoring areas damaged because of heavy dispersed camping use. An example is a heavily used dispersed camping site near Pot Creek and Road 4600042. This camping area is currently about 4 acres in size. The proposed action is to rehabilitate about a third of this area nearest the stream and discourage use in the rehabilitated area. Specific activities include decompacting soils; strategically placing boulders, logs, or root wads to discourage access; and planting native vegetation. Similar restoration would occur at sites shown on the maps in Appendix A and listed at s. 2.2.9P.

Section 2.2.9O addresses an adaptive management strategy. Since these sites change over time from continued unauthorized use, the strategy is to adapt these proposed restorations as needed to meet the objectives of containing dispersed recreation to appropriate areas and minimize degradation to riparian areas.

1.4 Other Management Direction

1.4.1 Forest Plan goals, standards and guidelines

The land allocations in the project area are displayed in section 1.2.1. Not all of the land allocations have actions proposed in them; section 2.2 discusses the land allocations that are relevant to each action.

The Forest Plan as amended contains management goals and desired future condition statements that direct how the Forest is to be managed (p. Four-1 to Four-44). It also contains standards and guidelines that were designed to guide projects to meet management goals and move the landscape toward the desired future condition.

Each resource heading in section 3 contains a discussion of management goals and standards and guidelines applicable to that resource. The Forest Plan describes the process for documenting exceptions to "Should" standards and guidelines (p. Four-45). The Forest Plan does not require a Forest Plan amendment for project level exceptions to these standards and guidelines. Where exceptions are appropriate to achieve Forest goals, the interdisciplinary project planning environmental analysis documents the rationale.

1.4.2 LSR Assessment

The North Willamette LSR Assessment (USDA USDI 1998) covers the project area. This assessment recommends thinning plantations (p. 6-17). The assessment specifically

recommended actions to accelerate late-seral structure similar to the current proposed action including the following.

- Thinning to produce large trees, or to release advanced regeneration of conifers, hardwoods or other plants
- Killing trees to make snags and coarse woody debris
- Developing multiple canopy layers, canopy gaps, and the development of patchy understory

1.4.3 Watershed Analysis

The project is covered by the Upper Clackamas Watershed Analysis (1995). It is incorporated by reference and summarized below. The analysis contains in-depth discussions with maps, of the setting, the ecological processes, the resource conditions and the history of management.

The watershed analysis recommended implementation of various objectives for increasing the connectivity of late-seral habitats, increasing the amount of interior forest habitat, increasing the patch size of early-seral openings (to more closely resemble the natural disturbance regime), and it provides for prioritization of the quantities, methods and distribution of timber harvest to achieve landscape objectives and timber harvest goals. It also made recommendations for road management.

Since those recommendations were made, many changes have occurred that have been considered to determine whether recommendations made over 20 years ago are still relevant today.

- There is much less early-seral habitat and more mid-seral habitat.
- The predicted and recommended quantities of regeneration harvest in mature forest were not achieved and there are few large patches of early-seral openings.
- The large and small openings recommended for mature forests were not achieved.
- Forage, particularly for deer and elk was plentiful then, but is now in short supply because plantations have grown up and shaded out forage.
- The level of timber harvest since then is approximately ½ the projected level.
- There is a northern spotted owl recovery plan (USDI 2011) and critical habitat designation (USDI 2012).
- Two small areas were added to the Wilderness system.
- Many lodgepole pine stands that were alive at the time have since died due to a mountain pine beetle infestation.
- Many system roads have been decommissioned or closed.

Because regeneration harvest in mature stands has not occurred in recent years, the recommendations for connectivity and continuous forest cover are less relevant today than they might have been if all of the recommendations were pursued fully.

This project has adopted the concepts for Riparian Reserve delineation described in the watershed analysis. The site-potential tree height for this project is 180 feet. Also

included in Riparian Reserves are certain unstable geological features. While streams, rivers, ponds, wetlands and certain unstable geological features were shown on maps in the watershed analyses, they were conceptual based on data available at the time with limited field verification. For this project, maps were refined based on field inspections. For example, some streams shown on the watershed analysis maps are not present while other unmapped streams were discovered. There is also newer information about fish presence. The project areas have been examined by a geologist to determine the presence or absence of unstable landforms. All of this field-verified information was used to create a more accurate Riparian Reserve map. This new map is not considered a change to the recommendations put forward in the watershed analysis or the Northwest Forest Plan but simply a more accurate refinement of the intent of those documents.

1.4.4 Northern Spotted Owl Recovery Plan

The Revised Recovery plan (June 2011) indicates that the most important range-wide threats to the spotted owl are competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, habitat loss or degradation from stand-replacing wildfire and other disturbances, and the reduction in quantity and alteration of distribution of spotted owl habitat as a result of past activities and disturbances (USDI 2011). The Revised Recovery Plan presents 33 actions that address overall recovery through maintenance and restoration of spotted owl habitat. Recovery Action #6 is particularly relevant to this project: "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that would benefit spotted owl recovery."

Critical Habitat for northern spotted owls was delineated in 2012 to define the areas managed for spotted owl habitat (USDI 2012).

1.4.5 Stewardship Authority

The Forest acting alone cannot achieve the proposed actions designed to meet the goals of increasing health and diversity of stands or the other actions identified. The proposal is to offer the rights to remove and utilize the timber to qualified contractors in exchange for accomplishing the variable-density thinning and other important work of the proposed action. This project is large enough to be broken into three or more contracts, and the Forest typically uses a mix of traditional Timber Sale Contracts and Stewardship Contracts. The type of contract used is outside the scope of this analysis and would be determined later depending on site-specific circumstances. Since stewardship contracting is new to some, the following is a brief overview comparing the contract types.

Legislation permanently authorizing stewardship contracting was included in the 2014 Farm Bill. It allows the Forest Service to enter into contracts to meet land-management objectives to reduce wildland fire risk and improve forest health. Stewardship contracts focus on producing desired results on the ground that improve forest health, restore resources and provide benefits to local communities. Among other things, the stewardship contracting authority allows the value of forest products to be exchanged for

ecological restoration services. Some key factors to qualify for stewardship contracting are that the logging component has some restorative elements and that a collaborative public participation process occurs. These things are not required for traditional timber sale contracting and a timber sale contractor cannot be required to do projects unrelated to the timber removal.

Traditional Timber Sale contracts are still an important tool and are used where appropriate. These contracts typically return monetary value to federal and local governments, and allow the Forest to retain funds for post-contract work. In traditional timber sale contracting, the contract is awarded to the high bidder; whereas stewardship contracts are awarded on a best value basis. The award of a stewardship contact is based on a proposal that addresses five factors, including how they would utilize the local work force to accomplish the work. Stewardship contracts also can include required stewardship projects to achieve a wide range of restoration objectives. Recent stewardship projects have included fire hazard reduction, huckleberry enhancement, road repairs, road decommissioning, snag creation, precommercial thinning, culvert upgrades, riparian planting, stream restoration, and restoration of unauthorized off-highway vehicle damage. Stewardship contracting authority also allows for any cash value that remains after funding the required stewardship projects to be retained and pooled with the receipts retained from other stewardship contracts. This pool of money is used to pay for restoration projects, even ones that are off-Forest. Some large projects require the pooled funding from several stewardship contracts.

The stewardship authority has a key collaborative element; local collaborative groups help the agency evaluate restoration proposals. For this project, the Clackamas Stewardship Partners (CSP) has been involved. The Clackamas Stewardship Partners is a collaborative group that describes itself as "a group of diverse stakeholders dedicated to restoring ecological function of the Clackamas River Basin while benefiting local economies." CSP meetings are open to the public. The CSP has a wide range of diverse participation such as environmental groups, the Clackamas River Basin Council, local water providers, Clackamas County, Oregon Department of Fish and Wildlife, local sawmills, and hunting groups. The Forest has been collaborating with this group since 2004. The CSP has been involved with this project since its inception and participated in field trips. The CSP has collaborated on several million dollars of stewardship projects that have been generated through stewardship contracting in the Clackamas basin. Recent stewardship contracts have provided retained receipts funding that was pooled and used as matching dollars to leverage more funding for larger projects. For example, culverts that were blocking fish passage where Porter Road crosses Delph Creek were replaced by a bridge. This off-Forest project was facilitated by CSP with $90,000 of retained receipts from Stewardship Contracts that leveraged the $355,000 of the total cost for the project (CSP 2012).

1.5 Decision Framework

The deciding official reviews this document in order to make the following decisions and determinations:

- What the optimal method of accomplishing the purpose and need (s. 1.3) for this project should be;
- Whether or not Forest Plan exceptions are appropriate for standards and guidelines;
- Whether the selected alternative should be modified in any way;
- What design criteria or best management practices should occur;
- Whether this action is in compliance with the Forest Plan as amended and Forest Service policies and procedures.

1.6 Public Involvement

A scoping process to request public input for this project was conducted. A letter describing the proposed project and requesting comments was sent out on March 18, 2016. The Forest publishes a schedule of proposed actions (SOPA) quarterly. The project appeared in numerous issues since 2014. Public field trips were conducted on August 12, 2014, June 9, 2015 and August 11, 2015 to visit the project area and discuss the purpose and need and resource concerns. The legal notice for the 30-day comment period for this project was published in The Oregonian on April 5, 2017.

Forest Service Handbook 1909.15, Chapter 10, provides a process for making incremental changes to alternatives. Ongoing collaboration can result in modification of a proposed action, resulting in a better proposal and ultimately a better decision. Since the time of project scoping, several changes have been made to the Hunter proposed action some of which were triggered by ongoing collaboration and public comments received and others triggered by ongoing interdisciplinary discussion and analysis. Because the changes result in relatively minor differences in resource benefits and impacts, the proposed action has been modified instead of creating a new action alternative. Most of the changes relate to proposals for individual roads and the size of one unit. These are addressed in the Response to Comments section of Appendix B.

This project is subject to objection regulations. Section 428 of The Consolidated Appropriations Act of 2012 included a provision establishing a pre-decisional objection process (36 CFR 218) for projects and activities implementing land management plans. Since this project is not a fuels-reduction project, it is subject to the Project-Level Pre-Decisional Administrative Review Process (Objection Process) as identified in 36 CFR 218, Subparts A and B.

Those who are eligible will be able to seek a review before the project decision has been signed under 36 CFR 218 (Objection Process). The Forest Service believes that considering public concerns before a decision is made aligns with our collaborative approach to public land management and increases the likelihood of resolving those concerns resulting in better, more informed decisions. The Forest Service also believes this will aid in our efforts to be more efficient with documenting environmental effects.

Individuals and entities (non-governmental organizations, businesses, partnerships, state and local governments, Alaska Native Corporations, and Indian Tribes) who submit timely, specific written comments regarding a proposed project or activity during any designated opportunity for public comment may file an objection.

Opportunity for public comment on this project includes scoping, a 30-day comment period and a 45-day public review period. Written comments are those submitted to the Responsible Official or designee during a designated opportunity for public participation provided for a proposed project. Specific written comments should be within the scope of the Proposed Action, have a direct relationship to the Proposed Action, and must include supporting reasons for the responsible official to consider.

1.6.1 Results of Public Involvement

Many comments were received through scoping, field trips, meetings with collaborators and the 30-day comment period. Responses to these can be found in Appendix B. The following highlights some of the concerns raised by the public.

1.6.1.1 Unroaded Areas

Public comments raised concerns about unroaded and undeveloped areas. The comment contained a map of several areas of concern. They stated that the project area includes some ecologically significant unroaded areas. They stated that areas as small as 1,000 acres should have the same protections as areas larger than 5,000 acres to maximize the amount of landscape not contributing sedimentation to watersheds. They stated that to protect forest stands, no new roadbuilding should occur to avoid changes in access, forest structure, habitat and character.

Project activities are not proposed in inventoried roadless areas. The impacts to unroaded and undeveloped values are addressed in s. 3.10. The deletion of unroaded and undeveloped areas would eliminate 154 acres of thinning and mistletoe treatment. The No-Action Alternative addresses this concern.

The analysis also shows that many of the resource issues normally associated with unroaded and undeveloped areas, such as intact old-growth stands, clean water, and key areas of wildlife refugia are not particularly relevant in the proposed treatment areas. The area was burned approximately 100 years ago and has grown up with very dense trees that are relatively small (the average tree diameter is 8 inches). The proposed treatment areas are relatively dry and have no streams; the analysis shows that sediment is not a concern in these areas. The interdisciplinary team did not find resources that had ecological significance.

The environmental impact of building and rehabilitating temporary roads and of thinning and treating mistletoe areas has been fully analyzed and disclosed in Chapter 3; the effects were found to be minimal. Section 2.2.8 discusses the details for these roads and sections 3.3 and 3.4 discuss the impacts to aquatic resources. The analysis found the impacts to be sufficiently mitigated by project design criteria (s. 2.2.9). Forest Plan standards and guidelines would be met (s. 3.3.5) and the project would be consistent with the Aquatic Conservation Strategy (s. 3.4.8.1).

Even though some commenters stated that only ecological process should occur in unroaded and undeveloped areas, the analysis shows that the proposal is a prudent action to achieve Forest Plan goals and the goals of the northern spotted owl recovery plan.

These comments were considered and a detailed analysis and disclosure of impacts to unroaded and undeveloped areas was included in s. 3.10. The impacts and benefits of avoiding unroaded and undeveloped areas are documented in the No-Action Alternative and are discussed further in section 2.3.1.3, Other Alternatives Considered.

1.6.1.2 Fire-Origin Stands

Public comments raised concerns about treatments in fire-origin stands, sometimes these were referred to as native stands or natural stands. They stated that stands have all the building blocks necessary for development into desired conditions. They stated that tree species, size and age vary and legacy trees and snags are common. They stated that the stands are already complex and are transitioning towards natural self-thinning. Other commenters offered support for treatment in fire-origin stands.

Only a few of the fire-origin stands have legacy trees; the other areas burned so hot that no trees survived. The fire-origin stands have trees that seeded in very densely and while they are about 90 to 100 years of age, they are small in diameter compared to the growth that the site is capable of with less density. The fire-origin stands are not in land allocations that emphasize natural process of self-thinning. The desired condition in the Matrix is to have stands that are relatively healthy with growth rates commensurate with site capability. The desired condition for spotted owl critical habitat is to have stands that contribute to dispersal and suitable habitat. The owl recovery plan recommends active management in critical habitat to improve conditions for the long term (USDI 2011 at III-19).

Even though some commenters stated that only ecological process should occur in fire-origin stands, the analysis shows that the proposal is a prudent action to achieve Forest Plan goals and the goals of the northern spotted owl recovery plan. These comments were considered during the development of the proposed action because they highlight the public concern about the effects of management actions in fire-origin stands. Many fire-origin stands were deleted from consideration because they had sufficient legacy trees to be considered suitable northern spotted owl habitat. The impacts and benefits of avoiding fire-origin stands are documented in the No-Action Alternative and are discussed further in section 2.3.1.5, Other Alternatives Considered.

1.6.1.3 Forage Creation Through Regeneration Harvest

Comments received from several public sources raised a concern about the proposal to use the **regeneration harvest method.** (Unit 102). Some objected to the unit size. The proposed action has been modified to change the size of Unit 102 from 98 acres to 60 acres; while this may satisfy some, others have suggested no regeneration harvest. Commenters state that there is sufficient forage in other areas and that it would be more appropriate to address the forage resource by reintroducing more fire back into the landscape. Others described the proposal as the "clearcut of the century." A photo was included of old-growth trees. They urged deleting such controversial logging projects. Some say that they have worked over the years to leverage public support in ending the "destructive practice of clearcutting" and interpret this proposed action as a relapse to the

type of traditional forestry that has led to the majority of human-caused, long-term impacts on the Forest today. Other commenters offered support for the actions that create or enhance forage.

In recent years, early-seral habitats have declined across the planning area. Deer and elk are management indicator species that require a mix of habitat types including early-seral habitats that provide forage. The Forest Plan as amended provides direction for the enhancement of forage to provide for deer and elk. The regeneration harvest (Unit 102) is located in the B11-Deer and Elk Summer Range land allocation that has an emphasis on providing appropriate habitats. Ten to 15 percent of this land allocation is supposed to be forage in plantations 0 to 15 years of age (Forest Plan page Four-278). At this time, the only forage with these ages is in a power line corridor, which amounts to 2% of the land allocation.

At the time of the Forest Plan, it was presumed that most of the forage would come from regeneration harvests in mature stands. Changes in forest management direction and practices over time have resulted in practices that favor the development of late-successional features over large areas of the forest. In the Hunter project area, for instance, nearly 55,000 acres are designated critical habitat for spotted owl. Additional areas are managed for wilderness characteristics, riparian values, and habitat for species dependent on late-successional forest. These changes make it prudent to consider the forage needs of deer and elk in other areas such as unit 102. See section 1.3.5.1.

While some commenters believe that Unit 102 involves clearcutting old growth, it is actually a plantation that was created between 1963 and 1970. The term regeneration harvest is used because 15% of the stand would be retained; 10.5% in skips and 4.5% as scattered individual trees. The average tree size in this unit is 12.6 inches diameter.

Commenters have some valid reasons to be concerned about clearcutting old growth. That practice has fragmented mature forests and impacted some species that depend on contiguous stands of mature forest including the northern spotted owl which is now a threatened species. The District has recognized these situations and the controversy surrounding them and has chosen a vegetation management path that focusses on younger stands for forage creation. A regeneration harvest in a plantation is not similar to past practices, but is a carefully chosen location and prescription to address the landscape-wide concern of declining forage and early-seral habitats without impacting old-growth stands.

The proposed action does involve the use of prescribed fire, but the areas where this is appropriate is very limited and none were located in the B11 land allocation.

Even though some commenters stated opposition to regeneration harvest, the analysis shows that the proposal is a prudent action to achieve Forest Plan goals for forage. These comments were considered, and the impacts and benefits of avoiding regeneration harvest are documented in the No-Action Alternative and are discussed further in section 2.3.1.6, Other Alternatives Considered.

1.6.1.4 Roads

Comments received from several public sources raised a concern about the reopening of closed system roads and reusing old road alignments and the construction of new temporary roads. They stated that ground disturbance associated with this work particularly where it is in close proximity to streams could affect aquatic resources. Other commenters offered support for temporary road construction and reconstruction of existing road alignments.

In order to avoid any potentially undesirable impacts to aquatic resources, new temporary roads are strategically located on gentle slopes and would not cross any streams. The proposed action would rehabilitate the temporary road alignments after project completion. Road work included in the proposed action includes only those road segments that do not pose an adverse impact on aquatic resources and are needed to efficiently achieve the vegetation, health and diversity objectives discussed in section 1.3.

The environmental impact of road use has been fully analyzed and disclosed in Chapter 3; the effects were found to be minimal. Section 2.2.8 discusses the details for these roads and sections 3.3 and 3.4 discuss the impacts to aquatic resources. The analysis found the impacts to be sufficiently mitigated by project design criteria (s. 2.2.9). Forest Plan standards and guidelines would be met (s. 3.3.5) and the project would be consistent with the Aquatic Conservation Strategy (s. 3.4.8.1).

Even though some commenters voiced concerns about roads, the analysis shows that the proposal is a prudent action to achieve Forest Plan goals. These comments were considered during the development of the proposed action because they highlight the public concern about the effects of roads on the environment. For example, road closures, decommissioning and stormproofing were included in the project; roads that access units were carefully examined for potential to repair problem areas; new temporary roads were carefully located; and the reconstruction of old road alignments was only proposed where minimal impact would occur and where post use rehabilitation would be effective. Some roads that could have potentially been reopened such as 4600290, were not proposed for reopening and the units there would be logged with helicopters. The area has relatively gentle slopes, and because the roads would be rehabilitated after use, the risk of substantial sedimentation of streams is very low. While the roads would be rehabilitated, the impacts would not immediately cease but would gradually dissipate as vegetation becomes established. These comments were considered, and the impacts and benefits of avoiding road construction or reconstruction are documented in the No-Action Alternative.

1.6.2 Issues and Alternatives

Many concerns were raised by the public and some of them were considered to refine the proposed action, including project design criteria. Some resulted in added clarification or increased analysis presented in Chapter 3. Some were considered in detail but did not change the proposed action or result in the development of other action alternatives. Alternatives considered but not fully developed are discussed at section 2.3.

The term 'issue' is used to describe substantial comments that generate new action alternatives. They can serve to highlight effects or unintended consequences that may occur from the proposed action, giving opportunities during the analysis to compare trade-offs for the Responsible Official and public to understand the differences between the proposed action and newly developed alternatives. Issues are statements of cause and effect, linking environmental effects to actions. While the comments and concerns that were received generated several alternatives that were considered at section 2.3, none of them are considered issues and no new alternatives were fully developed for analysis in Chapter 3.

2.0 Alternatives

This chapter describes and compares the alternatives considered for this project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

2.1 Alternative A - No Action

Under the no-action alternative, current management plans would continue to guide management of the area. No timber harvest or other associated actions would be implemented to accomplish project goals. Dense stands would continue to remain uniformly dense and the overstocked condition would result in stands with reduced vigor, small trees, increased mortality, and increased susceptibility to stressors such as insects, diseases and weather. Additionally, no forest products would be provided. In terms of roads, the No-action Alternative would not repair, close, stormproof or decommission any roads or replace culverts to provide passage for fish and other organisms. It would not improve the diversity of stands, enhance the safety around power lines and roads, or provide additional forage for deer and elk. Habitat for northern spotted owls would not be enhanced in the species' critical habitat.

2.2 Alternative B - Proposed Action

The Clackamas River Ranger District proposes a suite of integrated project types that work together to meet the desired conditions and goals of the Forest Plan as amended. Section 1.3 discusses the purpose and need and desired conditions that lead to these proposals, along with some introductory discussion.

2.2.1 Thinning

Approximately 1,880 acres of plantations and 260 acres of fire-originated stands would be thinned to address the purpose and need to improve forest health and diversity in densely stocked stands. Thinning is a timber harvest technique that involves removing the smaller trees in a stand while retaining the larger ones. While thinning is appropriate to provide for the health and growth of stands, the density of leave trees and the variability introduced during thinning can enhance other stand elements such as

diversity. A thinning technique called variable-density thinning is proposed to enhance diversity in these stands. The following are some of the features available through this technique to achieve desired conditions:

- Leave-tree spacing would vary within units and between units.
- Skips (areas where no trees are removed) and gaps (areas where most or all trees are removed) would be created in a variety of sizes. The sizes and total quantity would vary within and between units.
- Skips may be placed where there are special features such as clumps of minor species, large snags, wet areas, or locations of rare species.
- Leave trees may include minor species as well as trees with the elements of wood decay.

Variable-density thinning is considered an appropriate tool to accelerate the development of late-successional habitat for northern spotted owls and many other species.

This thinning activity is proposed on a variety of land allocations, including 400 acres in Late-Successional and Riparian Reserves and 1,720 acres within the Matrix. Within the Matrix, the affected land allocations include C1-Timber Emphasis, B2-Scenic Viewsheds, and B-8 Earthflow. In addition, some of these activities are proposed within designated critical habitat for northern spotted owl. These land allocations and designations have different objectives, but all would benefit from variable-density thinning with skips and gaps. Silvicultural prescriptions prepared for the affected stands would consider the special requirements of and desired conditions for each of the land allocations and designations.

Portions of the project area are relatively dry with units that contain no streams. In other areas, it is estimated that approximately ¾ of the gross acreage of stands would actually be thinned after accounting for stream-protection buffers and other leave areas.

2.2.1.1 Riparian Reserves

Protection buffers are a subset of Riparian Reserves and are areas adjacent to streams where thinning would not occur. These areas vary in width depending on site-specific factors to provide some woody debris recruitment to streams and shade. Protection buffer widths are discussed in section 2.2.9.A1. Outside the protection buffers, thinning would occur in the upland portions of Riparian Reserves. For this project, Riparian Reserve widths are 180 feet for non-fish-bearing streams and 360 feet for fish-bearing streams. In Riparian Reserves, the thinning outside the protection buffers would be designed to create conditions suitable for tree growth and to enhance diversity while providing sufficient quantities of large wood for future recruitment. The intention is to enhance Riparian Reserves by accelerating the development of mature and late-successional stand conditions.

Riparian Skips - Skips would be created outside of protection buffers that would vary in size and would be up to 5% of each unit. Gaps would not occur within Riparian Reserves.

There are some small seeps and wet areas. Riparian features that are not perennial or intermittent streams such as seeps, springs, ponds or wetlands would be protected by the establishment of protection buffers that incorporate the riparian vegetation.

2.2.1.2 Late-Successional Reserves

Thinning in LSRs would be designed to accelerate the development of mature and late-successional stand conditions and to enhance diversity. Where Riparian Reserves overlap Late-Successional Reserves, the protection buffers, and skips as described for Riparian Reserves would be used. Trees would be retained so that the average canopy cover including Riparian protection buffers, skips and gaps equals at least 40% canopy cover. In Late-Successional Reserves, trees would not be cut if they are greater than 20 inches in diameter (at a height of 4.5 feet) unless they need to be cut for skyline corridors, skid trails, landings or temporary roads, in which case they would be left on the ground. (The LSR units contain few trees of this size.)

LSR Skips & Gaps - Skips would vary in size and comprise a minimum of 10% of each unit. Where Riparian Reserves overlap Late-Successional Reserves, the protection buffers adjacent to streams may be counted as skips. Gaps would be created on 3 to 10% of each unit. Gaps would be up to 1/4 acre in size.

2.2.1.3 Matrix

In the matrix, thinning would be designed to increase health and growth that results in larger wind-firm trees and to enhance diversity and forage.

Skips would vary in size and comprise up to 5% of each unit. Where Riparian Reserves cross through matrix, the protection buffers adjacent to streams may be counted as skips. **Gaps** would be created on up to 5% of each unit to help create variability and diversity while meeting stand-level objectives. Gaps would be up to 3 acres in size. **Heavy thins** with about 40 trees per acre would be created on up to 10% of the matrix component of each unit. **Brushing** would occur in parts of some of the proposed thinning stands with areas of sparse stocking, where thinning is not viable but silvicultural treatments are proposed to release trees so they can grow to their full potential. Brush and small trees would be cut in parts of units where they are competing with conifers.

2.2.2 Lodgepole Pine Plantations

To address the need to re-establish conifer species in off-site lodgepole pine plantations, a shelterwood prescription would be used which would remove some lodgepole pine trees and retain others to provide sufficient shelter for seedlings and to ameliorate harsh site conditions. The area would be planted with non-lodgepole conifers to reestablish a mix of species more appropriate for the site. Approximately 116 acres would be treated

all within the Matrix land allocation, which is further subdivided into C1-Timber Emphasis and B11-Deer and Elk Summer Range land allocations. The action also occurs in designated critical habitat for the northern spotted owl. This activity is appropriate in these land allocations and in northern spotted owl critical habitat to move the stands toward late-successional conditions.

Other treatments in these units include decompacting primary skid trails.

2.2.3 Mistletoe Management

Approximately 81 acres of stands infected with dwarf mistletoe would be treated using a masticating machine to remove brush and small hemlock trees. Afterward, the stands would be planted with a mix of conifer species not susceptible to the parasite such as Douglas-fir, noble fir and western white pine. The larger hemlock trees would be retained to provide future snags. These stands are in the Matrix land allocation, which is further subdivided into C1-Timber Emphasis and B2-Scenic Viewsheds. They are also located in northern spotted owl critical habitat. These stands are not likely to meet the goals of the land allocations or critical habitat without intervention.

2.2.4 Blister Rust Management

Approximately 250 acres of plantations with western white pine would be pruned to enhance their resiliency and to encourage young trees to survive to maturity. Pruning the lower branches of young western white pine trees greatly decreases the risk of white pine blister rust infection. A prescription developed by a disease specialist would be used to prioritize which stands and which trees are prudent to treat. Some trees are not likely to benefit from pruning based site-specific factors such as the size of tree and the location of cankers on the branch. This treatment occurs on a wide range of appropriate land allocations.

2.2.5 Deer and Elk Habitat Enhancement

A variety of actions are proposed to enhance forage.

2.2.5.1 Regeneration Harvest

A regeneration harvest is proposed for a 60-acre unit in the Matrix within the B11-Deer and Elk Summer Range land allocation (Unit 102). This would result in a created opening of 60 acres in a plantation. The unit contains palatable brush species that are being shaded out by conifers. Within this unit, approximately 15% of the trees would be retained in skips and as scattered individual trees. Some areas would be seeded with appropriate forage species, and some large shrubs would be cut to encourage resprouting. Primary skid trails, landings and temporary roads would be decompacted and seeded to provide additional forage. In addition, this area has limited water resources. Installation of a wildlife guzzler is proposed to provide a dependable water source for wildlife. Slash would be piled and burned (s. 2.2.7.6). Reforestation would be accomplished by natural

seeding in of conifers from the leave trees. The photo at right shows what the trees look like in Unit 102.

2.2.5.2 Enhancement of Existing Forage

Forage maintenance and enhancement is proposed for approximately 115 acres within the project area. The forage areas identified are small and widely scattered. They occur on many land allocations including C1-Timber Emphasis, B2-Scenic Viewsheds, A1-Wild and Scenic River, A9-Key Site Riparian Area, Riparian Reserves and Late-Successional Reserves. These areas are relatively open and have grass and shrubs that are valuable to deer and elk. The proposed action is to maintain and enhance forage in these areas by actions that are site-specifically tailored to the needs of each site including invasive plant control, prescribed fire, seeding with appropriate native forage species, and shrub pruning/cutting to encourage resprouting and removal of encroaching conifers.

2.2.5.3 Meadow Burn

A prescribed burn is proposed on approximately 11 acres to enhance forage at Rhododendron Meadow. This area is in the A9-Key Site Riparian Area land allocation. Prescribed burning to maintain open meadows is consistent with the management direction for this land allocation (Forest Plan, Four-183, A9-026).

2.2.6 Utility Corridor Management

The proposed action is to remove the trees on approximately 66 acres that are either directly underneath or within 50 feet of the currently cleared power line corridor.

Slash would be piled in the 50-foot wide strips but in areas under the line, slash from felled trees would be moved out from under the line and burned elsewhere or used to block roads (s. 2.2.7.6). Grass seed would be spread to enhance the forage potential of these areas that would likely remain relatively open in the future.

2.2.7 Other Connected Actions

2.2.7.1 Danger Tree Management

The proposed action is to remove danger trees on approximately 296 acres along primary Forest roads. The trees may be removed and utilized as a wood product or used for fish logs or left on site depending on site-specific circumstances.

2.2.7.2 Aquatic Habitat Enhancement - Culverts

There are culverts within the planning area that are known to be too small to accommodate flood flows and/or to allow for adequate fish passage. The proposed action is to remove the existing culverts at the Pot Creek culvert on Road 4600 and the Lowe Creek culvert on Road 4672 and replace them with culverts that would accommodate higher flows and allow for fish passage.

There is another culvert on Lowe Creek at Road 4671. This is a very large open-arch culvert that is being undermined by the creek. The proposed action is to stabilize this stream crossing through reinforcement of the culvert to prevent additional damage and erosion.

There are failed culverts on road 4691120 that need to be replaced with properly sized culverts.

2.2.7.3 Stream Habitat Enhancement - Large Woody Debris

The proposed action includes felling trees into Lowe Creek and Pot Creek or bring logs in from off-site and place them in the creek. This would occur in the area where a proposed thinning unit (Unit 48a) borders Lowe Creek and along an eighth of a mile stretch of Pot Creek just downstream of the Forest Service Road 4660 creek crossing. In these areas, 20 to 30 trees would be introduced into the creeks at each site.

2.2.7.4 Riparian Habitat Enhancement - Dispersed Camping Areas

The proposed action includes enhancing riparian habitat by restoring areas damaged because of heavy dispersed camping use. One example is at a heavily used dispersed camping site near Pot Creek and Road 4600042. The proposed action is to rehabilitate about a third of this area nearest the stream and discourage use in the rehabilitated area. Specific activities include decompacting soils; strategically placing boulders, logs, or root wads to discourage access; and planting native vegetation. Similar actions would occur at several sites along the Clackamas River. Some of these have been worked on before but determined campers have moved boulders and root wads that were too small.

Section 2.2.9O addresses an adaptive management strategy. Since these sites change over time from continued unauthorized use, the strategy is to adapt these proposed restorations as needed to meet the objectives of containing dispersed recreation to appropriate areas and minimize degradation to riparian areas. The specific actions that are known at this time are elaborated at s. 2.2.9P.

2.2.7.5 Snags & Down Wood

Except in certain root rot patches where snags are abundant, live trees would be treated within harvest units and protection buffers to provide future snags and down wood. Tree topping is generally the technique used to create longer lasting snags and to create live trees with decay. Girdling is the technique used to create snags quickly but they decay, fall over sooner, and become down wood. Some trees are felled to get immediate down

wood. After harvest, and after one or two winters elapse, the units would be examined to determine whether trees died or fell down. In areas where the following target levels are not already met, additional trees would be topped, felled or girdled. In LSRs, there should be three trees per acre with broken tops, five trees per acre should be dead and two trees per acre should be on the ground. Outside LSRs, there should be one tree per acre with a broken top, and two trees per acre should be either dead or down. If trees need to be treated to meet these numbers, they would be treated farther than one tree-height from system roads to minimize safety issues and potential losses from firewood gathering.

2.2.7.6 Fuel Treatments

Slash that ends up at landings would be piled for later burning or removed to use to block roads. Where harvesters are used, slash would be placed in front of equipment and crushed down as the machine moves.

Other fuel treatments are estimated based on initial field visits. It is often difficult to estimate the eventual quantity and distribution of activity fuels; therefore, sometimes adjustments are needed after post-logging inspections. Project design criteria would be used to guide changes to fuel treatments, if any. A fuels report is in the analysis file and is incorporated by reference. It includes initial estimates of the extent and location of treatments by unit.

Fuel Treatment Type	Estimated Acres
Grapple Piling [1]	125
Roadside Piling [2]	105
Yarding Tops [3]	23

[1] Grapple piling would use a tracked excavator or log loader machine to mechanically pile slash for later burning.

[2] Roadside piling along certain main roads would use a tracked excavator or log loader machine to mechanically pile slash for later burning. The machine would stay on the running surface of the designated road and pile activity created slash within 40 feet of the running surface. The intention is to provide a sort of fuel break adjacent to commonly traveled roads.

[3] Yarding tops would keep the tops of cut trees attached to the top log and both would be brought to the landing where the tops would be piled. Some of this material may be removed but what is not removed would be burned.

2.2.7.7 Logging Systems

Logging systems are estimated based on aerial photo interpretation, terrain considerations and field visits. Further detailed analysis is needed in the field particularly for skyline systems to verify that they would work appropriately. Project design criteria are considered standard operating procedure when analyzing the feasibility of the type of logging system. A logging systems report is in the analysis file and is incorporated by reference. It includes initial estimates of the extent and location of certain logging system features such as landings.

Yarding System	Estimated Acres
Ground Based	1,662
Skyline	557
Helicopter	85

Landings

The project includes the use of landings. Landings are areas on or directly adjacent to roads where logs are brought to be loaded onto log trucks. Landing sizes vary based on the logging system and the types of equipment that need to be safely accommodated.

Many units that were logged before have existing landings that would be reused where feasible. Some existing landings have brush or small trees growing on them that would need to be removed. In total, landings would occupy about 21 acres, with most of the disturbance occurring within road prisms or other created openings that remain on the landscape from past timber management activities.

The final landing locations, quantity and sizes are approved by contract administrators using the project design criteria (PDCs). The PDCs include minimum spacing away from streams and post-harvest restoration.

2.2.8 Transportation System Management

2.2.8.1 Road Use and Management in Support of Vegetation Management Proposals

To facilitate the vegetation management activities proposed for the Hunter project area, it is important to ensure that the roads to be used by log trucks are safe. To address this need, the proposed action includes road maintenance and repair activities on 148 miles of Forest Service System Roads. Maintenance and repair include activities such as brushing, blading, deep patch repairs, culvert replacement, ditch cleaning, culvert cleaning and the addition of aggregate rock to road surfaces. A list of system roads needed for vegetation management and their treatment needs is included in section 3.11.

2.2.8.2 Temporary Roads and Existing Road Alignments

There has been some confusion over the use of the term ‘temporary road.’ In previous assessments, roads that were not system roads were referred to as temporary roads even though the road may have been constructed 50 years ago or the road was once a system road but had been decommissioned. The term ‘temporary road’ is contractual terminology and is used to describe non-system roads that are used by operators and have no planned need for public use. In today’s contracts, they are rehabilitated when contract use is completed using one or more of the techniques described below. There is no implication that the effects of these roads are temporary or that they would never be used again for future management. It is likely that road alignments built in appropriate locations on the landscape would someday be used again. In this document, roads that are not part of the Forest System are clearly identified as either new temporary roads or existing road alignments that are being temporarily reused. Maps in Appendix A show the location of these roads.

For this document, the term rehabilitation is used to describe the work that would occur on temporary roads and most existing road alignments after use. Rehabilitation includes a suite of actions that are tailored to site-specific situations and may include placement of one or more berms at the road’s entrance, construction of water bars, and/or placement of

debris such as root wads, slash, logs or boulders where available. Native surfaced roads would be decompacted as needed with the jaws of a log loader or excavator. Roads or sections of roads that have rock surfacing may be decompacted where site-specific circumstances warrant. The technique known as "cratering," which is a standard practice often used for system road decommissioning, may be used to decompact temporary roads or reused existing road alignments. Specific rehabilitation techniques for some roads that are known to have rock surfacing are described at section 2.2.9.P.

While some type of rehabilitation and closure to public access is standard practice today for temporary roads, many of the existing old road alignments were not rehabilitated after clearcutting, which was a common practice at that time (40 or more years ago).

The reuse of existing alignments is consistent with Forest Service policy as described in Forest Service Manual 7703.22. Because past practices for closing temporary roads and past practices for system road decommissioning varied and differ from current practices, the existing alignments used for temporary access are all different and unique (s. 1.3.8). Some of them have small trees or brush growing on them while many do not. Even with vegetation growing on them, these road alignments are considered the best place to temporarily reestablish a road because it results in less total ground disturbance compared to building another road somewhere else to access the stands.

The reuse of existing road alignments and the construction of new temporary roads listed here and shown on maps are estimated based on the judgement of transportation engineers, logging systems specialists and silviculturists. The estimation of the location and extent of roads required to facilitate harvest is based on the best information available at the time of planning. The final alignment of logging systems and the transportation infrastructure needed to facilitate that system may differ somewhat from this list and from locations shown on maps. The final alignments are proposed by contractors based on site-specific conditions, the capability of their equipment, their skills and safety requirements but are only implemented after approval by Contracting Officer. It is within the Contracting Officer's authority to approve or disapprove new temporary roads, use of existing alignments, landing locations and other logging system features on the ground as needed. Final alignments would be consistent with the Project Design Criteria and the provisions of the contract.

2.2.8.3 Temporary Road Construction and Reconstruction of Existing Alignments

Unit or Old Road Number	**Miles**	**Notes*** indicates additional notes below
4	0.09	Existing Alignment
7	0.06	New
18	0.07	New
22	0.13	Existing Alignment
34	0.33	New
38	0.16	Existing Alignment
38	0.08	New

Unit or Old Road Number	Miles	**Notes*** indicates additional notes below
40	0.08	Existing Alignment
60	0.03	Existing Alignment
68	0.14	Existing Alignment
88	0.13	Existing Alignment
94	0.08	Existing Alignment
94	0.08	New
96	0.12	Existing Alignment
98	0.09	Existing Alignment
100	0.21	Existing Alignment
102	0.17	Existing Alignment
108	0.50	New
109	0.11	Existing Alignment
111	0.24	Existing Alignment
111	0.07	Existing Alignment
114	0.15	Existing Alignment
114	0.16	Existing Alignment
115	0.22	New
115	0.02	Existing Alignment
116	0.24	Existing Alignment
126	0.05	Existing Alignment
126	0.07	Existing Alignment
134	0.06	Existing Alignment
162	0.08	Existing Alignment
212	0.10	New
213	0.47	New
214	0.51	New
219	0.04	New
220	0.11	New
4200390	0.17	Existing Alignment, Units 109,110. *
4200391	0.20	Existing Alignment, Units 109,110. Never was actively decommissioned, berm only.
4200399	0.25	Existing Alignment, Units 111,112. Never was actively decommissioned, no berm. Overgrown.
4210046	0.23	Existing Alignment, Unit 106. Road needs special rehabilitation post use to deal with drainage issues.
4220026	0.20	Existing Alignment, Unit 118
4650014	0.07	Existing Alignment, Unit 26
4650015	0.04	Existing Alignment, Unit 26
4650170	0.93	Existing Alignment, Unit 215. *
4651014	0.20	Existing Alignment, Unit 38
4651150	0.25	Existing Alignment, Unit 36
4660015	0.44	Existing Alignment, Unit 94

Unit or Old Road Number	Miles	**Notes*** indicates additional notes below
4660016	0.18	Existing Alignment, Unit 96
4660017	0.38	Existing Alignment, Unit 96. No berm, Never was actively decommissioned.
4660140	0.41	Existing Alignment, Unit 108
4661019	0.29	Existing Alignment, Unit 92
4661020	0.13	Existing Alignment, Unit 92
4661190	0.14	Existing Alignment, Unit 102. Never was actively decommissioned
4661193	0.13	Existing Alignment, Unit 102. Never was actively decommissioned
4661200	0.16	Existing Alignment, Unit 102
4670015	0.28	Existing Alignment, Unit 48. *
4670029	0.19	Existing Alignment, Unit 58
4670130	0.39	Existing Alignment, Unit 44. *
4672016	0.10	Existing Alignment, Unit 224
4672025	0.22	Existing Alignment, Unit 140
4672026	0.24	Existing Alignment, Unit 140
4672140	0.15	Existing Alignment, Unit 54
4680033	0.15	Existing Alignment, Unit 124. Never was actively decommissioned
4680136	0.10	Existing Alignment, Unit 120. Never was actively decommissioned, berm only.
5720013	0.15	Existing Alignment, Unit 62
5720014	0.16	Existing Alignment, Unit 62
5720015	0.33	Existing Alignment, Unit 62
5720019	0.15	Existing Alignment, Unit 64
5731013	0.20	Existing Alignment, Unit 66
5731014	0.17	Existing Alignment, Unit 62
5731118	0.06	Existing Alignment, Unit 70
6310020	0.12	Existing Alignment, Unit 50
6310026	0.50	Existing Alignment, Unit 14. Never was actively decommissioned
6310027	0.14	Existing Alignment, Unit 14. Never was actively decommissioned
6310172	0.04	Existing Alignment, Unit 6

*These roads are old system roads that were decommissioned using the entrance management technique. After use, they would be rehabilitated using an entrance management technique; they would look similar to the way they look now. The entrance management technique involves installing water bars along the used portion of the road with spacing based on gradient and topography, roughing up the first part of the road, and installing large berms at the road entrance.

2.2.8.4 Road Management for Reducing Resource Risks and Maintenance Costs

The Forest has developed a Transportation Analysis Report (TAR) described at section 1.3.8.2. To address opportunities to reduce resource risks and maintenance costs associated with Forest Service System Roads, the proposed action includes changes to roads. The current suite of road options includes closing roads, increasing or decreasing the maintenance level and decommissioning. The District has received comments from both the public and other agencies about the confusing use of the term ‘decommission.’

The term has not been used consistently. Current Forest direction recommends that roads that are needed to meet Forest resource management objectives should be retained and those that are not needed should be decommissioned. There are past decisions for road management that overlap the Hunter planning area, that reflect a different interpretation of needed vs unneeded and roads were decommissioned that are now being considered for reuse. For example, in the 2009 and 2011 Clackamas Road Decommissioning for Habitat Restoration EAs, roads were considered unneeded and eligible for decommissioning if there was no planned commercial harvest proposed within 10 years (see the 2011 EA's Appendix B). This project's proposed action includes project types that were not envisioned at that time. The table at s. 2.2.8.3 lists the old road numbers of the decommissioned roads that are proposed for temporary access.

2.2.8.5 Summary of Proposed Road Changes

Type of Change	Miles
Road Closure	24
Roads to Decommission (data change only)	0.9
Roads to Decommission (active)	0.7

Proposed Changes to Objective Maintenance Level (ML)	Miles
Roads Changed from ML 2 to 3	2.3
Roads Changed from ML 1 to 2	11.7
Roads Changed from ML 2 to 1	4.5
Roads Changed from Decommission to ML 2	0.3

Maintenance Level 1 – roads that remain on the Forest's system of roads in a closed status.

Maintenance Level 2 – roads that remain on the Forest's system of roads and are maintained for high clearance vehicles.

Maintenance Level 3 – roads that remain on the Forest's system of roads and are maintained for passenger cars.

The following table lists proposed actions. Many of these actions implement the recommendations of the TAR. Where the action is a change to the recommendations of the TAR, based on site-specific new information, the table indicates this with the word 'change.' Some of these actions are dependent on funding availability.

2.2.8.6 System Road Actions and Changes

Road Number	**Miles**	**Treatment** (objective maintenance levels would be changed at the time of the Hunter Decision while operational maintenance levels would be changed after actions occur.)
4200389	0.24	Correct database to show already closed
4200520	2.35	Close with Berm
4210041	0.34	Close with Berm, stormproof, seed, mulch
4210350	2.50	Close with gate at south end and berm at north end.
4220	2.3	Change a portion from milepost 6.73 to 9.06 from Maintenance Level 2 to 3. Provides improved access to Olallie Lake Scenic Area.
4230032	0.12	Data decommission, Change from Maintenance Level 1.

