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Environmental Assessment

North Umpqua Ranger District

Umpqua National Forest

Douglas & Lane County, Oregon

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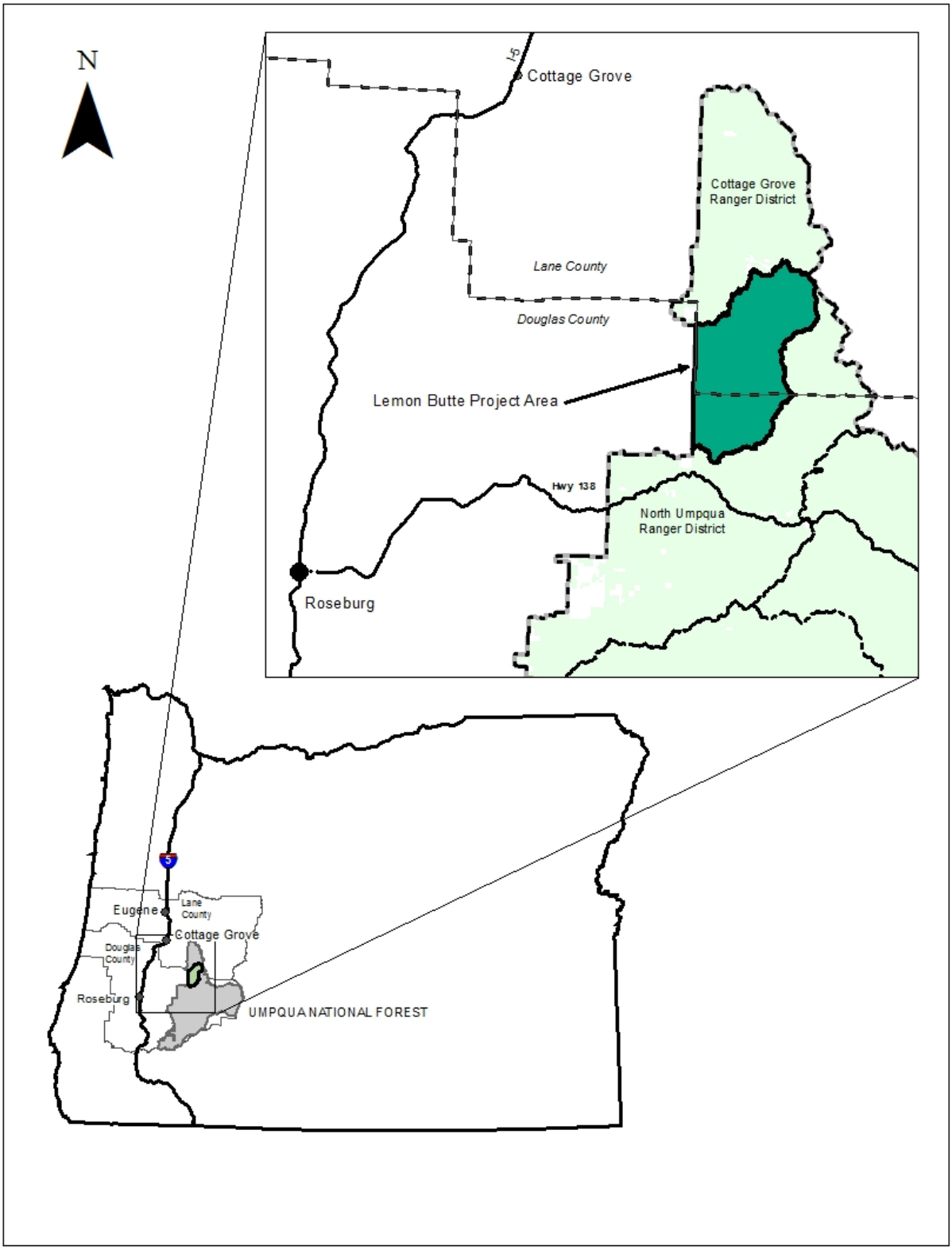


Figure 1. Vicinity Map of Lemon Butte Project Area.