Road Number	**Miles**	**Treatment** (objective maintenance levels would be changed at the time of the Hunter Decision while operational maintenance levels would be changed after actions occur.)
4600041	0.26	Active Decommission.
4600045	0.25	Change from Maintenance Level 1 to 2. Disposal site is needed for maintenance of road system.
4600074	0.20	Data decommission, Change from Maintenance Level 1.
4600075	0.35	Data decommission, Change from Maintenance Level 1.
4600324	0.26	Change from Maintenance Level 1 to 2. Inside quarry.
4600326	1.30	Change from Maintenance Level 2 to 1. Close road using entrance management technique keeping road on the system.
4600350	1.43	Change from Maintenance Level 1 to 2. Provides access to Bump Lake.
4600370	0.54	Change from Maintenance Level 1 to 2. Provides access to Bump Lake.
4600380	1.38	Change from Maintenance Level 1 to 2 from milepost 0 to 1.38. Power line access.
4600380	0.46	Active decommission, pull culverts from milepost 1.38 to 1.84. Change from Maintenance Level 1.
4651012	0.20	Data decommission, Change from Maintenance Level 1. Overgrown, in wilderness.
4660187	0.45	Close with berm, stormproof
4660390	1.80	Close road using entrance management technique keeping road on the system.
4661026	0.47	Would be closed by gate on 4210350.
4661180	1.35	Change from Maintenance Level 1 to 2. Needed for fire detection access.
4670019	0.10	Close with berm
4670031	0.14	Change from Maintenance Level 1 to 2. Mt. Lowe repeater.
4670150	4.39	Close with gate at milepost 0.4, stormproof, create turnaround.
4670220	0.40	Change from Maintenance Level 1 to 2. Mt. Lowe repeater. Trail head.
4671160	0.51	Close with berm, stormproof
4671240	0.42	Close with berm
4680	6.36	Change from Maintenance Level 1 to 2. Alternate route to Olallie Lake Scenic Area.
4680130	0.78	Close with berm, Change from Maintenance Level 2 to 1.
4680139	0.10	Change from Maintenance Level 1 to 2. Improve road to harden surface and provide drainage. Pump chance.
4680150	2.05	Close with berm, Change from Maintenance Level 2 to 1.
4680160	1.45	Closed by berm on 4680150.
4680180	0.36	Closed by berm on 4680150, Change from Maintenance Level 2 to 1.
4691120	0.20	Repair multiple stream crossings near Squirrel Creek.
5710030	0.20	Close with berm
5720018	0.12	Change from Maintenance Level 1 to 2. Access to weather station.
5731015	0.29	This road is coded as already decommissioned in database even though it is open and drivable. It was included in Increment 2 Decommissioning EA by mistake; it accesses power line. Change from Decommissioned to Maintenance Level 2. Add road back to system.
6310025	0.16	Closed by gate on 6310180, accesses power line.
6310040	0.12	Close with berm
6310180	1.43	Has existing gate that is always open. Close gate. Accesses power line.
6310182	0.53	Closed by gate on 6310180, accesses power line.
6310210	1.39	Close with gate, accesses power line.
6310270	1.01	Close with berm
6350286	0.11	Close with berm

Stormproofing usually involves waterbars or other structures to provide drainage.

Culverts would be retained unless specified. Where appropriate, the depth of fill material over culverts would be reduced.

Active decommissioning involves one or more of the following techniques: removing culverts, reestablishing former drainage patterns or natural contours at stream channels, installing water bars, removing gravel surfacing, decompacting road surfaces, pulling back unstable fill slopes or road shoulders, scattering slash on the roadbed, applying erosion control mulch or seed on disturbed areas, and blocking and disguising the former road entrance to prevent motorized vehicle traffic. A decommissioned road is removed from the Forest's transportation system database, is not maintained and is closed to the public.

Data decommissioning involves no action in the field. For roads that are overgrown and hydrologically stable, the only action is removing the road from the Forest's database.

2.2.9 Project Design Criteria (PDC)

These practices are part of the proposed action. They were developed to minimize effects to resources but do not necessarily eliminate all impact. The effects and benefits of these practices are included in the analyses of effects in section 3. In some cases, they are standard practices that are used in all similar projects and in other cases; they are specifically tailored to this project based on site-specific factors such as the underlying land allocation and associated standards and guidelines. Some of these practices are a project-specific implementation of the National Core Best Management Practices (BMP) Technical Guide (USDA 2012b) to minimize impacts to water quality. Effectiveness is addressed in s. 3.3.5.2-3. The National Core BMP Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act (CWA) and State water quality programs, and represents the best available science regarding best management practices. The 2012 Technical Guide (USDA 2012b) is incorporated by reference and detailed in the BMP checklist in the project file.

In this section, the 'dry season' is generally June 1 to October 31 depending upon seasonal conditions, and the 'wet season' is the rest of the year. PDC sections A through H are specifically designed to address Listed Fish Habitat (LFH) and are included in the Biological Assessment.

A. Stream-Protection Buffers

A1. Streams within the project area would be protected with buffers. Stream buffers are measured using slope distance from the edge of active channel (stream banks) on both sides of the stream. Within these buffers, tree felling or yarding would not occur (with the exceptions for danger trees, approved skyline corridors and down wood enhancement projects described in B1).

The following are minimum stream-protection buffer widths.

Intermittent Streams	Perennial Streams Hill Slope < 30%	Perennial Streams Hill Slope 30 to 60%	Perennial Streams Hill slope > 60%
50 feet	70 feet	75 feet	85 feet

The streams that have a connection to listed fish habitat (LFH) were examined by the fisheries biologist and the minimum widths above were adjusted based on the proximity to listed fish habitat, and other factors such as stream gradient and orientation and the cumulative quantity of other past management along these streams. *National Core BMP Technical Guide – Plan 3 and Veg 3.*

The following are prescribed widths for perennial streams in specific units.

Unit	Protection Buffer (feet)	Unit	Protection Buffer (feet)
2	180	80	180
4	87	88	85
4p	87	90	88
8a	75	94	85
8p	83	104	75
16	75	108a	180
34	180	118a	180
36	180	118b	180
38	180	120	180
48a	180	128	180
52	75	136a	180
54	81	136b	180
66	85	138	81
72	180	219	75
74	180	220	81
76	75	221	75
78	81		

A2. In certain instances, the buffer widths in A1 may be expanded, as directed by the District Ranger, based on recommendations by the unit fisheries biologist, hydrologist or geologist. Adjustments include unstable areas and areas with high water table such as wetlands, or seasonally saturated soils.
National Core BMP Technical Guide – Plan 3 and Veg 3.

B. Tree Felling in Riparian Reserves

B1. Trees would not be felled within the stream-protection buffers with the following exceptions:

a) A stream enhancement project within the stream-protection buffer zone of certain proposed thinning units involves the felling of some second-growth trees into streams. A fisheries biologist would select the trees to fell from areas that are

fully stocked with trees and would avoid unstable areas or areas with a high water table.

b) Danger trees may be felled from stream-protection buffers where necessary for safety. Felled trees would be left in place unless they land on a road.

c) In some units, skyline cables would cross streams to tie off on the other side to gain needed lift. Where logs are yarded from one side of the stream to the other as described below in C1 and 2, a corridor less than 15 feet wide would be created. Where no logs are yarded from one side to the other and only a cable crosses to gain needed lift, few if any trees would be cut in the stream-protection buffer. Any trees in the stream-protection buffer felled for skyline corridors would be left in place.

National Core BMP Technical Guide - Plan 3 and Veg 3.

B2. Harvested trees that would be yarded would be felled away from streams, springs, or wetlands, or parallel to the stream buffer. Trees that are inadvertently felled into the stream-protection buffer would be left on site. *National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 3, Veg 4 and Veg 5.*

C. Skidding, Yarding and Equipment Use Near Streams
See PDC section J for soils.

C1. Skyline yarding over streams is acceptable if the logs are fully suspended over stream channels and the ground within their protection buffers. One-end suspension would be required in skyline corridors outside the protection buffers. During lateral yarding, use one-end suspension to the extent practicable. *National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 2, Veg 3, and Veg 5.*

C2. Where skyline corridors are created by tree felling as described in C1, the number of skyline yarding corridors over perennial streams would be limited to no more than five corridors per 1,000 lineal feet of stream. Individual corridor widths would not exceed 15 feet. Corridors would be spaced at least 100 feet apart (along the stream). Deviation from this would only occur with the approval of the District Ranger based on recommendations from a fisheries biologist, and the inclusion of mitigating measures where needed such as making corridors narrower or adding straw bales. *National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 3, and Veg 5.*

C3. Existing landings would be used where feasible. Landings would be limited to the area needed for safe and efficient yarding and loading operations and would have proper drainage. Where necessary, straw bale catchments or silt fences would be used to minimize sediment transport to road ditches or streams. The catchments would be located to intercept runoff from the landing prior to reaching any road ditch or stream. *National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, Veg 4 and Veg 6.*

C4. Landings would generally not be constructed, reconstructed or used within the following distances of streams.

a) Within 200 feet of a stream, if the potentially affected stream reach is within 0.5 mile of LFH, or
b) Within 100 feet of any stream channel.

Distances are measured slope distance in the direction of the slope aspect (the direction water would flow) or distance would be measured along a road ditch if the ditch provides a hydrological connection from the landing to the stream.

Exceptions to these distances may be approved by the District Ranger depending on site-specific conditions such as hydrologic connection, size of landing and landing surfacing; based on recommendations from a fisheries biologist. If a landing is approved for use within these distances, erosion control measures would be installed prior to use where appropriate to prevent soil movement downslope from the landing. Erosion control measures may include, but are not limited to, use in the dry season, straw bales around landing perimeter, and rock surfacing. The portion of the landing outside a system road prism would be rehabilitated after use (compacted soils fractured, covered with slash or seeded and mulched). *National Core BMP Technical Guide - Plan 3, Road 1, Road 5, Veg 2, Veg 3, and Veg 6.*

C5. Landings used in the wet season, may need to be surfaced with aggregate material, dependent upon soil moisture conditions. *National Core BMP Technical Guide - Veg 2, Veg 3, Veg 6 and Veg 7.*

C6. Use existing landings and skid trails to the maximum extent possible. *National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, Veg 4 and Veg 6.*

C7. Skid trails would not be constructed through areas with a high water table, or be located in areas that would channel water onto unstable headwall areas, or located down swale bottoms. *National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, and Veg 4.*

C8. Adjacent to stream-protection buffers there would be additional restrictions for certain ground-based equipment. Only mechanical harvesting equipment used for tree falling would be allowed within 205 feet of listed fish habitat, or within 100 feet of other perennial streams, or within 75 feet of intermittent streams. Distances are measured slope distance in the direction of the slope aspect. Exceptions may be made for the use of existing skid trails by the District Ranger based on recommendations from the unit fisheries biologist or hydrologist, and where there is low risk of sediment entering streams. Additional erosion control measures may be required. *National Core BMP Technical Guide – Plan 3, Veg 2, Veg 3, Veg 4 and Veg 5.*

C9. Erosion control measures would be implemented to prevent off-site movement of disturbed soils from logging, and other related actions. Areas of soil displacement on steep slopes resulting from yarding systems would be treated to prevent rill and gully erosion and possible sediment delivery to stream courses. Where appropriate, erosion

control treatment on bare soils may include water bar placement, hillslope contouring, creating small ditches or diversions to redirect surface water movement, scattering slash on disturbed soils, placement of mulch, and application of approved seed. Mulch may be used on slopes greater than 20%. Effective ground cover would be installed prior to shutting down for the wet season. When operations occur during the wet season, erosion control work would be kept current and installed as soon as practicable. The coverage of effective ground cover would be sufficient to prevent off-site movement of soils as guided by Forest Plan standard and guideline FW-025 and by Forest Service Handbook 2509 (R6 supplement). *National Core BMP Technical Guide – Veg 2, Veg 3, Veg 4, Veg 5 and Veg 6.*

D. Temporary Road Construction and Existing Road Alignment Reconstruction
See PDC section K and P for additional discussion of temporary roads.

D1. New temporary roads would not be constructed within 180 feet of a perennial stream. *National Core BMP Technical Guide - Plan 3, Road 1, Road 5, Veg 2, Veg 3 and Veg 6.*

D2. Emphasize the reuse of existing road alignments rather than the construction of new roads where appropriate. Where stream crossings are needed on existing alignments, they would be designed to minimize impacts to aquatic resources using techniques such as French drains, log fords and temporary culverts. *National Core BMP Technical Guide - Plan 3, AqEco 2, Road 1, Road 5, Road 7, Veg 3.*

D3. New temporary road construction would generally occur on or near stable ridgetop locations, or on stable, relatively flat topography. Sidecast road construction techniques would not occur when the hill slope exceeds 30%. *National Core BMP Technical Guide - Plan 3, Road 1, Road 5, Veg 2, and Veg 3.*

D4. New temporary roads would not increase the permanent stream drainage network (i.e. Roads would be outsloped, or the outflow of new ditch relief culverts or other drainage structures would not drain to streams). *National Core BMP Technical Guide - Plan 3, AqEco 2, Road 1, Road 5, Veg 2, and Veg 3.*

D5. Where adjacent to system roads with ditches, temporary roads, reconstructed roads and landings would not obstruct ditch lines. Temporary obstructions of ditch lines or drainage ways may be approved if French drains or drivable dips are installed to provide effective drainage and prevent erosion. *National Core BMP Technical Guide – Road 1, Road 2, and Road 5.*

D6. Erosion control measures would be implemented to prevent off-site movement of disturbed or exposed soil associated with road and landing construction, use, and rehabilitation (including cutbanks, fills, ditches, etc.) on road segments that have the potential to directly or indirectly deliver sediment to any stream channel. Erosion control measures include silt fences, wattles, straw bales, matting, mulch, slash, water bars, ditch check dams, grass seed, or other products. This work would occur prior to shutting down for the wet season. When operations occur during the wet season,

erosion control work would be kept current and installed as soon as practicable. *National Core BMP Technical Guide – Road 1, Road 5, Veg 2, Veg 3, Veg 4, Veg 5 and Veg 6.*

D7. Where new temporary roads or non-system existing road alignments are used for more than one logging season, prior to shutting down for the wet season, roads would be treated to minimize erosion and prevent use by using techniques such as water barring, construction of berms, or culvert removal where appropriate. *National Core BMP Technical Guide – Road 1, Road 5, Veg 2, Veg 3, Veg 4, Veg 5 and Veg 6.*

E. System Road Renovation, Reconstruction, and Maintenance

E1. Limit soil disturbing road renovation and reconstruction activities to the dry season, unless the road segment has no hydrologic connection. *National Core BMP Technical Guide - AqEco 2, Road 3, Veg 2, and Veg 3.*

E2. During road maintenance activities, existing desirable vegetation (e.g. grass) growing in ditches that discharge to streams would not be removed unless an effective sediment trap is installed and maintained until vegetation is reestablished. This does not restrict brush or tree cutting that leaves roots intact. The fill slopes at stream crossings would be vegetated or otherwise stabilized such that road surface sediments are retained prior to entering the stream channel. Roads approaching stream crossings would have adequate cross drainage to divert potential ditch sediment toward slopes where material can be trapped. Stream crossings that do not fully meet these standards would be repaired, reconstructed, or mitigated as directed by the District Ranger based on input from the unit fish biologist, hydrologist or soil scientist by inclusion of erosion control measures such as silt fences, wattles, straw bales, matting, mulch, slash, water bars, ditch check dams, grass seed or other products. This work would occur prior to shutting down for the wet season. *National Core BMP Technical Guide – Road 4.*

E3. Material removed from ditches would not be graded onto the road surface where the road surfaces are between a cross drain culvert and a stream crossing culvert. Material that must be removed from ditch lines within this distance would be removed and stored farther than 100 feet of a stream and where they cannot flow directly to a stream. *National Core BMP Technical Guide – Plan 3, AqEco 2, Road 4, Veg 2, and Veg 3.*

E4. Excavated materials from ditch cleaning or other operations would be disposed of at approved sites. Material would be spread evenly over an appropriate area in non-conical shaped piles with a maximum layer thickness of three feet. Bare material would be seeded and mulched at the completion of operations. *National Core BMP Technical Guide – Road 4.*

E5. Where new cross drain culverts are needed, they would be located to drain to a stable slope with porous soils, allowing for water infiltration, with a low probability

of erosion, and where no new channel would connect to an existing stream. *National Core BMP Technical Guide –AqEco 2, Road 3, Road 4, Veg 2, and Veg 3.*

E6. Large woody material removed from stream channels during culvert maintenance would be retained in the stream network and would use techniques to minimize sediment mobilization. Typically, this would entail repositioning wood located upstream from a culvert to a location downstream of the culvert. *National Core BMP Technical Guide –AqEco 2, Road 4, Road 7 and Veg 3.*

E7. Water needed for dust abatement, road maintenance, reconstruction or construction, or other uses, may be acquired off-Forest or may be acquired on-Forest if the following criteria are met.

Drafting from occupied LFH stream reaches would not occur. Water withdrawal in unoccupied LFH, and within 1500' of any LFH (occupied or unoccupied) would be limited to 10 percent or less of the stream flow at the point of withdrawal, by visual estimation. In non-LFH streams greater than 1500' from LFH, water withdrawal would be limited to 50 percent or less of the stream flow at the point of withdrawal. Where multiple drafting operations occur, they would be dispersed in space and time. Pipe intakes would be screened; woven wire screens would have a maximum 1.75 mm gap, and perforated plate screens would have a maximum opening of 3/32nd inch. The following drafting sites are preapproved.

- Road 4660 crossing of Pot Creek - upstream side, <10%
- Road 4660 crossing of Cabin Creek, <50%
- Road 4660 crossing of Pan Creek, <50%
- Road 4690 crossing of Squirrel Creek, <10%
- Road 4690 crossing of Clackamas River, <50%
- Road 4600 crossing of Sisi Creek, <10%
- Road 4671 crossing of Hunter Creek, upstream side, <10%
- Road 4672 crossing of Rhododendron Creek, <50%
- Road 4672 crossing of Lowe Creek, <50%
- Road 4210 crossing of Last Creek, <10%
- Road 5700 crossing of Kink Creek, <50%
- Road 5700 crossing of Oak Grove Fork, <50%

  National Core BMP Technical Guide – AqEco 2, Road 4, WatUses 3.

E8. Special road work is required to minimize road-related sedimentation where aggregate-surfaced haul roads cross listed-fish streams. After pre-haul maintenance occurs and before haul, erosion control measures would be installed in ditches and roadsides such as silt fences, straw bales, wattles, matting and/or mulch. These treatments would be installed within 500 feet of the following stream crossing culverts: 4660 at Lost Creek, 4660 at Pot Creek, 4672 at Berry Creek, 4680140 at West Fork Pinhead Creek, and 4680140 at Pinhead Creek.

F. System Road Decommissioning (and other road construction or reconstruction work in close proximity to streams) *National Core BMP Technical Guide – Road 3, Road 6 and Road 7.*

F1. For road removal projects close to streams, recontour the affected area to mimic natural floodplain contours and gradient to the greatest extent possible but restored areas should not have slopes greater than a 2 to 1 ratio.

F2. For those road segments immediately adjacent to a stream or where the road fill is near a wetted stream, use sediment control barriers where needed such as certified weed-free straw bales or silt fencing between the project and the stream.

F3. Where decompaction is prescribed, the road surface would be de-compacted to a depth of 18 inches over an area sufficient to provide for water infiltration. The technique known as "cratering" may be used to decompact decommissioned roads.

F4. Where bare soil is exposed, the disturbed area would be treated as described in PDC C9 and D6 above. Where slash is not available, mulch would be applied at approximately 2,000 pounds per acre or so that there is completed coverage of the bare soil surface and the mulch is 4 inches deep. If seed is applied, it would be placed during conditions favorable for germination.

F5. Drainage features would be spaced to hydrologically disconnect road surface runoff from stream channels.

F6. Dispose of slide and waste material in stable sites out of the flood prone area. Waste material other than hardened surface material (asphalt, concrete, etc.) may be used to restore natural or near-natural contours.

F7. Minimize disturbance of existing vegetation in ditches and at stream crossings to the greatest extent possible.

F8. Conduct activities during dry-field conditions with low to moderate soil moisture levels. Road decommissioning activities would be suspended if there is more than one inch of rain in a 24 hour period or more than two inches of rain for the entire storm event as defined as precipitation in the last 48 hours at the Red Box Remote Automated Weather Station. If this site is not functioning, then use the information at the Peavine Ridge SNOTEL site or as determined by the Contracting Officer. Project operations would be suspended if soil moisture is recharged and streamflows rise above baseflow levels (Clackamas River at Three Lynx above 2,000 cfs).

F9. The Oregon Department of Fish and Wildlife Guidelines for Timing of In-Water Work would be followed. Exceptions to these guidelines for timing of in-water work may be requested from appropriate regulatory agencies.

F10. Activities associated with culvert removal or replacement in streams with active streamflow would be suspended if there is an increase of 10 NTU's (Nephlometric Turbidity Units) below the project area.

F11. Operations would be scheduled and conducted so as to prevent eroded material from entering any waterway. Live streams would be diverted from work areas prior to excavation of culverts, or any other stream crossing structure. A stream diversion plan would be developed prior to starting of excavation in live streams.

F12. Excavations to remove or replace stream culverts would be matched to the approximate bed elevation and bank-full stream width of the existing streambed. Cuts would match natural bank slopes.

F13. At culvert removal sites, the road would have waterbars or other drainage features constructed to route surface water away from the newly excavated slopes.

F14. Dispose of side-cast and waste material (asphalt, concrete, etc.) in stable sites out of the flood prone area. Native soils and rock used to construct the road may be used to restore natural or near-natural floodplain and bankfull contours, which were altered by the road and associated ditches and structures.

F15. When removing or replacing a culvert, techniques to minimize turbidity would be used where appropriate such as the use of temporary sediment retention devices including biobags, straw bales or burlap.

F16. For culvert removal projects, restore natural drainage patterns (floodplain and bankfull) and, when possible, promote passage of all fish species and life stages present in the area. Evaluate channel incision risk and construct in-channel grade control structures when necessary.

F17. In addition to all U.S. Army Corps of Engineers (USACE) permit conditions, the following 401 Water Quality Certification (WQC) conditions apply to all National Water Program (NWP) categories certified or partially certified by this 401 WQC, unless specified in the condition. The following 401 WQC Category Specific Conditions would be implemented where applicable.

Turbidity: All practical Best Management Practices (BMPs) on disturbed banks and within the stream shall be implemented to minimize turbidity during in-water work. OAR 340-041-0036 states that turbidity shall not exceed 10% above natural stream turbidities, except where allowed by the rule. This rule also states that limited duration activities necessary to accommodate essential dredging, construction or other legitimate activities and which cause the turbidity standard to be exceeded may be authorized provided all practical turbidity control techniques have been applied and a section 401 water quality certificate has been granted.

a. Monitoring: Turbidity monitoring shall be conducted and recorded as described below. Monitoring shall occur each day during daylight hours when in-water work is being conducted. A properly and regularly calibrated turbidimeter is recommended, however, visual gauging is acceptable.

i. Representative Background Point: a sample or observation must be taken every four hours at a relatively undisturbed area approximately 100 feet up-

current from in-water disturbance to establish background turbidity levels for each monitoring cycle. Background turbidity, location, and time must be recorded prior to monitoring down-current.

ii. Compliance Point: Monitoring shall occur every four hours approximately 100 feet down-current from the point of discharge and be compared against the background measurement or observation. The turbidity, location, and time must be recorded for each sample.

b. Compliance: Results from the compliance points should be compared to the background levels taken during each monitoring interval. Exceedances are allowed as follows:

MONITORING WITH A TURBIDIMETER

ALLOWABLE EXCEEDANCE TURBIDITY LEVEL	ACTION REQUIRED AT 1st MONITORING INTERVAL	ACTION REQUIRED AT 2nd MONITORING INTERVAL
0 to 5 NTU above background	Continue to monitor every 4 hours	Continue to monitor every 4 hours
5 to 29 NTU above background	Modify BMPs & continue to monitor every 4 hours	Stop work after 8 hours at 5-29 NTU above background
30 to 49 NTU above background	Modify BMPs & continue to monitor every 2 hours	Stop work after 2 hours at 30-49 NTU above background
50 NTU or more above background	Stop work	Stop work

VISUAL MONITORING

ALLOWABLE EXCEEDANCE	ACTION REQUIRED AT 1st	ACTION REQUIRED AT 2nd
No plume observed	Continue to monitor every 4 hours	Continue to monitor every 4 hours
Plume observed	Modify BMPs & continue to monitor every 4 hours	Stop work after 8 hours with an observed plume

When monitoring visually, turbidity that is visible over background is considered an exceedance of the standard.

If an exceedance over the background level occurs, the operator must modify the activity and continue to monitor every four hours or as appropriate (above). If an exceedance over the background level continues after the second monitoring interval, the activity must stop until the turbidity levels return to background. If, however, turbidity levels return to background at second monitoring level due to implementation of BMPs or natural attenuation, work may continue with appropriate monitoring as above.

If an exceedance occurs at: 50 NTU or more over background; 30 NTU over background for 2 hours; or 5-29 NTU over background for 8 hours, the activity must stop immediately for the remainder of that 24-hour period.

c. Reporting: Copies of daily logs for turbidity monitoring shall be available to DEQ, USACE, NMFS, USFWS, and ODFW upon request. The log must include: background NTUs, compliance point NTUs, comparison of the points

in NTUs, location, and time for each reading. Additionally, a narrative must be prepared discussing all exceedances with subsequent monitoring, actions taken, and the effectiveness of the actions.

d. Minimizing In-stream Turbidity:

i. Sequence/Phasing of work - The operator would schedule work activities so as to minimize in-water disturbance and duration of in-water disturbances;
ii. Bucket control - All in-stream digging passes by excavation machinery and placement of fill in-stream using a bucket shall be completed so as to minimize turbidity. All practicable techniques such as employing an experienced equipment operator, not dumping partial or full buckets of material back into the wetted stream, adjusting the volume, speed, or both of the load, or by using a closed-lipped environmental bucket shall be implemented;
iii. Limit the number and location of stream crossing events. Establish temporary crossing sites as necessary at the least impacting areas and supplement with clean gravel or other temporary methods as appropriate;
iv. Machinery would not drive into the flowing channel;
v. Excavated material would be placed so that it is isolated from the water edge or wetlands and not placed where it could re-enter uncontrolled; and,
vi. Use of containment measures such as silt curtains, geotextile fabric, and silt fence would be implemented and properly maintained in order to minimize in-stream sediment suspension and resulting turbidity.

F18. During road decommissioning, if danger trees need to be cut for safety reasons they would be left on site.

F19. For culvert removal or replacement projects, an experienced professional fisheries biologist, hydrologist or technician would be involved in project design.

F20. All stream crossing culverts would be designed to pass at least a 100-year flood streamflow.

G. Timber and Rock Transport (Haul)

G1. Haul would be stopped immediately, even in the dry season, if road use is causing rutting of the road surface, ponding of water on the road, failure of any drainage structure, or any other action occurs which increases the sediment delivery to a stream. Roads would be restored or repaired before haul resumes. *National Core BMP Technical Guide – AqEco 2, Road 1, Road 4, Veg 2, Veg 3 and Veg 7.*

Wet Season Haul

G2. Haul may occur during the wet season on paved roads. Haul would not occur on native surfaced roads during the wet season unless the following conditions are met.

a. Less than 1 inch of rainfall has occurred in the preceding 24 hour period determined by a rain gage installed adjacent to the haul route or as measured at a nearby RAWS or SNOTEL station at Wanderer's Peak (http://www.wrh.noaa.gov).
b. Soil moistures are below 20%.
c. And with approval by the District Ranger based on input from the unit fish biologist, hydrologist or soil scientist. *National Core BMP Technical Guide – Road 1, Road 4, Veg 2, Veg 3 and Veg 7.*

G3. Aggregate Surfaced Roads

a) On aggregate surfaced roads, wet season haul may be permitted if the criteria at E8 are met.

b) Haul routes would be inspected weekly, or more frequently if weather conditions warrant. Inspections would focus on road surface condition, drainage maintenance, and sources of soil erosion and sediment delivery to streams. If sediment traps are used, they would be inspected weekly during the wet season and entrained soil would be removed when the traps have filled to ¾ capacity. Removed materials would be deposited in a stable site that is not hydrologically connected to a stream.

National Core BMP Technical Guide – Plan 3, AqEco 2, Road 1, Road 3, Road 4, Road 7, Veg 2, Veg 3 and Veg 7.

G4. Generally haul would not occur when there has been 1.0 inch of precipitation (rain or combination of rain and melted equivalent of snow) or greater within any given 24 hour period as measured at a nearby RAWS or SNOTEL station. If these are not available, a temporary rain gauge may be installed near the transport route by written agreement with the Forest Service. The District Ranger with input from a unit transportation engineer, fish biologist, hydrologist or soil scientist, would consider precipitation quantity along with a visual inspection of roads and professional judgment to indicate when haul should be stopped to limit impacts to roads or streams. *National Core BMP Technical Guide – Plan 3, AqEco 2, Road 1, Road 3, Road 4, Road 7, Veg 2, Veg 3 and Veg 7.*

H. Other

H1. Spill Prevention - An approved Spill Prevention Control and Containment Plan (SPCCP) would be created, as required by contract clauses G.3.4.1/BT6.341, which describe measures to prevent or reduce impacts from potential spills. The SPCCP would include a description of the hazardous materials that would be used; and a spill containment kit would be located on-site. All trucks used for refueling would carry a hazardous material recovery kit. All vehicles and machinery would be free of petroleum leaks. Any leaks that occur would be immediately repaired. Power equipment would be refueled at least 150 feet from water bodies to prevent direct delivery of contaminants into a water body. If local site conditions do not allow for a 150-foot setback, then refueling would be as far away as possible from the water

body. For all immobile equipment, absorbent pads would be used. All petroleum products being transported or stored would be in approved containers meeting Occupational Safety and Health Administration standards and Oregon Department of Transportation. The Contracting Officer would be notified of any spills. Any contaminated soil, vegetation or debris must be removed from National Forest System lands and disposed of in accordance with state laws. *National Core BMP Technical Guide – Road 10.*

J. Soil

J1. Operation of off-road ground-based equipment would generally not occur in the wet season. This applies to off-road ground-based equipment such as tractors, skidders, harvesters or equipment used for fuels treatment. The District Ranger may approve ground-based operations in the wet season if soils are sufficiently dry, frozen or snow covered, based on input from a soil scientist.

Indications of sufficient dryness may include soil moistures of less than 20% or when operations on approved skid trails do not result in ruts that exceed 12 inches in depth over more than 10 percent of a designated skid trail system.

Soils may be considered appropriate for use if the following conditions are met.

Soil not frozen	Need 10 inches of machine-packed snow
2 inches of frozen soil	Need 6 inches of machine-packed snow
4 inches of frozen soil	No snow cover necessary

National Core BMP Technical Guide - Veg 2, Veg 4, and Veg 7.

J2. Bare soils would be covered by slash or other vegetative material or seeded and mulched. The coverage of effective ground cover would be sufficient to prevent off-site movement of soils as guided by Forest Plan standard and guideline FW-025 and by Forest Service Handbook 2509 (R6 supplement). Native plant materials are the first choice in revegetation of bare soils, [e.g., blue wildrye (*Elymus glaucus),* California brome (*Bromus carinatus*), slender hairgrass (*Deschampsia elongate*), and broadleaf lupine (*Lupinus latifolius*)]. Non-native, non-invasive plant species may be used if native plant materials are not available or as an interim measure designed to aid in the re-establishment of native plants.[e.g., annual ryegrass (*Lolium multiflorum)* and Madsen sterile wheat.] Non-native invasive plant species would not be used.

J3. All ground-based skidding equipment would be confined to pre-approved skid trails, roads or landings. Existing skid trails would be reused where possible unless they are hydrologically connected to a naturally occurring stream channel.

Where new skid trails are needed: skid trails would be spaced a minimum of 150 feet apart except where converging; skid trails would be located to minimize the alteration of surface hydrology; uphill skidding would generally be on slopes less than 20% except on short pitches; and downhill skidding would generally be less than 30%.

Where existing skid trails are used: some ground-based logging would occur on slopes steeper than 30% where existing skid trails are available and not

hydrologically connected. Skid trails in these situations are typically contouring or diagonally constructed skid roads with cut and fill. In these areas, equipment would stay on approved existing skid trails and directional felling and winching of logs would occur. *National Core BMP Technical Guide – Veg 2 and Veg 4.*

J4. Mechanical harvesting equipment used for tree falling would be limited to a single pass on each pathway unless operating on continuous slash-covered paths. The layer of slash would be as thick as possible given the slash available from harvested trees. A slash layer is not required when equipment is moving on approved skid trails. Mechanical harvesting equipment would generally operate on slopes less than 35%. Mechanical harvesting equipment may operate on slopes from 35 to 40% if farther than 180 feet from a stream and if equipment stays on existing approved skid trails or moves straight up and down the slope without turning. *National Core BMP Technical Guide – Veg 2 and Veg 4.*

J5. Rutting within skid trails would not exceed 12 inches in depth over more than 10 percent of a designated skid trail system. *National Core BMP Technical Guide – Veg 2 and Veg 4.*

J6. Rock may be used when necessary to reduce erosion, puddling and compaction on landings and temporary roads. To provide an efficient substrate for vegetative growth and water infiltration, rock would be removed and/or incorporated into the roadbed by subsoiling following harvest activities. *National Core BMP Technical Guide – Road 1, Road 5, Veg 2 and Veg 6.*

K. Operations

K1. Temporary roads, existing road alignments and adjacent landings that are used by the operator would be rehabilitated after use. In some cases, road-specific treatments are listed in PDC section P. The following applies to all other non-system, temporary roads and existing road alignments that are used by the operator.

Temporary roads and most existing alignments would be rehabilitated using a suite of techniques site-specifically designed for each, and may include placement of one or more berms at the road's entrance, construction of water bars, and/or placement of debris such as root wads, slash, logs or boulders where available. Native surfaced roads would be decompacted as needed with the jaws of a log loader or excavator. Roads or sections of roads that have rock surfacing may be decompacted where site-specific circumstances warrant. The technique known as "cratering," which is a standard practice often used for system road decommissioning, may be used to decompact temporary roads or reused existing road alignments.

Cross-drains or water bars would typically be installed every 150 feet, or more frequently, where the road grade exceeds 5%. Actual placement distances may vary with topography to ensure proper drainage. Temporary culverts would be removed.

Available logging slash, logs or root wads would be placed across the road and landing surface. Where slash, logs or root wads are not available in sufficient

quantities, bare soils would be seeded and mulched. The coverage of effective ground cover would be sufficient to prevent off-site movement of soils as guided by Forest Plan standard and guideline FW-025 and by Forest Service Handbook 2509 (R6 supplement). *National Core BMP Technical Guide – Road 5, Road 6, Veg 2 and Veg 3.*

K2. For Maintenance Level 1 System Roads (closed) - Roads would be reclosed and stormproofed as described in the post-haul maintenance specifications in the contract. Roads that need to be used for more than one logging season, prior to shutting down for the wet season, roads would be treated to minimize erosion and prevent use by using techniques such as water barring or construction of berms where appropriate. *National Core BMP Technical Guide – AqEco 2, Road 1, Road 3, Road 4, Road 6, Veg 2, and Veg 3.*

K3. To protect the integrity of roads, haul would not occur when the roadbed is under freeze-thaw conditions. To determine if freeze-thaw conditions exist, measurements of the road surface temperature should be taken at the highest and lowest elevations along the haul route on National Forest System Roads to ensure that haul roads are either completely frozen or completely thawed. Temperature readings at these locations should both be at or below 28° F., or both be at or above 38° F. Roads that have been under standing snow for at least 3 days with no evidence of snow melt may be assumed to be completely frozen. The Contracting Officer may allow haul to proceed if other methods are used to determine that the haul roads are either completely frozen or completely thawed. The Contracting Officer may suspend haul at any time when it is determined that road damage may occur based on observation of field conditions. *National Core BMP Technical Guide – Road 4.*

K4. Firewood would be made available to the public at landings where feasible. Certain units or portions of units may be made available for the removal of green biomass and firewood as part of the prescription. A mix of commercial and personal use removal may occur where feasible.

K5. Contracts would contain provisions for the protection of heritage resource sites found during project activities. In the event that sites are located during implementation, project activities would be halted until consultation with the Forest Archeologist can determine appropriate site-specific mitigation. Protection measures would be developed in consultation with the Oregon State Historic Preservation Officer (SHPO), appropriate Tribes, and, if necessary, the Advisory Council on Historic Preservation.

L. Invasive species

L1. All off-road equipment is required to be free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds prior to coming onto National Forest lands. Contracts would include provisions to minimize the introduction and spread of invasive plants. These provisions contain specific requirements for the cleaning of off-road equipment.

L2. Gravel or rock used for roads and landings would come from sources approved by the Forest invasive plant specialist.

L3. Road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants would be conducted in consultation with an invasive plant specialist.

L4. Seed used for erosion control or other reasons would preferably be grown under government-supervised contracts, or certified by the state of Oregon to assure noxious weed free status. In certain cases, non-certified seed may be used if it is deemed free of Oregon State Class A & B noxious weeds.

L5. When straw and mulch are utilized for erosion control, it would be annual ryegrass straw or spring wheat straw certified by the State of Oregon, or would originate from fields which grow State of Oregon certified annual ryegrass seed, or originate from Willamette Valley Oregon fields which grow only annual ryegrass seed for large-scale commercial seed production. In place of straw, wood fiber mulch may be used. *National Core BMP Technical Guide – Veg 4.*

M. Wildlife

M1. Northern Spotted Owl: There are restrictions during the breeding season for certain activities based on the type of activity and the distance to activity centers. Restrictions apply to the use of chainsaws (392 yards) and heavy equipment (363 yards) between March 1 and July 15. Portions of Units 38, 40, 52, 90, 209, 215, and 230 are within these distance zones.

There is a restriction for the use of helicopters. Details on the restrictions and rationale are in the U.S. Fish and Wildlife Service's Letter of Concurrence. No helicopter units occur within the specified zones. Because helicopter restrictions apply both during yarding and transit to other sites, a wildlife biologist would be consulted to determine if any restrictions are needed after operators finalize landing locations, flight paths and proposed seasons of operation.

M2. Deer and Elk: No harvest operations, road construction, use of motorized equipment or blasting would be permitted in Crucial or High Value winter range areas between December 1 and March 31. The restriction may be waived in the High Value area if snow accumulation levels are less than 12 inches or if it is determined that the area is not being used by elk. Units 34, 36, 42, 72, 74, 76, 78, 80, 120, 203, 204, 305, 311, 312, 419 and 466 are in the Crucial area. Units 2, 4, 4P, 6, 6P, 7, 7P, 84, 108, 150, and 154 are in the High Value area.

To minimize disturbance to deer and elk during the calving, fawning and rearing season, no chainsaw or heavy equipment use would be permitted in Units 58, 102 or 468 between April 1 and July 30.

M3. Peregrine Falcon: No chainsaws, heavy equipment, or helicopter use below 1,500 feet Above Ground Level would be permitted from January 15th to August 15th. This applies to unit 2. This restriction may be waived if the nest site is unoccupied or

if nesting efforts fail and there is not possibility of re-nesting. Documentation of nesting failures can be finalized no earlier than June 30th due to the possibility of re-nesting.

M4. Snags & Down Wood: To enhance diversity, variable-density thinning would include the retention of snags and wildlife trees.

Snags would be retained in all units where safety permits. If snags must be cut for safety reasons, they would be left on site.

To increase the likelihood that snags would be retained, they may be included in skips.

Certain live trees would also be selected as leave trees that have the "elements of wood decay" as described in the DecAID advisor. This may include trees with features such as dead tops, broken tops and heart rot. They may be retained in skips.

Old down logs currently on the forest floor would not be removed.

Additional down woody debris would be generated by operations. This would include the retention of cull logs, tree tops, broken logs and any snags that would be felled for safety reasons.

Some units have standing trees that were girdled or topped in the past. These would be protected where feasible.

N. Wood Enhancement in Streams

N1. The project fisheries biologist would select trees to be felled and the locations of in stream placement.

N2. Only live trees that are between 10 and 15 inches diameter would be felled or pushed over. Where appropriate, down wood lying above a stream would be bucked so that at least one end falls into the stream. Some wood would be brought in from off site.

N3. Trees or logs would be placed in a manner that creates new aquatic habitat and does not block fish passage.

N4. The Oregon Department of Fish and Wildlife Guidelines for Timing of In-Water Work would be followed. Exceptions to these guidelines for timing of in-water work may be requested from appropriate regulatory agencies.

N5. When operating chainsaws near streams, a vegetable based bar oil would be used.

N6. A post-project review would be conducted after winter and spring high flows and adjustments would be made where necessary to provide for fish passage or to minimize bank erosion.

O. Adaptive Management

This project would utilize the concept of adaptive management. The proposed action sections above and the Project Design Criteria describe the strategies that are currently considered appropriate particularly for dealing with road closures and unauthorized Off-Highway Vehicle use. The exact treatment details may be adjusted at the time of implementation. The potential actions described would be tailored to changing site-specific conditions with the objective of achieving resource protection and public safety.

This adaptive management strategy is needed because conditions in the field often change somewhat between the planning and implementation stages. Because potential funding through stewardship contracting, retained receipts or KV would not be immediately available, project implementation may take a few years. For example, road closure berms may be breached or gates may be damaged by vandalism.

Before final contracts are created, an interdisciplinary team would be assembled to review projects to ensure their effectiveness. The District Ranger would approve projects and certify that the anticipated effects and benefits fall generally within the range of effects and benefits described in this document.

P. Project Specific PDCs

Additional project-specific detail can be found in section 2.2 and in PDC A1, M1, M2 and M3.

P1. Existing road alignment to **unit 215**

This road was decommissioned with entrance management. It was previously known as 4650170. Entrance management involved roughing up the first part of the road (approximately 1/8 mile) with berms at the entrance. The rest of the road has aggregate surfacing and culverts. Only the first mile of this road is needed for unit 215.

This road would be used for temporary access. The junction with 4650 would need to be reconstructed to turn log trucks the other direction since the decommissioning of 4650 cut off the originally designed haul route. Before the road is reclosed, the newly used portion would be stormproofed with water bars. Culverts would be retained. After use, the road would be put back similar to the way it is now using the entrance management technique with large berms.

P2. Existing road alignment to **unit 44**

This road was decommissioned with entrance management. It was previously known as 4670130. Entrance management involved roughing up the first part of the road (approximately 1/8 mile) with berms at the entrance. The rest of the road has aggregate surfacing and culverts. Only the first 0.4 mile of this road is needed for unit 44.

This road would be used for temporary access. Before the road is reclosed, the newly used portion would be stormproofed with water bars. Culverts would be retained. After use, the road would be put back similar to the way it is now using the entrance management technique with large berms.

P3. Existing road alignment to **unit 110**

This road was decommissioned with entrance management. It was previously known as 4200390. Entrance management involved roughing up the first part of the road (approximately 1/8 mile) with berms at the entrance. The rest of the road has aggregate surfacing and culverts. Only the first 0.17 mile of this road is needed for unit 110.

This road would be used for temporary access. Before the road is reclosed, the newly used portion would be stormproofed with water bars. Culverts would be retained. After use, the road would be put back similar to the way it is now using the entrance management technique with large berms.

P4. Existing road alignment to **unit 48**

This road was decommissioned with entrance management. It was previously known as 4670015. Entrance management involved roughing up the first part of the road (approximately 1/8 mile) with berms at the entrance.

This road would be used for temporary access. Before the road is reclosed, the newly used portion would be stormproofed with water bars. After use, the road would be put back similar to the way it is now using the entrance management technique with large berms.

P5. **Dispersed camping near road 4600041**

A portion of the road was decommissioned in the past and boulders were placed to contain parking near Road 4600. The boulders were not large enough and they have been breached. User created routes go to edge of the Clackamas River. The area is now in Wilderness. Decommission the rest of road 4600041 (200 feet) and block with large boulders at Road 4600. Item 6 on maps A49-51.

P6. **Dispersed camping near road 4600042 and Pot Creek**

Rehabilitate about a third of this area nearest the stream and discourage use in the rehabilitated area. Decompacting soils, place boulders, logs, or root wads to discourage access, and planting native vegetation. Item 7 on maps A49-51.

P7. **Dispersed camping in Wilderness**

Dispersed camping is occurring on a user created road in the Big Bottom section of the Clackamas River Wilderness, adjacent to Road 4600 and the Clackamas River. Block with large boulders at Road 4600. Item 8 on maps A49-51.

P8. **Dispersed camping along Upper Clackamas River**

Boulders were placed at this site in the past to contain parking near Road 4600. The boulders were not large enough and they have been breached. New access routes were also created from Road 4600 to bypass the boulders. User created routes go to the edge of the Clackamas River. Retain parking area, but block user created routes with larger boulders. Item 9 on maps A49-51.

P9. **Dispersed camping at Kansas Creek**

Dispersed camping is occurring on a user created road from road 4651 to the edge of Kansas Creek. Place boulders, logs, or root wads to discourage access along entire length of route. Item 10 on maps A49-51.

P10. **User created OHV routes**

Dispersed camping is occurring adjacent to road 4651 on a reopened temporary road and user created OHV routes extend from there. Place boulders, logs, or root wads to discourage access along entire length of route and first section of OHV route. Item 11 on maps A49-51.

Q. Slash Treatment

Slash treatments would occur as described in section 2.2.7.6.

Q1. Where slash is piled for later burning, piles would be constructed 20 feet or farther from live trees where leave tree spacing allows. Piles would not be constructed in roadside ditches or in Riparian Reserves. Piles would be covered with 6 mil black polyethylene plastic over at least 50% of the pile. Piles would be constructed to minimize soil movement to protect soil productivity and provide for efficient burning.

Q2. Where roadside piling is prescribed, activity fuels in excess of 7 tons per acre within 40 feet of the running surface of the road would be piled. Pieces less than 4 inches in diameter and longer than 24 inches in length would be piled. Tonnage would be assessed by Forest Service using USDA Forest Service General Technical Report PNW-105, May 1980. If slash is moved into the unit farther than 40 feet to avoid piling, the final height of slash should not exceed 18 inches from mineral soil.