Introduction

We prepared this Environmental Assessment (EA) to determine whether implementation of the Lemon Butte project may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA).

The Lemon Butte Project EA proposes to commercially thin 603 acres, non-commercially thin 43 acres, and treat 310 acres of activity fuels within Late Successional Reserve 222, in the Steamboat Creek 5th field watershed. Necessary road work includes 91 miles of road maintenance, culvert and stream crossing replacements, and 3.25 miles of temporary road construction, which would be followed by obliteration. The Lemon Butte Project also includes several restoration and mitigation activities, such as, instream habitat restoration, snag creation, invasive weed removal, sub-soiling, native seeding, and reforestation.

Chapter 1 of this Environmental Assessment (EA) describes the Proposed Action, management direction, and Purpose and Need of the project, as well as the scope of the decision to be made. Chapter 1 also includes an explanation of the scoping process and how issues and concerns were addressed by project design features and alternatives in Chapter 2, and the effects analyses in Chapter 3.

Proposed Project Location

The Lemon Butte project area is located in the North Umpqua Ranger District of the Umpqua National Forest. The planning area is 64,882 acres and is located within the Steamboat Creek 5th field watershed approximately 25 miles east of Glide, Oregon. It sits within Lane and Douglas Counties in portions of Townships 23, 24, and 25 South, Ranges 1 and 2 East, of the Willamette Meridian. Please see Figure 1 on the previous page.

The planning area has mixed ownership of 98% Forest Service and 2% private land. Lemon Butte project activities would only occur on Forest Service land, which is identified as 100% Late Successional Reserves, including Riparian Reserves, by the Northwest Forest Plan (USDA & USDI, 1994a).

Figure 1. Vicinity Map of Lemon Butte Project Area.

Relationship to other Planning Documents and Analyses

The 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) and its amendments to date, including the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (NWFP), provide broad management direction for the Lemon Butte Environmental Assessment. The Lemon Butte planning area includes Management Areas (MA) 10, 11 and 12 as defined by the LRMP.

- Management Area 10 provides for production of timber on a cost-efficient sustainable basis consistent with other resource objectives.
- Management Area 11 provides for big game winter range habitat and timber production with other resource objectives. However, managing for big game winter range habitat will not be an objective for Lemon Butte stands within the Late Successional Reserve.

- Management Area 12 provides additional management direction to maintain or enhance the fisheries resource of Steamboat Creek and its tributaries.

The Lemon Butte planning area is identified as Late-Successional Reserve (LSR-222), which includes Riparian Reserves, by the NWFP.

- Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis.
- Late Successional Reserves management objectives are designed to protect and enhance habitat for late-successional and old-growth forest related species.

This Lemon Butte Project is designed to be consistent with the 1990 Umpqua National Forest Land and Resource Management Plan, as amended, and the 2005 Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program. Each resource section in Chapter 3 includes a regulatory framework section which includes relevant legal consistency per resource.

This EA also incorporates by reference the 2003 Umpqua National Forest Roads Analysis. The Umpqua Forest-Scale Roads Analysis (USDA, Umpqua National Forest, 2003) evaluated access issues for key road systems across the Forest and recommended further evaluations at the watershed and project scale, as needed. Roads analysis below the Forest scale is not automatically required, but may be undertaken at the discretion of the Responsible Official (FSM 7710).

A roads analysis below the Forest scale was not needed to support the Lemon Butte EA because no road management activities under this project would result in any changes to access, changes to current use, or changes in traffic patterns or road standards. The Lemon Butte project is consistent with and does not recommend any alterations to the Umpqua National Forest-wide Travel Analysis Report Subpart A. All maintenance level 1 roads used would have the appropriate closures as identified by the Travel Management Plan, Subpart B.