Q3. Slash piles near power lines would be burned when the smoke column drifts away from lines.

Q4. If the operator processes chips at the landing, the waste product called swail should be spread out across the landings and skid trails to a maximum depth of 6 inches, keeping at least a 10-foot buffer of bare ground between the swail and the edges of slash piles. The total size of the swail spread area should not exceed 2,500 square feet at each site unless otherwise approved by the District Ranger.

2.2.10 Monitoring

Prior to and during implementation, a multi-stage process is used on the Forest to ensure that a project is implemented as planned. Before beginning the on-the-ground contract preparation process, which includes layout of the units, designating the trees to retain, and cruising the timber, forestry technicians and field crew members meet with the Interdisciplinary Team to transition to the implementation phase of the project. Resource specialists identify any resource concerns in individual units or highlight any key project design criteria on a unit-by-unit basis. After the fieldwork is completed, the project moves into the appraisal and contract preparation phase. One of the first steps in the process is to complete the Contract Project Design & Implementation Crosswalk Form. The purpose of the crosswalk is to ensure that all components of the NEPA Decision, including the project design criteria and terms and conditions from consultation, are incorporated into the contract. For each required component of the NEPA decision, the crosswalk identifies how and what stage in the process the component would be addressed (e.g., during fieldwork, contract, contract administration, post contract monitoring). The information generated from the crosswalk process is used to guide the contract preparation process and to identify any issues that need to be addressed by resource specialists.

Prior to advertisement, a final review is conducted to ensure that the contract is prepared with the proper contract provisions and language; the project design criteria are properly inserted and contractually enforceable; and the contract and appraisal meets Forest Service Handbook, Forest Service Manual and Stewardship Guide (where applicable) regulations and direction. This final review may be informal or may be formalized in a Forest-level review or "Plan-in-Hand." "Plan-in-Hand" reviews are randomly selected and may or may not include this project. The goal of this formal review is to monitor and evaluate forest resource management prescriptions, to measure compliance with goals and objectives, and to make adjustments when needed. The "Plan-in-Hand" review is summarized in a letter to the Forest Supervisor, which is included in the final appraisal/contract packet.

During implementation, the Contract Administrator in conjunction with the Forest Service Representative and Contracting Officer are responsible to ensure that the contract is administered properly throughout all stages of implementation. The contract administration team monitors compliance with the contract, which contains the provision for resource protection, including but not limited to: seasonal restrictions, snags and coarse woody debris retention, stream protection, erosion prevention, soil protection, road closure and protection of historical sites. The Contract Administrator records observations demonstrating compliance as well as any concerns/issues on inspection reports that are signed by both the Forest Service and Purchaser Representative. The inspection reports would also document any resolutions that have been identified. As needed during the implementation process, the contract administration team may request a resource specialist or Line Officer to come for a field visit to discuss a resource issue that has been identified. In addition, a resource specialist may visit a project to conduct monitoring and to help insure that the project is being implemented as intended by the NEPA decision.

Monitoring is also conducted at the Forest level as part of the Forest Plan implementation, including monitoring of noxious weeds and BMPs. The monitoring of noxious weeds and invasive plants would be conducted where appropriate to track changes in populations over time and corrective action would be prescribed where needed.

The project would be part of a pool of completed units available for randomly selected BMP monitoring. More detail on monitoring can be found in sections 3.3.5.2-3.

2.3 Other Alternatives Considered

Section 1.6.1 discusses comments that were received from the public. Some comments were used to refine the proposed action, including the project design criteria, and to frame the analysis for this project. The comments that suggested the consideration of other alternatives are discussed in this section. There is some overlap with the discussion in s. 1.6.1. The following sections provide further elaboration.

2.3.1 Bark submitted seven suggestions and requested that the agency review these suggestions separately or together to assess their economic feasibility and ecological benefit. Bark's suggestions are considered separately below. Since they are all suggested and no rationale was provided for developing alternatives that include some but not all of them, the analysis below at section 2.3.1.8 addresses them together.

2.3.1.1 Add additional miles of road closures and decommissioning to the Hunter project. Recommendations were made for the following roads: 4640, 4660120, 4660140, 4660150, 4660170, 4651130, 4651140, 4680124, 4680125, 4650012 and 5731120.

These roads are addressed individually in Appendix B, Response to Comments, #S25. Most of these roads were authorized to be decommissioned under the 2009 Clackamas Road Decommissioning for Habitat Restoration, Increment 1 Decision Notice or the 2011 Clackamas Road Decommissioning for Habitat Restoration, Increment 2 Decision Notice.

This planning effort is not revisiting previous decisions or making decisions about the timing or funding of projects with previous decisions.

Bark identified that some of these currently have berms that have been breached and suggested blocking them with better berms until the decommissioning actually occurs.

Roads used by the Hunter project (4660120, 4660140), would have new berms installed afterward. However, road closures on relatively flat ground can be breached by drivers that are determined. These breached road closures are on flat ground or ridgetops and are a low aquatic risk. For these reasons, the roads were specifically closed to reduce road maintenance costs on the Forest. Since the roads are not being maintained, that objective is being met even though some closures are breached by unauthorized users. Although new berms would be installed upon completion of project activities, there is still a chance that an unauthorized user could breach a berm by going around it and it is not likely that a bigger berm would deter all unauthorized users. The Forest intends to prohibit access;

however, it is also prudent to acknowledge that unauthorized use may occur. Because these roads pose a low risk to aquatic resources, the berms proposed in this project would be similar to the berms previously constructed on these roads.

2.3.1.2 Rehabilitate and close unauthorized "ghost roads" referenced in these comments as part of the Hunter project.

Bark identified two short user created roads that branch off road 4651.

These two roads go to user created dispersed camping areas and go away from the Wilderness. These sites are unauthorized and impacts are occurring such as compaction from user created OHV routes and damage to riparian vegetation. The proposed action has been adjusted to include these on the list of other similar actions that would be rehabilitated where funding is available.

2.3.1.3 Remove new roadbuilding proposed into the currently unroaded Burnt Granite area. (Oregon Wild also advocated for this.)

See section 1.6.1.1 and 3.10 for discussion on this topic. This would eliminate 1 mile of new temporary road and approximately 120 acres of thinning.

The analysis looked at the unique features of this area as well as the key resources that are often considered well provided for in unroaded and undeveloped block and lacking in other parts of the developed landscape. These include a discussion of high quality or undisturbed soil; high quality water and sources of public drinking water; high quality air; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species; habitat for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; and other locally identified unique characteristics.

The No-Action Alternative describes the benefits and impacts of pursuing this strategy. With the proposed action, the unroaded and undeveloped block would still be over 1,000 acres in size.

The proposed action is guided by the Forest Plan with its goals and objectives. The area is not in a wilderness or an inventoried roadless area and there is no direction to manage smaller blocks of land for roadless values. In terms of Forest Plan land allocations, this area is split between the C1-Timber Emphasis and the B2-Scenic Viewshed land allocations. These have a primary or secondary objective of timber management (s. 1.2.1.3).

2.3.1.4 Exclude stands with high snag densities from any logging and apply protective buffers to key snags.

Live trees would be treated within harvest units and protection buffers to provide future snags. Tree topping is generally the technique used to create longer lasting snags and to

create live trees with decay. Girdling is the technique used to create snags quickly but they decay, fall over sooner, and become down wood. Quantities are described at s. 2.2.7.5. Snags would be retained in all units where safety permits. To increase the likelihood that snags would be retained, they may be included in skips, s. 2.2.9M4.

The District has not identified any units with high snag density. However, the stands that do have some legacy snags are the ones that would be eliminated with s. 2.3.1.5 below. An analysis of snags is at s. 3.8.7.

2.3.1.5 Remove units that have never been logged before. (Oregon Wild also advocated for this.)

This would delete units 203 to 318, which includes 260 acres of fire-origin stands, 81 acres of mistletoe stands and 296 acres of roadside danger trees. Even though stumps are present in some units from salvage operations or danger tree felling, the majority of these acres have not had any substantial logging. See sections 1.3.1.2, 1.6.1.2 and 3.7.3.2 for discussion on this topic. The analysis looked at the unique features associated with fire-origin stands.

Commenters stated that the stands have all the building blocks necessary for development into desired conditions and that the stands are already complex and are transitioning towards natural self-thinning.

The fire-origin stands are not in land allocations that emphasize natural process of self-thinning. These stands are in the C1-Timber Emphasis and the B2-Scenic Viewshed land allocations. These have a primary or secondary objective of timber management (s. 1.2.1.3). The desired condition is to have stands that are relatively healthy with growth rates commensurate with site capability.

These stands are in spotted owl critical habitat. The desired condition there is to have stands that contribute to dispersal and suitable habitat. The stands are not currently considered suitable owl habitat and the prescription would move the stands to develop in that desired direction.

While most stands are capable of developing without intervention, the Forest Plan encourages active management on these land allocations. And the owl recovery plan recommends active management in critical habitat to improve conditions for the long term.

2.3.1.6 Remove regeneration harvest. (Oregon Wild also advocated for this.)

Unit 102 would be deleted which amounts to 60 acres. See sections 1.3.5.1, 1.6.1.3 and 3.8.3 for discussion on this topic.

Commenters suggested that it would be the same as clearcutting and would be a return to the type of traditional forestry that has led to the majority of human-caused, long-term impacts on the Forest today.

While the Forest Plan and the Northwest Forest Plan allow and encourage regeneration harvest in old-growth stands, the District has not pursued that strategy in recent years. As a result, early-seral forests have declined dramatically in the past 20 years. The Forest Plan, as amended, provides direction for the enhancement of forage to provide for deer and elk particularly in the B11-Deer and Elk Summer Range land allocation. A regeneration harvest with skips and scattered retained trees in a plantation is not similar to past practices such as clearcutting old growth, but is in a carefully chosen location and prescription to address the landscape-wide situation of declining forage and early-seral habitats without impacting old-growth stands.

2.3.1.7 Remove commercial logging from Riparian Reserves unless it is demonstrated to be needed to achieve Aquatic Conservation Strategy (ACS) objectives in the areas proposed.

The analysis has shown consistency with ACS objectives, s. 3.4.8.1.

2.3.1.8 Bark's combined suggestions

Bark's combined suggestions would delete units 203 to 318 which includes 260 acres of fire-origin stands, 81 acres of mistletoe stands, 296 acres of roadside danger trees and 60 acres of regeneration harvest in unit 102.

This would eliminate 1.2 miles of new temporary road construction and 1 mile of reconstruction of previously decommissioned system roads.

It would add some road work to close 4640, 4660120, 4660140, 4660150, 4660170, 4651130, 4651140, 4680124, 4680125, 4650012 and 5731120. It would also rehabilitate and close unauthorized "ghost roads" that branch off road 4651.

The environmental impact and benefits of the projects Bark suggests deleting, have been fully analyzed and disclosed in Chapter 3; the effects were found to be minimal. Section 2.2.8 discusses the details for roads and impacts and benefits of these actions are discussed in several sections in chapter 3 such as, s. 3.1, s. 3.3.3 s. 3.4, s. 3.7.3, s. 3.8.3, s. 3.8.5. The analysis found the impacts to be sufficiently mitigated by project design criteria (s. 2.2.9). Forest Plan standards and guidelines would be met and the project would be consistent with the Aquatic Conservation Strategy (s. 3.4.8.1).

The Forest Plan as amended directs where it is appropriate and desired to manage vegetation to meet the multiple objectives of resource management. The areas affected by this request are on land allocations considered suitable for vegetation management as well as road construction.

The suggested alternative of removing units and adding more intensive road closures was considered but not fully developed because of the following factors.

- The suggestions would provide a similar level of resource protection when compared to the proposed action and therefore is not substantially different from the proposed action in that respect.

- It would not provide the benefits described in the purpose and need for approximately 700 acres, which represents 23% of the total acres where vegetation management is proposed.

    - 260 acres of forest land would continue on a trajectory of declining health as overcrowded, uniform conditions would continue to persist.
    - 81 acres would continue declining due to dwarf mistletoe infestation. They would not be providing future forest products in the Matrix land allocation, and they would not develop into suitable or dispersal habitat for northern spotted owls.
    - 296 acres would continue to have danger trees which would be a hazard to the public. Roads may need to be closed.
    - 60 acres in the B11-Deer and Elk Summer Range land allocation would have declining forage value.
    - Approximately five million board feet of lumber would not be processed by local mills.
    - If these units were deleted, there would be a reduction in value of approximately $600,000 that would not be available to help pay for road repairs or other important restoration work including road decommissioning, road stormproofing, culvert replacement, white pine pruning, forage enhancement and riparian restoration.

      It would also not be available to pay for approximately $10,000 of additional costs to berm the roads identified by Bark.

While Bark suggests that the projects recommended for deletion are controversial, they are consistent with the Forest Plan and are supported by the collaborative group, Clackamas Stewardship Partners (Response to Comments, Appendix B).

2.4 Comparison of Alternatives

This section presents a comparative summary of principal activities and the environmental effects for the alternatives being considered in detail. The summary is limited to the effects on the project's purpose and need, Forest Plan standards and guidelines, and other resources measurably affected and considered important for an informed decision.

Topic	Alternative A - No Action	Alternative B - Proposed Action
Purpose and Need Indicators		
Increase forest health and growth by thinning (s. 3.1)	Stands would begin to stagnate and become more susceptible to insects and diseases.	Trees in thinned stands would have the space they need to grow and increase diameter and expand their crowns.
Tree diameter in 50 years Plantations	18.1 inches. Not meeting late-successional character.	21.2 inches. Achieves the minimum size where stands begin to function as late successional.
Tree diameter in 50 years Fire Origin Stands	13.9 inches. Not meeting late-successional character.	18.2 inches. Stands are developing late-successional character.

Topic	Alternative A - No Action	Alternative B - Proposed Action
Diversity of vertical and horizontal structure by variable-density thinning (s. 3.2) Acres treated	Stands would remain relatively uniformly dense and overcrowded.	2,140 acres of variable-density thinning with skips, gaps, heavy thinning and forage openings would create greater structural diversity compared to no action.
Change in tree species	Douglas-fir would remain the dominant species in most stands.	Retention of minor species and removal of some Douglas-fir – results in greater representation of western hemlock, noble fir, Pacific silver fir, western redcedar and alder. More representative of historic species mix.
Change in other plants	Ground vegetation would remain unchanged. Shade would gradually increase.	More sunlight to forest floor would increase abundance of plants, including forage species.
Change in vertical canopy layers	Would primarily remain single story stands with small gaps created by natural disturbances.	Gaps and heavy thins would naturally regenerate and begin to grow young trees resulting in a two storied stand. Up to 10% gaps and up to 10% heavy thins.
Change in horizontal structure	Trees would remain uniformly dense.	A mix of gaps, skips, heavy thins, and variable-density thinning would result in diverse structure. Up to 10% gaps, up to 10% heavy thins, skips would be 5 to 10% plus riparian buffers.
Change to snags and down wood (s. 3.8.7)	High levels of small snags and down wood in next few decades in plantations.	Lower levels of small snags and down wood compared to no action. Levels for larger sized snags and down wood are slightly less compared to no action. Snags and down wood would be created.
Restore off-site lodgepole pine plantations. (s. 3.1) Acres treated	Lodgepole pine trees would eventually die from mountain pine beetle. Stands would not be productive or become owl habitat.	116 acres would be planted with more appropriate tree species. Stands would eventually become productive and would become owl habitat sooner compared to no action.
Change in tree species	Off-site lodgepole pine would remain until it dies.	A mix of species more appropriate to the site would be planted including noble fir, western white pine and Douglas-fir.
Restore mistletoe infected stands (s. 3.1) Acres treated	None.	81 acres would be treated by mastication and planting.
Change in tree species	Stands would continue to deteriorate to the point where rhododendron shrubs would be the predominant plant present.	A mix of species that are not susceptible to this parasite would be planted including noble fir, western white pine and Douglas-fir. The existing scattered overstory of infected hemlock would continue to die providing short-term snag habitat.
Protect blister rust infected trees (s. 3.1) Acres treated	None. Infections would continue to kill white pine trees.	250 acres would be treated to reduce the risk that blister rust would kill white pine trees and increase the likelihood that they would survive to maturity.
Deer and elk habitat (s. 3.8.3) Acres treated	Forage for deer and elk would continue to decline across the landscape. No acres treated.	Forage for deer and elk would improve slightly across the landscape. 186 acres would be treated specifically for forage, and 370 additional acres of treatment would have side benefits for forage.
Utility corridor management (s. 1.3.6) Acres treated	BPA would fall individual hazardous trees and leave them. Fire hazard would increase.	66 acres of treatment to ameliorate risks associated with power lines.

Topic	Alternative A - No Action	Alternative B - Proposed Action
Sustainably provide wood products (s. 3.16)		Several project types discussed above provide for the utilization of wood products.
Timber volume removed	No wood products provided to local and regional economies.	Provides approximately 20 MMBF of wood products.
Acres of matrix treated	Future productivity reduced as mid-aged stands stagnate. Diseases continue to reduce productivity.	Improves stand health for future productivity on 2,685 acres.
Removal of danger trees along roads (s. 1.3.7) Acres treated	None	296 acres
Transportation management (s. 3. 11) Miles treated	Roads would continue to impact hydrologic function and water quality. No roads maintained, repaired, closed or decommissioned.	Active road decommissioning and road repair, maintenance and stormproofing would reduce chronic sediment delivery, restore hillslope hydrology and reduce sediment impacts associated with the potential catastrophic failure of stream crossings during storm events. 157 miles treated.
Aquatic/riparian management (s. 1.3.9)	Problem areas remain unchanged.	5.5 miles of streams enhanced.
Summary of Actions (s. 2.2)		
Acres of mid-aged stands thinned to meet purpose and need	0	2,140
Acres of Riparian Reserve and LSR Enhanced	0	400
Acres of off-site lodgepole pine treated	0	116
Acres of mistletoe stands treated	0	81
Acres of blister rust treated	0	250
Acres of early-seral habitat created for deer and elk	0	60
Acres of existing forage enhanced	0	126
Acres of utility corridor managed	0	66
Acres of danger trees treated	0	296
Miles of temporary roads constructed and then rehabilitated	0	2.5
Miles of old road alignments reconstructed and then rehabilitated	0	11.4
Miles of system roads maintained	0	148
Miles of system roads decommissioned	0	1.6
Miles of system roads stormproofed	0	5.3
Miles of open roads closed	0	24
Stream crossings restored	0	6
Riparian Reserve/Dispersed recreation. Number of sites restored.	0	6
Miles of streams with added wood	0	1
Public Issues and Concerns		
Unroaded/Undeveloped Areas (s. 1.6.1.1) (s. 3.10) *Road construction and logging operations would alter the many values associated with unroaded areas.*	Four blocks of unroaded and undeveloped areas would remain unchanged.	Three blocks of unroaded and undeveloped areas would remain unchanged. One block would be reduced from approximately 1,969 acres to approximately 1,815 acres. Stands would be thinned and roads would be rehabilitated after use.

Topic	Alternative A - No Action	Alternative B - Proposed Action
Fire-Origin Stands (s. 1.6.1.2) (s. 2.2.1) *Thinning would alter stands that already have desired conditions and are already on a desired trajectory via self-thinning.*	Fire-origin stands would continue to develop without intervention. Some stands have very small trees and very slow growth rates.	Where legacy trees occur, large live trees would be retained as well as non-hazardous snags. Stands would acquire late-successional characteristics faster compared to no action.
Regeneration Harvest (s. 1.6.1.3) (s. 2.2.5.1) *Using the regeneration harvest method on such a large scale in a plantation is inappropriate and unnecessary.*	The targeted plantation would continue to become denser shading out forage plants.	Given the decline in forage for deer and elk across the landscape, the treatment would create some forage at an appropriate scale.
Roads (s. 1.6.1.4) (s. 2.2.8) *Roads cause unwanted impacts and should not be built and old alignments should not be reconstructed.*	No road construction or reconstruction.	Reconstruct 11.4 miles of existing road alignments and construct 2.5 miles of new temporary roads which would all be rehabilitated after use.
Effects Summary		
Water Quantity (s. 3.3.2)	No change	Very little change, not measurable
Water Temperature (s. 3.3.3.1)	No change	Very little change, not measurable
Sediment (s. 3.3.3.4)	Some problem areas continue to produce sediment, roads deteriorate.	Some minor short-term increase with long-term reduction from road repair, road closure, stormproofing and decommissioning.
Fisheries ESA Listed Fish Habitat (s. 3.4.6)	No Effect	May Affect, Not Likely to Adversely Affect
Fisheries MSA Essential Fish Habitat (s. 3.4.6)	No Impact	May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species
Aquatic Sensitive and Survey & Manage (s. 3.4.6)	No Impact	May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species
Management Indicator Species – Fish (s. 3.4.7)	Would not contribute to a negative trend in viability on the Forest	Would not contribute to a negative trend in viability on the Forest
Aquatic Conservation Strategy (s. 3.4.8.1)	Would not enhance late-successional characteristics of Riparian Reserves, replace or repair culverts, or restore dispersed recreation impacts.	Meets ACS Objectives. Would enhance late-successional characteristics of Riparian Reserves.
Soil Erosion (s. 3.6.5)	Gradual continued recovery of existing soil conditions. Roads continue to be unrestored.	Very small risk for a very short period of time with PDCs. Reduced erosion as roads are rehabilitated, decommissioned and stormproofed.
Detrimental Soil Disturbance (s. 3.6.6)	Gradual recovery. Many stands currently exceed S&Gs.	Uses existing skid trails & landings. Temporary roads, landings and some skidtrails would be restored. Exceptions to S&Gs.
Organic Matter (s. 3.6.7)	Gradual recovery as trees die and fall.	PDCs minimize alteration of duff and down wood. Some slash would be retained and would quickly decay.
Northern Spotted Owl (s. 3.7)	No effect. Some stands may never become suitable habitat without intervention.	Not Likely to Adversely Affect. Some stands accelerated toward suitable habitat.
Sensitive Species (s. 3.8.1, s. 3.12)	No impact	Not likely to result in loss of viability
Survey and Manage (s. 3.8.6.2)	No impact	No impact

Topic	Alternative A - No Action	Alternative B - Proposed Action
Snags (s. 3.8.7)	No change in the short term, many small snags in the long term, greater number of large snags in the long term.	Slightly fewer in the short term due to those felling of hazard snags. Some snags created. Half as many small snags in the long term. Sufficient number of large snags in the long term.
Deer and Elk (s. 3.8.3)	Declining populations due to lack of forage	Beneficial effect due to increases in forage
Pileated Woodpecker (s. 3.8.4)	No change	Very little change
American Marten (s. 3.8.5)	No change	Very little change
Scenery & Recreation (s. 3.9)	No change	Very little change. Inappropriate recreation in riparian areas is contained. Road closure reduces dispersed recreation.
Wilderness (s. 3.10.1)	No change	No change
Transportation (s. 3.11, s. 2.2.8)	Declining road condition. Eventually roads would become unsafe and may need to be closed.	Road problems fixed. Some unneeded roads decommissioned to reduce maintenance cost and resource impact.
Botany (s. 3.12)	No short-term change	No species found during surveys.
Invasive Species (s. 3.13)	No change. Several invasive plants are present	Invasive plants would be removed from some forage enhancement units. Some existing common invasive plants may spread somewhat, particularly along roads. PDCs would minimize spread of existing invasives and would minimize the introduction of new species.

3.0 Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

Cumulative Effects

A discussion of cumulative effects is included for each resource where appropriate. Cumulative effects are impacts on the environment that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. If the proposed action would have little or no effect on a given resource, a more detailed cumulative effects analysis is not necessary to make an informed decision.

The land area and the time scale used for cumulative effects analysis varies by resource depending on factors such as how far in space and time the direct and indirect effects are manifested. These are explained for each resource topic in section 3. The analysis considers the impact of activities on other ownerships where appropriate. In the vicinity of the planning area there are lands managed by the Confederated Tribes of Warm Springs and there is a small private parcel at Austin Hot Springs.

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.

The cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach:

- A catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), as well as by natural processes of growth and recovery since. Trying to isolate the individual actions that continue to have residual impacts would be nearly impossible.
- Providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions.
- Focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By 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 to those effects.
- The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.
- The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives would add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions

may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)"

Each specialist includes a discussion of how information on past projects was considered. For the reasons discussed above, the analysis of past actions is primarily based on current environmental conditions. Some specialists utilize the current GIS vegetation layer that includes information on current condition of forest stands as they have been affected by events such as forest fires, past regeneration harvest and road construction as well as the growth that has occurred since.

Other Factors

Other types of projects or activities that are not included in the proposed action but may occur because they are authorized by other documents are also considered where appropriate including road maintenance, road decommissioning, danger tree removal, gathering of special forest products, and recreational uses. There are several recent, ongoing or foreseeable projects in the vicinity that may be included, depending on the cumulative effects analysis area, which is unique for each resource.

Recent vegetation management projects in the Upper Clackamas Watershed include B Thin, Bass Thin, Day Thin, M Thin, O Thin, Roman Thin, Swag Thin, Wall Thin, Wolf Thin, and Y Thin. In terms of ongoing projects, the Slow (Lemiti) Fuels Reduction project is under contract but has not yet started. There are no other known foreseeable vegetation management projects in the watershed. Recent road management environmental assessments included road decommissioning; most included roads have been decommissioned but a few have been delayed but are considered foreseeable.

3.1 STAND GROWTH AND PRODUCTIVITY

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that vegetation management actions are appropriate to move stands in the desired direction in terms of health, growth and productivity in both the short and long term while minimizing effects to other resources.

This section summarizes the silviculture specialist's report, which is incorporated by reference. This section elaborates on the purpose and need relevant to stand health and growth in sections 1.3.1.1, 1.3.2.1, 1.3.3.1 & 1.3.4.1. See also the discussion at s. 1.3.1.2.

3.1.1 Methodology

An array of available information and tools were used in the analysis of vegetation treatments for Hunter. These include the Upper Clackamas Watershed Analysis, Aerial Insect & Disease Detection Survey data during the 2011 through 2015 seasons, local and Forest-level GIS data, local knowledge, walkthroughs of stands, and collected common stand-exam data. These were used in the development of the proposed action and in the analysis of effects and benefits.

The stand-exam data were uploaded into the US Forest Service Field Sampled Vegetation (FSVEG) database and prepared for the Forest Vegetation Simulator (FVS), a forest growth

simulation model developed by the Forest Service (USDA 2009). It is an individual-tree; distance-dependent growth and yield model, which can help show how vegetation would change in response to proposed management actions.

There are elements of the proposed action that would not have much if any impact on forest health, growth or diversity of the vegetation. These include road repair, road closure, road decommissioning, recreation projects, and stream projects. These elements of the proposed action are not elaborated below. Most of the proposed vegetation actions however, would likely affect health, growth and diversity and are addressed in the following sections.

3.1.2 Existing Condition

Vegetation series within the watershed include western hemlock (34%), Pacific silver fir (36%) and mountain hemlock (30%).

The planning area once contained large patches of mature Douglas-fir and hemlock in the lower elevations with other species mixing in at the higher elevations. It also contains large patches of younger stands that seeded in after fires. Now the planning area has areas of mature forest fragmented by plantations, roads and power lines. The plantations in the watershed have a wide range of ages and densities (from age 10 to 60). Some plantations have already been thinned, while many others have not. Some of the fire-originated stands have also been thinned.

Approximately 30,533 acres or 32% of the analysis area has been converted to plantations. Of these plantations, approximately 6% have already been thinned in the past 20 years, and 8% are included for various treatments in the proposed action. The remainder would be available for thinning in the next few decades as young plantations grow. Approximately 6,000 acres per decade would be available for thinning in the next three or four decades. Thinning has also occurred in approximately 1,234 acres of fire-origin stands in the project area.

Because of regeneration harvest and road construction, the trends in landscape pattern from the 1950s through the 1980s include increased early-seral habitat, increased edge habitat, decreased interior habitat, fragmented mature habitats, reduced connectivity of mature habitats, and a decrease in patch size. The trend since the 1990s has been a gradual transition of early-seral habitats to mid seral and the softening of edge effects as plantations grow. It is estimated that 3% of the planning area is currently in an early-seral condition.

From a silviculture perspective, site productivity in the watershed is relatively high. However, upper-elevation sites are typically less productive because of shorter growing seasons, thinner soils and brush competition.

A recent infestation of mountain pine beetle has resulted in substantial mortality of most lodgepole pine stands such as those in the Sisi, Lemiti and Rhododendron Ridge areas. The Lemiti Fuels Reduction Project involves fuel treatments in the southeast portion of the planning area that have not yet been implemented. That environmental assessment

has substantial detail and analysis of the dead lodgepole pine situation and is incorporated by reference.

3.1.3 Direct and Indirect Effects

No-Action Alternative

With no action, the benefits described in the purpose and need section (s. 3.1) would not occur. Vegetation rarely remains static; over time, processes of growth, death and decay would gradually change the stands we see today.

In densely stocked stands, no action would result in gradually declining health and growth. Trees that are uniformly spaced have less of a chance to express dominance. Therefore, when these stands reach density levels in which individual trees are competing with each other for growing space, growth slows. Trees that do not die would have some height growth, but diameter growth would drastically slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner, they are more likely to sustain wind damage in large groups. Also if drought conditions persist they may be more susceptible to insects and disease. With potential for heavy wind damage, the likelihood of Douglas-fir beetle outbreak could also increase (Furniss 2014).

Failure to maintain tree spacing while they are young can have consequences lasting the life of the stand (Oliver 1996). If no action is taken, the overstocked condition of current stands would result in stands with reduced vigor, small trees, increased mortality, and increased susceptibility to stressors such as insects, diseases and weather.

With no action, stands that have disease or stocking problems would not be treated and they would not likely develop on their own into stands that meet desired conditions.

Proposed Action

In general, thinning tends to improve the overall vigor, growth, health and architecture of trees. Thinning can directly affect productivity and forest health by maintaining growth rates of young stands. Thinning would redistribute growth potential to fewer trees, while maximizing the site's potential, leaving a stand with a desired structure and composition (Oliver 1996).

Thinning provides growing space, which gives residual trees the opportunity to take advantage of this growing space for the longest practical time, fully utilizing the ability of the trees to expand their crowns and roots into the growing room provided by the removal of neighboring trees (Oliver 1996). Trees with larger crowns have greater stem taper, that is, the base of the tree is relatively large compared with trees that have small short crowns. Thinning increases a tree's resistance to the wind (windfirmness) by maintaining a larger crown and increasing stem taper. Trees with more taper are less likely to suffer stem breakage or wind damage. In general, thinning increases both stem and root strength. Thinning can also improve the resistance of some trees to some pathogens by manipulating the structure and species composition of a stand.

The impacts on adjacent stands would be very minor for thinning treatments due to the density of the retained canopy. Adjacent to proposed regeneration harvests, there may be some wind damage along the edge because there would be increased exposure to trees that have grown relatively densely. Individual trees that may be blown down or damaged by wind would provide additional habitat for species that depend on down wood or broken-topped trees.

The proposed action would address tree-stocking issues in off-site lodgepole pine plantations and in dwarf mistletoe infected stands. It would also prune white pine trees to provide some protection against blister rust. These actions would result in healthier stands and put them on a trajectory to contributing to long-term forest productivity.

The proposed action would result in some stands being managed for objectives other than stand health and growth. These include forage enhancements (s. 1.3.5 & s. 2.2.5), utility-corridor hazard-reduction treatments (s. 1.3.6 & s. 2.2.6) and roadside danger tree removal (s. 1.3.7 & s. 2.2.7.1). These treatments are addressed in the silviculture specialist report and in the Forest Plan consistency section below.

In thinned stands, the average size of trees after 50 years of growth would be 21.2 inches diameter in plantations and 18.2 inches diameter in fire-origin stands, compared to no action, which would result in diameters of 18.1 and 13.9 inches respectively. Currently, the average diameters are 12.4 and 10.3 inches respectively.

3.1.4 Cumulative Effects

The effects of vegetation management on stand growth and productivity are generally experienced or expressed within the treated stands and in the areas directly adjacent; therefore the analysis area for cumulative effects would be the unit boundaries and the areas directly adjacent (approximately one tree height). This is appropriate because treatments inside the units would not likely affect the health and growth of stands elsewhere. Within one tree height of a treatment unit, there can be some minor changes from additional sunlight or changed wind patterns. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when stands were clearcut remain today, and alterations made during vegetation management have the potential to benefit health and growth 100 or more years into the future.

The existing condition includes past actions as they have affected growth including previous logging, site preparation, planting (including the selection of genetically appropriate seed), and precommercial thinning. It also includes past wild fires. There are no foreseeable future projects occurring inside the units or directly adjacent. While there may be future logging or other management within the units or in nearby areas, there are no current proposals with sufficient site specificity to conduct an analysis.

Because the impact of the proposed action on growth, health and productivity is a beneficial one, and there are no other additive impacts to consider, there would be no substantive cumulative effects.

3.1.5 Forest Plan standards and guidelines

Forest Plan References
Forestwide Timber Management Standards and Guidelines - FW-306 to FW-385, page Four-86
Northwest Forest Plan - Matrix Standards - page C-39

FW-306 and FW-307 (page Four-86)

FW-306 indicates that timber stands should not be regeneration harvested until they have reached or surpassed 95 percent of culmination of mean annual increment measured in cubic feet. FW-307 explains that exceptions to this may be made where resource management objectives or special resource conditions require earlier harvest.

Mean annual increment is a stand-exam calculation that measures stand growth and is derived using the Forest Vegetation Simulator (FVS). Culmination of mean annual increment is the time in a stand's life when it is considered biologically mature (i.e. when growth slows and when decay and mortality increases).

The proposed action would require an exception for FW-306.

- Unit 102 is a regeneration harvest in a plantation to create early-seral habitat for deer and elk (s. 1.3.5 & s. 2.2.5). The unit is in the B11 Deer & Elk Summer Range land allocation where B11-009 provides for the creation of forage. According to growth and yield modeling, Mean Annual Increment for this stand is 53.7 cubic feet per acre, which is roughly 60% of culmination of Mean Annual Increment. More discussion of the value of forage can be found in the Deer and Elk section at s. 3.8.3. The proposed action was developed intentionally to target forage creation in a plantation with the appropriate forage plants instead of targeting old-growth stands. An exception for FW-306 is proposed to achieve the forage goals for this area.

- The utility corridor treatments include 66 acres over 23 separate units in various land allocations (s. 1.3.6 & s. 2.2.6). The proposed action is to remove all trees that are either directly underneath or within 50 feet of the power line corridor within areas where this treatment is both feasible and safe. The removal of all trees in these areas is not considered a regeneration harvest or clearcut; there is no silvicultural intent to manage these areas for long-term timber production and they would not be planted with conifer tree species. The new openings would be managed for early-seral values, forage and safety of the utility corridor. Conifers would likely seed in from the edge but because of the safety issue, they would not be retained in these areas to maturity. Because the areas are not managed for timber production, FW-306 is not applicable.

3.1.6 Other Findings

The proposed action is consistent with the National Forest Management Act regulations for vegetative management. There would be no regulated timber harvest on lands classified as unsuitable for timber production (36 CFR 219.14) and vegetation manipulation is in compliance with 36 CFR 219.27(b).

FW-308 indicates that regulated timber harvest activities shall occur only on those lands classified as suitable for timber production. Timber cutting on unsuitable lands may occur for reasons such as to protect other multiple use values or activities.

The treatments underneath and adjacent to the power line are not being conducted as 'regulated timber harvest.' The purpose and need for this action is not to harvest timber to meet the Forest's proposed sale quantity, which is calculated from the suitable land base. It is also not proposed to facilitate the long-term productivity of lands available for timber harvest. The proposed treatments involve removing trees that are not compatible with safe management of the power line. Due to their proximity to the power line, these lands are considered unsuitable for long-term timber management and therefore the provisions of the National Forest Management act as codified in FW-308, are not applicable. Similarly, the requirement to restock these small areas in five years as suggested by FW-358 & 361 are also inapplicable. It would not make sense to plant trees that would eventually become hazardous, in areas that cannot be managed for timber production. Conifers would likely seed in from the edge but because of the safety issue, they would not be retained in these areas to maturity.

3.2 DIVERSITY

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that vegetation management actions are appropriate to move stands in the desired direction in terms of vertical and horizontal stand structure in both the short and long term while minimizing effects to other resources.

This section elaborates on the opportunities to address diversity described at section 1.3. This section summarizes portions of the silviculture specialist's report. This section elaborates on the opportunities to address diversity described at sections 1.3.1.1 & 1.3.1.3.

3.2.1 Introduction

Diversity is the distribution and abundance of different native plant and animal communities and species within an area. There are many types of diversity including but not limited to genetic, structural, horizontal, and vertical. At the landscape scale, a mix of forest types and ages can provide habitat for a wide range of plants and animals. At the stand scale, other elements become more relevant such as species composition, snag abundance or the number of canopy layers.

Both human actions and natural processes or events have the potential to alter wildlife diversity. Some actions or natural processes or events may seem to benefit one aspect of diversity and a suite of species while at the same time is less advantageous to other species.

At a landscape scale, the logging that created the plantations fragmented mature forest stands. Prior to the 1950s, the forests in the project area were relatively uniform mature forest with inclusions of second growth that came in after wildfires. The mature stands

became fragmented by clearcuts as plantations were established. This likely benefitted more than 150 native wildlife species that use early-seral vegetation including deer and elk but likely harmed species such as spotted owls that require large blocks of contiguous mature habitat.

In Douglas-fir forests, the component of standing and down dead wood is as important to ecosystem function as the live plants, soils or animals (Maser 1984). Plantations generally lack certain elements of diversity and complexity. They often do not contain the mix of tree species that were present in the original stand and they are relatively uniform in terms of tree species, size and spacing. When the original clearcut harvesting occurred, all of the large trees and snags were removed. The plantations tend to display minimal variability of vertical and horizontal stand structure and little sunlight reaches the forest floor resulting in low levels of diversity of ground vegetation.

Variable-density thinning is a technique that typically features skips and gaps and areas of heavy thinning. Leave trees include minor species, trees with the elements of wood decay and non-hazardous snags while some snags and down logs are created. Thinning that incorporates these features can change a uniform plantation into one with more variable vertical and horizontal structure and greater species diversity. These changes would be beneficial to a wide range of plants and animals. There would be a temporary increase in forage for deer and elk and temporary habitat for early-seral dependent species. As the stands continue to grow, they would acquire many of the characteristics of old-growth forests sooner than if left untreated. The fragmented nature of the landscape would become less evident as plantations blend in with surrounding mature forest stands. This is particularly important in LSRs and Riparian Reserves to restore them to the desired conditions for the key species that rely on unfragmented mature forest conditions.

3.2.2 Direct and Indirect Effects

With no action, diversity within densely stocked forested stands would continue to be lacking for longer periods. Stands would continue to be a single-canopy layer with only one age class. Species diversity especially in the plantations would also continue to be lacking as they were primarily planted with Douglas-fir, and with a closed canopy due to high densities, other tree species, herb, shrub and forb cover would not readily establish. These stands would continue to have low diversity in ground vegetation and overstory vegetation. Early-seral habitat would continue to decline.

With variable-density thinning, there would be an increase in spatial heterogeneity in stand density and tree growth as well as heterogeneity in understory vegetation within stands (Harrington 2005). By inducing fine-scale variation in these otherwise homogeneous plantations, biological and structural heterogeneity can arise to promote old-growth characteristics more quickly. Skips are areas where special habitats, snags, and downed logs could be more protected. Gaps would result in temporary open habitat and the eventual development of a new cohort and age class of trees.

The elements of the proposed action that enhance forage would provide early-seral habitat in a landscape where this habitat type is declining, therefore enhancing landscape scale diversity.

3.2.3 Comparison of Alternatives in terms of Diversity

Measure	No Action	Proposed Action
Acres Affected	0	Variable-density thinning would occur on approximately 2,140 acres.
Change in tree species composition	Tree species mix would not change. Stands that are currently predominantly Douglas-fir would remain (approximately 5% minor species in most stands).	Retention of minor species and removal of some Douglas-fir – resulting in greater representation of western hemlock, noble fir, Pacific silver fir, western redcedar and alder (as much as 20% minor species in some stands). Minor species are likely to seed into stands more readily than Douglas-fir. More representative of historic species mix. Western white pine would have a greater likelihood of surviving blister rust.
Change in abundance of ground vegetation and species richness	Shade tolerant plants on the forest floor would remain.	More sunlight to forest floor would increase abundance of plants such as forage species. Native forage plants would be seeded or planted.
Change in vertical canopy layers	Stands would primarily remain single story stands with small gaps created by natural disturbances. Live legacy trees present in some fire-origin stands would remain.	Gaps and heavy thins would naturally regenerate primarily with shade-tolerant trees resulting in a two storied stand. (Up to 10% gaps and up to 10% heavy thins). Some ingrowth would also occur throughout stands except in skips and riparian buffers. In mistletoe stands, an understory of unsusceptable tree species would be planted. Live legacy trees present in some fire-origin stands would remain.
Change in horizontal structure	Trees would remain uniformly dense for many years. Root rot pockets would create small gaps in stands where it is present.	A mix of gaps, skips, heavy thins, forage openings and variable-density thinning would result in more diverse structure. (Up to 10% gaps, up to 10% heavy thins, skips would be 5 to 10% plus riparian buffers).
Change in abundance and size of snags and down wood (s. 3.8.7)	In plantations, there would be high levels of small snags and small down wood in next few decades. In some fire-origin stands, legacy snags are present that would remain.	In plantations, the project would create some small snags and down logs now (s. 2.2.9.J4). In terms of natural mortality, there would be lower levels of small snags and down wood in the next few decades compared to no action. In the long term, levels of larger sized snags and down wood would be slightly less compared to no action. In some fire-origin stands, legacy snags would be retained where safety permits - some snags may be felled.

3.2.4 Cumulative Effects

The effects of vegetation management on stand diversity are generally felt inside the units; therefore, the analysis area for cumulative effects is the unit boundary. Other sections of this document contain discussions of landscape scale diversity such as effects to wildlife habitat in sections 3.7 and 3.8. The time scale for cumulative effects analysis

is quite long: impacts from up to 60 years ago when clearcutting occurred are still felt today, and changes made with vegetation management have the potential to benefit and impact elements of diversity 100 or more years into the future. The existing condition and the changes projected above include past actions as they have affected stand diversity including road construction, previous logging, site preparation, planting (including the selection of tree species), and precommercial thinning. There are no foreseeable future projects occurring inside the units or directly adjacent to them to consider. While there may be future logging or other management within the units, there are no current proposals with sufficient site specificity to conduct an analysis. For these reasons, cumulative effects for stand-level diversity would not occur, as the effects of this action are limited to direct and indirect effects and no other project overlaps in time or space to contribute to a cumulative effect. Variable-density thinning with skips and gaps is intended to enhance stand-level diversity. While there would be some change to certain decadence elements, cumulative impacts are not likely to occur.

3.2.5 Forest Plan standards and guidelines - Landscape and Stand Diversity

Forest Plan References
Forest Management Goals - #11 and 12, page Four-2
Forestwide Forest Diversity Standards and Guidelines – FW-148 to 169, page Four-67

The proposed action is consistent with these standards and guidelines.

Standard	Notes
FW-148 to 150	The prescriptions retain a diversity of species.
FW-152 &155	The prescriptions retain a diversity of tree species based on site potential and encourage the continued presence of minor forest tree species.
FW-156	No native species would be lost.
FW-157	Some areas contain an abundance of alder. It would be retained where feasible.
FW-158 to 160	No old growth would be altered.

3.3 WATER QUANTITY and QUALITY

This section summarizes the water quality specialist's report and data in the analysis file. After this section presents some background information, it discusses water quantity (s. 3.3.2), temperature (s. 3.3.3.1), and sediment (s. 3.3.3.4). There is additional discussion on related topics in the Fisheries (s. 3.4), Geologic Stability (s. 3.5) and Soil Productivity (s. 3.6) sections.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that actions provide appropriate protections and enhancements of water quantity and quality. PDCs were developed to detail how best management practices would be tailored to site-specific circumstances (s. 2.2.9). Cumulative effects were found to be minimal. Clean water is important in this area because of anadromous fish and the river downstream is used for domestic water supply.

Most of the elements of the proposed action have the potential to affect water. Some actions such as road decommissioning and road stormproofing are specifically designed to benefit water quality.

3.3.1 Background

In some other documents the term 'field' is used to describe the size of a watershed, such as 5th field, 6th field or 7th field. Since that terminology may be confusing and is used differently by different agencies, this document uses the term 'basin' to describe the 4th field size, 'watershed' to describe the 5th field size, 'subwatershed' to describe 6th field size, and 'drainage' to describe the 7th field size.

The project is located in the Clackamas River Basin and in the Upper Clackamas Watershed. The discussion below focusses on the Upper Clackamas Watershed and the five subwatersheds that comprise it.

Subwatersheds	Acres	Percent of the subwatershed managed by Forest Service
Cub Creek	14,510	100
Headwaters Clackamas River	26,018	78
Last Creek-Pinhead Creek	17,355	100
Lowe Creek-Clackamas River	19,692	100
Pot Creek-Clackamas River	22,983	99

3.3.1.1 Drinking Water

Approximately 300,000 people get water from the project area including Estacada, and much of the developed portions of Clackamas County including Oregon City and West Linn. The project area only provides a fraction of this water since it is mixed into the water of several other rivers and streams before it reaches the water providers. There are also reservoirs between the project area and the water providers that can affect water quality at the point of withdrawal.

3.3.1.2 Watershed Condition

Compared to other adjacent watersheds including the Collawash and Oak Grove Fork, the Upper Clackamas Watershed is a relatively cold, spring-fed system that is not as flashy during rain events and does not flow turbid very often.

The existing condition for the subwatersheds is based on datasets associated with the Northwest Forest Plan–The First 20 Years (1994-2013) Watershed Condition Status and Trend Report (Miller 2014). The watershed-monitoring module (also known as the Aquatic and Riparian Effectiveness Monitoring Program or AREMP) determines if the Northwest Forest Plan's (NWFP) aquatic conservation strategy is achieving the goals of maintaining and restoring the condition of watersheds. Since the time of the NWFP, watershed conditions have been improving due to restoration actions: roads have been decommissioned, culverts have been replaced, riparian vegetation impacted by past

timber harvest has grown, side channels have been reconnected, and regeneration timber harvest has declined.

3.3.2 Water Quantity

Peak streamflows of large magnitude in and downstream of the analysis area are generally generated by rain-on-snow events. The reservoirs downstream of the project area have some ability to modify peak streamflow events.

Record floods occur predominantly during November through January, caused by accumulated snow at lower elevations followed by a rapid rise in temperature, unusually high-elevation freezing levels, and heavy rainfall.

Changes in hydrologic processes associated with management activities can be grouped into two classes according to causal mechanisms. One class consists of change resulting from removing forest vegetation through harvest as measured by the Aggregate Recovery Percentage (ARP) methodology. A second class consists of changes in hydrologic processes consists of those that control infiltration and the flow of surface and subsurface water. This class is dominated by the effects of forest roads and is assessed using the Stream Drainage Network Extension Methodology.

3.3.2.1 Aggregate Recovery Percentage Methodology and Existing Condition

Changes in hydrologic processes associated with the removal of forest vegetation through harvest can be assessed using the Aggregate Recovery Percentage (ARP) methodology. The ARP model was developed for use in the transient-snow zone. It provides a methodology for indexing the susceptibility of a watershed to increased peak flows from rain-on-snow events associated with management created openings in the canopy. This method assumes that the greatest likelihood for significant, long-term cumulative effects on forest hydrologic processes is caused by created openings in the canopy (from both timber harvest and from the existence of roads) that impact snow accumulation and snowmelt.

Current level of hydrologic recovery

Subwatershed	ARP Existing Condition (percent recovered)
Cub Creek	93
Headwaters Clackamas River	78*
Lowe Creek-Clackamas River	94
Last Creek-Pinhead Creek	91
Pot Creek-Clackamas River	94

* This watershed has been impacted by an insect infestation that has killed most lodgepole pine stands. This calculation is incorporated from the Lemiti Fuel Reduction Environmental Assessment: the water quantity section of that EA is incorporated by reference. Even though the dead lodgepole pine is above what is typically considered the transient-snow zone, it was modeled as if it were in the transient-snow zone because of the potential for climate change. However, young trees have seeded in and the area would likely be

considered fully hydrologically recovered before the effects of stream run-off can be affected by climate change.

3.3.2.2 Stream Drainage Network Extension Methodology and Existing Condition

Changes in hydrologic processes that control infiltration and the flow of surface and subsurface water are dominated by the effects of forest roads. The relatively impermeable surfaces of roads cause surface runoff that bypasses longer, slower subsurface flow routes. Where roads are in-sloped to a ditch, the ditch extends the drainage network, collecting surface water from the road tread and intercepting any subsurface water exposed by roadcuts, and then transporting it to streams quicker than would occur in the absence of a road. These changes in hydrologic processes are assessed by estimating the extension of the stream drainage network associated with roads (Castro 2003).

Many roads do not have ditches or they do not intersect streams. However, where there is a road ditch and a stream, roads were examined to determine if the drainage network would be expanded. Based on experience with road decommissioning across the forest it was assumed that the average ditch-relief culverts are spaced approximately 350 feet apart.

Stream Drainage Network Extension

Subwatershed	Existing Condition
Cub Creek	11%
Headwaters Clackamas River	4%
Last Creek-Pinhead Creek	6%
Lowe Creek-Clackamas River	7%
Pot Creek-Clackamas River	8%

It is generally accepted that the minimum detectable change in peak flow is ±10 percent for site-scale analysis. Percentage changes in peak flow that fall in this range are within the experimental and analytical error of flow measurement and cannot be ascribed as a treatment effect (Grant 2008). The Cub Creek subwatershed is the only one greater than 10% where the effects of stream drainage network extension are likely to be noticeable. Since the effects of vegetation removal through harvest and roads are considered independent from each other and they are roughly additive, they are integrated when assessing management effects on peak streamflows within a watershed.

Combined Analysis of Peak Flows

Subwatershed	ARP Existing Condition (percent recovered)	Stream Drainage Network Extension (percent reduction)	Total Existing Condition
Cub Creek	93%	11%	82%
Headwaters Clackamas River	78%	4%	74%
Lowe Creek-Clackamas River	94%	6%	88%

Subwatershed	ARP Existing Condition (percent recovered)	Stream Drainage Network Extension (percent reduction)	Total Existing Condition
Last Creek-Pinhead Creek	91%	7%	84%
Pot Creek-Clackamas River	94%	8%	86%

Only the Headwaters Clackamas River subwatershed is near the threshold of concern according to The Effects of Forest Practices on Peak Flows and Consequent Channel Response Report (Grant 2008). That subwatershed has been affected by extensive insect mortality. Even though the dead lodgepole pine is above what is typically considered the transient-snow zone, it was modeled as if it were in the transient-snow zone because of the potential for climate change. However, young trees have seeded in and the area would likely be considered fully hydrologically recovered before the effects of stream run-off can be affected by climate change. After a detailed hydrologic and geomorphic analysis, it does not appear that peak streamflows are impacting stream channel morphology.

3.3.2.3 Water Quantity - Direct and Indirect Effects

No Action

With the no action alternative, hydrologic recovery would gradually continue as young stands on the Forest grow.

With no action, there would be no road decommissioning or stormproofing. Since those roads would remain on the landscape, they would continue to contribute to accelerated water movement and the stream drainage network extension would remain unchanged. Segments of the current road network would see minimal levels of maintenance due to limited road maintenance funds. Longer intervals between maintenance with reduced funding may pose a risk of failure. Off-site lodgepole pine plantations, and areas infected with dwarf mistletoe would continue to decline and as these areas die off they would reach the point where they are no longer hydrologically recovered.

Proposed Action

The proposed action is dispersed over a wide landscape overlapping parts of several subwatersheds. The ARP figures would decline by one percent or less. The slight changes in ARP associated with the project would not likely cause any additional changes in stream channel stability or increases in peak flows. There would be a slight reduction in stream drainage network as some roads with ditches would be decommissioned.

Cumulative effects for water quantity are addressed in section 3.3.4.

3.3.3 Water Quality

Rivers, streams, and lakes within and downstream of the treatment areas are used for boating, fishing, swimming, and other water sports. Water is also withdrawn for drinking water (s. 3.3.1.1). Additionally, the Forest streams provide habitat and clean water for fish and other aquatic biota, each with specific water quality requirements. The Clean Water Act (CWA) protects water quality for all of these uses.

By direction of the CWA, where water quality is limited, DEQ develops Total Maximum Daily Load (TMDL) plan to improve water quality to support the beneficial uses of water. For water quality limited streams on National Forest System lands, the USDA Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. The Clackamas Subbasin TMDL was approved by the Environmental Protection Agency on September 29, 2006. This TMDL among other issues addresses stream temperature in the project area.

The Forest developed a Water Quality Restoration Plan (WQRP) to serve as the TMDL Implementation Plan for the Willamette Basin TMDL (USDA, USDI 2012). Under the WQRP the protection and recovery of water quality depends on implementation of the Forest Plan, as amended. Key to this strategy are the standards and guidelines and the Aquatic Conservation Strategy (ACS) objectives for the protection, restoration, and active management of riparian areas.

The Oregon Department of Environmental Quality submitted Oregon's 2012 Integrated Report and 303(d) list to U.S. Environmental Protection Agency (EPA) in November 2014. Based on one sample per stream, the entire Clackamas River and a small unnamed intermittent stream (Lemiti Creek Trib) were listed as 303(d) streams based on a sampling of aquatic invertebrates. EPA will review and either approve or disapprove the 2012 303(d) list as submitted. After EPA has taken final action, the 2012 303(d) list will become effective for Clean Water Act purposes.

3.3.3.1 Stream Temperature Methodology and Existing Condition

RAPID is a shade model that runs in ArcGIS that was developed to complete a shade assessment at the watershed level and identify potential restoration sites. The utility of the model is to automate and streamline a shade assessment at the watershed scale for the preparation of Water Quality Restoration Plans (Stockdale 2013). Vegetation removal near water bodies has the potential of increasing solar radiation to surface water, which in turn may increase water temperature. In recent years, the portion of the Clackamas River that recorded warm temperatures were downstream from the project area.

For the subwatersheds associated with the Hunter Integrated Resource Project average existing shade and average potential shade are identified in the table below.

Subwatershed	Existing Shade %	Potential Shade %
Cub Creek	70	74
Headwaters Clackamas River	66	71

Subwatershed	Existing Shade %	Potential Shade %
Lowe Creek-Clackamas River	69	72
Last Creek-Pinhead Creek	66	71
Pot Creek-Clackamas River	70	73

All the subwatersheds are within 5% of the average potential shade for the area.

3.3.3.2 Stream Temperature – Direct and Indirect Effects

No Action Alternative

Stream temperatures are anticipated to remain at current levels. Primary shade zones (areas of riparian vegetation directly adjacent to streams) along perennial streams would continue to fill in with understory vegetation as young plantations grow. Since these areas are already densely vegetated, and streams are already relatively cold, no action would not likely result in cooler temperatures.

Proposed Action

This alternative proposes to thin trees within the dry upland portion of Riparian Reserves. The TMDL strategy was used to develop the stream-protection buffers listed in the PDC section at section 2.2.9.A1. Sufficient shade would be provided in the primary and secondary shade zones adjacent to streams so that there would be no increase in stream temperature resulting from implementation of this project. The project would meet the Clean Water Act standards for water temperature.

3.3.3.3 Sediment Methodology and Existing Condition

For this analysis sediment delivery associated with natural background levels from landslides, wildfires and road surfaces were examined. The Geomorphic Roads Analysis and Inventory Package (GRAIP) was used to determine the impacts of road systems on erosion and sediment delivery to streams (USDA 2014). Sediment yield associated with the road system was estimated using the GRAIP-Lite model. Mass wasting is a natural process that occurs to some extent in most forested basins in the Pacific Northwest. The time scale of mass wasting in a basin is important to an understanding of the sediment mass balance of a watershed. Mass wasting events may occur on a return interval of one or two years, decades, centuries, or even millennia. In a natural, unmanaged forested basin, the dynamic replenishment of material to the channels by mass wasting is essential to the diversity and health of the ecosystem (DNR 2011).

Natural Background Levels of Sediment Yield

Subwatershed	Estimated Natural Background from Slides (tons per year)
Cub Creek	0
Headwaters Clackamas River	0
Last Creek-Pinhead Creek	615
Lowe Creek-Clackamas River	1,599

Subwatershed	Estimated Natural Background from Slides (tons per year)
Pot Creek-Clackamas River	3,127
Total	5,340

Road networks in many upland areas of the Pacific Northwest are the most important source of management-accelerated delivery of sediment to anadromous fish habitats. The sediment contribution to streams from roads is often much greater than that from all other land management activities combined, including log skidding and yarding. Road related landsliding, surface erosion and stream channel diversions frequently deliver large quantities of sediment to streams, both chronically and catastrophically during large storms. Roads may have unavoidable effects on streams, no matter how well they are located, designed or maintained. Many older roads with poor locations and inadequate drainage control and maintenance pose high risk of erosion and sedimentation of stream habitats (USDA 1993).

Subwatershed	Estimated tons of Sediment Delivery per year from the existing road system
Cub Creek	46
Headwaters Clackamas River	131
Lowe Creek-Clackamas River	47
Last Creek-Pinhead Creek	36
Pot Creek-Clackamas River	114
Total	373

The contribution of the existing road system represents an increase of 7% over natural background levels.

3.3.3.4 Sediment and Turbidity – Direct and Indirect Effects

No Action Alternative

Sediment delivery to streams in the project area would remain at current levels or may increase associated with the deteriorating road network. The current road network would see minimal levels of maintenance associated with reduced funding levels and may pose a risk of failure and may contribute sediment to streams. Because known road problem areas would not be repaired, there is a risk of road failure, which would contribute sediment to streams. Vegetation that impedes erosion and sediment delivery would be maintained.

Proposed Action

Some ground disturbing activities in this alternative have the potential to dislodge soil particles that in turn may increase erosion. These activities include new temporary roads, road reconstruction, landings, skid trails, yarding corridors, in-stream large wood enhancement and areas of road maintenance and repair. A detailed discussion of soil erosion is contained in the soils section (s. 3.6.5). Levels of erosion or sediment delivery

would be small due to implementation of Best Management Practices (BMP) and Project Design Criteria (PDC), which include reusing existing skid trails and landings, maintaining protective groundcover, restricting ground-based equipment to appropriate slopes, and application of seed and mulch on disturbed soils. Stream-protection buffers and the additional equipment restriction provide an effective filtration zone that keeps most erosion from reaching streams.

Changes in hydrologic processes that affect erosion and sedimentation are dominated by the effects of forest roads.

Lengths of road construction and reconstruction, system road maintenance, repair and decommissioning and system road conversion to maintenance level 1 are summarized in sections 1.2.3.2 and 2.2.8.

Road maintenance prior to log haul would help maintain the designed drainage of the road surface, ditches and culverts that reduce the potential for sediment inputs. This includes the placement of new aggregate surfacing where necessary, blading, removing debris, brushing out encroaching vegetation, removing berms, and ditch and culvert inlet cleanout where needed. Aggregate road surfacing can minimize the amount of fine sediment from road surfaces entering streams following log haul, especially during and following rainfall events. Ground-disturbing road maintenance activities would be limited to the dry season.

Some road maintenance activities have the potential to increase road related erosion and sediment during rainfall events. This increase is associated primarily with blading, ditch cleaning and culvert cleaning on aggregate and native surface roads although ditch cleaning associated with paved roads is a potential sediment source. Implementation of PDCs that include installation of erosion control measures would further reduce the risk of sediment introduction. Any sediment delivered to streams during these activities would be minimal, short-term duration, and undetectable at a subwatershed or watershed scale. The probability of any degradation to water quality or fisheries resources caused by sedimentation due to road construction, reconstruction and maintenance is low.

Log hauling would not measurably increase the amount of fine sediment in streams. The roads along the haul route have for the most part well vegetated road ditchlines that allow any eroded soil to be stored adjacent to the roads. The potential for sediment input into streams along the haul routes would further be minimized by permitting haul only when conditions would prevent sediment delivery to streams. PDCs restrict log hauling when necessary to minimize water quality degradation. Haul would be stopped if there is rutting of the road surface or a noticeable increase in the turbidity of water draining to the road ditches or at stream crossings. Erosion rates are likely to drop substantially without traffic even during heavy rainstorms (Dubé 2004).

Temporary road work includes construction of 2.5 miles of temporary roads and re-opening 11.4 miles of existing road alignments for temporary access. None of the proposed new roads would be in Riparian Reserves. With the implementation of PDCs associated with the location of temporary roads and erosion control measures to prevent

movement of disturbed or exposed soil, there would be a very low probability of any sediment from temporary road surfaces reaching streams. The new temporary roads and re-opened alignments would be rehabilitated as described at s. 2.2.8.2 following completion of harvest operations to help minimize surface erosion and re-establish natural drainage patterns.

Active road decommissioning and stormproofing would reduce chronic sediment delivery, restore hillslope hydrology and reduce sediment impacts associated with the potential catastrophic failure of stream crossings during storm events.

Estimated Sediment Yield from the Road System (Tons per year)

Subwatershed	Existing Condition	During the implementation *	After implementation**
Cub Creek	46	42	42
Headwaters Clackamas River	131	131	131
Lowe Creek-Clackamas River	47	54	46
Last Creek-Pinhead Creek	36	38	31
Pot Creek-Clackamas River	114	121	110
Total	373	386	360

* While the proposed action is being implemented, there are instances of fresh road maintenance and recent road repairs and new temporary roads. Log haul is ongoing during appropriate weather conditions. The increased sediment yield was modeled presuming that all of the work would occur in one year. In reality, the work would be spread out over several years as different harvest units are accessed, and therefore the sediment would be less than shown.

** The figures for post implementation show the situation after temporary roads and existing road alignments are rehabilitated and system roads are decommissioned or stormproofed.

Estimated Sediment Yield from all Sources (Tons per year)

Subwatershed	Natural Background from Slides	Sediment Delivery from the Existing Road System	Change in Sediment Yield During Implementation	Change in Sediment Yield Post Implementation
Cub Creek	0	46	-4	-4
Headwaters Clackamas River	0	131	0	0
Last Creek-Pinhead Creek	615	36	2	-5
Lowe Creek-Clackamas River	1,599	47	7	-1
Pot Creek-Clackamas River	3,127	114	7	-4
Total	5,340	373	12	-13

During project implementation, the sediment increase would be only 0.2% over natural back ground levels. After project implementation including road decommissioning, stormproofing and road restoration, there would be a decrease of 0.2% compared to natural back ground levels. This level would not likely be detectable at the subwatershed or watershed scale.

Timber harvest alone rarely initiated large amounts of runoff and surface erosion, particularly when newer harvest practices were utilized (Litschert 2009). Sediment

delivery from timber harvest may be further reduced by locating skid trails away from streams, maintaining high surface roughness downslope of water bars, and promptly rehabilitating skid trails following harvest. PDCs would require skid trails to be located away from streams, they would have erosion control measures such as water bar placement, hillslope contouring, creating small ditches or diversions to redirect surface water movement, scattering slash on disturbed soils, placement of mulch, and application of approved seed. Effective ground cover would be installed prior to the wet season. When operations occur during the wet season, erosion control work would be kept current and installed as soon as possible. The coverage of effective ground cover would be sufficient to prevent off-site movement of soils as guided by Forest Plan standard and guideline FW-025 and by Forest Service Handbook 2509 (R6 supplement); and maintain high surface roughness downslope of water bars.

3.3.4 Cumulative Effects for Water Quantity and Quality

The boundaries for the cumulative effects analysis areas are subwatersheds identified earlier which extend far enough downstream that direct effects from the project would not likely be measurable. This boundary includes the Confederated Tribes of Warm Springs Reservation and a small parcel of private land. At this time, there are no known future actions on the reservation or on private lands that are foreseeable.

The time frame used to include or exclude actions varies by the type of action. Some impacts are considered permanent with no modeled recovery including permanent roads, quarries and the power lines. Some impacts such as regeneration harvest would recover gradually over approximately 35 years.

Because several actions have the potential to impact water quantity, the ARP model was used to describe cumulative effects. Past disturbances within the affected subwatersheds are the most substantial contribution to reductions in hydrologic recovery associated with the ARP model, and include fires, timber harvest, quarries, power line right-of-way clearing and road construction, regardless of land ownership.

Ongoing actions include the Lemiti Fuel Reduction Project. There are no other foreseeable future projects on the Forest to consider. While there may be future logging or other management of federal lands within the watershed, there are no current proposals with sufficient site specificity to conduct an analysis.

In terms of water quality, the following restoration actions at the broader landscape scale, have cumulatively contributed to a trend of stable or improving aquatic conditions in the project area.

- In-stream restoration projects including the reconnection of side channels, and the addition of wood and boulders
- Replacing undersized culverts with larger ones that allow improved fish passage and the ability to withstand larger flood events
- Decommissioning roads
- Managing Riparian Reserves for shade, large wood recruitment, and the development of late-successional conditions

- Managing Off-Highway Vehicle use to avoid erosion near sensitive streams
- Treating fire hazards to minimize the size and intensity of wildfire

3.3.4.1 Cumulative Effects - Water Quantity

While current and predicted conditions on the reservation and private lands would likely result in a slight increase in the risk of stream channel altering high flow events, these actions are not sufficiently foreseeable to model the effects. The proposed action would not likely substantially exacerbate this situation because it would result in a one percent or less change in hydrologic recovery as measured by the ARP model. While the proposed actions result in a minor short-term reduction in hydrologic recovery, there are also many young and middle-aged plantations across the federal landscape that are growing rapidly resulting in continual gains in hydrologic recovery that compensate for the impact of the proposed vegetation management.

In addition, stream drainage network extension that identifies roads that are hydrologically connected to the stream network is either static or is decreasing associated with road decommissioning and stormproofing activities that are part of the proposed action. This would indicate little potential for additional peak flow increases associated with the infiltration and the flow of surface and subsurface water associated with roads.

Since the cumulative impact of vegetation removal associated with all proposed actions is minimal, there are no substantive cumulative effects anticipated for water quantity.

3.3.4.2 Cumulative Effects - Stream Temperature

Activities are not expected to increase water temperature due design criteria designed to maintain existing primary and secondary shade vegetation adjacent to streams. As described in the direct and indirect effects section, this project would maintain existing water temperatures. At the broader landscape scale, operations associated with the Clackamas River Hydroelectric Project have been changed to provide cooler water in the Clackamas River downstream of the confluence with the Oak Grove Fork.

Because the stream buffers were found to be sufficient to prevent any increase in water temperature, there would not likely be any substantial or measurable cumulative effect.

3.3.4.3 Cumulative Effects - Sediment

Past management actions including logging and road construction as well as more recent road decommissioning are incorporated in the discussion of existing conditions (s. 3.3.3.3). Management-related sediment production and delivery comes primarily from the road system (s. 3.3.3.3).

Since the early 1990s, many factors have contributed to a trend of stable or improving stream habitat conditions on the Forest (s. 3.3.4, s. 3.4.7). Harvest levels since the Northwest Forest Plan have been well below the level projected. Recent projects have been designed using the standards and guidelines of the Northwest Forest Plan and its emphasis on restoration of Riparian Reserves.

The cumulative effects of this project when added to other past actions as well as foreseeable and ongoing actions would not likely be substantial or contribute to a downward trend for water quality in local streams or downstream rivers because the quantities of sediment introduced from this project and the quantities of sediment removed would be small compared to the overall baseline sediment load for the drainage. No detrimental cumulative effects are expected.

3.3.5 Forest Plan Consistency

Forestwide Water Standards and Guidelines - FW-54 to FW-79, FW-109 to FW-114, FW-127 to FW-136, page Four-53
Northwest Forest Plan Standards and Guidelines for Riparian Reserves p. C-31 through C-38

The project is consistent with Forest Plan standards and guidelines that relate to water quality and quantity. Several Forest Plan standards and guidelines address hydrologic recovery. Since very little regeneration harvest has occurred in recent decades, all subwatersheds and watersheds are well within the parameters established by the Forest Plan. The project is fully consistent with all of the standards and guidelines addressed below.

3.3.5.1 Key Watersheds

The Key Watershed delineation for the project area does not include entire watersheds but a narrow band on either side of the Clackamas River. The standard and guideline for Key Watersheds requires no net increase of system and non-system roads.

Within the project area, in the Key Watershed delineation there were 157 miles of roads. Approximately 37 miles of roads have already been decommissioned or 24% of the original mileage. There would be no net increase in the amount of roads in the Key Watershed.

Other standards and guidelines for Key Watersheds are met: Watershed Analysis has been completed prior to harvest operations, and there are no actions in inventoried roadless areas.

3.3.5.2 Forest-Wide Monitoring

To assess compliance with the Clean Water Act, the Forest conducts a variety of monitoring and inventory programs to determine status of meeting state water-quality standards as well as other regulatory and agency requirements. In an average year, approximately 75 sites are monitored for water temperature throughout the Forest. In addition, other water quality monitoring occurs at various locations throughout the Forest. This could be turbidity monitoring, in-stream sediment sampling, water chemical sampling, or surveys of physical stream conditions. Currently, approximately 25 miles of physical stream habitat is surveyed every year and to date approximately 1,787 miles of stream have been surveyed. Some of the information collected during these surveys includes the number of pools and riffles, amount of large wood, riparian area condition and

types, and numbers of fish and other aquatic organisms. The effectiveness of the techniques included as PDCs in this project and on the projects that have been implemented in recent years has been validated because Forest-wide monitoring has shown an ongoing trend of improving conditions for water quality. The PDCs in this project have been refined where appropriate based on past monitoring to make them more implementable and more effective. Past monitoring indicated that PDCs were implemented as planned on 85% of the samples and were effective at avoiding impacts to water quality on 94% of the samples.

This project would go into a pool of similar projects to be selected for project level BMP implementation and effectiveness monitoring as per the National BMP Monitoring Protocol. If selected, an Interdisciplinary Team would evaluate whether the site-specific BMPs were implemented and the effectiveness of the BMPs.

3.3.5.3 Project-Level Monitoring

Prior to and during implementation, a multi-stage process is used on the Forest to ensure that a project is implemented as planned. Before beginning on-the-ground layout of the units, a transition meeting with the Interdisciplinary Team occurs to identify key components of the environmental assessment. After fieldwork is completed, the project moves into the appraisal and contract preparation phase. A Contract Project Design & Implementation Crosswalk Form is completed. The purpose of the crosswalk is to ensure that all components of the NEPA decision, including the project design criteria and terms and conditions from consultation, are incorporated into the contract. Prior to advertisement, a final review is conducted to ensure that the contract is prepared with the proper contract provisions and language; the project design criteria are properly inserted and contractually enforceable; and, the contract and appraisal meets Forest Service Handbook, Forest Service Manual and Stewardship Guide (where applicable) regulations and direction.

During implementation, the Contract Administrator in conjunction with the Forest Service Representative and Contracting Officer are responsible to ensure that the contract is administered properly throughout all stages of implementation. This team monitors compliance with the contract, which contains provisions for resource protection. The Contract Administrator records observations demonstrating compliance as well as any concerns/issues on inspection reports that are signed by both the Forest Service and Purchaser Representative. The inspection reports would also document any resolutions that have been identified. As needed during the implementation process, the contract administration team may request a resource specialist or Line Officer to come for a field visit to discuss a resource issue that has been identified. Also, a resource specialist may visit a project without a formal request to conduct monitoring and to make sure that the project is being implemented as directed by the NEPA decision.

The ability to implement the techniques included as PDCs is moderate to high because of these multiple checks.

This monitoring is used in an adaptive management process to inform and improve management activities so that lessons learned can be used to make future projects better and to share with other appropriate Federal, State and local agencies.

3.4 FISHERIES

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) including the Aquatic Conservation Strategy. Anadromous fish listed as threatened are present; the project would not likely adversely affect these fish. The project includes actions that provide appropriate protections of water quality and enhancements of impacted streams and riparian areas. PDCs were developed to detail how best management practices were tailored to site-specific circumstances (s. 2.2.9). Cumulative effects were found to be minimal.

This section summarizes the Fisheries Biological Evaluation and the fisheries report, which are incorporated by reference. In addition to fish, other aquatic species are addressed where appropriate. Aquatic issues such as sediment and water temperature are discussed in the water quality section (s. 3.3) and are only repeated here where needed to add clarification.

The project is located in the Upper Clackamas Watershed that has side tributaries that are steep, boulder-strewn streams of high gradient and flashy character. There is also flat bottom valley area known as Big Bottom that is replete with braided channels and complex fish habitat.

The watershed supports populations of at-risk anadromous fish, including spring Chinook salmon, winter steelhead and coho salmon. Streams with these fish are referred to as listed-fish habitat (LFH). There are also streams that support native resident cutthroat and rainbow trout. Bull trout have been reintroduced to the Upper Clackamas Watershed.

3.4.1 Management Indicator Species

See section 3.4.7 for discussion of effects.

Because of their relative sensitivity to change, the family of fishes, known as salmonids, was selected as "an indicator species group" for aquatic habitats. This group of species is especially important for their commercial and game values and because they occupy the spectrum of aquatic habitats on the Forest. It is assumed that if the needs of salmonids are met, the needs of other fish and aquatic species would also be met. Management Indicator Species for the Forest include Chinook salmon, coho salmon, steelhead, coastal cutthroat trout and rainbow trout. A Forest-level analysis of the status of these species and their habitat was conducted in 2011. The state of Oregon, in concert with the regulatory agencies, manages fish populations while the Forest manages the habitat. For a population to be viable, attributes such as species abundance, productivity, spatial structure, and genetic diversity are needed for the species to maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. All of these attributes are affected by habitat and other environmental conditions that influence species behavior and survival.

3.4.2 Federally Listed Species

See section 3.4.6 for discussion of effects. These threatened species occur within the watershed.

Scientific Names	Common Name
*Salvelinus confluentus**	Columbia River Bull Trout
Oncorhynchus mykiss	Lower Columbia River Steelhead
Oncorhynchus tshawytscha	Upper Willamette River Chinook
Oncorhynchus kisutch	Lower Columbia River Coho Salmon

*Threatened throughout most of its range, Bull Trout is considered a "non-essential population" in the Clackamas River for because it has been reintroduced.

3.4.3 Sensitive Species and Survey and Manage Species

See section 3.4.6 for discussion of effects. These sensitive species may occur within the watershed.

Scientific Names	Common Name	Watershed Presence
Entosphenus tridentatus	Pacific lamprey	Yes
Oncorhynchus clarkii clarkia	Coastal cutthroat trout	Yes
Dicamptodon copei	Cope's giant salamander	Unknown

No aquatic survey and manage species occur in the watershed.

3.4.4 Existing Condition, Direct and Indirect Effects Summary

The watershed's aquatic habitat has been impacted over the past century by timber harvest, road building, fires, fire suppression, and recreational activities. Clearcut harvest converted mature forest habitat to plantations and Riparian Reserves have been altered by road building. Past clearcut timber harvest often occurred within riparian areas and to the edges of adjacent streams. These past actions have had a negative effect on the quality and quantity of habitat for aquatic species. The harvest impacted stream shade, and water temperatures, but shading has recovered in recent decades as trees grow.

Stream temperature data in the watershed show relatively stable stream temperatures. The stands proposed for thinning are relatively dense and provide shade for adjacent streams.

Large woody debris (LWD) is important in streams because it creates pools, enhances deposition of spawning gravels, boosts trophic processes, and adds structural complexity. Between the 1950s and 1970s, the Forest routinely removed LWD from streams and along the Clackamas River because the log jams were thought to impede fish passage. Because some riparian stands were harvested in the past, there is less potential for "large" woody debris recruitment into associated streams than prior to the 1950s. Despite restoration efforts over the past three decades, removal of LWD prior to that reduced fish habitat quality and resulted in stream incision that is still evident today.

Since the early 1990s, many factors elaborated at section 3.3.4 have contributed to a trend of stable or improving stream habitat conditions in the watershed.

Protection buffers would result in no change in stream temperature (s. 3.3.3.2) and levels of erosion or sediment delivery would be small due to implementation of Best Management Practices (BMP) and Project Design Criteria (PDC) (s. 3.3.3.4). The proposed action would also reduce potential sediment by repairing roads, closing roads, stormproofing roads, decommissioning roads, and rehabilitating dispersed recreation sites.

3.4.4.1 Wood Recruitment

With no action, large wood placement in streams would not occur. If the proposed silviculture treatments adjacent to streams does not occur, forested riparian stands would have smaller trees but more snags. The snag discussion at section 3.8.7 describes the difference between action and no action. While some live trees can fall across streams, the primary input of down wood to streams and riparian areas comes from trees that die and eventually fall. With no action, there would be abundant down wood, but most of it would be small.

The proposed action includes felling and placing logs across Lowe Creek and Pot Creek. This action would restore some of the complexity that was lost when the adjacent stands were clearcut decades ago.

Where thinning would occur adjacent to streams, protection buffers would provide high levels of small wood recruitment similar to the level described for no action. Thinning within the upland portion of the Riparian Reserve would reduce levels of down wood because the stands would be healthier. The stands proposed for thinning are not the only sources of wood recruitment along stream reaches. There are mature forest stands along the affected stream reaches that also contribute wood to streams and the wood from these stands would be much larger than what is contributed from plantations. As trees respond to thinning there would be large sized trees that would become available for recruitment to tributary channels and Riparian Reserves. In the future, there is the potential to manually fall trees toward the stream if necessary to meet objectives for in-stream wood instead of waiting for trees to die and relying on chance that the dead tree would fall toward the stream.

3.4.5 Cumulative Effects

The boundaries for the cumulative effects analysis is the Upper Clackamas Watershed, which extends far enough downstream that direct effects from the project would not likely be measurable. This boundary includes the Confederated Tribes of Warm Springs Reservation and a small parcel of private land. At this time, there are no known future actions on the reservation or on private lands that are foreseeable.

The time frame used to include or exclude actions varies by the type of action. Some impacts are considered permanent with no modeled recovery including permanent roads, quarries and the power lines. Some impacts such as regeneration harvest would recover gradually over approximately 35 years to provide shade and hydrologic recovery, but

would take up to 100 years to provide trees large enough for large wood recruitment to streams.

Ongoing actions include the Lemiti Fuel Reduction Project. There are no other foreseeable future projects on the Forest to consider. While there may be future logging or other management of federal lands within the watershed, there are no current proposals with sufficient site specificity to conduct an analysis.

Since the early 1990s, many factors have contributed to a trend of stable or improving stream habitat conditions on the Forest (s. 3.3.4). Harvest levels since the Northwest Forest Plan have been well below the level projected. Recent projects have been designed using the standards and guidelines of the Northwest Forest Plan and its emphasis on restoration in key watersheds. As a result, recent thinning projects, road decommissioning, danger tree felling, road maintenance, and recreation are not creating measureable impacts to streams or aquatic resources at the watershed or subwatershed scales. The proposed action and other recent thinning projects would improve stream and riparian conditions by moving the stands toward late-successional conditions.

In the last decade, road decommissioning has occurred and more is planned. The Forest has been making periodic decisions to decommission roads or change their maintenance status since the 1990s. Previous planning efforts that overlap the project area include: *Collawash and Upper Clackamas Restoration EA* (1996), *2007 Clackamas Restoration Projects EA* (2007), *Clackamas Road Decommissioning for Habitat Restoration EA* (2009) (sometimes referred to as Increment 1), and *Clackamas Road Decommissioning for Habitat Restoration, Increment 2* (2011). These projects resulted in decisions to close or decommission roads on the Forest's transportation system. The proposed action and other projects would improve road conditions and reduce sedimentation of streams, and thereby not have a substantive cumulative effect with other past, ongoing, or future projects.

The proposed action would not have a measurable or substantive effect on aquatic resources, including wood recruitment and riparian vegetation because of protections provided by project design criteria including stream-protection buffers. While there are likely some short-term cumulative effects related to wood recruitment and riparian vegetation, there would also be some cumulative benefits as Riparian Reserves are restored to late-successional conditions and as roads are repaired, stormproofed and decommissioned. For these reasons, cumulative effects would not be substantial.

3.4.6 Effects to Listed Species

This section summarizes the Biological Evaluation.

Columbia River Bull Trout (*Salvelinus confluentus*) Threatened

Bull trout were historically present in the Clackamas River system and the lower mainstem Collawash River. They were believed to be extirpated in the entire Clackamas watershed. Bull trout were reintroduced into the upper Clackamas River in 2011 as a nonessential experimental population.

Lower Columbia River Steelhead (*Oncorhynchus mykiss*) Threatened

Lower Columbia River (LCR) steelhead occur in the Clackamas River, Sandy River, and Hood River basins. They also occur in the West Columbia Gorge tributaries. Adult winter steelhead enter rivers and streams on the Forest primarily during April through June with peak migration occurring in May. Steelhead use the majority of the mainstem rivers and tributaries as spawning and rearing habitat. LCR steelhead occur within the watershed.

Upper Willamette River Chinook (*Oncorhynchus tshawytscha*) Threatened

Upper Willamette River (UWR) spring Chinook salmon that occur in the Clackamas River consists of both naturally spawning and hatchery produced fish. Only wild naturally produced Chinook are allowed to pass PGE's North Fork Dam onto National Forest lands in the upper Clackamas watershed. These fish primarily spawn and rear in the mainstem Clackamas River and larger tributaries.

Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*) Threatened

The Clackamas River Lower Columbia River Coho has both an early and late run. The early run of the Coho has naturalized from hatchery stocks within the Clackamas Basin. The late run contains the last remaining viable run of wild winter Coho in the Columbia Basin. Both early and late-run Coho salmon occur within the mainstem Clackamas River, and the lower reaches of primary streams.

Because the anticipated impacts summarized above could have some localized impact to stream reaches containing ESA-listed fish, particularly due to small increases in fine sediment from road maintenance and hauling, the Hunter Integrated Resource project **may affect, but is not likely to adversely affect** Lower Columbia River steelhead trout, Lower Columbia River Coho salmon, and Upper Willamette River Chinook salmon. This effect determination also applies to steelhead, Coho and Chinook salmon designated critical habitat. There would be no effect to Columbia River bull trout individuals. Essential Fish Habitat would **not be adversely affected** as it overlaps Chinook and Coho salmon critical habitat.

Sensitive Aquatic Species

Pacific Lamprey

The Pacific Lamprey historical distribution in not well known in some parts of Oregon, but were likely widely distributed. Documentation of current distribution is complicated by the difficulty in identifying Pacific Lamprey larval forms among other lamprey species. They typically spawn in similar habitat to Pacific salmon and trout. PGE, as part of their new hydropower license, upgraded their fish passage facilities for Pacific Lamprey. They have tracked radio tagged fish as far as the mainstem Clackamas at the downstream end of the Upper Clackamas Watershed. Because of the minor effect to water quality and distance from their habitat, there would be no impact to Pacific Lamprey.

Coastal Cutthroat trout

Coastal cutthroat trout use a large variety of habitat types, including lower and upper reaches of both large and small river systems, like the Clackamas River and its tributaries. They spend more time in fresh water environments than other anadromous Pacific salmonids. In fresh water, they prefer deeper pool habitat and cover, such as that formed by woody debris. Because of the minor effect to water quality and the retention of buffers adjacent to harvest units, and PDCs, there would be no impact to this species.

Scott's Apatanian Caddisfly

Habitat for the Scott's Apatanian caddisfly larvae is sub-alpine forested mountain areas that are high elevation; cold (3 to 6 °C), pure, well-oxygenated water in springs, and small streams. The streams or springs were 35 – 200 cm wide with depths of 5-45 cm. "Wiry" moss was also present. All sample locations where Scott's Apatanian caddisfly were collected had substrate either dominated by gravel or cobble and generally a mix of the two substrates; and little sand. Scott's Apatanian Caddisfly is sometimes found on moss fronds in small, cold, alpine streams. The caddisfly has been collected on the Mt. Hood National Forest at elevations between 3,500 and 5,722 feet.

The species may occur in the watershed. The PDCs designed to protect aquatic species would benefit Scott's Apatanian caddisfly, and the risk of affecting this species is low.

Cope's Giant Salamander

Cope's giant salamanders are found in small, rocky, and usually steep-gradient streams in conifer or mixed forests. They can be found under stones, slabs of bark, or other cover in streams, and are often found in pool habitat units with still water rather than faster-flowing riffles. In high-moisture conditions, they can be found crawling among rocks and vegetation along stream banks at night. Down wood is associated with observations of this species.

Within Clackamas County, the salamander has been found in the Upper Eagle Creek subwatershed. The salamander has not been found in the watershed but is presumed present. The proposed action would have no impact on Cope's giant salamanders because of protective measures that would be employed to streams.

3.4.7 Management Indicator Species (MIS)

Management Indicator Species (MIS) for the Forest include the threatened anadromous species (Chinook salmon, coho salmon and steelhead), and resident trout.

Several MIS fish species were listed as threatened under the Endangered Species Act due to concerns for their population levels and the condition of habitat and other factors such as commercial fishing and hydroelectric dams. Since the creation of the Northwest Forest Plan, the following factors have contributed to a trend of stable or improving stream habitat on the Forest.

- In-stream restoration projects including the reconnection of side channels, and the addition of wood and boulders
- Replacing undersized culverts with larger ones or bridges that allow improved fish passage and the ability to withstand larger flood events
- Decommissioning several hundred miles of roads
- Managing Riparian Reserves for shade, large wood recruitment, and the development of late-successional conditions
- Managing Off-Highway Vehicle use to avoid erosion near sensitive streams.
- Treating hazardous fuels to minimize the impact of wildfire on riparian areas and fish
- A new FERC license agreement for PGEs hydropower facilities

Viability

In summary, the PDCs would minimize negative effects of sediment or turbidity. By adhering to the PDCs that address wet season haul, and other erosion preventions, and by repairing, stormproofing and decommissioning roads, there would be reduction in sediment.

For MIS fish, the direct, indirect and cumulative effects to water quality and the physical habitat for these species are low to immeasurable due to protections provided by PDCs, and the low potential for any sediment to reach streams where these species reside. As such, this project would not contribute to a negative trend in viability on the Forest for MIS fish.

3.4.8 Forest Plan Standards and Guidelines

The Forest Plan has guidelines for water (FW 54-79), riparian (FW 80-136), fisheries (FW 137-147), and other areas (B7-28 to B7-39). The Northwest Forest Plan has Riparian Reserve Standards and Guidelines (pages C-31 to 38). The project is consistent with the standards and guidelines that address Best Management Practices FW-055 to 059. While some streams do not have the desired characteristics spelled out in these standards and guidelines, the propose action does not substantively harm aquatic resources and it enhances them in many ways described above. The proposed action is consistent with Forest Plan goals and these standards and guidelines. In the long term, the proposed action would enhance riparian areas, water quality, and aquatic species and habitat at both the project and watershed scale.

Northwest Forest Plan Standard and Guideline TM1 (Pages C-31-32) suggests the application of silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain the Aquatic Conservation Strategy. The project is consistent with this standard because Riparian Reserve treatments have only been designed to further the goals of the ACS objectives. While some short-term impacts have been disclosed, the following section explains in detail how the objectives would be met and why active management is proposed.

3.4.8.1 Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan (USDA USDI 1994) was developed to restore the health of watersheds and aquatic ecosystems. The ACS objectives are detailed on page B-11 of the Northwest Forest Plan. At B-10, the Northwest Forest Plan indicates that, to meet the intent of the ACS, management activities should either maintain the existing condition or lead to improved conditions in the long term.

The no-action alternative would maintain the current conditions and would result in stands that are overstocked with relatively uniform trees with low levels of diversity. They do not have mature and late-successional stand conditions (s. 3.4.4).

The following discussions for each of the nine ACS objectives are based on the analyses found elsewhere in this document, particularly in sections 3.3 and 3.4, which focus on key aquatic parameters or indicators.

ACS Objective 1 - Watershed and Landscape-Scale Features

Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

The vegetation in the watershed including Riparian Reserves has been changed from one predominated by mature forest to one fragmented by clearcuts and plantations with low levels of diversity. Past clearcutting and road construction have also reduced pool and margin habitat in streams, reduced aquatic cover habitat, and removed or delayed future recruitment of large down wood, large snags, and live trees. Large wood loss also resulted in loss of habitat connectivity for species like mollusks and salamanders that use logs that span streams that access uplands areas. (s. 3.4.4.1).

The project would accelerate the restoration of late-successional conditions and reduce fragmentation. Riparian prescriptions would restore stands by creating diversity and complexity in largely homogenous stands. Stream-protection buffers provide in-stream woody debris recruitment. The proposed action would also fall trees directly into streams to provide some immediate benefit. The proposed action provides a balance between the maintenance of existing habitat for aquatic and terrestrial riparian species, populations, and communities, and landscape scale restoration. Maintenance results primarily through no-harvest stream-protection buffers. Restoration results from thinning stands to accelerate the move toward late-successional conditions and improve the distribution, diversity and complexity typical of landscape features that developed under natural conditions. Over time, as late-successional conditions are restored in Riparian Reserves, missing elements such as large woody debris complexity both at the stream and landscape scales would be restored. (s. 1.3.1.3, s. 3.2, s. 3.4.4.1)

For these reasons, the objective of maintaining and restoring watershed and landscape-scale features would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 2 - Connectivity Within and Between Watersheds

Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Connectivity in the project area has been affected by the construction of roads and clearcutting in riparian areas. Connectivity has been disrupted by roads that cross streams with culverts impassable to aquatic organisms. Roads and clearcuts in riparian areas have also broken some connections for dispersal of terrestrial riparian dependent species such as salamanders. In recent years, road decommissioning and the replacement of certain culverts has removed some of these barriers. (s. 1.3.8.2, s. 3.3.2.2)

In the project area, a network of Riparian Reserves covers rivers, streams, springs, ponds and wetlands and the land adjacent to them. Due to climatic and geologic factors, the watershed has a relatively dense network of streams, springs and wet areas all providing for spatial connectivity for aquatic and riparian dependent species. Maintenance of natural flow paths on the landscape and within the project area assure temporal connectivity. (s. 3.3.2.2)

New temporary road construction would not cross streams or follow streams closely. Temporary roads that are reconstructed would be used for the project and would be rehabilitated after use. Reconstructed temporary road alignments have no connectivity to streams and their rehabilitation after use would restore spatial and temporal connectivity. Stream temperature, current wood recruitment and undisturbed terrestrial dispersal corridors would be maintained in the short term by protection buffers adjacent to streams and the falling of trees into streams. Riparian treatment prescriptions would restore stands in the long term by accelerating the creation of missing diversity and complexity elements including large diameter trees, skips, and down wood. As these and other Riparian Reserve stands are enhanced across the watershed, aquatic connectivity and late-successional connectivity would be restored more rapidly. On system roads, the project would maintain, repair, close, stormproof and decommission various roads. It would repair or replace culverts to improve aquatic organism passage and reduce sedimentation. As these enhancements are made, spatial and temporal connectivity at the site scale would be restored to more natural flow paths. (s. 1.2.3.2, s. 2.2.1, s. 3.3.2 to 3.3.3.4, s. 3.3.4, s. 3.4.4).