The Lemon Butte EA also incorporates by reference the following six watershed analysis: Canton Creek (USDA, 1994; USDA & USDI, 1995), Cedar Creek (USDA, 1995), City Creek (USDA, 1996), Lower/Middle Steamboat Creek (USDA, 1999), Lower Steamboat Creek (USDA, 1999), Upper Steamboat Creek (USDA, 1997) Watershed Analyses, and Upper and Lower Steamboat Creek Watershed Analyses Iteration (USDA, 2007). These watershed analyses document an overabundance of densely-stocked second growth stands in the planning area and recommend the use of thinning and prescribed fire in these managed stands to move landscape patterns back toward desired reference conditions. The project area also was identified in the 2011 Upper Steamboat Watershed Action Plan, which recommends the use of prescribed fire to reduce the probability and effects of a large wildfire.

This EA incorporates by reference the recommendations and analyses in the 2006 Umpqua Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan and the 2006 Steamboat Watershed Restoration Plan.

This EA incorporates by reference the Project Record (40 CFR 1502.21). Chapter 3 provides specialists' input in adequate detail to support the rationale for the decisions and the appendices provide supporting documentation. The Project Record contains supplemental information and other technical documentation used to support the analysis and conclusions in this EA. Incorporating this information implements the CEQ Regulations provision that agencies should reduce National Environmental Policy Act (NEPA) paperwork (40 CFR 1500.4), and that

environmental documents shall be "analytic rather than encyclopedic, and shall be kept concise and no longer than absolutely necessary (40 CFR 1502.2)". The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review by request.

Purpose and Need for Action

The purpose of treatment within an LSR is to promote the development and maintenance of late-successional forest conditions in existing even-aged stands in LSR (USDA & USDI, 1994b, C-12). The Lemon Butte Project proposes to meet this purpose through these three objectives:

The purpose of the Lemon Butte Project is to do the following:

- Restore the species and structural composition consistent with natural disturbance regimes.
- Accelerate late seral characteristics in early to mid-seral forest stands to promote high quality, more resilient wildlife habitat.
- Promote the development of a more fire resilient landscape, by reducing fuel loading and continuity, which reduces the probability and effects of large scale wildfires and makes management of fires safer and more effective.

Silviculture treatments proposed for the Lemon Butte project are consistent with recommendations in the Standards and Guidelines of the NWFP, as well as the LRMP, and have two principal objectives:

1. Promoting the development of old-growth forest characteristics in young stands, including large trees, snags, logs on the forest floor, deep tree crowns, and canopy gaps that enable establishment of multiple tree layers (vertical diversity) and diverse species composition; and
2. Preventing large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of this portion of LSR RO-222 to sustain viable populations of forest species (B-5, USDA & USDI, 1994b).

The need for treatment is driven by the previous clearcutting, reforestation practices, and over 100 years of fire exclusion in these watersheds. Previous clearcutting, reforestation practices, and the exclusion of fire over the last several decades has created dense, second-growth forest stands in both uplands and riparian areas that are now in the stem exclusion stage of development and lacking species diversity. Historically, sugar pine trees were naturally abundant on south and west aspects in the planning area and were maintained by the fire regime. Sugar pine populations have diminished and regeneration has slowed due to past reforestation practices, fire exclusion, and white pine blister rust. Dense stand stocking leads to low growth rates and impedes the timely development of late successional stand characteristics and some desired riparian habitat characteristics, such as large diameter trees that ultimately provide large down wood to streams.

Fire exclusion over the last 100 years has resulted in unsustainable forest fuel loadings and stand structures that increase the risk of stand replacement, high severity, wildfires. Field studies in and around the project area suggest that fires naturally occurred in these landscapes every 35-50 years and were generally of mixed severity. Wildfires in the North Umpqua corridor over the past 15 years are further evidence of this area's active fire history. These fires include: the 1996 Spring

Fire, 2002 Apple Fire, 2008 Rattle Fire and 2009 Williams Creek Fire. Costing tens of millions of dollars, these wildfires threatened public safety, disrupted transportation and commerce, impacted natural resources and damaged both public and private infrastructure and lands.