For these reasons, the objective of maintaining and restoring connectivity within and between watersheds would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 3 - Physical Integrity

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

The physical integrity of aquatic systems has been affected by the construction of roads, and clearcutting in riparian areas. (s. 1.2.2, s. 1.3.8.2, s. 3.3)

Stream-protection buffers and road use restrictions during the wet season and other PDCs would minimize erosion and changes to stream shorelines, banks and bottom configurations and maintain the integrity of stream channels. New temporary road construction would not cross streams or follow streams closely. Roads that are constructed or reconstructed would be temporary and would be rehabilitated after use. Reconstructed temporary road alignments have no connectivity to streams. System road repairs and maintenance have PDCs to protect the physical integrity of the aquatic system. Changes in peak streamflows associated with vegetation manipulation and roads were assessed and it was determined that peak flows would not likely cause stream channel destabilization or impacts to the physical integrity of the aquatic system. (s. 1.2.3.2, s. 1.2.2, s. 1.3.8.2, s. 3.3.3.2, s. 3.3.3.4, s. 3.3.4)

For these reasons, the objective of maintaining and restoring physical integrity of aquatic systems would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 4 - Water Quality

Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Temperature and sediment in the project area have been affected by the construction of roads, and clearcutting in riparian areas. Temperature and sediment situations are gradually improving as roads are improved or decommissioned and as riparian vegetation grows and provides shade. (s. 3.3.3.2, s. 3.4.7)

The quality of water would be maintained by following PDCs that include restrictions on wet season logging and haul, equipment slope restrictions and erosion control methods. On system roads, the project would reduce sedimentation by decommissioning and closing roads, replacing and repairing culverts, and maintaining all haul routes. As these enhancements are made, water quality would improve. Stream-protection buffers would maintain stream temperatures and filter out sediment where timber harvest is taking place. (s. 2.2.9, s. 3.3.3.2, s. 3.3.3.4)

PDCs for logging and road construction and maintenance would insure that project activities minimize sediment delivery. There may be some short-term localized increases in sediment delivery associated with temporary roads, culvert removal and other actions; however, the level of sediment is very low compared to the natural background sediment level in the watershed. The short-term sediment impacts associated with the temporary roads would also be spread out in time and space. The analysis of aquatic species found that the biological, physical and chemical aspects of water quality were within the range

needed to support survival, growth, reproduction and migration. (s. 2.2.9, s. 3.3.3.4, s. 3.4.4.1, s. 3.4.6, s. 3.4.7)

For these reasons, the objective of maintaining and restoring water quality would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 5 - Sediment Regimes

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Even though this watershed has a history of natural erosion processes through landslides, debris flows, and fire; as well as human activities, such as road construction have changed the frequency and timing of erosion processes. Road decommissioning efforts have already restored the highest risk road segments. (s. 3.3.3.4)

Peak stream flows were examined by assessing the effect of vegetation manipulation and roads on peak stream flows individually and in combination and it was determined that implementation of the project would not impact the timing, volume, rate or character of sediment input, storage or transport. The watershed has recovered hydrologically as trees in young stands grow. Implementation of project activities including thinning mid-aged stands, repairing roads, rehabilitating reused temporary roads and decommissioning system roads are not anticipated to have any impact on base stream flows. On system roads, the project would decommission and close roads, replace and repair culverts, and maintain all haul routes. As these enhancements are made, a more natural sediment regime would result at those locations. (s. 3.3.2, s. 3.3.4.1)

The project would implement PDCs that include restrictions on wet season logging and haul, equipment slope restrictions and erosion control methods. Stream-protection buffers would trap material away from streams. New roads would not cross streams. Road repairs, maintenance, culvert replacement or repair and decommissioning would result in a road system that minimizes sedimentation. (s. 3.3.3.4)

For these reasons, the objective of maintaining and restoring sediment regimes would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 6 - In-Stream Flows

Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.

The project area is prone to rain on snow events. Past road construction and regeneration timber harvest caused some drainages to exceed hydrologic recovery standards. The trend in recent years has been toward full recovery as young stands grow. Compared to

regeneration harvest, thinning has much less effect on hydrologic flow patterns and the potential for increased peak streamflow. (s. 3.3.2, s. 3.3.4.1)

Peak stream flows were examined by assessing the effect of vegetation manipulation and roads on peak stream flows individually and in combination and it was determined that implementation of the project would not impact the timing, magnitude, duration or spatial distribution of in-stream flows. Hydrologic recovery would continue to improve, and the in-stream flow regime, including the magnitude of flows would be maintained. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan and benefits to in-stream habitat for fish and other aquatic organisms would continue. On system roads, the project would decommission and close roads, replace and repair culverts, and maintain all haul routes. As these enhancements are made, improvements to sediment, nutrient and wood routing would occur at those locations. Implementation of project activities including thinning mid-aged stands, repairing roads, rehabilitating reused temporary roads and decommissioning system roads are not likely to have any negative impact on base stream flows. Protection buffers would provide shade and riparian vegetation sufficient to prevent reduced flows during low flow periods. (s. 3.3.2, s. 3.3.4.1)

For these reasons, the objective of maintaining and restoring in-stream flows would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 7 - Floodplain Inundation

Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The timing, variability and duration of floodplain inundation and water table elevation in some meadows and wetlands have been altered by past clearcutting and the removal of large wood in streams over the past 50 years. Riparian Reserves overlay and surround streams, wetlands, and wet meadows. (s. 3.3)

Protection buffers adjacent to streams, seeps, springs, ponds, meadows and wetlands would provide a source of small woody debris recruitment. The felling of trees into streams and the bucking of logs that span streams would provide an immediate benefit to streams. Over time, wood recruited to streams naturally from protection buffers would add complexity and slow flow as meanders and pools are created. By physically protecting these areas and by also protecting the timing, magnitude, duration and spatial distribution of peak, high, and low flows as described in Objective #6, the timing and duration of floodplain inundation and water table elevation in meadows and wetlands would be maintained. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan as young stands grow, resulting in long-term restoration of floodplain habitats and water tables. (s. 3.3.2, s. 3.3.4.1, s. 3.4.4.1)

For these reasons, the objective of maintaining and restoring flood plain inundation and water tables would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 8 - Species Composition and Structural Diversity of Plant Communities

Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Past regeneration harvest has changed both the species composition and structure in Riparian Reserves. Stands are dominated by dense, mid-serial Douglas-fir stands. (s. 1.2.2, s. 1.3.8.2, s. 3.1.2, s. 3.2)

Thinning in uniform mid-aged Douglas-fir stands in Riparian Reserves would diversify and restore native tree composition including retention of minor tree species. This project would promote the recruitment of structurally diverse plant communities by protecting areas of unique diversity such as wetlands, and by variable-density thinning with skips, gaps, heavy thins and forage creation to enhance structural diversity. Gaps, heavy thins, pruning, and forage areas would allow light to penetrate beneath the canopy and provide space for natural recruitment of diverse plant communities (s. 3.1.3, s. 3.2, s. 3.4.4.1, & s. 3.8.7). Protection buffers along streams would provide for short-term wood recruitment needs. Trees would be felled into streams to provide an immediate benefit. Thinned Riparian Reserves would promote the growth of trees and over the long term, provide sufficient large woody debris for uplands, riparian areas, and stream communities. Public comments have suggested that the maximization of dead trees by not thinning would be the best way to meet this objective. This project has focused on creating a sufficient quantity of snags balanced with treatments for accelerating the development of large live trees, diversifying and restoring native tree composition, and creating horizontal and vertical diversity through skips and gaps.

For these reasons, the objective of maintaining and restoring species composition and structural diversity of plant communities would be met for this project because it would lead to improved conditions in the long term.

ACS Objective 9 - Well-Distributed Populations of Native Species

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

Past regeneration harvest and road construction has changed both the species composition and structure in Riparian Reserves. Aquatic species were affected by removal of shade, increases in sedimentation from road construction and the blockage of movement by culverts. Some key aquatic species have become rare, and some unwanted plant species have flourished along roads and are outcompeting desired species. There is an ongoing trend of improving watershed conditions as trees and vegetation regrow, as roads are decommissioned, and as uniform riparian vegetation is made more diverse. (s. 3.2, s. 3.4.7, s. 3.13)

Thinning prescriptions would retain minor native tree species and would restore uniform stands to a more diverse mix of native species and accelerate attainment of late-successional characteristics. Design criteria address measures to minimize the spread of invasive plants and to use native species for erosion control. Protection buffers along streams would provide for short-term wood recruitment needs and provide shade to minimize impacts to invertebrate and vertebrate aquatic and riparian-dependent species. Thinned Riparian Reserves would promote the growth of native trees and over the long term, provide sufficient large woody debris to benefit a wide range of native plant and animal species. A more diverse arrangement of large wood and native plants in Riparian Reserves and along streams would host native invertebrate, and riparian dependent species for the improved health of the aquatic and riparian system. (s. 2.2.9J2, s. 2.2.9L1 to L5, s. 3.2, s. 3.4.4.1)

For these reasons, the objective of maintaining and restoring well-distributed populations of native species would be met for this project because it would lead to improved conditions in the long term.

ACS Summary

While some short-term impacts to aquatic resources have been disclosed, the impact would be minimal and in most cases undetectable at the subwatershed scale. The project would lead to improved water quality and enhanced riparian and watershed conditions in the long term because of the following:

- Stream-protection buffers would provide sufficient stream shade, a source of woody debris recruitment to streams and would minimize the potential for sediment transport to streams.
- Variable-density thinning with skips would enhance structural diversity in Riparian Reserves.
- Thinning in Riparian Reserves would accelerate the development of late-successional conditions.
- Felling trees into streams would lead to improved stream conditions as pools develop.
- The decommissioning of system roads would lead to improved water quality.
- System road repairs and maintenance would allow for safe use while ameliorating water quality issues.

For these reasons, the objective of maintaining existing conditions or implementing actions that restore watershed and landscape-scale features in the long term would be met for this project. This project is consistent with the Aquatic Conservation Strategy Objectives.

3.5 GEOLOGIC STABILITY

Summary - This section shows that the project complies with Forest Plan direction in terms of land stability. Areas of concern have been examined in the field by a stability specialist. As a result, some treatment area boundaries were adjusted to eliminate the areas of concern for potential landslides. A cumulative effects analysis using the

Aggregate Recovery Percentage methodology was used for earthflows: no substantive cumulative effects were found.

3.5.1 Methodology

The likelihood of management-induced landslides occurring within or near a planned management activity is determined by inspection of the slope by a slope-stability specialist. Trees have a beneficial effect on slope stability by lowering the groundwater table through evapotranspiration and tree roots stabilize the upper several feet of soils.

Many of the proposed vegetation management units are located in previous regeneration harvest units (clearcuts). Previous regeneration harvest units that show no signs of shallow or deep-seated post-harvest slope instability are assumed to remain stable after thinning. Areas that have post-harvest signs of instability are dropped from consideration for treatment. Areas that have not been 'tested' by previous regeneration harvest and areas that are proposed for regeneration harvest were examined for slope stability issues.

In-depth field examination was prioritized by using historical aerial photos, existing landslide mapping (GIS layer), field reports of landslide incidence by other resource specialists, and field visits to selected units by a slope stability specialist.

An analysis was conducted using the Aggregate Recovery Percentage methodology (ARP) to determine the likelihood of cumulative effects on earthflow terrain. By measuring the percent of an area in a hydrologically recovered condition, the ARP model evaluates the risk of accelerating the movement of earthflows.

3.5.2 Existing Condition

The proposed thinning units are located on a wide variety of landforms but these landforms can be grouped into two general types: ancient landslide deposits and all other landforms.

Extensive glaciation in the distant past over steepened the valley walls. Once the glaciers melted and removed lateral support from the valley walls, large portions of those valley walls collapsed as massive landslides composed mostly of the highly altered, clay-rich, pyroclastic material. The ancient landslide deposits developed during a much wetter climate than our present climate. During that time, unstable hillslopes collapsed and formed earthflows and large debris slides that became large coalescing deposits of landslide material. These landslide deposits can be several square miles in area and may be several hundred feet deep. Slope angles are usually gentle. These landslide deposits are more stable now than they were in the past but there are still portions of them that are adjusting to their "new" slope position. Most of the ancient landslide deposits are dormant and would require a major change in their hydrology or slope geometry to become active again.

Portions of these ancient landslide deposits have been recognized as being recently active. Evidence for recent movement includes fresh scarps, cracks, very tilted trees, and similar clues. These recently active landslide deposits have been mapped as active

landslides. These adjustments usually occur during or immediately after major storm events, when the ground water table is high.

The large, ancient, mostly-dormant, landslide deposits in this area have been classified as high-risk earthflows, moderate-risk earthflows, and low-risk earthflows. The high-moderate-low adjectives describe the relative susceptibility of the terrain to reactivation of ground movement from any cause. High and moderate-risk earthflows are included in their own land allocation and are covered by the 'B8 – Earthflows' set of Forest Plan standards and guidelines. The low-risk earthflows do not have a land allocation because they are relatively stable but are covered by a set of standards and guidelines at FW-001 to FW-021.

Landslides can also occur on landform types other than ancient landslide deposits. Usually these are debris slides and debris flows that originate on steep slopes. Debris slides typically occur on slopes that are greater than 60%. Debris flows typically originate in channels that have a gradient that is steeper than about 35%. On these landform types the soil depths are relatively shallow and tree root strength is a factor in slope stability.

The following Hunter units occur within the dormant ancient landslide deposit landform; 2, 4, 4p, 6, 6p, 7, 7p, 14, 150, 162, 164 and 211. No units occur on active landslide landforms.

Poorly located, poorly constructed, or poorly maintained roads can result in slope stability problems and can result in resource damage. Well-located, well-constructed, and well-maintained roads would have a minimal effect on slope stability. Most of this area was heavily roaded beginning in the late 1950s and continuing through the 1980s. Road construction practices gradually improved though the decades but there remain many roads that were poorly located and/or poorly constructed in the past. Without proper maintenance, these roads can be a threat to water quality and fish habitat. Beginning in the mid-1970s and continuing to the present, many unstable portions of existing roads have been rebuilt or modified to stabilize the road and the hillslope. More recently, road decommissioning projects have removed many problem areas and reduced the potential for road-related landslides and the resulting adverse effects on water quality and fish habitat.

Debris flows are a natural process in the northwest part of the planning area and can have some beneficial effects by delivering boulders and large woody debris to lower elevation stream segments, which enhances fish habitat. Debris flows can also have detrimental effects, such as delivering excess fine sediments to fish habitat, or blocking road crossings and diverting drainages. Poorly designed or poorly located road/stream crossings can impede this natural process and have an adverse effect on fish habitat.

3.5.3 Existing Condition using the ARP Methodology

The analysis area for geologic stability includes the earthflow landforms in the project area. This includes two moderate-risk earthflows: Two Rivers and Austin.

The ARP model ranks recovery from 0 to 100 with 100 being fully recovered. Stands that have trees greater than 8 inches in diameter and over 70% canopy cover are considered fully recovered in terms of hydrology (Forest Plan, FW-064, B8-031 and B8-032). In the ARP model, stand age is used to determine whether stands meet these criteria.

The stands proposed for treatment are currently hydrologically recovered. There has been no regeneration harvest in the past two decades but the power line corridor that crosses through these earthflows is maintained as a permanent opening. Because of these factors, the earthflows are close to their maximum recovery level in the upper 80% range. The ARP values are increasing by approximately 0.5% per year in these areas as mid-aged stands grow and as past thinning actions recover.

The current condition for each earthflow

Earthflow Name	Acres	Current Condition (percent recovered)
Two Rivers	724	89%
Austin	195	87%

3.5.4 Effects

Approximately 87% of the vegetation treatments of the proposed action were regeneration harvest units (clearcuts) in the past. The removal of all the trees in an area has a much greater potential impact on the slope stability of that area than a thinning would. The level of stability of the slopes of previously clearcuts was therefore "tested" in the past by that original harvest. Other units that have steep slopes were also examined. All of the treatments in areas identified as earthflows or on steep slopes are proposed for thinning.

After field examination, the boundaries of two proposed units (2 & 8) were modified to exclude from treatment those areas that were judged to be unstable or potentially unstable. Roads proposed for construction or reconstruction were examined and found to be stable.

3.5.4.1 Direct and Indirect Effects

Alternative A (No Action)

No logging would occur under the no-action alternative. The level of instability of deeper-seated active landslide areas would likely remain about the same.

Road access would remain as it presently exists. Little maintenance or repair of existing roads would be scheduled so there would be an increasing risk of resource damage from the existing road system.

Alternative B (Proposed Action)

Under Alternative B, vegetation management actions would occur in areas that are considered to be stable by a slope stability specialist. Known unstable or potentially unstable areas have already been deleted from the proposed units. Thinning would enhance tree growth and tree root growth over the long term, restoring hill slope stability to original levels. The vegetation management actions would likely reduce hill slope stability slightly for a few years after treatment when dying tree roots have not yet been replaced by new root growth. Existing shallow landslide scars within the project area would be protected and would continue to slowly heal as vegetation on the scars became denser. The level of instability of deeper-seated active landslide areas would be unaffected by proposed vegetation management actions.

Within earthflows, 0.06 mile of new temporary roads would be constructed and 0.09 mile of existing road alignments would be temporarily reused. All temporary roads are located on stable ground and their construction or reconstruction would have no perceptible effect on slope stability. These roads would be rehabilitated after use. Existing system roads that would be used for timber haul would be maintained and repaired. These actions would greatly reduce the risk of resource damage from these roads.

Properly decommissioned roads reduce the potential for road-related landslides and the resulting adverse effects on water quality and fish habitat. Roads that are properly decommissioned or storm-proofed and closed require no maintenance and therefore allow the limited Forest road maintenance funds to be applied more effectively to a smaller road system. Better-maintained roads have less environmental impact than poorly maintained roads.

3.5.4.2 Direct and Indirect Effects using the ARP Methodology

There would be very little change in terms of earthflow stability as measured by the ARP model under any alternative because the ARP percentages remain in the upper 80s.

The following table shows the reduction in ARP value with project implementation.

Earthflow Name	Acres Treated	Percent Change in ARP value
Two Rivers	73	2.2
Austin	23	1.7

Individual stands that are thinned below 70% canopy cover would be considered partially recovered in terms of the ARP model. These impacts would last a few years until the canopy closes in again as trees grow in response to the thinning. The power line crosses these earthflows and treatments on approximately 14 acres underneath and along the edge of the power line corridor would have all trees removed to address hazards. These areas would likely be maintained as long-term openings. With the relatively high levels of hydrologic recovery for these earthflows, the slight changes associated with the project would not likely cause the acceleration of movement of earthflows.

3.5.4.3 Cumulative Effects

The cumulative effects analysis area for geologic stability includes the earthflow landforms in the project area. This includes two moderate-risk earthflows Two Rivers and Austin. These are appropriate boundaries because actions outside these areas would have little or no effect on stability of that earthflow. In terms of the time frame, past actions are included where they resulted in stands that are not yet hydrologically recovered: this would include clearcuts that occurred within the past 30 years, and all roads and other created openings regardless of their time of creation because they are currently considered unrecovered. The analysis above for existing condition includes all past and foreseeable timber harvest, fires, roads, quarries and the power line right-of way. Recent projects in the analysis area include Roman Thin, Day Thin and Bass Thin. There are no foreseeable future actions within these earthflows.

Cumulative effects pertaining to earthflow stability are not expected because changes to hydrologic recovery as projected by the ARP model are very small in a landscape that has relatively high levels of recovery.

3.5.5 Forest Plan Consistency

This analysis has focused on B8-032. The project is fully consistent with this standard.

Earthflow Name	Risk Level	Forest Plan Goal	Proposed Action 2017
Two Rivers	Moderate	>75%	86.9%
Austin	Moderate	>75%	85.7%

Note: The ARP values change constantly as stands grow. Even though 2017 is projected as a harvest date for modeling purposes, it is highly likely that this harvest would be spread out over several years and therefore ARP values would likely be even higher by then.

The proposed action is consistent with the following standards and guidelines.

Standard	Notes
FW-001 to 003	Slope stability has been examined in the field and the project is consistent with goals of maintaining stability.
FW-004 to 009	Active landslides have been avoided. (Earthflows are not active landslides)
FW-010 & 011	Debris slide and debris flow areas have been avoided.
FW-012 to 014	The slope stability specialist report has documented geologic hazards and made recommendations for project adjustments.
FW-015 to 016	Where appropriate, road repairs are proposed on haul roads that would stabilize actively moving areas.
FW-017 to 021	These apply to low-risk earthflows. There are no low-risk earthflows in the project area.
B8-009 to 024	These wildlife standards do not apply inside the project area.
B8-028 to 037	See discussion for exception to B8-036 in the soils section. Even with this exception, earthflow stability would not be affected. The slope stability specialist has found the project to be consistent with the goal of maintaining stability.
B8-040	See exception for soil productivity standard B8-040 in the soils section. Even with this exception, earthflow stability would not be affected. The slope stability specialist has found the project to be consistent with the goal of maintaining stability.

Standard	Notes
B8-048 to 051	Roads were examined in the field and assessed by the slope stability specialist. Some temporary roads would be reconstructed and then rehabilitated: they do not cross the toe or scarp of any earthflows. Road maintenance and repair would also occur with an emphasis on drainage structures. These practices were designed to prevent the reactivation or acceleration of unstable areas. The slope stability specialist has found the project to be consistent with these standards and guidelines.

All unstable and potentially unstable areas have been examined and dropped from this project. This project would maintain the existing slope stability in this area.

3.6 SOIL PRODUCTIVITY

This section summarizes the soil specialist report and data in the analysis file that are incorporated by reference. This section details potential effects to the soil resource for the proposed treatment units. Other sections cover related topics including geology (s. 3.5) and water quality (s. 3.3).

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended). While PDCs were developed to minimize impacts to soils (s. 2.2.9), the existing condition of many stands from past clearcut logging exceeds the standards for detrimental soil condition that we have today. Exceptions are discussed for a few standards and the rationale for why cumulative effects would not be substantial.

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities may adversely affect the natural capability of soils and their potential responses to use and management. Disturbances may reduce the soil's ability to supply nutrients, moisture, and air to support soil microorganisms and vegetation growth. The productivity and resilience of a soil is directly tied to the physical properties of the soil and the amount of fine organic matter and coarse woody debris retained or removed from the site. Forest soils are a non-renewable resource as measured by human lifespans, so maintenance and enhancement of soil productivity is an integral part of Forest management.

3.6.1 Methodology

Soil types within the planning area are mapped in the Mt. Hood National Forest Soil Resource Inventory (SRI) (Howes 1979). Interpretation of that mapping was informed by other sources including historic aerial photographs, and digital spatial data in the Forest's corporate Geographic Information System (GIS). These sources were used along with topographic maps, silvicultural reports, field-based reconnaissance and sampling to characterize local conditions and analyze the likely environmental consequences of the alternatives. Actions addressed in this report include those associated with proposed timber harvest activities, silvicultural and forest health treatments, system road usage, road closure and decommissioning, temporary road construction, and proposed resource projects.

Priority stands were chosen for field evaluation and validation of soil mapping units, slopes, hydrologic characteristics, and other features. Appropriate map changes were made to reflect field observations. With updated and validated soil mapping, pertinent management interpretations are more accurate and therefore provide high confidence when determining levels of risk. Stands were also chosen based on treatment type and past harvest history for field estimates of existing soil disturbance conditions. Soil disturbance condition was assessed using visual observations on the ground, and quantitative estimates were made using historic aerial photos and GIS mapping.

The condition of soils was determined from field observations of a sample of proposed treatment units visited during the summer and fall of 2016. Stands were chosen based on logging method, with an emphasis on ground-based systems.

3.6.2 Measures

For this analysis three measures are used to assess impacts; accelerated erosion, soil disturbance and organic matter.

Accelerated Erosion

Natural, or geologic erosion, is erosion of the earth surface under natural or undisturbed conditions. It includes loss of soil particles from weathering processes and by forces of water, wind and gravity. Natural erosion occurs at a relatively uniform rate except during extreme natural events when large quantities of soil can erode in short periods of time. Under natural conditions, vegetation and other effective ground cover retards erosive processes. Removal of vegetation, concentration of overland flow, or interception of subsurface flow by harvest, road building, or other ground moving activities disturbs natural conditions and the erosion rate accelerates. Accelerated erosion is the increase in soil erosion and sediment production over natural erosion.

Soil erosion can directly affect soil productivity by reducing soil depth and volume, resulting in a loss of nutrients and water holding capacity. An indirect affect from soil erosion is runoff from bare areas carrying soil particles to water bodies where it becomes sediment. Sediment is addressed in section (s. 3.3.3.3). The erosion hazard rating is based on bare surface soil properties that affect detachability, such as climate, slope gradient and length, soil texture and structure, permeability of the surface soil, and hydrologic characteristics of the soil and bedrock materials. Management ratings for erosion risk follow the variability of the soils across the landscape, with some soils mapped with a severe erosion risk, others with slight, and many in between. Although ratings are a good preliminary analysis tool, in actuality almost any soil regardless of rating can become more erosive than rated depending on site-specific circumstances. Soils with a slight erosion risk rating that are compacted and bare can become erosive even on gentle slopes. Conversely, erosive soils occurring on very steep slopes may be stable for decades because of sufficient protective groundcover (vegetation, tree needles, leaves, wood, rocks, etc.). The naturally occurring background levels of erosion and sedimentation are discussed at section 3.3.3.4. Accelerated erosion is measured by acres of exposed soil.

Soil Disturbance

Soil productivity and soil water-storage capacity can be affected by compaction, puddling, displacement, erosion and severe burning. These conditions, if severe enough can result in soils that have low levels of porosity, reduced root penetration, increased runoff, reduced infiltration, reduced soil water storage capacity, reduced soil water availability, reduced nutrient availability, and reduced levels of mycorrhizae and other soil organisms. Not all soil disturbance is widespread or severe enough to be considered detrimental: the Forest Service Manual contains guidance on the size and intensity of disturbance sufficient to cross the threshold to detrimental soil condition (Forest Service Manual 2521.1, Region 6 supplement 2500-96-2, effective 6/4/96). Soil disturbance is measured by percent of units in detrimental soil condition.

Organic Matter

Soil fertility and soil biological systems would properly function if certain components are present, such as appropriate levels of organic matter. Organic matter includes all of the material on the forest floor such as duff, leaves, twigs and coarse woody debris. Course woody debris helps retain moisture and moderate soil temperature. It also provides habitat for a diverse array of fungi and macro-/micro-invertebrates that improve soil structure and quality, cycle organic carbon, and facilitate nutrient cycling. Organic matter is measured by acres of soil organic layer removed.

3.6.3 Analysis Area

The analysis areas for soil resources for direct, indirect and cumulative effects are the boundaries of the stands proposed for thinning, decommissioned road locations, and other areas where heavy equipment would be used. These are appropriate boundaries because actions outside these areas would have little or no affect to soil productivity within the treatment areas, and the actions within and treatment areas would have little or no affect to soil productivity elsewhere. Forest Plan standards and guidelines also address soil productivity at the scale of the activity area rather than at a broader landscape scale (p. Four-49). In terms of the time scale, timber harvest and road construction that has occurred since the 1950s has created soil impacts that remain today.

Elements of proposal that could affect soil productivity

For this project, the following actions have the potential to adversely affect soil productivity: actions that disturb soil such as the skidding and yarding of logs, the use of mechanical tree harvesting equipment, the construction of temporary roads and landings, the reconstruction of existing road alignments, the use of mechanical brushing equipment, dispersed recreation rehabilitation, and the burning of a meadow, forage openings, and slash piles. Other aspects of the proposed action such as road repair, road closures, log haul, road decommissioning through database changes, danger tree removal, pruning of western white pine, culvert replacement, wood placement in streams, and the creation of snags would not have a meaningful or measurable effect on soil productivity because they do not alter soil conditions. Some actions are specifically designed to

benefit soil productivity including creation of down logs, road decommissioning, and decompacting temporary roads, landings and skid trails.

The analysis also considers restorative actions and the design criteria and best management practices that are intended to minimize the extent of detrimental soil impacts. For example: existing roads, landings and skid trails would be reused where feasible, equipment would be restricted to appropriate slopes, erosion control methods such as water bars, seed and mulch or slash cover would be used.

3.6.4 Existing Condition, Direct, Indirect and Cumulative Effects

The current condition described in the analysis below incorporates all past actions that have occurred within the analysis areas, which correspond to the proposed project boundaries. There are no other foreseeable future actions to include. While there may be future thinning, there is no proposal now for future actions that have sufficient site specificity to conduct an analysis.

3.6.5 Erosion

3.6.5.1 Existing Condition

In the project area, surface soil erosion potential varies from slight to moderate across the majority of the project area. Some areas on steep slopes are rated as severe. Subsoil erosion potential is low to moderate on gentle slopes and varies from low to high on steep slopes. Ground cover can be used as an indication of erosion risk.

3.6.5.2 Direct and Indirect Effects

Soil erosion can directly affect soil productivity by reducing soil depth and volume, resulting in a loss of nutrients and water holding capacity. An indirect effect from soil erosion is runoff from bare areas carrying soil particles to water bodies where it becomes sediment (s. 3.3.3.4). Other negative effects occur such as decreased air quality from dust (silt size soil particles) carried in the atmosphere.

3.6.5.3 No Action

Erosion rates within the analysis area would remain as they are in the short term. Over time, as bare areas become revegetated, erosion levels would decrease. If an existing slide were to become more active, or if new landslides were to occur, an increased level of soil erosion would be expected in the exposed soil areas.

3.6.5.4 Proposed Action

Soil erosion risk would increase with the proposed action because bare soil would be exposed during implementation. Erosion would not occur where duff and other effective ground cover is retained. Therefore, practices which limit the amount of soil exposure, or which re-establish ground cover after soil is exposed, would result in less erosion occurring. Of the proposed yarding systems, ground-based systems result in a greater

amount of ground exposure than skyline and helicopter systems. Units that are prescribed for ground-based yarding systems and other mechanized treatments generally have gentle to moderate slopes, so even if the potential for erosion may be high, eroding materials would not move far before redeposition occurs. On units prescribed for ground-based mechanical felling systems where slopes approach 40%, the potential for erosion increases.

Bare soil would be exposed as logs are dragged on the ground and machines travel over the ground surface. Approximately 16 acres of new temporary roads and reused existing road alignments, 21 acres of landings not on existing road surfaces, and 128 acres of felling and yarding area would be used or reused. Most of this acreage was disturbed during past regeneration harvest, but currently has effective ground cover. A total of approximately 165 acres would have potential accelerated erosion as a result of harvest and other activities. Disturbed areas, particularly where slopes are greater than 25%, would be potential chronic sources of erosion until successfully revegetated or sheltered by effective ground cover. Effective ground cover such as down logs, slash or mulch would dissipate energy from runoff and minimize erosion. Slash and mulch are considered effective in the short term as ground cover until vegetation in the form of grass, shrubs or trees become established either from direct reseeding or through natural seeding.

Actual resource damage (accelerated erosion or sedimentation) is dependent on ground cover and weather events that provide the energy to move soil material from one location to another. In order to diminish this risk while soils are exposed, certain erosion control techniques which limit the amount of soil exposure, or which re-establish ground cover after soil is exposed, are implemented to lessen erosive energies. The use of PDCs for stream-protection buffers, designated skid trails, waterbars, and establishing effective ground cover by applying logging slash or seed, fertilizer, and mulch on the disturbed soils, reduce erosion features and disturbance, and results in a low potential for soil to be moved to streams and a low potential for substantive effects to soil productivity.

The road decommissioning, stormproofing, and dispersed recreation restoration projects would have a beneficial effect on long-term erosion rates and water quality. These projects would increase infiltration capacity of the roadbeds, resulting in a reduction in overland flow, establish effective ground cover on the road surfaces and allow for revegetation. Road closures use would help minimize impacts to soils.

3.6.5.5 Cumulative Effects - Erosion

See sections 3.6.3 & 3.6.4 for discussions of analysis areas and time frames for cumulative effects analysis. In some areas, past ground disturbance including clearcut logging, and road and landing construction, ground cover was removed. Since then, the stands have regrown groundcover protecting the soil surface and erosion has decreased. Existing surface erosion is mainly confined to exposed soil on unpaved road surfaces, road cutbanks, ditches, with a few isolated occurrences on steep skidtrail segments.

Treatment activities would result in a temporary reduction in effective ground cover

within forage openings, Rhododendron Meadow, rehabilitated dispersed recreation areas, and on primary skid trails, landings, yarding corridors, and to a lesser extent on ground between primary skid trails. BMPs and PDCs applied within treatment areas and road projects would result in constructing or improving drainage structures and establishing effective ground cover, resulting in a reduction in erosion from those areas.

The cumulative effects of the proposed actions when combined with past actions and foreseeable future actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.6 Soil Disturbance

3.6.6.1 Existing Condition

Soil disturbance includes soil compaction, soil displacement and puddling, and severe burning. The majority of readily observable detrimental ground disturbances in the field were heavily compacted old skid trails, landings, and temporary roads. It was observed that units visited still show signs of skid trail, landing and temporary road compaction or displacement. Soil quality has been degraded where detrimental soil conditions persist, and long-term site productivity is diminished on those sites. Rates of tree growth on detrimentally-impacted areas are likely diminished, and the soils' ability to perform other ecosystem services is compromised.

Management practices at the time of original clearcut harvest was less restricted and operators were not required to limit their skid-trail system, landings, and temporary roads to a specified extent. In some cases past actions also included removing woody debris, intense burning, and extensive duff and topsoil displacement during site preparation for planting. Therefore existing detrimental impacts to soil are generally higher than allowed under the current Forest Plan standards and guidelines.

Natural recovery from historic impacts has occurred to varying degrees depending on the inherent productivity and resilience of the sites, but residual impacts remain and are detectable in all of the previously harvested stands.

In some cases, old skid trails, landings, and existing road alignments have trees, brush or other vegetation growing on them. To the casual observer, this vegetation may appear to be evidence that these features have "recovered." While the vegetation does provide some cover to mitigate erosion as discussed in section 3.6.5, it does not indicate the recovery of soil disturbance: the areas remain compacted and displaced top soil has not been replaced. Even where vegetation is growing on some old skid trails, landings or existing road alignments, there has not been substantial recovery in terms of soil productivity. Generally, historic disturbance still rates as detrimental in nearly all cases.

The estimated percent area of detrimental soil condition in each of the treatment units can be found in the analysis file.

For stands that were previously harvested, existing detrimental soil condition was calculated to range from 8% to 27%. Outside these impacted areas, the proposed units

have soils in good condition. Most units exceed the Forest Plan standard of 15% detrimental condition. None of the areas in units previously logged with cable methods exceed 15%.

For stands not previously harvested, existing detrimental soil condition is very low. However, some of these areas have had some equipment impact or have existing road alignments in them. For these, the existing detrimental soil condition was calculated to range from 4% to 10%.

Direct and Indirect Effects

3.6.6.2 No Action

No further losses or gains in soil productivity in the short or long term are expected with this alternative. Detrimental conditions in the units would remain. Existing road alignments and landings would not be restored, and would likely remain in a detrimental condition for the foreseeable future. Detrimental soil compaction and displacement would remain localized to existing system and non-system roads, skid trails and landings.

In the long term, percent disturbed soil condition would slowly decline as compacted areas move toward recovery due to physical and biological processes, but the rate would largely be dependent on root growth of vegetation, the resilience of the soil, and the intensity of the disturbance.

In dispersed recreation areas, detrimental soil conditions would get worse as unrestrained recreators continue to push user created roads into riparian areas.

3.6.6.3 Proposed Action

A net increase in disturbed soil condition is predicted particularly where ground-based equipment is used such as mechanical tree fellers and where more skid trails, yarding corridors, landings and roads would be constructed than already exist. Thinning treatments would indirectly increase the productivity of dense and overstocked stands by alleviating competition. In dispersed recreation areas, detrimental soil conditions would be restored and vehicles would be constrained to appropriate sites.

Existing landings, roads, and skid trails would be reused where feasible. Detrimental soil compaction on existing landings and road alignments that are reused would be restored where appropriate by deep soil tillage. In a few units proposed for regeneration harvest and shelterwood harvest, primary skid trails would also be restored by deep soil tillage. Deep soil tillage of skid trails would use a subsoiler, or if soils are too rocky, decompaction with an excavator and thumbed bucket, locally known as “munching”. In addition, displaced soil adjacent to the skidtrails would be returned to the skidtrail area where feasible, slash and organic material would be spread over the surface, and access points barricaded or hidden. Leave trees in both the regeneration and shelterwood units are widely spaced and can easily be avoided by the equipment. Outside these restored areas, existing detrimental conditions from past ground disturbance would remain in a status of lengthy recovery for several decades. The proposed action includes closing and stormproofing some roads and

decommissioning others. Some impacted sites including most skid trails in thinning units, would remain heavily compacted and recovery would be prolonged.

The net change in detrimental soil condition in previously harvest units is estimated to range from a reduction of approximately 4% to an increase of approximately 9.5%. For stands not previously harvested, the change would range from 3 to 9%.

The proposed action includes rehabilitating temporary roads and existing road alignments and system-road decommissioning. The rehabilitation of skid trails in thinning units by deep soil tillage is not proposed because the roots of trees have penetrated into the skid trails, and that treatment would cause adverse impacts to tree roots that have penetrated into skid trails, leading to reduced growth, and increased root disease and tree mortality. The opportunity to mechanically rehabilitate skid trails in thinning units may come in the future if regeneration harvest occurs. Slash or other ground cover would be placed on skid trails to help reduce increases in soil disturbance, reduce erosion, and improve future soil condition.

3.6.6.4 Cumulative Effects – Soil Disturbance

See sections 3.6.3 & 3.6.4 for discussions of analysis areas and time frames for cumulative effects analysis. The table below shows a summary of effects from past harvest actions, the estimated effects from the proposed action, and the cumulative effects of the past plus proposed actions.

Past Actions	Direct Effect Proposed Action	Cumulative Effect
Up to 27%	-4% to 6.7%	3% to 31%

Approximately 61% of the treated acres would exceed 15% detrimental soil condition after treatment. The average for previously harvested stands would be approximately 20%.

In dense stands, site and soil resources are used by all the stems to stay alive with little left over for root expansion and stem strength. When high tree density is coupled with the existing extent of detrimental soil conditions, productivity could be considered low. Conversely, thinning to maintain tree spacing and therefore stand health, results in a reallocation of site and soil resources to the remaining trees, therefore offsetting to some degree, the negative effects of detrimental soil condition. The availability of site and soil resources for growth would increase substantially after thinning.

The cumulative effects of the proposed actions when combined with past actions and foreseeable future actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.7 Organic Matter

3.6.7.1 Existing Condition

Fuel treatments from initial clearcut harvests have reduced duff levels and organic soil

materials on all units. Field visits and aerial photo interpretation indicate that fuel treatments included broadcast burning and windrowing. Course woody debris retains moisture and moderates soil temperature. It also provides habitat for a diverse array of fungi and macro-/micro-invertebrates that improve soil structure and quality, cycle organic carbon, and facilitate nutrient cycling.

In stands previously harvested, duff layers are relatively thin due to the past harvest and fuel treatment history, and range from 0.5 to 2 inches with an average of 1 inch. Some units have low levels of course woody debris on the forest floor. In these areas the level is below historic ranges of course woody debris that naturally occurred prior to harvest and fuel treatment. Course woody debris plays an important role in nutrient cycling; where there are low levels there is expected to be diminished site productivity in the long term. Course woody debris levels vary between units primarily due to differences in past fuel treatments and the degree of decay in the mature trees and whether cull logs were removed or left in place during the original harvest.

In stands not previously harvested, duff and course woody debris levels are higher. Stands that originated after fire have high levels of course woody debris from killed trees.

Direct and Indirect Effects

3.6.7.2 No Action

Forest organic litter input, organic decomposition rates, duff layer development and soil fauna and microbe activity would be unchanged. Organic matter decomposition and nutrient cycling is influenced substantially by temperature and moisture, which would remain unchanged in the short term but would likely be influenced by climate change in the long term. Organic materials would be subject to disturbances such as wind damage or fire. As unthinned stands age, trees would die and fall (see snag and down wood analysis in s. 3.8.7). These stands would eventually produce large trees, which would be a source of future large decaying logs on the ground.

3.6.7.3 Proposed Action

Logs existing on the forest floor would be retained. The harvesting operations would add small woody debris the size class of the cut trees. This would include the retention of cull logs, tree tops, branches, broken logs and any snags that would be felled for safety reasons. Snags or green trees that fall down after the harvest operation would contribute to the down wood component of the future stand. Treatments to add additional snags and logs are discussed in section 2.2.7.5. Most fire-originated stands currently have sufficient quantities of coarse woody debris.

Duff disturbance would be minimized where full suspension yarding occurs in skyline and helicopter operations, where designated and existing skid trails are used in ground-based yarding operations, and where harvesters travel over slash mats. Soil microbial populations would likely be reduced initially in areas of exposed soils. Leaving branches and needles throughout the units where trees are felled should help maintain carbon and nutrient levels. Organic material would be displaced on approximately 168 acres of soil

exposed during mechanical felling, yarding and road construction and reconstruction operations.

Road decommissioning, new temporary road and existing road alignment rehabilitation, and restoration of dispersed recreation sites would increase soil organic matter where course woody debris is used to cover bare soils. The units that would have mastication of brush and small trees would have a dense mat of chipped material.

3.6.7.4 Cumulative Effects – Organic Matter

See sections 3.6.3 & 3.6.4 for discussions of analysis areas and time frames for cumulative effects analysis. In the analysis area, previous timber harvest, fuel treatment, and road construction activities have resulted in reduced duff and large woody debris levels, and a probable change in soil organism communities in disturbed areas. Decomposition of large wood recycles nutrients, is an important contributor to biological carbon sequestration, contributes to soil structure, slows evaporation of soil moisture during dry periods, and maintains a moist environment and food source for a large variety of soil and other organisms. Cumulatively the reduction of large wood removed by clearcutting has had long-term impacts to these ecological processes.

The cumulative effect of additional disturbance from the proposed action added to the existing condition would slightly increase displacement of organic material on exposed soils, increase numbers of coarse woody debris logs the size of thinned material, and reduce the decay cycle timeframe of rotting down logs that are moved or run over by equipment.

A sufficient tonnage of branches and down logs left after harvest is completed is expected to remain on site to provide for organic matter input to the ecosystem once all activities are complete. Based on previous experience with plantation thinning stands, approximately 27 tons per acre of debris would be retained in the units which is a sufficient level in west side forests to maintain long-term productivity. Course woody debris levels would likely be higher in fire-originated stands do the large quantities of trees that were killed and have fallen.

The cumulative effects of the proposed actions when combined with past actions and foreseeable future actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.8 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References
Forestwide Soil Productivity Standards and Guidelines - FW-22 to FW-38, page Four-49
Earthflow Standards and Guidelines - B8-28 to B8-41, page Four-264
See Mt. Hood FEIS pages IV-11, and IV-155 to IV-167
Northwest Forest Plan - Coarse Woody Debris Standards and Guidelines - page C-40
Soil Disturbance Standards and Guidelines - page C-44
Modify Fire and Pesticide Use, Minimize Soil Disturbance Standards and Guidelines - page C44

Standard	Notes
FW-22 to 23	See discussion below for exception.
FW-24	Minimization of rutting would be achieved through the BT6.6 and CT6.6 (or similar) provisions in the contract.
FW-25	Ground cover would be maintained at the prescribed levels.
FW-28 to 30	See discussion below for exception.
FW-31 to 34	Sufficient woody debris would be left on site including existing down logs, tops, branches, and trees felled to create coarse woody debris.
FW-037	Many aspects of the project include design features that limit disturbance to the soil's organic horizon: broadcast burning and mechanical fuel treatments would not occur, skyline and helicopter systems are used where appropriate, existing temporary roads, landings and skid trails would be reused where appropriate and mechanical fellers would operate on top of branches and tops.
B8-036	See discussion below for exception.
B8-040	See discussion below for exception.

Exceptions

Exceptions to Forest Plan standards and guidelines FW-022, FW-028, B8-036, and B8-040 are proposed. These relate to soil productivity, which is defined in the Forest Plan as the capacity of a soil to produce a specified crop such as fiber or forage under defined levels of management. Productivity is generally dependent on available soil moisture and nutrients, and length of growing season (Forest Plan Glossary p. 30).

FW-022

The combined cumulated detrimental impacts, occurring from both past and planned activities, of detrimental soil compaction, puddling, displacement, erosion or severely burned soil should not exceed 15% of the activity area.

Many thinning units (about 61% of the proposed treatment acres) already exceed 15%. The proposed action would increase it somewhat in some units while reducing it in other areas depending on site-specific factors (s. 3.6.6.4). An exception to FW-022 is proposed. The potential to reduce impact even further as suggested by FW-028 was considered and is discussed below.

There was no standard and guideline for limiting the extent of detrimental soil impacts when the original clearcuts were logged prior to the Forest Plan. Back then, ground-based logging was less restricted and operators were not required to limit their skid-trail system, landings, and temporary roads to a specified extent. Post-harvest activity such as site preparation for reforestation often added to the extent of detrimental ground disturbance after the initial harvest.

Some system roads have been decommissioned and while these were previously not included in the calculation, they are included now because the decommissioning has not fully restored soils.

The Forest will continue to manage soil resources with the goal of maintaining or enhancing its productivity. The proposed action has been designed to minimize additional detrimental soil impacts. The following project design criteria and contractual specifications would be employed that aim to contain the extent of detrimental soil conditions.

- All or portions of 22 thinning units that were originally logged with ground-based equipment would be thinned using skyline machines or helicopters, which have lower soil impact.
- Old roads and landings would be reused where appropriate.
- Existing skid trails would be reused where they are not hydrologically connected.
- Where the existing skid trail pattern has far more trails than are needed with today's equipment and logging techniques, only the skid trails that are needed to efficiently operate would be reused and the unused skid trails would be allowed to continue to recover.
- Where new skid trails are needed due to changes in logging system or landing location, they would be spaced 150 feet apart and on appropriate slopes.
- Mechanical harvesters would walk on layers of slash.
- Ground-based operations would occur when weather conditions provide for soil moisture conditions that are sufficiently dry to prevent excessive compaction, rutting or erosion.
- Some trees would be felled to create down woody debris.
- Appropriate erosion control techniques would be used including constructing waterbars on skid trails and placing slash on certain skid trails.
- After operations are completed, new temporary roads, existing road alignments and landings that were used would be decompacted where appropriate.
- After operations are completed, primary skid trails would be decompacted where feasible on approximately 60 acres of unit 102 and on approximately 116 acres of the lodgepole pine shelterwood treatments.
- Some system roads would be decommissioned.
- Some system roads would be stormproofed and closed.
- In areas not disturbed again, natural recovery would continue to occur, as roots and burrowing animals penetrate and break up compacted soils, as organic matter accumulates, and as soil wetting/drying and freezing/thawing cycles occur.