Proposed Action

To meet the purpose and need for the project, the Forest Service is proposing the following activities:

1. Commercially thin approximately 603 acres of stands 45-59 years of age, utilizing a range of silviculture prescriptions that would retain approximately 50 trees per acre (tpa). Gap creation (1/2-acre and 1-acre openings) is proposed for 3-10% of each timber sale unit's individual area to initiate structural diversity and understory vegetation development; all prescriptions are designed to increase growth, health, and vigor of the leave trees and are anticipated to result in approximately 11 million board feet of timber.

    a. Approximately 185 acres of ground-based, or mechanized, logging systems and 418 acres of skyline logging systems would be employed to implement the thinning prescriptions. Mechanized equipment is generally utilized on slopes under 35% and skyline systems over 35% slope. Landings would be used in both the skyline and ground based units. The average landing size would be about 0.50 acres in both skyline and ground-based units.

    b. Wet season logging and haul was identified for approximately 180 acres of skyline units. Haul may occur on designated roads only as described on pages 185-187. Resource concerns would be mitigated by the use of additional PDFs, BMPs, and Mitigation Measures as described in Appendix A.

    c. Generally, felled material down to a six inch diameter top would be yarded and removed from the site and material from six to three inch diameter tops would be brought to the landings. Whole-tree yarding could occur, provided enough slash remains on site to meet temporary spur road obliteration and winterization requirements. Yarded material may be chipped, left on the landing for firewood cutters, processed into biochar, or burned.

    d. The activity fuels, or slash, would be treated on approximately 310 acres, in order to break up continuity of the fuels throughout the timber sale units. Methods of treatment would include grapple piling, hand piling, and springtime prescribed underburning in units 31, 54, & 69 (37.9 acres). Approximately 1.3 miles of hand line would be constructed to support areas of underburning. Landing piles would be burned. Implementation of these treatments would be subject to a post-harvest fuels assessment.

    e. Harvest would occur within Riparian Reserves outside of no-cut buffers. No-cut buffers would be a minimum of one tree height,

180 feet, on each side of stream channels along fish-bearing (class 1 and 2) streams. Non-fish bearing perennial stream (class 3) no-cut buffers would be 85 feet on each side of stream channels, and non-fish bearing intermittent stream (class 4) no-cut buffers would be 25 feet each side of stream channels. Where instability or slope breaks are present, buffers may be widened to protect sensitive riparian areas. Harvest acres within riparian reserves, but outside the established no-cut buffers are estimated as follows:

i. Fish bearing streams (class 1&2): approximately 13 acres

ii. Perennial non-fish bearing streams (class 3): approximately 5 acres

iii. Intermittent, non-fish bearing, streams (class 4): approximately 20 acres

iv. No more than 12 landings would exist within Riparian Reserves. These landings would occur on the outer upslope edges of the Riparian Reserves outside of the no-cut buffers.

2. Non-commercially thinning from below in Unit 71 would occur on 43 acres to promote fire resiliency in the adjacent owl core and also develop connectivity to the surrounding suitable habitat for Northern Spotted Owls.

3. Road Work Implementation: No new permanent system roads would be constructed and all temporary roads would be obliterated after use.

a. New temporary road construction- Approximately 0.5 miles of new temporary road would be constructed to gain access into thinning units, none of which would be located within Riparian Reserve areas or within no harvest buffers.

b. New temporary road construction on previously decommissioned road- Approximately 1.25 miles of new temporary road would be constructed on the existing footprint of previously decommissioned roads to gain access into thinning units. No construction would be located within Riparian Reserve areas or no-harvest buffers. The previously decommissioned roads proposed for use include 3806-495, 3821-060, and 3828-148.

c. Existing temporary road reconstruction- Approximately 1.5 miles of temporary spur routes to gain access into thinning units would be located on the existing footprint of skid roads, fire lines, and abandoned or unclassified roads that were built to access the original harvest units. No construction would be located within Riparian Reserve areas or no-harvest buffers. Reconstruction would give the Forest Service the opportunity to properly obliterate and hydrologically restore these roads after temporary use.

d. Temporary road obliteration – After use, approximately 3.25 miles of temporary roads would be obliterated with an excavator equipped with a "winged subsoiler" to de-compact soil as needed. Any excavated material, including soil and woody material, would be pulled back over the road. A native forage seed mix would be applied to all subsoiled temporary roads and landings to minimize erosion and the establishment of invasive weeds.

4. System Road Reconstruction- Road reconstruction would include reconstruction to meet standards and guidelines of the Northwest Forest Plan, in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen the risk of erosion (USDA & USDI, 1994; ROD C 32-33), while providing for safe, cost-efficient timber haul.

    a. Road Reconstruction would include: Placement or replacement of surface rock; the replacement of approximately 25 ditch relief culverts; armoring culvert outlets; stabilizing road fills and road shoulders; and the replacement of 15 undersized or deteriorated stream crossings where failure is imminent. Road reconstruction work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

5. Road maintenance- Road maintenance would be implemented in order to meet the Standards and Guidelines of the Northwest Forest Plan which are designed to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (USDA & USDI, 1994; ROD C 32-33), while providing for safe, cost-effective timber haul.

    a. Road maintenance would occur on up to 91 miles of existing National Forest System roads to facilitate log haul. This work would include: brushing roadsides and blading roadbeds; placing or replacing surface rock; cleaning ditches and culverts; falling danger trees to meet OSHA safety requirements; grading and shaping of existing road surfaces; constructing water bars; installation of waterbars and cross ditches; bridge maintenance; and opening existing closed roads and re-closing after use. Work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

    b. Road maintenance would include the use of quarries, stockpiles, and waste disposal sites within the Lemon Butte project area boundary.

6. Similar and connected actions would include the following activities:

    a. Underplanting- Necessary to accelerate development of late successional habitat characteristics, specifically a multi-storied stand structure. Planting would occur on 55.5 acres within ½- and 1-acre gaps and would utilize native seedling species planted in appropriate landscape positions and growing sites.

b. Sub-soiling and native seeding- All landings, temporary roads, and skid trails, would be subsoiled, covered with slash, and in some cases seeded with native grass seed.

c. Invasive Weed Management- Includes weed management and removal within the project area to be completed over a three year period.

d. Snags/Down Wood- Create snags and coarse woody debris, to enhance wildlife habitat and create natural features on the landscape where there are deficiencies in treated units.

e. Instream Habitat Restoration- Approximately 5 miles of Steamboat Creek has been identified for instream restoration activities. Individual restoration sites would typically occupy up to 0.1 acre per site and be limited to within one potential tree height of the stream banks. In the 5 mile reach up to 50 sites may be selected resulting in approximately 5 acres were activities may occur. Instream restoration activities would include placement of upslope-sourced large wood, placement of large boulder complexes, and placement of riparian-sourced trees into Steamboat Creek within the project area boundary. Methods of placement may include the use of helicopters and ground based equipment. Ground based equipment would be predominantly restricted to existing road prisms using cables to place the instream habitat structures.

Decision to be Made

Based on the analysis documented in this Environmental Assessment, the North Umpqua District Ranger would decide the following:

- To implement the project as proposed; to implement a modified version (alternative) of the project that addresses unresolved issues, or to not implement the project at this time (no action).
- If the project is implemented, which monitoring requirements, water quality best management practices, project design features and similar or connected actions are necessary to achieve the resource goals and objectives of the project.
- Whether there is a significant effect on the human environment that would require preparation of an Environmental Impact Statement.