In dense stands, site and soil resources are used by all the trees to stay alive with little left over for root expansion and stem strength. When high tree density is coupled with the existing extent of detrimental soil conditions, productivity could be considered lower than the sites potential. Conversely, thinning to maintain tree spacing and therefore stand health, results in a reallocation of site and soil resources to the remaining trees, therefore offsetting to some degree, the negative effects of detrimental soil condition. The availability of site and soil resources for growth would increase substantially after thinning.

The objective of maintaining long-term site productivity would still be met. Section 3.6.6.4 describes that site productivity has not been substantially impaired. The

silviculture report also indicates that stands are growing well and that they would grow even better after thinning. The cumulative effects of the proposed actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

FW-028

Following completion of project activities, if more than 15% of the activity area remains in an impaired (e.g. compacted, puddled, displaced or eroded) soil condition, rehabilitative techniques should be used to restore the soil resource to a level of less than 15% impaired.

Even though many units already exceed this level it is not possible or practical to rehabilitate all of the impacts at this time, therefore an exception is proposed. At the time of the original clearcut harvest, ground-based logging was less restricted and operators were not required to limit their skid-trail system, landings, and temporary roads to a specified extent. Temporary roads and landings were also created to access the stands. Some of the detrimental condition has been caused by site preparation techniques prior to planting that used tractors or involved intense burning.

Existing road alignments, landings and skid trails are a key part of the stand-management transportation system and where appropriately located, would likely be reused when stand management is proposed. Stand management techniques have evolved over time changing the portion of land used for the stand-management transportation system and the portion kept productive and resilient to grow trees and other vegetation at appropriate rates.

Even though there have been advances in the past 50 years in understanding the critical role soil conditions play in forest productivity, it is not always possible to reverse all past impacts so that soils can be returned to the same level of functionality that they once had. For example, where severe burning resulted in scorched soils or where duff and the top soil horizon have been moved a great distance; it is not feasible to restore these impacts quickly. Some actions are proposed to restore or minimize impacts to soils including those listed above for FW-022; they would provide some benefit but they are not likely to fully restore soils.

One technique used in the past to partially restore soils is to use deep soil tillage equipment on skid trails. This has been done before in regeneration harvests where a winged subsoiler pulled by a tractor was used to decompacted soils on skid trails. This technique is recommended by another guideline (FW-030) which suggests that all logging skid trails should be considered for rehabilitation through deep soil tillage techniques as a means to achieve the goals of FW-028. This technique is appropriate in some circumstances such as directly after a regeneration harvest but is not appropriate in other circumstances. This guideline was not a requirement at the time of the initial clearcutting.

Deep soil tillage is being proposed for the primary skid trails (and existing road alignments and landings) on several units. Unit 102 is a plantation which would have a regeneration harvest with skips and scattered leave trees for the purpose of creating forage for deer and elk (s. 1.3.5, s. 2.2.5.1). Several lodgepole pine units on approximately 116 acres would have a shelterwood prescription (s. 1.3.2, s. 2.2.2). Even with deep soil tillage on skid trails, road alignments and landings, these units would not likely get below 15% because a portion of the detrimental impact comes from past site preparation which displaced topsoil and duff; tillage would not repair that damage.

Most thinning units have existing skid trails that are still considered to have detrimental soil conditions. However, there are tree roots that have penetrated into the skid trails. Reusing the skid trails again may add some additional compaction around these roots but they would likely remain intact. Deep soil tillage of skid trails in a thinning unit would break the roots that have penetrated into the trails and lead to reduced growth, increased root disease and tree mortality. Using this technique on skid trails that are not reused at this time, (e.g. where there are more skid trails than needed or where units are changed to skyline or helicopter) would require that trees growing in the trails be cut prior to treatment. This would set back the partial recovery that has occurred on these skid trails.

Deep soil tillage was considered for all skid trails but the technique was not selected for thinning units. The project is consistent with FW-030 because serious consideration was given to this technique even though it was not selected in every case. The opportunity to mechanically rehabilitate skid trails by deep soil tillage may come in the future if regeneration harvest occurs in these stands. Most units that were logged with ground-based equipment in the original clearcut harvest would remain above 15% detrimental soil condition.

The objective of maintaining long-term site productivity would still be met. Section 3.6.6.4 describes that site productivity has not been substantially impaired. The silviculture report also indicates that stands are growing well and that they would grow even better after thinning. The cumulative effects of the proposed actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

B8-040

The combined cumulated detrimental impacts, occurring from both past and planned activities, of soil compaction, puddling, displacement, erosion and/or severely burned soil, should not exceed 8% of a project activity area.

This standard and guideline applies to the B8 - Earthflow land allocation. The few units in this land allocation are already over 8% detrimental soil condition from previous actions when the unit was clearcut, therefore an exception is proposed. The same rationale for soil productivity described for FW-022 and FW-028 apply to this guideline as well. The Forest's slope stability specialist has determined that there would be no risk of accelerating earthflow movement with the proposed action.

B8-036

Ground machine yarding of logs should not occur.

This standard and guideline applies to the B8 - Earthflow land allocation. For the proposed action, ground-based yarding would be used on some earthflow thinning units, therefore an exception is proposed. The selection of logging system was based on the relatively gentle nature of the topography and the existence of roads, skid trails and landings. The same rationale for soil productivity described for FW-022 and FW-028 apply to this guideline as well. The Forest's slope stability specialist has determined that there would be no risk of accelerating earthflow movement with the proposed action. In earthflow units, the objective of earthflow stability would still be met by thinning to create healthy, productive stands using ground-based methods.

3.7 NORTHERN SPOTTED OWL

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and the Northern Spotted Owl Recovery Plan, and that vegetation management actions are appropriate to move stands in the desired direction for spotted owls. The project is not likely to adversely affect spotted owls.

This section summarizes analysis in the Wildlife Report and Biological Evaluation, which is incorporated by reference. Late-Successional Reserves (LSR) are the primary habitat for spotted owls as designated under the Northwest Forest Plan. Several proposed actions are in the LSR. The objective of the LSR is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for the late-successional and old-growth related species including the northern spotted owl (USDA, USDI 1994a).

The project area is covered by the North Willamette LSR Assessment (USDA, USDI 1998). The purpose of the LSR Assessment is to document current conditions and functions of the LSRs and present sideboards for management activities in the LSR to meet the objectives in the Standards and Guidelines of the Northwest Forest Plan.

3.7.1 Endangered Species Act Compliance

The northern spotted owl is federally listed as a threatened species under section 4 of the Endangered Species Act (ESA). The Forest has consulted on this project with the U.S. Fish and Wildlife Service (USFWS). A Letter of Concurrence dated August 12, 2016 (FWS Reference Number 01EOFW00-2016-I-0385) (USDI 2016) is incorporated by reference.

The U.S. Fish and Wildlife Service revised designated critical habitat for the northern spotted owl (USDI 2012). This designation, under the Endangered Species Act is not the same as the LSR land allocation. These are different land bases with different management approaches. Many of the proposed actions occur in critical habitat.

3.7.2 Habitat Methodology & Existing Condition

Known Owl Sites are sites that were or are occupied by a pair or resident single as defined by protocol (USDA USDI 2016, USDI 2016). Since there are few recent surveys for spotted owls that show the locations of known active nest sites on the Forest, historical spotted owl information is used. Historical nest sites are used because studies show that nests are used for many years and when a site has been found to be unoccupied during surveys, it can be subsequently utilized by a different pair of owls years later.

Suitable Habitat

While none of the proposed vegetation management actions occurs in suitable habitat, it is discussed here because of the long-term implications of accelerating the growth and diversity of stands toward suitable habitat.

Suitable habitat consists of forested stands used by spotted owls for nesting, roosting and foraging (NRF). Features that support nesting and roosting typically include a moderate to high canopy cover (60-90%); a multi-layered, multi-species canopy with large overstory trees (greater than 30 inches diameter); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (USDA USDI 2014, USDI 2015). This habitat is described as *nesting and roosting* habitat in the revised spotted owl recovery plan (USDI 2011).

Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USDI 2011). Trees within foraging habitat may vary in size, and could be of smaller diameter than tress in nesting and roosting habitat depending on site-specific conditions. Together, nesting, roosting or foraging habitat comprise suitable habitat in this document.

Suitable Habitat within Home Range: For the Willamette Province the northern spotted owl home range is a 1.2-mile radius circle (2,955 acres) centered on the historic nest site. There are 33 known owl sites that have suitable habitat present within 1.2 miles of proposed project activities. The U.S. Fish and Wildlife Service recommends that spotted owl nest territories should have at least 40% suitable habitat in the nest territory (provincial home range) to avoid substantial impact (USDI 2011). Currently, 10 of the 33 known sites within 1.2 miles of proposed Hunter project activities are below the 40% threshold.

Suitable Habitat within Core Nest Area: A core nest area has been defined as the area within a home range that receives disproportionately high use (503 acres or 0.5-mile radius circle) centered on the historical nest site. The U.S. Fish and Wildlife Service recommends that spotted owl nest territories should have at least 50% suitable habitat in the core nest areas to avoid substantial impact (USDI 2011). Thirteen of the 33 known owl sites have core nest areas that are currently below the 50% threshold in suitable habitat.

There are no proposed treatments within suitable habitat that would alter suitable habitat.

Dispersal Habitat

Dispersal habitat allows spotted owl movement across the landscape between stands of suitable habitat and for juveniles to disperse from natal territories. This habitat generally lacks the optimal characteristics to support nesting and typically lacks multi-storied canopies, large trees or large snags and down wood. Dispersal habitat generally consists of mid-seral stands between 40 and 80 years of age with canopy cover of 40% or greater and trees with a mean diameter of 11 inches or more (USDI 2011).

There are proposed treatments within dispersal habitat in the project area, some of which would remove this habitat characteristic.

Barred Owls

The Revised Recovery Plan identified competition from the barred owl as an important threat to the spotted owl (USDI 2011). Current science shows that the barred owl is an invasive species from the eastern United States and has expanded its range extensively throughout the Pacific Northwest. Unlike the northern spotted owl, it is a generalist that can utilize a wide range of habitat types and forest age classes. The species has a wide diet range and can survive on many different prey types (Forsman 2004, USDI 2011). As a result, northern spotted owl population densities have decreased and barred owls are believed to be out competing spotted owls for habitat and food (USDI 2011). The barred owl resilience to habitat fragmentation and modification increases the likelihood of persistence on the landscape. Hybridization levels may increase if northern spotted owl population levels decrease substantially (Courtney 2004). Vegetation management activities can also benefit barred owls indirectly by providing habitat and prey species that are not necessarily preferred by the northern spotted owl.

Since routine surveys have not been conducted for spotted owls on the Mt. Hood National Forest since approximately 1994, it is unknown as to what extent their presence has affected the population of spotted owls. However, within the Oregon demographic study areas, there has been a steady increase in the number of barred owls as measured by the proportion of spotted owl sites with barred owls detected, with as many as 60 percent of the spotted owl sites having barred owls detected (Forsman 2011). Conserving large blocks of contiguous old-forest habitat is important for reducing interference competition between the two owl species.

Disturbance

The U.S. Fish and Wildlife Service has concluded that noise can result in a disruption of breeding, feeding, or sheltering behavior of the spotted owl such that it creates the potential for injury to individuals (i.e. incidental take in the form of harassment) (USDI 2011). For a substantial disruption of spotted owl behavior to occur, the disturbance and spotted owl(s) must be in close proximity. The northern spotted owl breeding season generally extends from March 1st to September 30th with March 1st to July 15th considered to be critical from a disturbance perspective (USDI 2016).

The seasonal restrictions for northern spotted owl apply to a few actions listed at s. 2.2.9M1.

3.7.3 Direct and Indirect Effects by Alternative

3.7.3.1 No Action

No short-term effects to the spotted owl would occur with this alternative. For the short term (0-10 years), the areas that are currently providing dispersal habitat would continue to function as dispersal habitat. Snag and down wood levels would gradually increase due to overstocked stands.

Most of the stands currently providing dispersal habitat would grow into low quality suitable habitat (nesting, roosting & foraging) in the next 50 to 70 years. Compared to Alternative 2, the live trees would be smaller and would not have a multi-layered structure. Stands with lodgepole pine and dwarf mistletoe would likely not become suitable habitat and may eventually deteriorate to the point where they cease to be dispersal habitat.

With no action, there would be no noise related disturbance to owls.

3.7.3.2 Proposed Action

None of the stands identified for treatment are currently suitable habitat. Several actions would affect dispersal habitat. Some actions, such as variable-density thinning, dwarf mistletoe treatments, and off-site lodgepole pine conversion would enhance habitat for spotted owls by accelerating stand development toward diverse suitable habitat. Other actions, such as forage creation by regeneration harvest and the power line safety treatments along an existing utility corridor, would delay or eliminate the development toward suitable habitat.

Structural diversity is a combination of several stand characteristics, which would include, but would not be limited to, horizontal and vertical variability of the tree canopy, number of canopy layers, down wood, and snags. With the proposed action, structural diversity would be improved by initiating a new age class and by creating small openings. Thinning would also release the retained trees to grow larger. While the thinning would likely result in fewer dead snags and less down woody compared to no action, the proposed thinning would produce sufficient quantities to meet the needs of owls. In addition, there would be some snag and down wood creation as part of the project that would offset some of the loss of current snags.

Recent studies have shown that uniform thinning can have negative effects on the abundance of some northern spotted owl prey species, particularly northern flying squirrels which can make up almost 50% of the diet in some cases (Wilson 2013). These studies suggest that reductions in northern flying squirrel abundance following thinning may be driven by increased susceptibility to predation created by removal of critical above-ground cover. Predation, lack of canopy connectivity, and reduction in suitable nest substrates may all contribute to reduced northern flying squirrels abundance

following thinning. The long-term benefits of variable-density thinning treatments may be positive for flying squirrels, but this may not be realized for several decades or more. The development of a midstory layer of trees is important for this species (Wilson 2013). The use of stream buffers and skips should help maintain some habitat connectivity for northern flying squirrels in the short term until the units develop into late-seral habitat.

Effects Determination - Habitat

Alternative A would have **no effect** to northern spotted owl or its habitat. Alternative B **may affect**, but is **not likely to adversely affect** territorial or dispersing northern spotted owls and their habitat, due to maintaining, by avoidance, all suitable habitat conditions. There would be some loss of dispersal habitat but there would remain sufficient dispersal habit across the planning area to allow owls to move through the area. Variable-density thinning would eventually move stands toward the development into suitable habitat. Short-term impacts may impact northern spotted owl habitat use, prey species, and indirectly benefit barred owls due to their generalist nature. None of the proposed vegetation treatments are in suitable habitat and may improve existing habitat conditions in the long term; however, those improvements would not be observed for 30 years or more. Because there would be no suitable habitat impacted by project activities and because dispersal habitat would be maintained at sufficient levels, it is unlikely that the proposed project activities would impact the health or survival of any northern spotted owls.

Direct and Indirect Effects - Disturbance

The project may potentially have disturbance effects from the use of helicopters, chain saws, and heavy equipment. A spotted owl with the potential to be disturbed at a roost site is presumably capable of moving away from a disturbance without a substantial disruption of its behavior. Since spotted owls forage primarily at night, projects that occur during the day are not likely to disrupt its foraging behavior. The primary concern with disruption is with breeding behavior at active nest sites. Since the project was planned to avoid spotted owl habitat as much as possible, most project activities would occur outside the threshold zone for disruption of nesting. A few proposed activities have a seasonal timing restriction to mitigate effect to spotted owls.

With seasonal restrictions, disturbance impacts from proposed actions would not harm spotted owls or interfere with essential nesting, roosting, or foraging behaviors because the activities would occur beyond the *disruption* distances. However, since some actions may occur within the *disturbance* distance of known owl sites, such actions **may affect, but are not likely to adversely affect**, nesting spotted owls.

Revised Recovery Plan for the Northern Spotted Owl - The Revised Recovery plan indicates that the most important range-wide threats to the spotted owl are competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, habitat loss or degradation from stand-replacing wildfire and other disturbances, and the reduction in quantity and alteration of distribution of spotted owl habitat as a result of

past activities and disturbances. This project is consistent with the goals and criteria identified in the Revised Recovery Plan for the Northern Spotted Owl (USDI 2011).

Effect determination for Critical Habitat - There are approximately 1,813 acres of treatments in Critical Habitat. Because the proposed activities would not affect the Primary Constituent Elements (PCEs) identified in the recovery plan, and because Critical Habitat in the project area would continue to support the life history needs of dispersing spotted owls, the Proposed Action ***may affect, but is not likely to adversely affect***, northern spotted owl Critical Habitat.

3.7.3.3 Cumulative Effects

The analysis area for cumulative effects is the area within the 33 affected home ranges. Because alterations to owl habitat are long lasting, the time frame for cumulative effects analysis goes back to the beginning of active management in the 1960s.

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. The landscape pattern of vegetation within and surrounding the project area has been affected by past timber harvest, wildfires, and insect mortality which all can impact the habitat for spotted owls. Past road construction, decommissioning, and maintenance have also contributed to the cumulative effect. These activities and events have created a landscape where there is reduced quantity, quality and distribution of suitable habitat and dispersal habitat. Some ecologically important features of landscape pattern are amount of edge habitat, degree of fragmentation of late-successional forest, and amount of interior forest. As fragmentation of a landscape pattern increases, the amount of interior forest habitat decreases and the amount of edge habitat increases which impacts organisms that prefer large patches of interior habitat, such as the spotted owl.

A combination of past actions and wild fires have created a situation where suitable owl habitat is fragmented. In recent years, thinning projects have occurred within the analysis area that incorporated variable-density thinning and therefore moved the stands toward enhanced conditions for northern spotted owls. There are ongoing vegetation management projects that overlap some of the 33 owl home ranges including, Bass Thin, Drum Thin, Mag Thin, and the Pie and Jelly Huckleberry Enhancement projects. There may be future vegetation management projects in dispersal habitat; however, there is currently no proposal for future actions that have sufficient site specificity to conduct an analysis.

Since the proposed action does not affect suitable habitat and because there would continue to be sufficient dispersal habitat after implementation, the effects to northern spotted owls from the Hunter project when added to these other actions, would be negligible and would not impact northern spotted owl survival, reproduction, feeding, or care of young. The USFWS considered cumulative effects and has concurred that the

proposed project ***may affect,*** but is ***not likely to adversely affect the northern spotted owl*** (USDI 2016).

3.7.4 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References
Forestwide Wildlife Standards and Guidelines – FW-170 to 186, page Four-69
Northwest Forest Plan - Standards and Guidelines - section C

The proposed action is consistent with all relevant standards and guidelines.

3.7.4.1 Late-Successional Reserves

The proposed action includes 309 acres of thinning in the LSR. Stands are less than 80 years of age.

Variable-density thinning features skips, gaps, and areas of heavy thinning. Leave trees include minor species, trees with the elements of wood decay and non-hazardous snags while some snags and down logs are created. Thinning that incorporates these features can change a uniform plantation into one with more variable vertical and horizontal structure and greater species diversity. As the stands continue to grow, they would acquire many of the characteristics of old-growth forests sooner than if left untreated. The fragmented nature of the landscape would become less evident as plantations blend in with surrounding mature forest stands. This is particularly important in LSRs to restore them to the desired conditions for the key species that rely on unfragmented mature forest conditions.

The LSR Assessment recommended retaining down wood cover at a rate of 10 to 15%. To achieve this, most of the trees that need to be cut to achieve thinning objectives would need to be left on the ground. The cost of creating down wood at these rates would not allow for an economically viable timber sale (There are no other funding sources available to do this work). There are also negative consequences associated with leaving large quantities of down wood including high fire hazard and it would attract Douglas-fir bark beetles, which would spread and kill trees in adjacent stands.

The proposed thinning in the LSR would meet the objectives for managing LSRs and is consistent with LSR standards and guidelines. This conclusion was reached in part for the following reasons:

- At the landscape scale, down wood levels are consistent with the objectives for managing LSRs.
- The LSR is currently at approximately 67% late-successional habitat, compared to the minimum level of 70 percent late-successional habitat in the Western Hemlock Zone (Note: Most of the potential harvest units within the LSR occur within this Zone). Mid-seral stands currently are lacking late-successional characteristics of large trees and multiple stories. This project would move stands toward the desired future condition for this LSR.

- Thinning these young stands now would result in a size class distribution and canopy structure that more closely resembles the late-successional habitats that meet the Desired Future Conditions identified in the LSR Assessment in a much shorter length of time than if no treatment occurred.

The proposed action is consistent with standards and guidelines for northern spotted owls.

3.8 OTHER WILDLIFE

This section discusses other wildlife species including those that are categorized as sensitive species, survey and manage species, management indicator species and migratory birds. It also includes a detailed discussion of snags and down wood, which are important for many species.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended), and that proposed actions are appropriate to move stands in the desired direction for a variety of wildlife species. No species would have a loss of viability or have a trend toward federal listing.

3.8.1 Sensitive Species (SS)

A biological evaluation has been developed by a wildlife biologist to address the potential effect of activities on sensitive species. The objective is to avoid a trend toward Federal listing under the Endangered Species Act (ESA). This section summarizes the biological evaluation, which is incorporated by reference. Species that are aquatic/riparian obligates are addressed in the Fisheries section.

Methodology for Sensitive Species

The most recent Region 6 SS wildlife list (dated July 13, 2015) was reviewed and 23 species that may occur in or near the Mt. Hood National Forest were identified. Not all of them have potential to occur in the project area. A pre-field wildlife review of the project area for all Region 6 SS was completed using Heritage database records, district data, literature reviews, communication with district personnel and the Forest Plan to identify which SS to analyze. Species that have neither habitat nor documented occurrences within the project area would have 'no impact'. The following species have potential habitat or documented occurrences: peregrine falcon, bald eagle, Johnson's hairstreak (butterfly), and western bumblebee.

3.8.1.1 Peregrine Falcon (*Falco peregrinus anatum*)

A peregrine falcon nest site exists outside the planning area. However, one unit of the Hunter project is within the disturbance zone. A seasonal restriction is in place during the breeding season to protect this species (s. 2.2.9M3).

3.8.1.2 Bald Eagle (Haliaetus leucocephalus)

Migrating or wintering bald eagles are likely to avoid the Hunter Integrated Resource project area during project activities, so some short-term displacement effects may occur. No known nesting or roosting sites occur within one mile of the project area; therefore, no impacts to nesting or roosting habitat are anticipated. The primary winter food source - deer carrion, and summer food source - fish and waterfowl, would continue to be available. Potential roosting habitat would continue to exist in late-successional stands and riparian areas.

3.8.1.3 Johnson's Hairstreak (*Callophrys johnsoni*)

These butterflies occur within coniferous forests which contain the mistletoes of the genus *Arceuthobium*, commonly referred to as dwarf mistletoe. Currently the range of this butterfly is not certain; one reason for infrequent sightings of this butterfly could be due to the species spending a majority of its time in the top of the forest canopy. There are no known occurrences of Johnson's hairstreak within the project area; however, dwarf mistletoe is abundant in portions of the project area. The proposed action includes treating 81 acres of dwarf mistletoe infected hemlock stands with the objective of changing the stand composition by removing young hemlock trees and brush and planting conifer species not susceptible to dwarf mistletoe. The larger infected trees would be retained but they are likely to die eventually because the infection is severe. It is estimated, however, that there are as many as 2,000 acres of hemlock stands severely infected by dwarf mistletoe within the Hunter Integrated Resource project area as well as tens of thousands of acres of stands across the landscape with light to moderate infection.

3.8.1.4 Western Bumblebee (*Bombus occidentalis*)

The western bumblebee was widespread and common throughout the western United States and western Canada before 1998. While the species has been declining, it is difficult to accurately assess the magnitude of the decline since most of this bee's historic range has not been sampled systematically. While the western bumblebee was historically known throughout Oregon and Washington, it is now largely confined to high-elevation sites and areas east of the Cascade Crest. The primary threats to the western bumblebee at the sites where it currently exists in Oregon and Washington include pathogens from commercial bumble bees and other sources, impacts from reduced genetic diversity, and habitat alterations including conifer encroachment (resulting from fire suppression), grazing, and logging. Other threats include pesticide use, fire, agricultural intensification, urban development and climate change.

The project may impact western bumblebees by temporarily impacting flowering plants during project activities, including prescribed burning in a meadow and maintaining early-seral habitat. Reducing this food source would reduce the ability of foraging bumblebees to find nectar at these sites, which is a required food source for young bumblebees. It is expected that these plants would regenerate within a few years and that the bumblebees would have other nectar plants available within the project area. Long-term effects would be beneficial because the treatments to enhance early-seral habitats for

forage would also enhance flowering plants. The project may impact current and potential nest sites with heavy equipment during project activities, temporarily reducing the number of nests and potential future nest sites and, therefore, reducing the number of bumblebees that this area could support. Nest sites would increase within a few years after treatment.

3.8.1.4 Sensitive Species Summary

Alternative A would have no impact to these species. Alternative B **may adversely impact individuals, but is not likely to result in a loss of viability** or cause a trend toward federal listing. The proposed action is consistent with Forest Plan Standards and Guidelines related to sensitive species.

3.8.1.5 Cumulative Effects

The recent and planned actions in the project area involve thinning which were found to have little effect on sensitive species because they do not involve harvest of mature trees and have protections for riparian and aquatic resources. Based on this analysis, these cumulative actions are not likely to cause a trend to federal listing or loss of viability to the species.

3.8.2 Management Indicator Species (MIS)

3.8.2.1 Methodology

A literature review of species habitat requirements was used to compare existing habitat conditions based on field visits and GIS analysis to suggest potential presence of species and the effect the project would have on that species. Professional knowledge and experience with the species was used to determine the effect the project would have on each species analyzed. A Forest-wide analysis for Management Indicator Species was developed in 2011 and is incorporated by reference (USDA 2011).

3.8.2.2 Background

The National Forest Management Act (NFMA) requires the Forest Service to manage wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species. The Forest Plan identified Management Indicator Species. The primary assumption of this process is that indicator species represent the habitat needs of other species that have similar habitat requirements.

Mt. Hood National Forest Westside Wildlife Management Indicator Species

MIS	Habitat Description
Northern Spotted Owl	Old Growth
Deer	Early Forest Succession and Mature/Old Growth
Elk	Early Forest Succession and Mature/Old Growth
Pileated Woodpecker	Mature/Over-Mature
American Marten*	Mature/Over-Mature

*This species was known as pine marten at the time of the Forest Plan but has since been changed to American marten.

A Forest-wide analysis for Management Indicator Species has been conducted. It summarizes the Forest's consistency with the National Forest Management Act goal of managing wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species. The Forest-wide analysis was conducted at a coarse scale using available GIS data. The project level interdisciplinary team took the Forest-wide data and refined it based on field examinations and local knowledge of habitat conditions.

Surveys were not conducted to gather site-specific, project-scale population data. Habitat is used as a proxy for population monitoring. The Forest Plan, as amended, provides habitat to maintain viable populations of these species. Land allocations near or adjacent to the project area that provide habitat for these species include Wild and Scenic Rivers (A1), Wilderness (A2), Late-successional Reserves (LSR), and Riparian Reserves (RR) for pine marten, pileated woodpecker and the northern spotted owl; and Winter Range (B10) and Summer Range (B11) for deer and elk. There are also numerous Forest-wide standards and guidelines that pertain to these species. This project has been designed to minimize effects on management indicator species.

3.8.2.3 Northern Spotted Owl

The spotted owl was selected as a MIS because it represents old-growth habitats. Section 3.7 has detail on the species and its habitat requirements.

The overall trend for spotted owl populations is declining in the Pacific Northwest. The recovery for the species is covered under the U.S. Fish and Wildlife Service Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*) (USDI 2011). Because the northern spotted owl is listed as a threatened species, the Forest Service consults on the effects to the species and its habitat with the U.S. Fish and Wildlife Service prior to making decisions on actions by the agency. The US Fish and Wildlife Service has not found any proposed actions on the Forest to place the northern spotted owl in jeopardy. While other factors have contributed toward population declines, the type of projects proposed in this document have not been found to substantially affect northern spotted owls or contribute to a negative trend in viability on the Forest.

3.8.3 Deer and Elk

Deer and elk were selected as management indicator species because they are economically important game animals. Deer and elk utilize early-successional forest habitat for foraging along with their use of forest stands for cover.

Elk are more sensitive to the effects of forest management than deer, and are most often used to represent the general habitat requirements of both species. In the late 1980s when the Forest Plan was being developed, wildlife managers considered cover crucial to deer and elk survival and production and cover was considered the element most at risk with large-scale regeneration harvest common at the time. More recent research has indicated that cover is not as important as was once thought and that forage quality and abundance is much more critical. Research has found that thermal cover did not enhance elk survival and production, and was not required by elk where food was not limiting, and

could not compensate for inadequate forage conditions (Cook 1998). Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, and population growth and stability (Cook 2013). The increased importance of available forage abundance and quality compared to thermal cover has also been supported by nutritional and physiological studies of black-tailed deer (Parker 1999). With the reduction in timber harvest using regeneration methods on the Forest in the past two decades, continued tree growth, and suppression of fire, cover habitats now far exceed the desired levels for optimal and thermal cover but openings for forage are becoming scarce making forage a limiting factor on the Forest.

Both species migrate using summer and winter ranges. Elk and deer migration is due to habitat and forage accessibility in the summer and winter months. Summer range areas occur at higher elevations from spring through early winter and continue until the snow depth drives them out. Winter range areas are typically below 2800 feet in elevation on the Westside of the Cascades on the Forest and are areas where elk congregate during the cold season. Deer and elk use natural openings (such as wet meadows) extensively for foraging, breeding and calving.

Open roads have long been identified as having impacts on big game populations. Studies at the Starkey Project in northeast Oregon have disclosed even more information on the effects of roads and open road densities on deer and elk (Wisdom 2005). Others found the direct impacts of roads and associated traffic on elk, in addition to outright mortality from vehicular collisions as follows: (1) Elk avoidance of areas near open roads varies in response to traffic rates; (2) Elk vulnerability to mortality from hunter harvest, both legal and illegal, increases as open road density increases; and (3) In areas of higher open road density, elk exhibit higher levels of stress and increased movement rates (Rowland 2005).

Elk herds exhibit a close association with riparian habitat in areas of gentle terrain. Small areas of forage are widely scattered and are generally of low quality on the westside of the Cascades. The low quality of the forage, especially in winter range, and the lack of wetlands and permanent low-gradient streams within winter range are considered limiting factors for elk and deer on the Forest.

Across the Forest, road decommissioning and closure over the past two decades has resulted in a landscape where open road density is seldom a concern for deer and elk. Within the project area, approximately 189 miles of roads have been decommissioned.

3.8.3.1 Existing Condition

Black-tailed deer are common and relatively abundant in the within the project area. Elk are less common. Population numbers for deer and elk are probably most limited by the unavailability of quality forage on both, summer and winter range in the project area. With the reduction in regeneration timber harvest, the project area now has abundant optimal and thermal cover, but openings for forage are becoming scarce. There is an opportunity to increase early-seral habitat and the productivity of forage plant species.

3.8.3.2 Alternative A (No Action) – Direct and Indirect Effects

This alternative would continue a trend of declining forage. No action would result in plantations continuing to grow thicker and denser allowing very little light to reach the forest floor. The lack of light would suppress the growth of forbs and browse that would be forage for deer and elk. The impact of no action would be to reduce deer and elk production and population in the project area.

3.8.3.3 Alternative B (Proposed Action) – Direct and Indirect Effects

The project would be beneficial for deer and elk. Many elements of the proposed action would enhance forage: regeneration harvest in a plantation, prescribed burning in a meadow, controlling invasive plants in existing small forage areas, the creation of early-seral habitat under and adjacent to power lines, and the gaps and heavy thins that would occur inside thinning units.

Open road density is low enough and is not a concern in the project area. However, 24 miles of additional roads would be closed to reduce road maintenance costs.

Noise during project activities would cause some displacement resulting in a temporary decrease in use of the area. However, project activities would likely be dispersed across the area and not all occurring at the same time. Animals would be able to find sufficient solitude.

3.8.3.4 Cumulative Effects

The analysis area for cumulative effects is the Upper Clackamas Watershed. This area incorporates a sufficient land base to provide for the summer and winter needs of deer and elk. Alterations to habitat characteristics are not long lasting: regeneration harvest areas that were cut 15 or more years ago have grown dense young stands that shade out any forage that was enhanced at the time of harvest. As stands grow dense, they become cover again. Recent thinning projects have created some minor quantities of forage. The Lemiti Fuels Reduction Project would remove the standing dead trees, which would allow more grasses and forbs to grow which would result in increased forage for deer and elk. The increase in forage opportunities is especially important in summer range where forage in late summer and fall is critical to deer and elk survival.

These activities, events and growth that have occurred with the passage of time, have created a landscape where early-seral habitat and forage are severely lacking and cover habitat has substantially increased. The project would begin to reverse this trend.

The current population trend for deer and elk on the Forest is decreasing due to the incremental reduction in early-seral habitat across the Forest. The project would increase forage production and improve conditions for deer and elk and would therefore ***contribute to a positive trend in viability on the Forest for deer and elk.***

3.8.3.5 Forest Plan Standards and Guidelines relating to Deer and Elk

Forest Plan References
Forestwide Wildlife Standards and Guidelines - FW-187 to FW-214, page Four-71
B10 Deer and Elk Winter Range Standards and Guidelines - B10-012 to B10--028, page Four-274
B11 Deer and Elk Summer Range Standards and Guidelines - B11-009 to B11--025, page Four-278

The standards and guidelines of the Forest Plan as amended would be met with the proposed action. This project has a balance of forage creation in appropriate locations and quantities interspersed with cover, sufficient to move the landscape in the desired direction for deer and elk.

3.8.4 Pileated Woodpecker (*Dryocopus pileatus*)

This species was selected as a Management Indicator Species because of its association with mature and over-mature habitat, and their need for large snags and decadent trees (USDA 1990).

Pileated woodpeckers use mature and older, closed canopy stands for nesting and roosting, but may use younger (40 to 70 years), closed-canopy stands for foraging if large snags are available; large snags and decadent trees are important habitat components for pileated woodpeckers on the west side of Oregon and Washington (Hartwig 2004)(Mellen 1992). The association with late-seral stages comes from the need for large-diameter snags or living trees with decay for nest and roost sites, large-diameter trees and logs for foraging on ants and other arthropods, and a dense canopy to provide cover from predators. Nest cavities average 8 inches in diameter and 22 inches in depth and are excavated at an average height of 50 feet above the ground, therefore nest trees must have a large diameter in order to contain nest cavities. Because ants are the main diet for pileated woodpeckers, large diameter snags and logs with some decay are selected for foraging because carpenter ants inhabit these sites.

3.8.4.1 Alternative A (No Action) – Direct and Indirect Effects

Alternative A would have no direct effects on pileated woodpecker because no new activities would occur. In the short-term without treatments, the plantation thin units would not provide nesting habitat and snag levels would remain essentially unchanged. In 20 to 30 years, the stands would start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood. Some of the stands may eventually become suitable habitat. However, with no action, it could take as long as 60 to 100 years for these stands to develop into suitable habitat. The fire-originated stands would likely develop into suitable habitat sooner due to the legacy tree component within many of the stands. The areas of lodgepole plantations and hemlock stands with mistletoe are unlikely to develop into suitable habitat without treatment.

3.8.4.2 Alternative B (Proposed Action) – Direct and Indirect Effects

Effects on pileated woodpecker would be minimal because treatment units are not within preferred pileated habitat. Pileated woodpeckers depend on large tracts of dense mature

and late-successional stands with large snags and a closed canopy. None of the proposed harvest units provide nesting habitat for this species. Most of the stands proposed for treatment are young managed plantations and range in age from about 40 to 70 years. The main threats to pileated woodpecker include activities that reduce the number of snags, logs, and cover which may reduce the ability of an area to support nesting, roosting, and foraging. The Proposed Action would temporarily reduce cover in the plantation thin stands by opening the stands, but as these stands respond to thinning treatments, the cover needed by pileated woodpecker would return in 20 to 30 years. Except for snags that need to be removed for safety reasons, the number of snags and down logs that are currently in these units would not be impacted. The proposed treatments include a thinning prescription that would improve the growth rate of the stands. Larger trees would eventually be provided in the second-growth stands in a faster period than they would with no thinning. This would increase the rate that suitable nesting and foraging (large snags) habitat would be available for pileated woodpeckers. The fire-origin stands would become suitable habitat in a shorter time period due to the number of legacy trees within many of the units. No legacy trees are proposed for removal. The proposed treatments in lodgepole plantations and hemlock stands with mistletoe would put those stands on a trajectory to eventually become suitable habitat that likely would not occur without treatment. The treatments that create forage for deer and elk and the power line units would reduce or delay that time it takes for these stands to become habitat.

The Watershed Analysis found that Late-Successional Reserves and Riparian Reserves provided sufficient mature habitat to provide for this species. The project combined with other recent thinning in the watershed and across the Forest would have an additive positive cumulative effect for pileated woodpeckers. The current trend for pileated woodpecker is increasing and the project ***would not contribute to a negative trend in viability on the Forest for pileated woodpecker.***

There are no standards and guidelines specific to pileated woodpecker because there are no B5 land allocations in the project area. Snag standards and guidelines are addressed in section 3.8.7.

3.8.5 American Marten (*Martes americana*)

This species was selected as a Management Indicator Species because of its association with mature and over-mature habitat, and their need for large snags and large amounts of down wood (USDA 1990).

American marten are typically associated with late-seral coniferous forests with closed canopies, large trees, and abundant snags and down woody (Zielinski 2001). Coarse woody debris is an important component of marten habitat.

3.8.5.1 Alternative A (No Action) – Direct and Indirect Effects

Effects would be similar to that of the pileated woodpecker. Alternative A would have no direct effects on the marten because no new activities would occur. In the short-term

without treatments, the plantation thin units would not provide habitat and snag levels would remain essentially unchanged. In 20 to 30 years, the stands would start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood. Some of the stands may eventually become suitable habitat. However, with no action, it could take as long as 60 to 100 years for these stands to develop into suitable habitat. The fire-origin stands would likely develop into suitable habitat sooner due to the legacy tree component within many of the stands. The areas of lodgepole plantations and hemlock stands with mistletoe are unlikely to develop into suitable habitat without treatment.

3.8.5.2 Alternative B (Proposed Action) – Direct and Indirect Effects

There is no suitable marten habitat proposed for removal with this project. The marten depends on dense mature and late-successional stands with large coarse woody debris, large snags, and a closed canopy. The proposed action would temporarily reduce cover by opening the stands, but as these stands respond to thinning treatments, the cover needed by American marten would return in 20 to 30 years. Snags that are felled for safety reasons would be left on site. The proposed treatments include a thinning prescription that would improve the growth rate of the stands. Variable-density thinning would provide sufficient quantities and sizes of snags and down wood over time to provide for this species. The treatments that create forage for deer and elk and the power line units would reduce or delay that time it takes for these stands to become habitat.

The Watershed Analysis found that Late-Successional Reserves and Riparian Reserves provided sufficient mature habitat to provide for this species. The project combined with other recent thinning in the watershed and across the Forest would have an additive positive cumulative effect for American marten. The proposed treatments include a thinning prescription that would improve the growth rate of the stands. Larger trees would eventually be provided in the second-growth stands in a faster time frame than they would with no thinning. This would increase the rate that suitable habitat would be available for American marten.

The current trend for American marten is stable and the proposed action ***would not contribute to a negative trend in viability on the Forest for American marten.***

There are no standards and guidelines specific to American marten because there are no B5 land allocations in the project area. Down log standards and guidelines are addressed in section 3.8.7.

3.8.6 Other Species

3.8.6.1 Oregon Spotted Frog

The Oregon spotted frog (*Rana pretiosa*), is a threatened species that can occur on the Mt. Hood National Forest. Habitat for this species is moderate to large wetlands with extensive emergent marsh coverage that warms substantially when Oregon spotted frogs are active at the surface (Cushman 2007). There are no known occurrences, suitable

habitat or Critical Habitat for the Oregon spotted frog within the project area. The project would have "**no effect**" to this species.

3.8.6.2 Survey and Manage Species

The Survey and Manage standard and guideline has changed several times since its inception and has been the subject of several court cases. Currently the 2001 management plan is in effect using the 2003 species list (USDA USDI 2001) with the Pechman exemption. Plantation thinning stands are less than 80 years of age, so the survey and manage standard and guideline does not apply to them. Other stands have been surveyed and no species were found.

3.8.6.3 Migratory Birds

Migratory birds are addressed by Executive Order 13186 (66 Fed. Reg. 3853, January 17, 2001) "Responsibilities of Federal Agencies to Protect Migratory Birds." It 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 habitat. A Memorandum of Understandings (MOU) was developed between the Forest Service and U.S. Fish & Wildlife Service to conserve birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporate migratory bird conservation into agency planning processes whenever possible.

Many species of migratory birds are of international concern due to naturally small ranges, loss of habitat, observed population declines, and other factors. The Forest Plan contains a variety of objectives, standards, and guidelines that further the conservation of migratory birds. The most relevant objectives for bird conservation are those relating to vegetation diversity, landscape structural diversity, snags and down woody material, riparian condition, habitat improvements, and disturbance processes. Standards and guidelines are designed to help achieve those objectives and are implemented at the project level.

The species likely to occur in the project area include those that are associated with mixed conifer and mature forests such as northern goshawk, blue grouse, rufous hummingbird, northern flicker, Pacific-slope flycatcher, olive-sided flycatcher, Hammond's flycatcher, brown creeper, winter wren, varied thrush, hermit warbler and purple finch. Species associated with grasslands and meadows include Oregon vesper sparrow and Lincoln's sparrow.

Alternative A (No Action) - Alternative A does not propose management activities and therefore, would not alter habitat conditions for migratory birds. Existing vegetation conditions would continue to follow natural successional pathways, and bird populations would respond accordingly. Snag habitat used by some species of migratory birds would not be affected in the short term. Additional snag habitat would occur incrementally through natural mortality in forest stands. No Action would result in a continuation of uniform dense stands that are favored by some species.

Alternative B (Proposed Action) - Thinning generally does not change habitat conditions so dramatically that bird species can no longer use the stand, but often temporarily increases or decreases bird abundance depending on species. Silvicultural treatments can improve avian biodiversity by that promoting understory shrub development, trees species diversity, deciduous trees, the growth of larger trees, maintain snags and downed logs; and creating skips and gaps. Treatments that create forage for deer and elk would remove habitat for some species while enhancing habitat for others. The project may affect habitat for individual migratory birds, but is not expected to have a measurable effect on their overall habitat or populations because of the amount of adjacent untreated habitat. It would be expected to see some shifts in species composition post treatment within the project area, however, any effects would be short-term as more structurally diverse conditions are expected to return as these stands develop over the next 20 to 30 years. Habitat changes proposed by this project should not affect this group of species such that their ability to persist in the vicinity of the project area or throughout their ranges would be compromised. There may be some shifts in species composition but no substantial changes are likely at the landscape scale because there are abundant dense second-growth stands not altered that are available for those species that depend on that habitat.

3.8.7 Snags and Down Wood

Across the Forest, snags and downed wood exist at lower levels than the historic range of variability due to large stand replacing fires early in the 20th century, past timber harvest and firewood cutting. Between the years of 1870 to 1920, roughly 300,000 acres or nearly one third of the Forest was burned by stand replacement fires. There have also been 350,000 acres harvested since 1900. The combination of large-scale stand-replacing fires and harvest acres have contributed to the current situation where almost 60% of the forest is in a "mid stage" of stand development with relatively few large snags. However, in recent years large wildfires have burned around the Forest and in the Bull of the Woods Wilderness creating some concentrations of snags.

3.8.7.1 Methodology

Analysis of current and future conditions of snag and downed wood habitat is complex. It uses knowledge about the wildlife species that rely on habitat that exists in the area along with modeling snag development into the future under different management actions. This information is combined with field reconnaissance for verification, and relevant "best available science" factors embedded in the models and analysis.

This snag and down wood analysis is based on Standards and Guidelines from the Forest Plan as amended, DecAID Advisor analysis tool, GNN (Gradient Nearest Neighbor) analysis, and Forest Vegetation Simulator (FVS) modeling. DecAID takes advantage of the spatially-comprehensive dataset of vegetation structure developed for Oregon and Washington by a team from the Pacific Northwest Research Station and Oregon State University using the statistical imputation method Gradient Nearest Neighbor (GNN) (LEMMA 2015). DecAID includes a process (Distribution Analysis) that allows use of GNN data to evaluate the current frequency distribution of different densities of snags

and amounts of cover of down wood within geographic areas. By using inventory plot data from unharvested areas and information on historic disturbance regimes, the process also allows estimation of reference conditions for both snags and down wood (Mellen-McLean 2012). FVS is an individual-tree, distance-independent, growth and yield model (Dixon 2002). It is a system of highly integrated analytical tools that is based upon a body of scientific knowledge developed from decades of natural resources research and experience. FVS answers questions about how forest vegetation would change in response to natural succession, disturbances, and proposed management actions.

3.8.7.2 Existing Condition

When the plantations proposed for treatment were first created, all of the trees were removed along with all of the snags. These plantations are beginning to experience suppression mortality that may eventually have an abundance of small snags and down wood. There is some large diameter down wood scattered throughout the proposed thinning units; most of which came from past harvest that left unmerchantable logs on the ground.