Public Involvement and Tribal Consultation

Public involvement for the Lemon Butte Project began with the publishing of the May 2014 Schedule of Proposed Actions (SOPA). A scoping notice describing a draft proposed action was sent to approximately 80 members of the public on August 19, 2014, which initiated the scoping period. The scoping letter also included an open invitation to attend a public field trip to the project area on September 12, 2014. Eleven members of the public attended the field trip.

The Lemon Butte interdisciplinary team received eight letters from the public; seven letters were supportive with suggestions and one letter was against. The Confederated Tribes of Grand Ronde Indians, the Confederated Tribes of Siletz Indians, and the Cow Creek Band of Umpqua Indians'

Tribal governments were sent a letter describing the project and solicited comments, however no comments were received.

The scoping letter included a project level Forest Plan amendment that would allow thinning up to the boundary of unique dry habitats and within 50 feet of unique mesic to wet habitats. The Forest completed a Programmatic Forest Plan Amendment for Unique and Mosaic Habitats in January 2015 which permanently amended the Forest Plan and changed the C5-I and C5-III prescriptions to allow for commercial timber harvest and firewood cutting within 150 feet of unique and mosaic habitats. The change in Forest Plan prescriptions is critical to restoring natural disturbance regimes and improving habitat for the diverse plants and animals occupying these areas. Since the Forest Plan has been amended, a project level amendment is no longer necessary.

The scoping letter also included treating a 6,058 acre natural stand prescribed fire area in the proposed action. The prescribed fire area has been removed from this EA and is discussed as an alternative eliminated below. A letter was sent to the scoping mailing list describing this change on May 20, 2015.

On November 9, 2015 another update letter was sent to inform the public that the commercial thin portion of the proposed action was reduced from 1,046 to 603 acres. After additional field review it became clear that some areas within the initially proposed units already met density prescription objectives. Additionally, some of these areas already have small openings with species and structural diversity considered characteristic under a natural disturbance regime. The Deciding Official determined that silviculture treatments in these areas would be unwarranted

The Lemon Butte administrative record contains a detailed scoping summary that describes Forest Service outreach efforts, the scoping comments received for the project, and how the Forest Service addressed scoping comments in the Lemon Butte EA.

Issues and Concerns

Issues associated with a proposed action are unresolved conflicts expressed in terms of cause and effect relationships. In an Environmental Assessment, issues can help drive alternative development, be resolved through the addition of mitigation measures or project design features, or are carried forward into analysis to better inform the responsible official (40 CFR 1502.14).

The interdisciplinary team considered the scoping comments to identify potential issues and any potential effects of the Proposed Action. No issues that would drive new alternatives were identified by the team for the project. However, commenters did request consideration of additional alternatives, which are discussed in Chapter 2, and further clarification and analysis of the several concerns, listed below and discussed in Chapter 3.

Issues Resolved by Clarifying the Proposed Action, Additional Mitigation Measures, or Further Discussion in Chapter 3:

Several concerns were resolved by clarifying the proposed action, by further discussing issues with the people who raised them, or by further refining the proposed action and mitigation measures. These issues did not require the development of an alternative to the proposed action. These are discussed below by category.

Concerns resolved by clarification or refinement of the Proposed Action

Comments suggesting that road construction should be avoided or minimized was addressed by clarifying the Proposed Action, as no new permanent roads are proposed in association with this project, and all temporary spur roads would be obliterated after use. Also, temporary spur road work decreased from 6.5 miles during scoping to 3.25 miles due to further refinement of the Proposed Action after the scoping period.

Concerns were raised regarding commercial thinning activities and landings in Riparian Reserves and a suggestion was made to avoid these activities when possible. This concern was addressed during further refinement of the proposed action after the scoping period. The result was a decrease of approximately 200 acres of commercial thinning and 10 landings in Riparian Reserves.