The current amount of snags and down wood within the fire-originated stands proposed for treatment is highly variable. Most of the stands have large amounts of legacy down wood and large diameter snags that are broken off at about twenty feet. Three of the stands have a large number of live and dead legacy trees as well as large amounts of down wood. Most of the stands consist of densely stocked, small diameter trees that would eventually experience suppression mortality that would likely result in an abundance of medium to small snags and down wood.

Other parts of the analysis area contain abundant dead lodgepole pine killed by mountain pine beetles. These dead and down trees are relatively small.

The DecAID analysis shows snags and downed wood exist at lower levels than the historic range of variability. In the Montane Mixed Conifer Forest habitat type, for snags with a minimum diameter of 20 inches, the portion of the landscape lacking snags is more than twice the area estimated for reference conditions. The area estimated to contain 0-2 snags/acre is more than 1.5 times reference conditions. The areas estimated to contain 6 or more snags/acre are less than half the area estimated for reference conditions. A similar trend exists for snags in the Westside Lowland Conifer-Hardwood Forest habitat type and for down wood.

3.8.7.3 Direct and Indirect Effects

FVS modeling was used to project the development of snags over time for action and no action. The reference age of 200 years is used for comparison - the age at which stands should be fully functioning as late-successional habitat.

With variable-density thinning, plantations would have approximately 10 snags per acre greater than 20 inches diameter, while the no action scenario would have 14 per acre.

With the Fire-origin stands, there would be approximately 1.4 snags per acre greater than 20 inches diameter with either alternative.

For smaller snags, there would be approximately double the number with no action compared to the proposed action for both plantations and fire-origin stands.

In most cases, down wood size and quantity is correlated with snag size and quantity because over time, snags fall.

The No-Action Alternative would have more snags and down wood in the short and long term, particularly in the smaller size classes. The proposed action would create some snags after treatment, and skips and riparian protection buffers would provide dense areas where snags would develop in a manner similar to that described for no action. While the proposed action would have fewer snags and less down wood, there would be sufficient quantities across the landscape to provide for the needs of dependent species over time. The proposed thinning treatments also result in larger live trees in the future that could be treated manually to create additional large snags if needed.

3.8.7.4 Cumulative Effects

The analysis area for snags and down wood is the Upper Clackamas watershed. Many species that utilize dead wood range over a relatively large landscape. In terms of the time frame, logging actions that occurred 50 or more years ago have still left area with few large snags or down logs. The fires that occurred approximately 100 years ago created abundant down wood and in some cases the snags that were created then still remain. The existing condition of the watershed serves as a proxy for past human actions, wildfires and insect outbreaks that have formed the snag and down wood landscape we see today.

In terms of foreseeable future and ongoing actions, the Lemiti Fuel Reduction Project would remove many small lodgepole pine snags.

The DecAID analysis described above shows how the existing condition for the watershed and how it has been shaped by past clearcutting, thinning, wildfires and insect outbreaks. The proposed action and the Lemiti project would result in some reductions of snags and down wood, but across the landscape the needs of snag and down wood dependent species are improving and being met across the landscape now and into the future. The Hunter project, when added to past, current and foreseeable actions, would not result in substantive cumulative effects.

3.8.7.5 Forest Plan Standards and Guidelines

Forest Plan standards and guidelines FW-163 to 169, FW-215 to 239; Northwest Forest Plan page C40 to C42.

Forest Plan standards and guidelines for snags and down wood would be met.

3.9 SCENERY AND RECREATION

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended). Uses in the project area are primarily thought of as dispersed activities such as recreational driving, camping, hunting, and fishing. Primary viewer positions are from Forest Road 4600 and the Clackamas River. Some proposed actions are designed to ameliorate the effects of inappropriate recreation activities. The effects to scenery and recreation were found to be minimal.

This section summarizes the recreation report, which is incorporated by reference. Scenery and recreation are closely linked; sections 3.9.1 to 3.9.5 focus on scenery, sections 3.9.6 to 3.9.11 focus on recreation and section 3.10 focuses on the values present in unroaded and undeveloped landscapes.

Under the Wild and Scenic Rivers Act, portions of the Clackamas River have been designated with both recreational and scenic segments. A river management plan was completed in 1993 and is incorporated by reference. It amended the Forest Plan, established a boundary and included new standards and guidelines. The river corridor land allocation was changed from B1 to A1. The outstandingly remarkable values include Botany/Ecology, Fish, Wildlife, Recreation and Cultural Resources. The river is also a state scenic waterway. The river corridor is overlapped by the Late-Successional Reserve land allocation.

3.9.1 Existing Situation - Scenery

Several aspects of the proposed action have the potential to affect scenery. Logging, fuels treatments and brush removal can alter canopy density and texture, stumps remain and red slash remains on the ground or in piles. Bare soil and straight lines can be created at landings, skid trails and skyline corridors. The construction of new temporary roads that branch off from open system roads has the potential to alter scenery.

This analysis describes the character of the existing landscape from various viewer positions and the likely outcome for each alternative and examines the various visual quality objectives associated with specific land allocations. The analysis is focused on areas near proposed actions that may alter scenery.

The stands proposed for vegetation management currently meet the criteria of being visually recovered. The analysis area is experiencing a period of steady visual recovery because there has been relatively little regeneration harvest in the past two decades and young stands are growing rapidly.

The following list of viewer positions where proposed actions are likely to be viewed, are ranked from most sensitive to least in terms of scenery.

- Clackamas River
- Road 4600 north of Road 4690
- Road 4600 south of Road 4690
- Rhododendron Ridge Trail

- Local open roads, other trails

Direct and Indirect Effects

3.9.2 No Action

Changes in scenery would come slowly from forest growth. Gradually, over approximately 50 years, the contrast between young or mid-aged stands and mature forest would become less evident but stands would remain dense and uniform in texture.

3.9.3 Proposed Action

Most of the proposed actions involve thinning or partial harvest that would introduce variability in the stands. Other scenery altering elements of the proposed action include, 81 acres of mistletoe treatment, 60 acres of forage creation, and 66 acres of utility corridor management. These actions would be more visible than thinning as seen from local open roads.

3.9.3.1 Effects to Scenery as seen from Sensitive Viewer Positions

Sensitive viewer positions identified in the Forest Plan include the Clackamas River, campgrounds, Rhododendron Ridge Trail and Road 4600. The sum total of all the area seen from the river and Road 4600 is considered the 'viewshed' in the Forest Plan (page Four-110). The delineation of this area considers only topographic screening and not vegetative screening, therefore the area actually seen by forest visitors is often much smaller due to dense roadside and riverside vegetation. Approximately 1,200 acres of scenery altering vegetation treatments are in the viewshed. Consistency with visual quality objectives is described at section 3.9.5.

Most of the proposed actions involve thinning intended to introduce variability in the stands. Portions of the stands in stream-protection buffers and skips would be unthinned. Other portions of the stands would have gaps, temporary road construction, landings, helicopter landings, skid trails and skyline corridors that would be open. The rest of each stand would have variable-density thinning. Similar thinning has been implemented in this and other viewsheds and the results confirm that this type of treatment has very little effect to scenery. The thinning units that are the closest in terms of foreground views are 72, 128, and 138. After landing slash cleanup, these treatments would not likely be visually objectionable to forest visitors.

The 60 acres of forage creation in unit 102 is not within the B2 - Scenic Viewshed land allocation and cannot be seen from any of the sensitive viewer positions due to topography and vegetative screening. Portions of the mistletoe treatment and utility corridor treatments are within the viewshed but they are one to two miles away and are not readily seen due to a combination of topographic screening, vegetative screening near the viewer position, the distance and the viewer angle. The mistletoe treatment would retain the largest trees, which would provide additional softening of visual impact. The utility corridor treatment involves removing most of the trees in small areas. The treatments are directly adjacent to the power line, which is already a linear feature on the

landscape; it would make the linear feature slightly wider. Project design and the location on the landscape would result in no noticeable change to the casual observer; the viewer would not notice any dramatic changes in forest structure or see bare ground or slash from primary viewer positions.

3.9.3.2 Effects to Scenery as seen from Local Roads

Local roads are generally roads that were built by loggers to access the forest for timber harvest. Drivers on these local roads would expect to see other roads and some evidence of logging. They would see a closer view of the "patchwork" pattern that exists and would see landings, stumps, skid trails and rock quarries. They would see large power lines and the right-of-way clearing up close. They would see side roads that have berms.

The vegetation management elements of the proposed action would be more evident from local open roads, but those viewer positions have much less visual sensitivity. This is primarily due to user expectation and the activities engaged in such as firewood gathering and hunting are more focused on actions rather than passive viewing.

Thinning, partial harvest, mistletoe treatment, slash treatment, forage creation, and utility corridor management would result in some changes to foreground views from local open roads. The proposed action would emphasize the reuse of existing roads, landings and skid trails. Log landings, temporary roads, skid trails and skyline corridors that lead to the landings and slash piles would be noticeable by viewer positions at the landings. Landing size would be kept to the minimum size needed for safety and areas of bare soil would be seeded with grass or covered with ground cover or slash. The stands may have some bare soil, red slash and stumps visible in the short term, but in a few years, this would become less noticeable.

3.9.4 Cumulative Effects

The analysis area for scenery is the entire viewshed within the Upper Clackamas Watershed. The time frame is relatively long because past regeneration harvests can take 20 to 40 years before the trees grow and become less visually evident. Other actions in the project area include the Lemiti Fuel Reduction Project. The proposed actions and the Lemiti project cannot be seen from the same viewer positions. Visitors heading to the Olallie Scenic Area would drive past a few thinning units and the treatments of the fuel reduction project depending on their selected route. Since alterations of scenery would be minimal with those thinning units, there would not likely be any substantive cumulative effects.

3.9.5 Forest Plan standards and guidelines
Mt. Hood Forest Plan References

Forestwide Visual Resource Standards and Guidelines - FW-552 to FW-597, page Four-107
Scenic Viewsheds Standards and Guidelines - B2-12 to B2-42, page Four-221

FW-554 & B2-012 Visual Quality Objectives

The Forest Plan identifies visual quality objectives both by viewsheds that are seen from sensitive viewer positions (page Four-110) and by land allocation (page Four-108).

In the land allocations that have visual quality objectives of partial retention or higher, approximately 48 acres are in A1 - Wild and Scenic Rivers and 1,160 acres are B2 - Scenic Viewsheds. Approximately 1,208 acres of proposed actions that would affect scenery, occur in the designated viewshed for Road 4600 and the Clackamas River.

Most of the proposed actions involve thinning intended to introduce variability in the stands. Similar thinning has been implemented in this and other areas and the results confirm that this type of treatment has very little effect to scenery. The thinning units that are the closest in terms of foreground views are 72, 128, and 138. After landing slash cleanup, these treatments would not likely be visually objectionable to forest visitors.

No special treatments are needed to meet visual quality objectives because project design and the location on the landscape would result in no noticeable change to the casual observer; the viewer would not notice any dramatic changes in forest structure or see bare ground or slash from primary viewer positions. The project would be consistent with Forest Plan standards and guidelines for visual quality management. It would meet the visual quality objectives of partial retention and retention as seen from primary viewer positions because of topographic and vegetative screening. It would meet the visual quality objective of modification as seen from local roads because the prescribed treatments would retain leave trees and skips.

3.9.6 Recreation

Several aspects of the proposed action have the potential to affect recreation. The proposed vegetation management could affect dispersed recreation opportunities in treated stands, along roads, and at landings. Log haul, road construction, reconstruction, closure and decommissioning also have the potential to affect recreation. Some proposed actions are specifically designed to constrain user created impacts in riparian areas.

This analysis examines the various recreation opportunity spectrum objectives associated with specific land allocations and describes the available opportunities across the landscape and how recreation could be affected by each alternative.

3.9.7 Existing Situation

The project area is seen by forest visitors on their way to recreational destinations, and viewing scenery is an important recreational activity. Roads 4600 is a primary travel route to many of the Forest's recreation areas including, Olallie Lake Scenic Area and many campgrounds. Road 4600 is part of the West Cascades Scenic Byway. It is also part of the Cascading Rivers Scenic Bikeway.

Some users of the project area are passing through; including those driving for pleasure and cycling. The primary uses near the proposed actions include dispersed camping, special forest product gathering, fishing and hunting. Fire rings are present at many old landings and road junctions. Dispersed recreation sites were inventoried and mapped during project planning. Most dispersed sites are small and accommodate appropriate activities while others have resource damage caused by inappropriate use. Some appropriate sites are overused and have issues with human waste near streams. Inappropriate dispersed recreation in the project area includes the following.

- User created roads to get vehicles close to streams
- Damaged riparian vegetation
- Road closures breached by vehicles
- Target shooting that damages vegetation
- User created Off-Highway vehicle routes
- Garbage dumping

These inappropriate uses occur at low to moderate levels compared to other problem areas across the Forest. Open roads that allow for dispersed uses have declined in recent years through road closure and decommissioning. Other roads have deteriorated from lack of maintenance.

3.9.8 Recreation Opportunity Spectrum

The project area crosses land with various recreational objectives. The Recreation Opportunity Spectrum (ROS) is a framework to inventory, plan, and manage recreational opportunities. The ROS objective for most of the project area where actions are proposed is Roaded Natural and Roaded Modified.

3.9.9 Direct and Indirect Effects

With no action, the roads needed for recreation access would not be repaired. The roads that are currently accessible to the public would remain accessible, at least in the short term. They would soon reach the point where they would need to be closed to the public because they would become unsafe.

With the proposed action, the main roads that access primary recreation opportunities would be maintained and repaired. Approximately 148 miles of roads would receive some form of maintenance or repair. There would be short-term disruptions of dispersed recreation and road related recreation during project implementation. Some roads would be closed or decommissioned resulting in a longer-term reduction in road-related dispersed recreation opportunities. Approximately 1.6 miles of system roads would be decommissioned and about 24 miles of system roads would be closed. Some users may be able to shift to other open roads. In the long term, the project would not substantively change remoteness, scenic quality, the level of development of facilities, the number or type of social encounters or the degree of naturalness encountered by visitors.

One of the proposed projects involves restoring some riparian areas that have been damaged by unauthorized user-created roads and routes in popular dispersed camping

areas. This action would contain vehicles to more appropriate parking areas but would not eliminate camping use.

3.9.10 Cumulative Effects

The analysis area for recreation is the Upper Clackamas watershed. This area is appropriate because the recreational activities within this area are relatively uniform. The time frame is relatively long because road construction, logging, and road closures have been happening for a few decades and these continue to affect recreation today.

The Forest has been making periodic decisions to decommission roads or change their maintenance status since the 1990s. Previous planning efforts that overlap the Hunter project area include: *Collawash and Upper Clackamas Restoration EA* (1996), *2007 Clackamas Restoration Projects EA* (2007), *Clackamas Road Decommissioning for Habitat Restoration EA* (2009) (sometimes referred to as Increment 1), and *Clackamas Road Decommissioning for Habitat Restoration, Increment 2* (2011). These projects resulted in decisions to close or decommission roads on the Forest's transportation system.

Other actions in the project area include the Lemiti Fuel Reduction Project. The presence of large areas of dead trees and the fuel treatments proposed there may push some dispersed recreation uses into other surrounding areas. One of the objectives of the Lemiti Fuel Reduction Project is to provide greater safety along the routes to the Olallie Scenic Area. In the event of a fire, the area would need to be evacuated and the roadside fuel breaks would provide a safer evacuation process.

The cumulative change in roads available for roaded recreation from past actions, past decisions that have not yet been implemented, and the Hunter proposed action is a reduction from an original 489 miles to approximately 205 miles or a reduction of 58%. This change affects the land base available for dispersed camping, special forest product gathering and other uses. Similarly, across the Forest, roaded recreation opportunities have been gradually declining as road decommissioning and other road closures occur. These contribute to the cumulative decline of roaded recreation opportunities Forest wide. At the same time, opportunities for unroaded recreation has increased, even though the affected portions of the landscape have been allocated to roaded modified and roaded natural settings in the recreation opportunity spectrum.

Scoping comments about certain special dispersed recreation sites resulted in a change to the original proposed action, which resulted in keeping a few roads open that had been proposed for closure in the scoping letter.

The Forest's goal with this proposed action and the other actions that have altered roads, is to balance the need for recreation access with the funding available to maintain roads for safety and minimal resource impact. Access to the most heavily used recreational sites would be maintained. Since changes to recreational opportunities would be minimal with the proposed action, there would not likely be any substantive cumulative effects.

3.9.11 Forest Plan standards and guidelines

Mt. Hood Forest Plan References
Forestwide Dispersed Recreation Activities Standards and Guidelines - FW-453 to FW-466, page Four-98
Clackamas River Management Plan, standards and guidelines A1-CLA-01 to A1-CLA-70, Appendix F, pages F10 to F15.

The proposed action is consistent with recreation standards and guidelines. The Recreation Opportunity Spectrum objectives would be met.

Scenic and Recreational River

Portions of Units 72, 74, 78, 128, 419 and 466 are in the scenic sections and portions of Units 2 and 22 are in the recreational sections.

The outstandingly remarkable values (ORVs) include: Botany/Ecology, Fish, Wildlife, Recreation and Cultural Resources. The effects and benefits of each alternative in relation to the ORVs are disclosed in sections 3.3, 3.4, 3.7, 3.8, 3.10, 3.12 and 3.18.1. The maps in Appendix A show that the units listed above are in the outer portion of the river buffer. These units cannot be seen from the river bank. Based upon the above discussion, neither alternative would have a "direct and adverse effect" to the values for which the rivers were added to the National Wild and Scenic River System. For the proposed action, the distance from the river bank, the retention of a sufficient quantity of trees and other vegetation, and the protection of the outstandingly remarkable values would result in little or no adverse effect. The prescriptions would result in enhanced diversity in stands that are on a trajectory to become late successional with larger trees and variability of vertical and horizontal structure.

The proposed action is consistent with the standards and guidelines. The ORVs would be protected.

3.10 UNROADED AND UNDEVELOPED CHARACTER

During public scoping, comments were received about unroaded and undeveloped areas (s. 1.6.1.1). The proposed action involves both vegetation management and temporary road construction in areas that are relatively 'undeveloped' and 'unroaded.' These terms have different meanings for different people: the absence of certain types of roads and certain types of logging activities may be considerations and sometimes a minimum size is considered.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that effects to resources often thought to be special in unroaded areas are either not present or would be minimally affected. While a public concern was raised about this topic, the benefits of the suggested changes discussed at s. 1.6.1.1 and s. 2.3.1.3 were not found to be sufficiently substantial to warrant setting aside the benefits and desired conditions described in the project's purpose and need (s. 1.3).

3.10.1 Wilderness

The Sisi Butte (3,245 acres) and the Big Bottom (1,264 acres) sections of the Clackamas Wilderness are in the project area. Some units touch the Wilderness boundary and the other elements of the project are separated from the Wilderness by roads. Maps in Appendix A show these features.

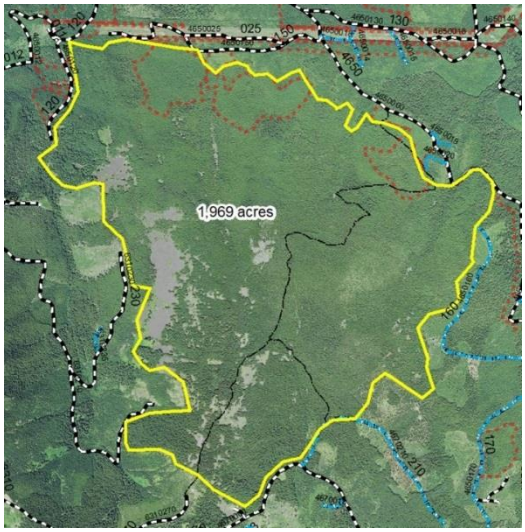
3.10.2 Inventoried Roadless Areas (IRAs) and Potential Wilderness

The Olallie IRA (7,612 acres) overlaps the planning area. No proposed actions would occur in the IRA. Potential Wilderness is defined by FSH 1909.12 chapter 71. There are no portions of the project area that meet Forest Service criteria for Potential Wilderness because the unroaded/undeveloped portions of the landscape are less than 5,000 acres in size, are not contiguous to existing wilderness, and are not self-contained ecosystems. This IRA was not added to the wilderness system in the 2009 Omnibus Public Land Management Act. Maps in Appendix A show IRAs.

3.10.3 Unroaded and Undeveloped Character

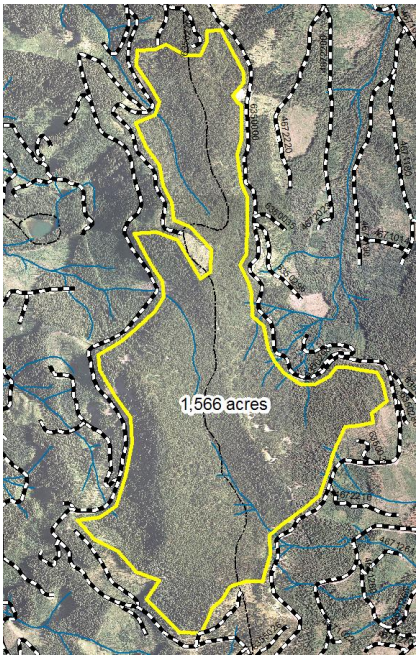
In this document, the terms "unroaded" and "undeveloped" are used to denote any areas that are not already Wildernesses, Inventoried Roadless Areas or Forest Service Potential Wildernesses. Unroaded and undeveloped areas are portions of the landscape that do not contain forest roads (36 CFR 212.1). 'Forest roads' have been called system roads, classified roads or forest development roads: they are a part of the Forest's network of roads necessary to protect, administer, and use the national forest system and its resources. Other roads may or may not be present such as temporary roads, user created roads, or old decommissioned roads. Unroaded and undeveloped areas generally do not contain developments such as rock quarries, power lines, campgrounds or logged areas that have changed the character of the area. While many Wilderness areas less than 5,000 acres and as small as 1,264 acres were added to the wilderness system in the 2009 Omnibus Public Land Management Act, the areas identified during project scoping were not added.

The following section focuses on what is special about the unroaded and undeveloped parts of the project area. No minimum acreage size is used to exclude areas from this discussion.



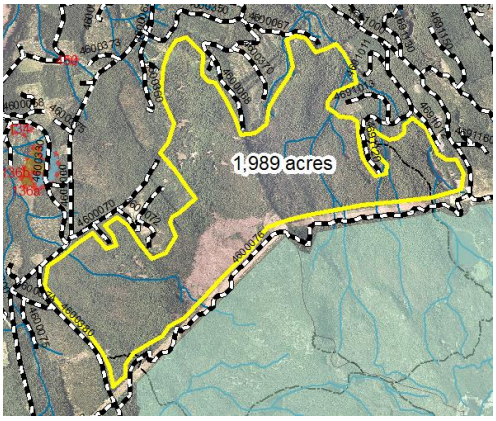
Four blocks of unroaded and undeveloped land are included in this discussion. They are described by their size; 1,989 acres, 1,969 acres, 1,566 acres, and 978 acres. These areas burned very intensely approximately 100 years ago. No salvage logging occurred. The areas reseeded gradually over time.

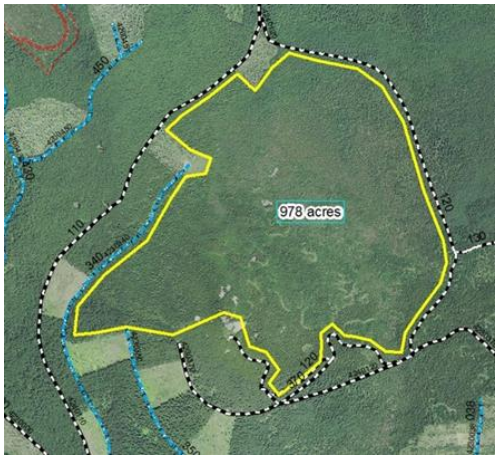
The analysis of cumulative effects below includes disturbances created by past harvest and road construction. There are no other current planned projects or any foreseeable future projects that would affect these blocks.



The following statements describe the look and feel of the unroaded and undeveloped portions of the area and what uses occur.

- The roads that surround these blocks are relatively remote and are used primarily for roaded recreation, firewood gathering and hunting.
- Trails cross through the three largest blocks.
  - The trail in the 1,969-acre block is no longer a system trail. It has been partially maintained by volunteers. In the Forest Plan, the trail was identified as 'sensitivity level 3', which does not require any special treatment for scenery. The trail is no longer maintained by the District because it receives very light use. (Unit 240 is crossed by this old trail alignment.)
  - The Rhododendron Ridge Trail #564 crosses the 1,566-acre block. It is a sensitivity level 2 trail with a visual quality objective of Partial Retention for the first 660 feet on either side of the trail. It receives light to moderate use.
  - The Red Lake Trail #719 crosses a corner of the 1,989-acre block. It is a sensitivity level 1 trail with a visual quality objective of Retention for the first 660 feet on either side of the trail. It receives moderate use.





- The areas are relatively dry with few streams. Streams that are present are primarily intermittent.
- No campgrounds occur near these blocks.
- The areas receives some unauthorized use by Off-Highway Vehicles (OHV) but are not considered heavily used areas. Portions of the terrain are relatively gentle making it possible for the development of unauthorized user created routes. The Forest's OHV Management Plan restricts OHV use in these areas.
- The north edge of the 1,969-acre block and the south edge of the 1,989-acre block have large power lines with two sets of metal towers each. The power lines create a crackling buzzing noise.
- The forest stands are relatively uniform mid-seral mixed-conifer stands.

- There is little old growth in the unroaded and undeveloped blocks.
- The blocks are bounded by roads and developments. The centers of the unroaded and undeveloped blocks have the greatest solitude while the edges have a more roaded and developed feel.

3.10.4 Direct and Indirect Effects

The measure of change for this topic is the acres treated and miles of road constructed. Since actions would occur in only one block, the following discussion focusses on the 1,969-acre block.

Size of Block	Acres of Vegetation Treatment	Miles of temporary road
1,989 ac.	0	0
1,969 ac.	154	1.0
1,566 ac.	0	0
978 ac.	0	0

The proposed action would alter some of the unroaded and undeveloped character of the project area. Cutting trees, and disturbance from logging equipment, fuels treatment, landings and road construction would affect unroaded and undeveloped values. The 1,969-acre block would be diminished in size but would continue to provide some unroaded and undeveloped benefits. In terms of Forest Plan land allocations; this block is split between the C1-Timber Emphasis and the B2-Scenic Viewshed land allocations. These have a primary or secondary objective of timber management (s. 1.2.1.3).

The following discussion focuses on several key resources that are often considered well provided for in unroaded and undeveloped blocks and lacking in other parts of the developed landscape. Some of these topics relate to standards and guidelines that are documented in other sections.

High quality or undisturbed soil

Soils are addressed in s. 3.6. The soils were affected by intense fire. Landings, roads and skid trails would result in some soil impact. Soil impacts would be within the limits set by Forest Plan standards and guidelines for long-term productivity.

High quality water and sources of public drinking water

Water quality is addressed in s. 3.3.3. There are very few streams in the 1,969-acre block; none are in or adjacent to vegetation management units and no streams are crossed by proposed new roads. Project design criteria minimize the risk that sediment would reach any stream. The project is in the Clackamas Watershed, which provides drinking water for many people. Water is removed from the Clackamas River more than 35 miles downstream with three dams in between. The acres of vegetation treatment in the block would affect a very small portion of the watershed (0.0002%). It is very unlikely that these treatments would affect drinking water.

High quality air

Air quality is addressed in s. 3.15. The unroaded and undeveloped block is too small to have an airshed that would be unaffected by surrounding air pollution sources.

Small quantities of debris would be piled and burned at landings resulting in some smoke during the late-fall burning season.

Diversity of plant and animal communities

Diversity is addressed in s. 3.2 and s. 3.8. The block has relatively uniform stands of second growth. The proposed action would leave some snags and down wood and would introduce some variability through skips and gaps. No special plant or animal communities have been identified within the treatment units.

Habitat for threatened, endangered, proposed, candidate, and sensitive species

Fish are addressed in s. 3.4. The proposed treatments in this block would have no effect on threatened fish species. The nearest listed fish are over a mile away and there is no hydrologic connection.

Owls are addressed in s. 3.7. The proposed action would not remove suitable habitat for the threatened northern spotted owl. The thinning would also not likely affect the owl's ability to disperse across the landscape. The block is in critical habitat for owls and the recovery plan has recommended active management to accelerate habitat development (s. 1.4.4).

Botanical species are addressed in s. 3.12. No rare or sensitive botanical species were found during project surveys.

Habitat for those species dependent on large, undisturbed areas of land

Wildlife is addressed in s. 3.7 and 3.8. The edge effect of surrounding forest roads, old clearcuts and power lines, and the noise generated by vehicles on adjacent forest roads reduce the habitat effectiveness of the unroaded and undeveloped block for species that need unfragmented habitat and solitude. The proposed action would reduce the size of the unroaded and undeveloped block. However, the proposed thinning is a relatively light treatment, and the temporary roads that would be constructed would be rehabilitated after use; no new system roads would be constructed. Since the proposed treatments are on the edge of the 1,969-acre block they would reduce the size to approximately 1,815 acres but would retain interior habitats. Species that require large undisturbed areas of land would likely persist at this site and they would find similar forest types in Wildernesses and other undisturbed blocks elsewhere on the Forest. Approximately 20,000 acres of Wilderness and undisturbed blocks in the planning area would remain unaltered. The proposed treatments are designed to enhance northern spotted owl critical habitat. As trees grow, they would eventually contribute mature interior habitats for species such as spotted owls that benefit from large intact blocks of suitable habitat.

Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation

Recreation is addressed in s. 3.9.6. The land allocations for the 1,969-acre block are B2 – Scenic Viewsheds and C1 – Timber Emphasis. These have a prescribed Recreation Opportunity Spectrum (ROS) of Roaded Natural and Roaded Modified respectively.

This block is not prescribed for Primitive, Semi-Primitive Non-Motorized, or Semi-Primitive Motorized classes of dispersed recreation. Low levels of non-motorized use occurs in the block, primarily on a non-system user-maintained trail. Prior to abandoning this trail, the visual quality objective was Modification based on its low level of use and based on the Sensitivity Level 3 rating in the Forest Plan (page Four-116). The proposed action may reduce non-motorized recreation opportunities for those that choose to avoid closed roads or thinned areas by approximately 8% in this block.

The temporary roads would be rehabilitated after use; therefore, there would be no long-lasting change to vehicular access, or the number or type of social encounters. The project would have little impact on recreation. Users of the non-system trail would encounter Unit 240, which is a mistletoe treatment; no logging would occur, but a mechanical masticating machine would chip up rhododendron and small hemlock trees to prepare the site for planting. In the longer term, the area would begin to look like a plantation with legacy trees.

Reference landscapes

Similar landscapes are present in abundance on the Forest in places such as the Sisi Butte portion of the Clackamas Wilderness, the Salmon-Huckleberry Wilderness, the Roaring River Wilderness, and in portions of the Olallie Lake Scenic Area. These areas provide opportunities for researching and experiencing these landscapes and some of them are much larger than the unroaded and undeveloped blocks in the project area.

Natural appearing landscapes with high scenic quality

Scenery is addressed in s. 3.9. The 1,969-acre block is part of a broader viewshed where the visual quality objective is Partial Retention. The viewer positions are Road 4600 and the Clackamas River, which are 2 to 3 miles away in the places where the block can be viewed. The proposed vegetation treatments in this block would meet the visual quality objectives and would not be readily noticeable by viewers on the river or highway.

Traditional cultural properties and sacred sites

Heritage Resources are addressed in s. 3.18.1. No known sites are present within proposed treatment areas.

Other locally identified unique characteristics

No other unique characteristics have been identified.

Public comments have been received requesting deletion of all project elements in the unroaded and undeveloped block. Some suggested that blocks as small as 1,000 acres in size should be protected. This section has been developed in response to these comments. See section 1.6.1.1 and 2.3.1.3. The No-Action Alternative describes the benefits and impacts of pursuing this strategy. With the proposed action, the unroaded and undeveloped block would still be over 1,000 acres in size.

3.10.5 Cumulative Effects

Past actions including road construction and logging have created the boundaries of the unroaded and undeveloped blocks. The ongoing action at the Lemiti Fuel Reduction project has reduced some unroaded and undeveloped character in that area. No other foreseeable actions would occur in the unroaded and undeveloped blocks.

At the landscape scale, the Forest has approximately 315,000 acres of unroaded and undeveloped areas in Wilderness and another 35,000 acres in Inventoried Roadless Areas. This represents approximately 1/3 of the Forest. The values provided by unroaded and undeveloped landscapes are well represented on the Forest.

The proposed action would reduce the unroaded and undeveloped opportunities in the Hunter Planning area by less than 1%, and would reduce the opportunities on the Forest by less than 1/10 of 1 percent. For these reasons, and because no extraordinary features were identified in the areas of proposed treatment, the cumulative effect is not substantial.

3.10.6 Forest Plan Goals, Standards and Guidelines

There are no specific standards and guidelines for unroaded and undeveloped blocks.

3.11 TRANSPORTATION

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that the road system would be managed appropriately to provide safe public access, access for project implementation and to minimize effects to resources.

3.11.1 Existing Condition

In 2015, the Forest completed a Travel Analysis Report (TAR), which was a synthesis of previous efforts and set the stage for project-level decisions about whether to retain roads, close or decommission them, and what level of maintenance they should receive. This project-level analysis takes the general information in the TAR and looks at the local roads with proposals that may differ from what was listed in the TAR based on better site-specific information and field reconnaissance.

The Forest's transportation system provides multi-use access for trans-forest travelers, the recreating public, commercial users and administrative users. System roads are managed at several levels: from Maintenance Level 5 (commonly paved, Road 4600 is an example) to Maintenance Level 1 (storage roads closed to public traffic and not maintained for use). They include asphalt-paved roads, aggregate (gravel) surfaced roads, improved (stabilized or pit-run aggregate) roads, and native surface roads. Maintenance for these roads is conducted utilizing appropriated funding which is prioritized to focus on maintenance for those roads that accommodate higher levels of traffic and are commonly used by passenger vehicles. The maintenance and reconstruction of roads used primarily for commercial use is provided through the contract and is funded by the value of the timber removed.

Appropriated funding combined with maintenance and repairs performed by commercial operators is lower than the level needed to properly maintain all of the roads on the Forest. Several planning efforts in the past two decades have decommissioned and closed roads to attempt to get the Forest's road system in alignment with available funding.

Limited funding for road maintenance over the past decades has resulted in a backlog of uncompleted road maintenance and repairs. This has left roads that are overgrown with vegetation, have non-functional or poorly functioning drainage systems, have travel surfaces in disrepair, and have multiple subgrade or road base failures.

The Forest Transportation System within the Hunter Project Area

Forest Road Status	Approximate Miles
National Forest System Roads Prior to the 1990s Road Decommissioning Efforts	489
Current National Forest System Roads	300
Decommissioned National Forest System Roads (no longer part of the Forest's Transportation system)	189
National Forest System Roads Authorized to be Decommissioned (not yet completed)	16
National Forest System Roads Currently Closed	55

In addition to system roads, many short road alignments were constructed in the past by loggers to access landings. These old non-system alignments were originally constructed for temporary project use only, but were not always rehabilitated to the extent that would meet today's standards. As a result, many of these old alignments still exist in a condition that could be utilized for temporary access under this project's proposed action with minimal reconstructive effort.

Effects Analysis

3.11.2 Direct and Indirect Effects - No Action

The No-Action Alternative would involve no haul of logs, no road reconstruction, no road decommissioning or stormproofing and no contract related road maintenance. Since heavy haul of materials is the most impactful action regularly applied to the transportation resource, the No-Action Alternative would result in no additional heavy haul wear and tear on the roads. The only wear and tear that would occur would come

from recreation and administrative use; normally in passenger vehicles. Volume of public use on this system would likely decrease slightly over time due to decreased navigability of the roads and increasing depth of potholes. Current road failures, drainage failures, and erosion control problems that have been identified (s. 2.2.8) within this road system would not be repaired and roads would continue to deteriorate.

Road surface, road subgrade, and road base failures present physical hazards to drivers, reduce a driver's ability to maintain positive control over a vehicle, and increase the potential for the development of erosion hazards on road slopes including soil slumps and slides due to pooling of water and increased soil saturation in the road bed. Failed or poorly functioning drainage systems increase sedimentation in streams and waterways due to their failure to properly mitigate erosion. Unbrushed roadways also present an additional safety hazard to road users due to decreased sight distance for stopping and maneuvering.

In the longer term, as maintenance and minor repairs continue to be deferred, the condition of system roads would deteriorate to the point where major repairs are needed or roads would need to be closed to the public as they become unsafe. Many uses of the road system would be hindered including recreation, special forest product gathering, and fire suppression activities.

3.11.3 Direct and Indirect Effects - Proposed Action

The needed repair and maintenance items discussed in section 3.11.3.1 would be performed by the contractor prior to and during operations for haul roads. Some road repairs are needed beyond the scope of what is considered road maintenance. Repairs would be performed by the contractor prior to haul to bring the road up to acceptable standards in order to ensure safe transport of products and to provide for the protection of the Forest's natural resources and its transportation resource. Repairs are also proposed for some roads that are not needed for safe haul, but are proposed to reduce sedimentation to streams, provide better fish passage and enhance safety for forest visitors.

Proper road maintenance and timely repairs result in an improved transportation system with respect to both safety and the environment. Road surface, road base, and road subgrade failures would be repaired to minimize physical hazards to drivers and reduce the potential for erosion.

In addition to National Forest System Roads, the project would utilize other non-system roads including new temporary roads and existing old road alignments (s. 2.2.8.3). These roads are intended for project use only. These access roads are built or reconstructed in order to temporarily access landings needed for logging, and are rehabilitated upon completion of operations in each unit.

Commercial haul would typically occur during the dry season, dependent upon moisture conditions in the materials of the road base and subgrade. Under dry weather conditions, the stresses produced by heavy haul would result in relatively normal wear and tear that does not create undue cost and damage to resources. Road conditions would be

monitored during haul (even during the dry season when rains come) to ensure timely enforcement of contract provisions that require log haul to be suspended when wet weather conditions make continued haul unsafe, would contribute to stream sedimentation, or would threaten the integrity of the road's surface or subgrade.

The proposed action would decommission or close and stormproof a number of system roads within the project boundary. It would also repair some roads not used for commercial haul.

3.11.3.1 Road Maintenance and Reconstruction

Proper road maintenance and timely repairs result in an improved transportation system with respect to both safety and the environment. Road surface, road base, and road subgrade failures would be repaired to minimize physical hazards to drivers and reduce the potential for erosion.

Road maintenance would occur on all roads used for haul of commercial materials (log and rock haul). These road maintenance activities create limited disturbances contained within existing road prisms and is conducted prior to and during operations to ensure minimum safety standards and effective roadway drainage. Regular road maintenance activities that would occur on roads, as needed, may include brushing, blading, spot rocking, ditch cleaning, culvert cleaning, maintaining drainage, removing danger trees, and treating invasive weeds. Road reconstruction would occur to repair problem areas that cannot be handled by routing maintenance. These may include roadbed reconditioning, ditch reconditioning, roadside clearing & grubbing, culvert replacement, road resurfacing, full-depth asphalt patches, asphalt pulverization, installing new drainage culverts, underdrain installations, sinkhole repairs, slide removal, deep patch repairs with geotextile, slope stabilization, road realignments, bridge replacement, hardened low-water fords, earth retaining structures, roadside guardrails, rock-fall arresters, road paving, and road daylighting.

The itemized repairs listed below and their costs are estimated based on the preliminary judgement of transportation engineers. Road decommissioning, road closures and repairs not related to haul are listed at s. 2.2.8.6.

3.11.3.2 Repairs and Maintenance Along System Roads used for Vegetation Management

Road Number	Length (miles)	Cost $1,000	Notes
4200	6.38	24	
4200		500	Replacement of Last Creek bridge - Due to the extended time line for bridge design, this section of road 4200 would not likely be used as a haul route for Hunter. There are alternate haul routes that can be used in the short term, such as 4680140. The bridge is included in this assessment because its replacement is needed for long-term management.
4200473	0.21	3	
4210	4.69	27	
4220	1.10	3	

Road Number	Length (miles)	Cost $1,000	Notes
4600	22.00	340	
4600324	0.26	4	
4600326	1.30	21	
4600330	3.56	22	
4650	5.88	352	Road reconstruction: surface reconditioning, ditch reconditioning, aggregate placement
4650012	0.15	2	
4650025	0.48	4	
4650120	1.61	32	
4650130	1.05	8	
4650140	0.29	3	
4650150	1.20	9	
4650170	0.93	6	
4651	0.71	50	
4651120	0.85	11	
4660	3.96	52	
4660120	0.30	5	
4660140	2.00	6	
4661	5.88	88	
4661120	0.47	4	
4661130	0.71	23	Quarry access. Road reconstruction: roadside clearing, road reconditioning, aggregate, placement, ditch reconditioning, drainage structure at quarry entrance
4661170	0.14	2	
4661180	0.46	7	
4661190	0.41	4	
4670	13.38	114	
4670017	0.10	2	
4670150	2.36	43	
4672	3.85	28	
4672013	0.16	2	
4672130	1.57	9	
4680	3.07	22	
4680031	0.66	6	
4680130	0.78	3	
4680140	2.76	82	Detour around road 4200/Last Creek bridge. Road reconstruction: place and compact new lift of surface aggregate full width over full length of roadway, add temporary erosion control at 2 stream crossings.
4680150	0.80	4	
5710	3.74	26	
5710140	0.57	3	
5720	7.26	38	
5720180	1.28	7	
5731	2.35	15	
5731116	0.36	3	
6300	0.25	2	
6310	5.60	35	
6310019	0.32	3	
6310020	0.12	1	
6310031	0.60	2	
6310033	0.15	1	
6310130	1.08	16	

Road Number	Length (miles)	Cost $1,000	Notes
6310172	0.04	1	
6310180	1.43	12	
6310182	0.23	1	
6310190	0.60	4	
6310200	0.52	2	
6310203	0.05	1	
6310210	1.84	13	
6310220	0.84	4	

3.11.3.3 Transportation Planning & Status of Roads

In 2015, the Forest completed a Travel Analysis Report (TAR), which was a synthesis of previous planning efforts and set the stage for project-level decisions about whether to retain roads, close or decommission them, and what level of maintenance they should receive. The project-level analysis in this document takes the general information in the TAR and looks at the local roads with proposals that may differ from what was listed in the TAR based on better site-specific information and field reconnaissance.

While the proposed action includes road decommissioning and road closure, it also includes decisions to change the status of certain roads based on better site-specific information and public comments. The analysis file contains records and notes for each road. Road maintenance levels with example photographs.

This table summarizes the roads where the proposed action implements the TAR objectives.

Implementing TAR Objective Maintenance Level (ML)	Miles
Road Closure	20
Road Decommission	0.2

This table summarizes the roads where the proposed action is changing the TAR objectives.

Changes to TAR Objective Maintenance Level (ML)	Miles
Changed up from ML 2 to 3	2.3
Changed up from ML 1 to 2*	11.7
Changed down from ML 2 to 1 **	4.5
Changed down from ML 1 to Decommission **	1.4
Changed up from Decommission to ML 2	0.3

* These roads are currently open. The change to objective ML2 means the intention is to keep them open, whereas previously the intention was to eventually close them.

** The closure and decommissioning are also included in the proposed action.

Road Maintenance Level 3

Roads open and maintained for travel by prudent drivers in standard passenger cars. User comfort and convenience are low priorities. Roads in this maintenance level are typically low speed, single lane with turnouts, and spot surfacing. Some roads may be fully surfaced with either native or processed material. These roads have low to moderate traffic volume. Potholing or washboarding may occur.

Road Maintenance Level 2

Roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Roads have low traffic volume and low speed.

Road Management Level 1

Assigned to intermittent service roads during the time they are closed to vehicular traffic. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads are closed to vehicular traffic, but may be open and suitable for nonmotorized uses. Vehicular traffic is eliminated, including administrative traffic. Roads are physically blocked or entrance is disguised.

In addition to the above, some data base errors were encountered and corrected. For example, some roads had an Objective Maintenance Level of 1 (indicating the desire to close the road) and an Operational Maintenance Level of 2 (indicating that it was still open); field visits confirmed that the road was already closed. These data base corrections are part of the process of project-specific travel analysis.

3.11.4 Cumulative Effects

The analysis area for cumulative effects is the project area and the haul roads outside the planning area.

The proposed action would result in increased effectiveness and overall value of the Forest's transportation system while minimizing impacts to other resources. There would be no substantive cumulative effects because all projects that use roads also provide maintenance and repair commensurate with their use.

3.11.5 Forest Plan standards and guidelines

Forest Plan References

Forestwide Transportation System Standards and Guidelines - FW-407 to FW-437, page Four-95

All proposed actions related to the Forest Transportation System are consistent with the Forestwide Transportation Standards and Guidelines.

The Forest-wide Roads Analysis (2003), the Travel Analysis Report (2015), and this assessment document constancy with FW-416.

All temporary roads constructed and existing alignments reconstructed for project use would be rehabilitated and/or blocked and treated to meet or exceed the standards of FW-433 and FW-436.

Other standards and guidelines related to transportation are specifically addressed and enforced through contract provisions included with each individual contract.

3.12 BOTANY

This section addresses special status/sensitive species including fungi, bryophytes, lichens and vascular plants on the Regional Forester's Special Status/Sensitive Species list and survey and manage species. Invasive species are discussed in s. 3.13.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that no species would have a trend toward federal listing. No target species were found during surveys.

A combined biological evaluation and botany specialist report has been prepared by an agency botanist to address the potential effect of activities on special status/sensitive species and survey and manage species; it is incorporated by reference and summarized below.

No federally listed endangered or threatened plant species, or plant species proposed for federal listing, are known to occur on the Forest.

Intuitive-controlled field surveys were conducted to protocol for botanical species during the summers of 2015 and 2016.