Concerns were raised for the need of "skips" and "gaps" in the treatment units. The silviculture section in Chapter 3 clarifies that untreated areas "skips" and heavy thin areas "gaps" are a tool used to meet LSR diversity requirements. The South Cascades Late Successional Reserve Assessment (SCLSRA, p. 141; USDA, 1998) specifically states that in order to be exempt from Regional Ecosystem Office (REO) Review commercial thinning treatments in stands under 80 years old must

"…increase diversity within relatively uniform stands by including areas of variable spacing as follows:

> *1). Ten percent or more of the resultant stand would be in unthinned patches to retain processes and conditions such as thermal and visual cover, natural suppression and mortality, small trees, natural size differentiation, and undisturbed debris.*
>
> *2). Three to 10 percent of the resultant stand would be in heavily thinned patches (i.e., less than 50 trees per acre), or in openings up to 1/4 acre in size, to maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity.*
>
> The Lemon Butte proposed action includes openings (gaps) over ¼ acre in size, therefore is subject to REO review. Please see the silviculture section in Chapter 3 for more information.

Several comments referenced or suggested system road decommissioning. Lemon Butte EA Proposed Action does not include road decommissioning. All temporary roads would be obliterated after use.

A commenter suggested that temporary roads be considered as candidates for permanent roads in the anticipation of future needs. The proposed temp roads are short spurs used to access specific units. The proposed treatments in these units are expected to promote the development late successional conditions and reduce the risk of large scale disturbance (p. 50); therefore it is unlikely that these short spurs would be used for access in the future.

Concerns resolved through PDFs, BMPs, and Mitigation Measures, Appendix A

The following comments were addressed through project design features (PDFs), Best Management Practices (BMPs), and mitigation measures that are specifically developed for the purposes of minimizing resource damage.

A commenter expressed concerns about winter haul and equipment restrictions. The Interdisciplinary Team has identified several roads available for winter haul and compiled PDFs, BMPs, and Mitigation Measures to address associated resource concerns.

A commenter is concerned that timber operators may not be fully aware, committed, and/or qualified to achieve the projects restoration goals. These goals are protected by PDFs, BMPs, and Mitigation Measures which will be brought forward into timber sale contracts.

A commenter expressed concerns about hardwoods being crushed during operations. Timber sale contracts protect residual trees in several provisions. Some examples include T.S. Contract provision C2.35 which requires only listed tree species be cut and T.S. Contract provision B6.32, "Protection of Residual Trees," states that operations shall not unnecessarily damage young growth or other tress to be reserved.

Some commenters were concerned about the spread of weeds. The treatment of invasive weeds is included as a connected action, analyzed in Chapter 3, and is discussed in the Project Design Features.

Concerns were raised regarding thinning activities and landings in Riparian Reserves and a suggestion was made to avoid these activities whenever possible. The Lemon Butte Project is consistent with the Aquatic Conservation Strategy. Starting on page 146 it is discussed how the activities proposed in the Action Alternative conform to the nine ACS objectives. In addition many PDFs, BMPs, and monitoring activities in Appendix A were developed and included specifically to minimize and avoid effects to riparian areas. These measures are found throughout the Appendix, particularly under the subheading entitled Riparian Areas Within or Adjacent to Cutting Units.

Concerns carried forward into analysis, Chapter 3

A commenter expressed concern that the Umpqua N.F. needs to propose economically viable timber sales that meet the socio-economic goals identified in the LRMP: *"The LRMP provides the opportunity for maintenance and enhancement of income and employment through the provision of ASQ approximating historical levels" (LRMP III-6).* The Lemon Butte Project is predicted to result in a positive timber sale contract, indicating the sale(s) would receive bids in a competitive market. For more information see the economic analysis section, starting on page 172.

Concerns were expressed about building new temporary roads, especially on decommissioned road beds.