Surveys to detect the presence of most fungi species are not considered practical because of the variability in fruiting-body production from year to year. Therefore, fungi (other than *Bridgeoporus nobilissimus*) were not targeted during field surveys.

3.12.1 Direct and Indirect Effects

Surveys found no special status/sensitive species or survey and manage species.

Where field surveys determined the presence of suitable habitat for a particular species of fungi, it was presumed to be present. There are 18 species of special status/sensitive fungi identified as having potential habitat in the project area. For these fungi, the proposed action would have an effects determination of **May impact individuals or habitat but is not likely to lead to a trend toward federal listing.**

Where habitat is present for special status/sensitive species that were not found during field surveys there is still the potential to alter their habitat. There are 28 species of vascular plants, 8 species of bryophytes, 4 species of lichens and one additional fungus having potential habitat in the project area. Because it is possible to miss present species during surveys, the action would have an effects determination of **May impact individuals or habitat but is not likely to lead to a trend toward federal listing.**

While special status/sensitive or survey and manage botanical species are not known to exist currently in the proposed treatment areas, there may be some short-term impact to potential habitat and to botanical diversity. For thinning treatments, the variable-density thinning proposed would likely facilitate the development of late-successional/old-growth characteristics (e.g., large trees, snags, and downed logs; a multi-layered canopy; vertical and horizontal spatial complexity; and species diversity) and foster the development of

understory plant communities. These changes would occur sooner with thinning compared to no action. Structural and spatial complexity creates a diversity of ecological niches for many forest botanical species.

With no action, there would be no potential for impact to any species that are known or suspected to occur in the proposed project area.

Coldwater Corydalis

Coldwater corydalis (*Corydalis aquae-gelidae*) is present in the project area along Rhododendron Creek, Hunter Creek, and along the Clackamas River between the bridges on roads 4650 and 4670. It is a Region 6 sensitive vascular plant on the Regional Forester's Special Status Species List and a Survey and Manage species.

The cold streams and rivers along the upper Clackamas River and the Oak Grove Fork of the Clackamas River provide for extensive populations. Coldwater corydalis is confined to streams and streambanks and requires some indeterminate and unquantifiable combination of sunlight and shade for suitable habitat.

No coldwater corydalis was found in any of the proposed treatment areas. There is the potential for impact to this species from actions that add sediment to streams. The sediment analysis (s. 3.3.3.4) shows that there would be some short-term sediment from road repairs, culvert replacement and log haul but there would long-term benefits from road repairs, road maintenance, road stormproofing, and road decommissioning that would result in a net reduction of sediment compared to the existing condition.

3.12.2 Cumulative Effects

The analysis areas for botanical species for cumulative effects are the treatment units and other connected actions and the areas directly adjacent to them, including Riparian Reserves. These are appropriate boundaries because actions more than a few hundred feet outside the treatment areas would have little or no effect to botanical species within the units, and the actions within the treatment areas would have little or no effect to species elsewhere. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when stands were clearcut persist today particularly for species that are old-growth dependent; and alterations made during proposed treatments have the potential to affect botanical species that may be present in the stands for many years into the future. The Biological Evaluation discusses the rarity of species across the Forest and Region based on impacts from all past actions and habitat availability.

Since there would be little negative direct or indirect effect to rare botanical species such as sensitive species and survey and manage species with the proposed action or the adjacent actions, there would be no measurable incremental impact and no substantial cumulative effect. However because it is often difficult to find rare species, it can be presumed that some are present even though not found during surveys. Therefore, as more of the landscape is managed, the risk to undetected individuals becomes incrementally greater with every action. Since many of the rare species are old-growth

dependent, they would not likely occur in great numbers in the habitats present in the treatment areas.

Project design criteria, including the retention of live trees, snags, legacy trees, Riparian Reserves and skips would minimize impacts to rare species that may be present but were not discovered. The proposed action would not likely contribute substantially to changes to species across their range, and it is not likely to lead to a trend toward federal listing.

3.12.3 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References
Forestwide Threatened, Endangered and Sensitive Plants and Animals Standards and Guidelines - FW-170 to FW-186, page Four-69

> The appropriate surveys and analysis has been conducted for sensitive species as described in FW-176.

2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001 ROD) (USDA USDI 2001).

> Most of this project (1,880 acres) is exempt from this because it involves thinning stands less than 80 years of age, due to the Pechman exemption. However it is applicable to the rest of the project. No survey and manage species were found during surveys.

3.13 INVASIVE SPECIES

This section addresses invasive plants. A combined Biological Evaluation and botanist report has been developed by a botanist to address the potential effect of activities on invasive species; it is incorporated by reference and summarized below. Invasive plants are sometimes called noxious weeds.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that invasive plant species would be managed appropriately to minimize their spread.

The Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS, was completed in 2005, and the "Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area in Oregon, including Forest Plan Amendment #16" FEIS, was completed in 2008. The invasive plant risk assessment for the proposed project is tiered to the 2005 and 2008 FEIS. The 2005 FEIS provides invasive plant management direction to all National Forest Land and Resource Management Plans in Region 6. The management direction includes invasive plant prevention and treatment/restoration standards intended to help achieve stated desired future conditions, goals, and objectives. They are expected to result in decreased rates of spread of invasive plants while protecting human health and the environment from the adverse effects of invasive plant treatment. The 2008 FEIS, in

turn, is tiered to the 2005 FEIS. It identifies 208 invasive plant treatment areas on the Mt. Hood National Forest and Columbia River Gorge National Scenic Area, where integrated invasive plant management methods (e.g., manual, mechanical, chemical, biological, and/or cultural treatments) would occur; authorizes the use of 10 herbicides; and provides for an early detection/rapid response (ED/RR) program. The goal of ED/RR is to identify and treat invasive plant populations early when they are still small since treatment and control become more difficult as populations get larger. Like the 2005 FEIS, the 2008 FEIS seeks to protect human health and the environment from the adverse effects of invasive plant treatment by minimizing risks to human health; drinking water; and botanical, terrestrial wildlife, and aquatic species. The design criteria in section 2.2.9 related to invasive species were developed from the recommendations of these plans.

3.13.1 Introduction

Non-native plants are species that have been introduced either intentionally or unintentionally to areas where they do not naturally occur. Invasive plants can dominate a site, displacing native plants and altering a site's biological and ecological integrity.

3.13.2 Risk Assessment

The risk level for the introduction, establishment and spread of invasive plants/noxious weeds is moderate for this project. The following species are present in the project area.

Species Name	Common Name
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Cytisus scoparius	Scotch broom
Digitalis purpurea	foxglove
Geranium lucidum	shiny leaf geranium
Geranium robertianum	herb Robert
Hypericum perforatum	St. John's-wort
Hypochaeris radicata	hairy cat's-ear
Leucanthemum vulgare	oxeye daisy
Mycelis muralis	wall lettuce
Rubus armeniacus	Himalayan blackberry
Senecio jacobaea	tansy ragwort

These noxious weed species present in or nearby the proposed project area are included in the Oregon Department of Agriculture's (ODA) "A" or "B" List. Some of these species (e.g., Canada thistle, bull thistle, Himalayan blackberry, oxeye daisy, Scotch broom, St. John's-wort, tansy ragwort) are widely established regionally and management objectives are to control infestations on a case-by-case basis. However, the others are considered "ecosystem-altering" species because of their ability to quickly overrun and alter natural habitats and negatively affect ecosystem functions. Garlic mustard, false brome, orange hawkweed, meadow hawkweed, spotted knapweed, and diffuse knapweed, are not at all widely established; so early detection followed by rapid response (implementation of control measures) is recommended to check the spread of these species. None of these ecosystem-altering species were found in the project area.

3.13.3 Direct and Indirect Effects

With no action, there would be less potential for the spread of invasive species, including noxious weeds; however, they may continue to spread even with no action because of vehicles traveling on open roads spreading seeds.

With the exception of the "ecosystem-altering" invasive species listed above, the other invasive plant species are common along roadsides, in old landings, in clearcuts, and in other areas with a history of ground disturbance throughout much of the Clackamas River Ranger District. With the proposed action, vehicles and heavy equipment can be a major vector for the spread of invasive plants along roads and from roads into forest and forest openings. Other elements of the proposed action would reduce the potential spread of invasive plants including road closures and road decommissioning.

The project design criteria in section 2.2.9 would reduce the spread of invasive plants. Design criteria at s. 2.2.9C & J would minimize soil disturbance and erosion, s. 2.2.9L specifies the use of weed-free erosion control methods, and would require the cleaning of equipment and other practices to minimize the spread of weeds. These PDCs implement the standards and guidelines of the Region 6 FEIS for Preventing and Managing Invasive Plants (USDA 2005). The FEIS rates the effectiveness of these practices and explains the rationale for the effectiveness ranking. The use of native plant materials (particularly locally collected seed, cuttings, and divisions, and nursery-grown seedlings propagated from them) in revegetation of bare soils and the utilization of certified straw and mulch are considered highly effective. The cleaning of off-road equipment and the use of gravel from weed-free sources are ranked as moderately effective.

3.13.4 Cumulative Effects

The analysis areas for invasive plant management for cumulative effects are the treatment areas and other connected actions, the areas directly adjacent and the roads leading to the project. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when roads were constructed and the stands were clearcut persist today, and activities during treatment, particularly along roads, have the potential to affect the spread of invasive plant species that could persist for many years into the future.

The 2005 Record of Decision and FEIS for Preventing and Managing Invasive Plants and the 2008 Record of Decision and FEIS for Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area provide additional cumulative effects discussion across a broader landscape. The former applies to all national forests in the Pacific Northwest Region (Region 6).

Other ongoing actions across the Forest include the spraying of certain concentrations of invasive plants approved by the 2008 Record of Decision. The 2008 plan did not identify any potential spray areas in or directly adjacent to proposed actions. The Oregon Department of Agriculture treats populations of Japanese knotweed, spotted and diffuse knapweed, rush skeletonweed, herb Robert, and Canada thistle that are scattered in the

Clackamas District annually or biennially depending on the species and population persistence. A number of these populations are located along haul routes (e.g., Highway 224).

Another action that is likely to occur is herbicide spraying of oxeye daisy in forage unit 416a. This action is authorized by the 2008 Record of Decision and FEIS for Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area.

The proposed action and all of the existing contracts that use the same roads, have similar contract provisions to minimize the likelihood of spreading existing species or introducing new invasive species from outside the project area. Practices such as the washing of equipment and the use of certified weed-free straw for erosion control and the use of certified weed-free seed for revegetation have been found to be effective in reducing the introduction, establishment, and spread of unwanted species. Ongoing actions of early detection and rapid response to identify and spray weeds of concern also contribute toward a landscape where invasive plants are contained to the degree identified in the 2008 Record of Decision.

3.14 FUELS AND FIRE HAZARD

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that activity fuels would be managed appropriately to minimize fire hazard while also minimizing effects to resources. Fuel treatments include machine piling, yarding tops, crushing branches and tree tops, and mastication. Smoke created by pile burning would be managed to minimize air quality impacts.

This section summarizes the fuels specialist report, which is incorporated by reference and summarized below.

3.14.1 Present and Past Fire History

The Hunter project area receives the majority of the lightning on the Forest. It is also a high use recreation area with numerous dispersed campsites and has a high rate of human starts. Most fires early in the season are typically small (1/10 acre) due to high fuel moisture, early detection and rapid suppression. As the season moves from late July into August, conditions dry out with reduced rain and increases in east wind events. During this time, the fire occurrence increases as well as fire size (>1/4 acre). Occasionally fires become larger (>10 acres); these have a higher resistance to control, require more suppression forces, take much longer to fully suppress and in turn cost much more.

In the project area, several large fires burned in the early 20th century as demonstrated by the fire-originated stands that seeded-in that are approximately 100 years old. There was no salvage on the Forest at that time. Large fires occurred at Lemiti Butte, Burnt Granite, Peavine Mt. and Rhododendron Ridge; these predate the era of effective fire suppression.

This panoramic photo taken in 1934 shows the results of the Burnt Granite fire in the foreground. A burned area on Peavine Mt. can be seen in the distance on the left.

This panoramic photo taken in 1934 shows the results of the Rhododendron Ridge fire in the foreground.

This aerial image of the Lemiti area shows dead lodgepole pine that seeded in after the last wildfire in that area.

In recent years, fires in adjacent areas with similar conditions have burned with increasing regularity, size and intensity. For example, the Olallie complex burned 2,622 acres in August of 2001; the Blister fire burned 735 acres in August of 2006; the Lake Lenore fire burned 550 acres in August of 2008; the View Lake Complex burned 4,860 acres in August of 2010; the Mother Lode fire burned 2,740 acres in September of 2011; the Badger Fire burned 2,400 acres in August of 2011; the Waterfalls 2 fire burned 12,000 acres in August of 2012; the Camas Prairie Fire burned 5,920 acres in July of 2014; and the 36 Pit Fire burned 5,500 acres in September of 2014.

A recent insect epidemic has resulted in the death of most lodgepole pine stands such as those in the Sisi, Lemiti and Rhododendron Ridge areas. The Lemiti Fuels Reduction Project involves fuel treatments that have not yet been implemented. That environmental assessment has substantial detail and analysis of the dead lodgepole pine situation and is incorporated by reference.

3.14.2 Fire Management

Large, intense wildfire is not the desired condition for this landscape at this time. The landscape is managed for many human values such as scenery, clean air, recreation, safety, and timber production. It is also managed to provide habitats for rare species. The Mt. Hood Forest Plan, as amended by the Northwest Forest Plan, requires an appropriate suppression response for all wildfires in this area to protect these values.

Other values at risk in the project area also include the following.

- Adjacent Confederated Tribes of Warm Springs Reservation
- Austin Hot Springs, a private parcel with high levels of recreation use
- Two sets of power lines managed by Bonneville Power Administration
- The adjacent Olallie Lake recreation facilities
- Sisi lookout tower and electronic site
- Mt. Lowe radio repeater site
- Red Box remote automated weather station
- Two small Wilderness areas

The preferred fire suppression strategies and tactics are those that provide primarily for firefighter and public safety and secondly would be the most cost-effective commensurate with the objectives for the Fire Management Unit (FMU) and/or Land Management Area within which the fire occurs. Initial action on all wildfires is to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety (USDA 2012a). All fires in the project area are actively suppressed at the smallest footprint.

3.14.3 Wildfire Hazard

Fire Hazard generally refers to the difficulty of controlling potential wildfire. It is commonly determined by fire behavior characteristics such as rate of spread, intensity, torching, crowning, fire persistence and by resistance to control (Brown 2003). High intensity fires may occur any time conditions are right but typically occur from August through October in the project area, and depends on the presence of dry fuels and extreme wind events (USDA 2012a).

3.14.4 Disturbance Regime

Fire is the dominant landscape-scale disturbance agent in the planning area. There is a mix of Fire Regime V with a 200-year or greater frequency and high stand-replacement severity and Fire Regime IIIC with a 100-200 year frequency and mixed severity.

The recent large fires described above are near the project area but not inside it. Fire suppression within the project area has resulted in a landscape where there have been no large fires. This may be because the project area has good road access and relatively rapid response times for suppression forces.

3.14.5 Fire Behavior Modeling

The Wildfire Decision Support System (WFDSS) was used to model spatial fire behavior. Flame length is a critical component of fireline intensity and affects appropriate suppression techniques. It can also be loosely correlated with the severity of resource impacts. Fires with flame lengths less than 4 feet can use direct attack suppression strategies with hand crews. Where flame lengths are greater, indirect techniques would have to be used with equipment such as dozers, and the risk of crowing, spotting and major fire runs are probable.

The vertical arrangement and quantity of fuels affect flame length and fire intensity. Where ground fuels and ladder fuels are present, fires have the potential to transition into crown fires. A significant ladder fuel in this area is the lichen draped in the branches of trees. This light and flashy ladder fuel can cause fire to climb into tree crowns and spread embers to surrounding trees. During normal seasons, these events are slow moving but are difficult to stop the spread.

3.14.6 Direct and Indirect Effects

With no action, the modeled flame lengths would be 4 to 8 feet. These flame lengths pose a hazard to suppression resources and increase the likelihood of large fire growth. Increased fire intensity would impact resources and air quality. With no action, there would be no activity fuels to treat.

The proposed action's vegetation treatments would not reduce or prevent wildfire occurrences but they create conditions that moderate fire behavior and increase effectiveness of suppression efforts. It would reduce fuels, alter the distribution of fuels, and increase forest health and diversity on 2,653 acres.

The proposed vegetation treatments would compartmentalize the landscape into blocks that are spatially separated; this facilitates fire suppression and reduces associated costs. It adds depth to fuel breaks along primary roads (USDA 2012c). This has the potential to moderate fire behavior by reducing flame lengths to 4 feet on treated portions of the landscape and limit the potential for surface fires to transition to crown fires. These treatment units would provide suppression forces places to anchor their fire attack.

Generally, fuel treatments aim to reduce surface fuels, increase crown base-height, and decrease the amount and horizontal continuity of canopy fuels (Scott 2001, Agee 2005). Effective fuel treatments mitigate fire severity within treated stands (Pollet 2002, Graham 2003, Agee 2005, and Cram 2006).

Some branches and tops and other debris created in thinning units would be retained on the ground to decompose naturally to enhance site productivity. In units operated with a harvester machine, branches and tops would be placed in front of the machine and compressed as it progresses through the stand. Previous experience with similar thinning has shown that snow pack and processes of decay cause the debris to break down and compress quickly to the point where fire hazard is not a concern. During the recent 36 Pit Fire, a crown fire dropped to a low-intensity ground fire when it encountered stands treated recently in this manner. In some units, activity fuels would be piled for later burning. Some activity fuels and other debris would be used to block or cover roads, landings and skid trails.

Reducing the fuels from an estimated 27 to 47 tons per acre to approximately 25 tons per acre and rearranging the depth of the fuel within these units has the potential to reduce flame length to under 4 feet. This is especially important in the fire-origin stands that have higher current levels of down material. This reduction in surface and ground fuels would reduce the resistance to control of fires in this area and have greater potential to keep fires manageable for suppression resources. Slash piled along major roads would create a partial fuel break that would allow roads to be used as containment lines in the event of a wildfire.

In the short term (1-2 years), there would be increased surface and ground fuels due to logging slash. Once the slash piles are burned and as the decomposition of fine fuels occurs, fire hazard for this area would be reduced.

3.14.6.1 Road Management

The Forest road system is integral for fire management on the Forest. Fire suppression strategies typically use engines and hand crews as the primary initial attack strategy; these require roads to get as close as possible to the fire origin. On large extended-attack fires, roads provide efficient and effective pre-existing control lines. It is more efficient and less impact on the land to utilize existing roads as much as possible for primary, secondary and contingency lines rather than use handline or dozer-line. Roads are strategically used for direct-attack containment lines and indirect-attack burn out operations. Roads provide effective escape routes.

Closing roads with intensive techniques like decommissioning, berms or deep piles of slash hinders initial and extended attack efforts by reducing access, limiting tactics and management options to effectively suppress fires. The proposed action would close 25 miles of roads. Longer roads would use gates to allow for faster fire suppression response times.

Since some fires are human caused, roads open to the public are often sources of ignition from escaped campfires, target shooting, or tossed cigarettes.

3.14.7 Cumulative Effects

Because wildfires can be large, the appropriate scale for cumulative effects analysis is the entire Upper Clackamas Watershed. This includes portions of the Confederated Tribes of Warm Springs Reservation and private land at Austin Hot Springs. This analysis area is appropriate because it is large enough to encompass the size of a typical wildfire in this area. The time frame for the discussion is quite long – approximately 100 years which represents the approximate time that fire suppression actions have occurred in the project area.

The analysis includes all past management actions including timber harvest and road construction. In terms of ongoing actions in the project area, the Lemiti Fuel Reduction Project is planned but not yet completed. There are also approved road decommissioning projects that have not yet been implemented. At this time, there are no known actions on the reservation that are foreseeable. Tribal managers are seeking funding to conduct some fuel treatments on the reservation but this funding is not certain and there is insufficient site specificity to conduct an analysis because treatment type, size, and location are unknown. If treatments are funded, it is likely that they would be complimentary to the treatments occurring on the Forest and would serve to provide more effective fire hazard reduction. There are no other foreseeable future actions to include; while there is potential for future projects or other management in the area, there are no current proposals with sufficient site specificity to conduct an analysis.

The effects of the proposed treatments when added to previous vegetation management projects and the Lemiti Fuel Reduction Project would result in a more fire resilient landscape by reducing the amount of amount and arrangement of fuels within the area. Reducing the density of trees, raising the canopy base-height and reducing the vertical

arrangement of fuels have the potential to moderate wildfire by limiting the potential for crown fire transition. Cumulative effects would be beneficial.

3.14.8 Forest Plan Consistency

The following section addresses management goals, desired future conditions and standards and guidelines from the Forest Plan that relate to fire and fuels. Page numbers are from the Forest Plan unless otherwise noted. The numbered sections provide the text from the Forest Plan as amended, and the italicized text is an explanation of how this project fits with those management goals, desired future conditions and standards and guidelines.

Provide fire protection, fuels treatment and pest management programs that are responsive to land and resource management goals and objectives. (#22, p. Four-4)

The proposed action would contribute toward this goal because a fuel treatment would reduce fire size and intensity, aid in the suppression of wildfires and would minimize risk to resources.

An appropriate suppression response will be made to all wildfires. When fire suppression forces reach the wildfire, they will apply the appropriate fire suppression strategy, which allows for the control of the fire with minimum cost plus damage to the resources affected. (p. Four-25)

The proposed action would result in a situation where fire suppression forces would be able to safely suppress a wildfire. Wildfires are expected to be smaller, suppression costs would be reduced and there would be reduced impact to resources.

The project is consistent with the standards and guidelines at FW-248 to 268.

3.15 AIR QUALITY

The following actions have the potential to affect air quality: burning slash, exhaust generated by vehicles, equipment, chainsaws and helicopters and dust created by vehicles that drive on aggregate surface and native surface roads.

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended) and that activity fuels would be managed appropriately to minimize fire hazard while also minimizing effects to resources. The timing and quantity of smoke created by pile burning and broadcast burning would be managed to minimize air quality impacts.

Fine particulates less than PM2.5 (2.5 micrometers in diameter) cause reductions in visibility due to absorption and scattering of light by suspended particles. Almost all smoke particles from wildfire and prescribed fire, residential wood stoves and fireplaces, industrial boilers, field burning, diesel combustion, and other combustion processes can be characterized as fine particulates, primarily PM2.5 (ODEQ 2014). These small particulates can be inhaled and cause respiratory problems, especially in smoke sensitive

portions of the population, such as the young, elderly, or those predisposed to respiratory ailments. Particles can accumulate in the respiratory system and aggravate health problem such as asthma.

Oregon Department of Environmental Quality classifies Class I Areas as "certain wilderness areas designated by Congress as federal Class I Areas that are subject to visibility protection under the Environmental Protection Agency's Regional Haze Rule and the federal Clean Air Act"(ODEQ 2014). The Mt. Jefferson Wilderness is located 1 mile south and is the only sensitive areas within the vicinity of the Hunter project area.

The closest communities to the Hunter Project area are Detroit, which is 12 miles to the southwest, Estacada, which is 22 miles to the northwest, and Warm Springs, which is 33 miles to the southeast. Winds in this area can blow in different directions potentially affecting these communities.

3.15.1 Direct, Indirect and Cumulative Effects

The analysis area is quite large because smoke from fires in the project area can conceivably extend to the Portland metropolitan area in the event of an east wind event to central Oregon if the wind blows from the west.

If a fire does occur, there would be effects to air quality in the airshed but they would likely be reduced compared to no action.

The burning of slash piles would typically be implemented during fall when favorable smoke dispersal conditions are expected. Traditionally, pile burning prescribed fires are conducted when the ground is frozen or saturated, reducing the potential of smoldering and creeping into adjacent fuels. Prescribed burning would occur when the weather conditions would minimize visibility effects to Class I airsheds.

Cumulatively, this project uses similar techniques and timing as other projects such as the Lemiti Fuel Reduction Project. While it is not known what year treatments would occur in or when piles would be available for burning, it is likely that prescribed burning of various projects would occur spread over several years and at appropriate times of the year which would result in less air quality impact compared to wild fire. Air quality throughout Oregon can be affected by wildfire. Projects that reduce the likely size or intensity of wildfire have the effect of reducing overall air quality impact.

Cumulative effects of the proposed action when added to other fuel reduction projects and the impacts of wildfire and of fire suppression tactics would not be substantial, and the effects would be lower compared to no action.

3.15.2 Forest Plan Standards and Guidelines

The project is consistent with FW-039 to 053 because smoke would be minimized.

The Oregon Smoke Management Plan, which is administered by the Oregon State Forester, regulates the amount of forestry related burning that can be done at any one

time. The amount of burning that can occur on any one day depends upon the specific type of burning, the tons of fuel loading to be ignited, and the atmospheric conditions available to promote particulate matter mixing and transportation of smoke away from sensitive areas. Through compliance and cooperation in the implementation of the Oregon Smoke Management Plan, the Proposed Action would comply with the following laws and regulations.

- The Federal Clean Air Act (CAA) is the primary legal basis for air quality regulations across the country.
- Oregon Smoke Management Plan, OS477.013, as administered by Oregon Department of Forestry
- Oregon State Implementation Plan (The Federal Clean Air Act Implementation Plan)
- Oregon Administrative Rules OAR 629-0048-0001: Smoke Management Rules
- Oregon Visibility Protection Plan for Class I Areas, OAR 340-200-0040, section 5.2
- Forest Service Best Smoke Management Practices 2012
- Forest Service Manual 2500-Watershed and Air Management, Chapter 2580-Air Resource Management - The project would minimize the impacts on air quality through compliance and cooperation with Federal, state and local air regulations to prevent significant adverse effects of air pollutants, mitigation of adverse impacts form prescribed fire on air resources though the application of Best Smoke Management Practices, and protection of air quality related values within Class I areas.

As required by Agency policy (Forest Service Manual 5100 - Fire Management, Chapter 5140 Fire Use) and through inclusion, the 2008 Interagency Prescribed Fire Implementation Procedures Guide, a site-specific prescribed fire burn plan would be developed for all prescribed fire units in the project area. Prescribed fire plans are implementation documents to ensure that purposed and need goals and resource management objectives identified in the Proposed Action are clearly defined, that site-specific prescriptions are developed to meet these goal and objectives, and to ensure plans and mitigations are in place to mitigate against undesirable fire effects, including smoke intrusions into sensitive airsheds, visibility impairment to Class I and II airsheds, and human health effects. PDCs would be incorporated into prescribed fire burn plans where appropriate.

3.16 ECONOMICS – FINANCIAL ANALYSIS

Summary - The following sections show that the proposed action complies with direction in the Forest Plan (as amended). A qualitative analysis shows that the project is likely to be viable and receive bids.

One of the aspects of the purpose and need (s. 1.3) and one of the dual goals of the Northwest Forest Plan is to provide a sustainable level of forest products for local and regional economies and to provide jobs. The Northwest Forest Plan Final Environmental Impact Statement has an in-depth analysis of the economic basis behind the goal of providing forest products for local and regional economies. It also contains an analysis of the social and economic benefits and impacts of preservation, recreation and other

values. To benefit local and regional economies, timber is offered to bidders. For contracts to receive bids they must have products that prospective purchasers are interested in and they must have log values greater than the cost of harvesting and any additional requirements.

The purpose of this analysis is to provide a comparison of the alternatives.

The no-action alternative would not provide forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies now and in the future. It would not provide the employment associated with proposed actions such as white pine pruning, mistletoe treatment, danger tree removal, forage enhancement, culvert replacement, large woody debris recruitment into streams, dispersed recreation restoration, road repair, or road decommissioning.

The proposed action would provide for jobs associated with logging and sawmill operations and would contribute to meeting society's forest product needs. The Northwest Forest Plan Final Environmental Impact Statement (p. 3&4-297) contains an analysis of employment in the timber industry. The annual incremental contribution of each million board feet of timber is approximately 8.3 jobs. This includes the jobs in the timber sector but does not include jobs created by the many restoration projects that are also a part of the proposed action. The purpose and need (s. 1.3) is not solely to create jobs but to provide forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies. Jobs are only a part of that equation. Thinning and other vegetation treatments are needed to keep forests healthy and productive to provide wood products now and in the future – people need and use wood products. Approximately 20 MMBF of wood products would be produced now and stands would be made healthier and more productive for future management.

Cost effectiveness is considered in the design of vegetation management and in the road treatments proposed.

Based on past experience with similar stands with similar prescriptions, it is likely that there would be sufficient value of timber removed to accomplish vegetation management and to also fund many of the other project elements included in the proposed action.

3.16.1 Forest Plan standards and guidelines

Forest Plan References
Forest Management Goals - 19, page Four-3, page Four-26
Northwest Forest Plan Standards and Guidelines page A-1

The proposed action is consistent with Forest Plan goal to efficiently provide forest products.

3.17 CLIMATE CHANGE

Summary - The proposed action would result in some carbon emissions and some carbon sequestration. The benefits to forest health and resiliency with the proposed

action would allow stands to adapt to the future climate (s. 3.1.3). The Forest Plan, as amended, does not contain direction related to climate change.

3.17.1 Introduction

A growing body of scientific evidence and climate modeling indicate that climate change is occurring. While there are no specific projections for the project area, the situation would likely be one where the summers are drier and the snow melts earlier in the spring (Bare 2005) (Mote 2003) (Mote 2005) **(**Dale 2001). Some believe that climate change is not occurring or that it is not human caused. This document is not intended to present arguments on any of these theories because they are well documented elsewhere and are outside the scope of this analysis.

This project was not specifically designed to mitigate or respond to potential climate change. This section qualitatively addresses aspects of the project that may affect carbon emission or sequestration and how the project may help or hinder the forest's ability to deal with climate change. This analysis does not attempt to quantify carbon emission or sequestration.

3.17.2 Existing Situation

This project involves the thinning of second-growth stands and other vegetation management treatments, most of which are designed to enhance the health, growth and diversity of stands. It also involves removing logs for utilization in wood products. Rapidly growing forests are recognized as a means of carbon sequestration (FAO 2007). Forest health and growth issues are discussed in section 3.1.

3.17.3 Direct, Indirect and Cumulative Effects

This project is not likely to have direct localized effects on climate. By its very nature, the discussion of a project's effect on climate change is indirect and cumulative because the effects occur at a different time and place, and because the scale of the discussion is global. Since it is not reasonable to measure a project's global impact, the discussion here focuses on key elements of forest management discussed in the scientific literature.

For this proposal, the following actions have the potential to affect carbon emissions or sequestration:

- Thinning and other treatments to enhance the health of the residual stand would result in trees that are better able to withstand stresses such as dry summer conditions (Millar 2007) (Spittlehouse 2003). The no-action alternative would result in trees in these overcrowded stands that are stressed by moisture competition.

- Variable-density thinning with skips and gaps and the retention of minor species would result in stands that are resilient and better able to respond to whatever changes come in the future (Millar 2007). The no-action alternative would result in continued uniform, crowded conditions in these stands.

- Fossil fuel is used by equipment such as saws, tractors, skyline yarders, helicopters and log trucks. It is possible for some of this equipment to use biofuels, and it is likely to be used where it is available and price competitive. Helicopters would use more fuel than other yarding options. The no-action alternative would not use fuel.

- Some debris and other wood from tree tops and braches would be burned, releasing carbon into the atmosphere. Most tree tops and branches would be left on the ground. However, some would be piled at landings and other locations. Some may be removed as firewood for burning in residences. Some of the debris that is not removed may be burned on site; however, some debris at landings would not be burned but would be used to block roads. Debris on the ground would readily decay and would not result in a high fire hazard situation. The proposed action involves some prescribed burning to enhance forage. This action would release some carbon into the atmosphere; most of the fuel consumed would be grass and shrubs. The no-action alternative would not have any burning.

- Woody debris retained on the ground increases soil carbon sequestration (Millar 2007). The proposed action would retain existing debris and logs on the ground and would add more in the form of logging slash such as branches and tree tops and trees felled to create coarse woody debris. The no-action alternative would result in stagnation of trees and some would die and fall to the ground.

- Utilizing trees to create long-lived wood products sequesters carbon (IPCC 2007) (FAO 2007) (Stavins 2005) (Upton 2007). The no-action alternative would not create any long-lived wood products.

The no action alternative would not result in carbon emissions from vehicles or burning and would result in the retention of relatively slow growing trees. The mortality that results would be retained on site (s. 3.1.3, s, 3.8.7).

The proposed action would affect approximately 2,587 acres of forest by thinning and other vegetation treatments designed to enhance health and growth. Variable-density thinning is designed to improve health and growth and enhance elements of diversity include the inclusions of skips, gaps, patches of heavy thinning, forage openings, brushing, snag and down log creation.

The Forest is comprised of about 1.1 million acres. The vegetation management portion of the proposed action equates to approximately 0.3% of the Forest. This scope and degree of change would be minor relative to the amount of forested land 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.

In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change (IPCC) 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 for conversion of forest into agricultural land or developed landscapes (IPCC 2000).

This project does not fall within any of these main contributors of greenhouse gas emissions. Forested land would remain forested and not converted to agriculture or development. In fact, forest stands would be thinned or treated in some other way to maintain a vigorous forested condition that can continue to support trees and sequester carbon in the long term.

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 proposed action is consistent with these recommendations because it would enhance the health and growth of mid-aged stands and would sequester some wood in long-lived wood products.

Timber management projects can influence carbon sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding 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, respectively (IPCC 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The proposed action falls into this category.

The proposed action would result in some carbon emissions and some carbon sequestration. The benefits to forest health and resiliency with the proposed action would allow stands to adapt to the future climate (s. 3.1.4).

3.18 OTHER REQUIRED DISCLOSURES

3.18.1 Heritage Resources

Section 106 of the National Historic Preservation Act of 1966 requires documentation of a determination of whether each undertaking would affect historic properties. The Forest operates under a programmatic agreement between the Oregon State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation for consultation on project determination. Consultation with SHPO was completed for this project.

Surveys have been conducted for this project and are discussed in heritage report number 2016-060609-020. The report found that the project would have no effect on archaeological resources.

Contracts would contain provisions for the protection of sites found during project activities. Based on the proposed protective measures, the project meets the criteria in the Programmatic Agreement for "Historic Properties Avoided" determination (Stipulation III (B) 2).

This action is consistent with Forest Plan goal to protect important cultural and historic resources.

3.18.2 Consumers, Civil Rights, Minority Groups, Women, and Environmental Justice

Executive Order 12898 directs agencies to identify and address disproportionately high and adverse human health or environmental effects of projects on certain populations. This includes Asian Americans, African Americans, Hispanics, American Indians, low-income populations and subsistence uses. The Civil Rights Act of 1964 prohibits discrimination in program delivery and employment. There are communities with minorities and low-income populations that may be affected by the project. The town of Estacada (the nearest community) is approximately 40 miles away. Even farther away, but potentially affected are the American Indian communities of Warm Springs and Grande Ronde. There are no known areas of religious significance in the area. There are no known special places for minority or low-income communities in the area. Individuals may work, recreate, gather forest products or have other interests in the area. Neither the impacts nor benefits of this project would fall disproportionately on minorities or low-income populations.

No disproportionate impacts to consumers, civil rights, minority groups, and women are expected from this project. Vegetation management and other work would be implemented by contracts with private businesses. Contracting for the project's activities would use approved management direction to protect the rights of these private companies. No adverse civil rights impacts were identified. There would be no meaningful or measurable direct, indirect or cumulative effects to environmental justice or civil rights.

3.18.3 Floodplains and Wetlands

The Clean Water Act of 1977 and subsequent amendments established the basic structure of regulating discharges of pollutants into waters of the United States. The Environmental Protection Agency (EPA) has the authority to implement pollution control programs and to set water quality standards for all contaminants in surface waters. The EPA delegated implementation of the CWA to the States; the State of Oregon recognizes the Forest Service as the Designated Management Agency for meeting CWA requirements on National Forest System lands. The proposed action is in compliance with the Clean Water Act as described in s. 3.3.

There would be very limited impacts to floodplains or wetlands from this project. Due to the steepness of the topography, small stream size and confined nature of streams in this area, floodplain width is fairly limited. The impacts to wetland and floodplains are

discussed in section 3.3. Due to the PDCs and BMPs, which are aimed at minimizing the impacts to wetlands and floodplains, there would be minimal direct and indirect effects.

3.18.4 Wild and Scenic Rivers

Section 7(a) of the 1986 Wild and Scenic Rivers Act prohibits agencies of the United States from assisting in any water resources project that "…would have a direct and adverse effect on the values for which such a river was established…" Section 7 provides authority to the Secretary of Agriculture to evaluate and make a determination on water resources projects that affect wild and scenic rivers. The authority for that determination for projects on National Forest System lands is delegated to the Forest Supervisor (Forest Service Manual 2350). The project has action in the recreational and scenic sections of the Clackamas Wild and Scenic River corridor. A management plan for the Clackamas River was completed in 1993. Compliance is addressed in section 3.9.11.

3.18.5 Air Quality

The Clean Air Act as amended in 1977 addresses the air quality in Wilderness areas. All planned ignitions are conducted according to the Operational Guidance for the Oregon Smoke Management Program (OSMP). The Operational Guidance contains the direction for meeting the terms of the OSMP. The Environmental Protection Agency has approved the OSMP as meeting the requirements of the Clean Air Act, as amended. The OSMP, which is administered by the Oregon State Forester, regulates the amount of forestry related burning that could be done at any one time. To comply with the Clean Air Act, the Forest Service is operating under the Oregon Administrative Rule (OAR) 629-43-043. The proposed action is in compliance with the Clean Air Act as described in s. 3.15.

3.18.6 National Forest Management Act

The National Forest Management Act (NFMA) of 1976 requires that the Agency develop land management plans. It also requires the Forest to determine the suitability of a specific land area for timber management and contains other requirements that are built into Forest Plan standards and guidelines. The proposed action was developed to be in full compliance with NFMA via compliance with the Forest Plan, as amended. This document contains numerous references as to how this project complies with Forest Plan, as amended, and the Silvicultural Prescription in the Analysis File contains a discussion of compliance with NFMA's requirement to identify lands unsuited for management.

3.18.7 Treaty Resources and Reserved Indian Rights

No impacts on American Indian social, economic, or subsistence rights are anticipated. No impacts are anticipated related to the American Indian Religious Freedom Act. The Confederated Tribe of Warm Springs and the Confederated Tribes of Grand Ronde were contacted in reference to this Proposed Action.

3.18.8 Inventoried Roadless Areas, Unroaded and Potential Wilderness Areas

The proposed project is not in an Inventoried Roadless Area. The project area does not meet Forest Service criteria for Potential Wilderness because the unroaded/undeveloped portions of the landscape are less than 5,000 acres in size, are not contiguous to existing wilderness, and are not self-contained ecosystems. Unroaded and undeveloped character is discussed at section 3.10.

3.18.9 Prime Farmlands, Rangelands, and Forestlands

None of the alternatives would have an adverse impact to the productivity of farmland, rangeland, or forestland. No reductions in long-term productivity are expected. See section 3.6.

3.18.10 Potential or Unusual Expenditures of Energy

The No Action alternative would not require any expenditure of fuel or energy. The Proposed Action would require expenditures of fuel for workers to access the project area, use power equipment, and to utilize the logging systems. Jet fuel use for helicopter operations would also occur. Overall, the proposed action would not result in any unusual expenditure of fuel (s. 3.17).

3.18.11 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that are forever lost and cannot be reversed. Irretrievable commitments of resources are considered those that are lost for a period of time and, in time, can be replaced. The use of rock for road surfacing is an irreversible resource commitment; however, rock quarries have sufficient capacity to provide for the long-term needs for surfacing rock.

3.18.12 Conflicts with Plans, Policies, or Other Jurisdictions

NEPA at 40 CRF 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with . . . other environmental review lands and executive orders."

The proposed action would not conflict with the plans or policies of other jurisdictions, including the Tribes. It would not conflict with any other policies and regulations or laws, including the Clean Water Act, Clean Air Act, Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, or National Historic Preservation Act. Refer to the following sections for discussions regarding these laws.

- Section 3.3 – Clean Water Act
- Section 3.4 and 3.7 – Endangered Species Act
- Section 3.4 - Magnuson-Stevens Fishery Conservation and Management Act
- Section 3.18.1 – National Historic Preservation Act
- Section 3.15 – Clean Air Act

3.18.13 Competing and Unwanted Vegetation

The Record of Decision and Mediated Agreement for the "Managing Competing and Unwanted Vegetation" Final Environmental Impact Statement (USDA 1998) no longer apply to invasive species management but are still applicable to unwanted native vegetation, brush control and fuel treatments. Fuels treatments in thinning projects are exempt. Slash treatments associated with other vegetation management actions and road construction is included. The slash, woody debris and root wads that result from the temporary road construction associated with this project would be temporarily set aside and used to block the road when logging is completed. There would be no burning of this material.

An analysis in the silviculture report documents consideration of prevention and early corrective strategies through appropriate vegetation and slash treatments to keep unwanted vegetation below damage thresholds.

This project is consistent with standards and guidelines for competing and unwanted vegetation.

4.0 Consultation and Coordination

The Forest Service consulted the following Federal, State, and local agencies and tribes during the development of this assessment:

4.1 FEDERAL, STATE, AND LOCAL AGENCIES

U.S. Fish and Wildlife Service
National Marine Fisheries Service
Oregon Historic Preservation Office
Portland General Electric
South Fork Water Board
Clackamas River Water
Mt. Scott Water District
Oak Lodge Water Board
City of Gladstone
Bureau of Land Management
City of West Linn
Clackamas River Basin Council
City of Estacada
Oregon Department of Fish and Wildlife
City of Lake Oswego
Clackamas County
City of Oregon City
Environmental Protection Agency

Consultation with the U.S. Fish and Wildlife Service is documented in section 3.7.1.
Consultation with the National Marine Fisheries Service is documented in section 3.4.6.
Consultation with the Oregon Historic Preservation Office is documented in section 3.18.1.

4.2 TRIBES

Confederated Tribes of Warm Springs
Confederated Tribes of Grand Ronde

4.3 LIST OF PREPARERS

Mark Boyll - Botanist. Mark earned his BS in Botany at Oregon State University. In addition to vascular plants, his areas of expertise include lichenology, mycology and myxomycology. He has worked for the Forest Service in Oregon, Washington, California, Montana and Idaho since 1989.

Gwen Collier - Soil Scientist. Gwen has a B.S. in Biology and Environmental Science from Willamette University and a B.S. in Soil Science from Oregon State University. She has worked for the Forest Service for 34 years in Oregon, Washington and Idaho. She is a specialist in soil science and hydrology.

Tom DeRoo - Geologist. Tom graduated from the University of Washington in 1978 with a B.S. in Geology. He has worked as a geologist for the Forest Service for 38 years in Washington and Oregon, including 30 years on the Forest.

Jeff Goldberg – Westside Zone Wildlife Biologist, Mt. Hood National Forest. Jeff has a B.S. degree in Wildlife Biology and Management from Humboldt State University and an A.S. degree in Wildlife & Fisheries from Feather River College. Jeff has worked as a professional Wildlife Biologist for the Forest Service for 13 years in California, South Dakota, and Oregon. He has also worked as a Wildlife Biologist for the BLM and in the private sector.

Lucas Jimenez - Roads Project Engineer. Certified as an Engineer in Training (EIT) and Land Surveyor in Training (LSIT) through the California State Board for Professional Engineers and Land Surveyors. Received specialized training for the design and construction of Low-Volume Roads through the United States Marine Corps Engineer Specialist's Course, Fort Leonard Wood, MO. Lucas has 16 years of experience as a Civil Engineering Technician and Survey Crew Chief, along with 5 years of experience in construction inspection.

David Lebo - Westside Zone Botanist, Mt. Hood National Forest. B.A. Frostburg State College; M.A. University of Montana; M.S. University of Washington (forest ecology). David specializes in forest ecology and botany with a particular interest in cryptogamic botany (fungi, lichens, and bryophytes). He has worked for the Forest Service for two decades in Washington and Oregon including a six-year stint as interagency ecologist for the BLM and Forest Service in the Klamath Basin in southern Oregon.

Philip Monsanto – Westside Zone Silviculturist, Mt. Hood National Forest. Philip has a B.S., M.S., and MFR degrees from the University of Washington. His Master's Thesis explored the effects of salvage logging on coarse woody debris dynamics and its implication to soil heating in an eastern Cascades dry forest type. He worked 11 seasons in wildfire and fuels before taking a silviculture track. In 1998, he was a Peace Corps Volunteer placed in the Dominican Republic where he worked with a community to develop a tree nursery, teach environmental education to rural schools, and organized latrine construction for a number of family members. He also participated in disaster relief efforts after Hurricane Georges. From March 2009 to February 2016, he worked on

the Naches Ranger District, Okanogan Wenatchee National Forest where he attained his USFS Silviculture Certification before moving to the Mt. Hood.

Debbie Ortiz – Archaeologist. Debbie graduated from New Mexico State University in 2010 with a Master's Degree in Archaeology. She has worked as an archaeologist for the Forest Service on Mt. Hood for 10 years.

Todd Parker – Hydrologist. Todd has a B.S. in Forest Management and a B.S. in Business Management from Oregon State University, 1981. He has been the Hydrologist on the Columbia Gorge and Zigzag Ranger Districts since 1992. He has considerable experience with watershed resources, watershed restoration and geographic information systems.

Jim Roden - Writer/Editor. Jim has a B.S. in Forest Management from Northern Arizona University. He has worked as a forester for the Forest Service for 39 years in Wyoming, California, Idaho and Oregon. He is a specialist in timber sale planning and geographic information systems.

Jack Williamson - Fish Biologist. Jack has a M.S. in Fish Biology from Colorado State University and B.S. in Philosophy and General Science from University of Oregon. He has worked for the federal government for 17 years in California and Oregon and for the state of Oregon for 6 years.

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