- Ecological effects of all temporary roads are addressed in the soils (p. 126, 164), hydrology (p. 140, 144), and fisheries (p. 158), botany sections (p. 100).
- The current condition of the decommissioned road bed as well as the date of the previous decision and decommissioning is disclosed in the engineering section. See page 184.
- The cost of using decommissioned footprints is disclosed in the engineering section. See page 184.

Several commenters expressed concern about the economic viability, ex. lack of funds, for the prescribed burn area. The prescribed burn area has since been removed from the EA, for reasons independent of economic viability. See Table 32 for an economic summary of the project.

Comments regarding residual stand variability and the need for clumps is addressed in the silviculture section. In summary, "clumping" is included as part of the prescription and uniform spacing is not desired (p.55).

Concerns were raised regarding whole tree yarding and the resultant down woody debris and burning of slash. This is addressed the in the fuels (p.115) and soils sections (p. 119-130).

Concern was expressed regarding snags and down wood, the effects to which are disclosed in the wildlife section. Proposed activities may result in short term loss of snag and down wood through harvest and burning activities, however to mitigate these losses active snag and down wood creation would be utilized following timber harvest. A watershed level analysis can be found in the Coarse Woody Debris section pages (93-94) and for relevant species related to snags and down wood a more detailed analysis can be found in the Cavity Nesters (pages 90-92) and Northwest Forest Plan Snag Retention Species (p. 92) sections.

Comments were received requesting an explanation of the need for thinning in Riparian Reserves to achieve Aquatic Conservation Strategy (ACS) objectives and which ACS objectives would be met by the Proposed Action. The Lemon Butte Project is consistent with the Aquatic Conservation Strategy. See page 146 for an analysis of the Proposed Action in relation to the nine ACS objectives.

Concerns were raised about gap size, specifically why the gap size is larger than the ¼ acre recommended in LSR direction. Pages 52-54 discusses the need for gaps larger than a ¼ acre. In summary larger gap sizes are better replicate natural disturbances, increase structural diversity, and promote the successful establishment of native sugar pine seedlings.

A commenter questions the need to replant conifers in gaps and associated ecology. Desired native conifer species are being planted in gaps to meet the first element of the purpose and need: restore the species and structural composition consistent with natural disturbance regimes. See page 52-54 for more discussion about the objectives of reforestation and associated ecology.

Project Implementation

Should one of the action alternatives be selected, the Forest Service would implement the timber harvest, road construction and reconstruction through timber sale contracts. In the course of implementing complex harvest projects with several fuels treatments and connected actions, minor changes may be needed during implementation to better meet on-site resource management and protection objectives. In determining whether and what kind of further NEPA action is required to document any changes, the criteria for whether to supplement an existing Environmental Assessment (Forest Service Handbook 1909.15 sec. 18) would be followed.

Chapter 2- Proposed Action and Alternatives

Introduction

The National Environmental Policy Act (NEPA) requires analysis of a proposed action and other reasonable alternatives, including no action. The no action alternative provides a baseline for estimating environmental effects. One action alternative will be analyzed in detail. Other alternatives were considered, but eliminated from detailed study.

Alternatives Considered, but Eliminated from Detailed Study

Alternative including 6,058 acre prescribed fire treatment area

The scoping letter included a 6,058 acre prescribed fire treatment area in the proposed action. The proposed action element read: "a low intensity prescribed fire would be used to treat a 6,058 acre natural stand area. Prescribed burning would reduce fuel loading in the 0-3" size classes and remove excess understory and ladder fuels in the Upper Canton and Upper Steamboat Watersheds." During the Chapter 3 analysis period, as discussions evolved with the interdisciplinary team, regional specialists, and the US Fish & Wildlife Service it was determined that there was a need to do more analysis, modeling, and refinement of the prescribed fire area in order to ensure a successful prescribed burn for all resources. At that time the Responsible Official decided to remove the prescribed fire area from the EA and pursue it in the future as a stand-alone project. Therefore it will no longer be included within the Lemon Butte Environmental Analysis.

Develop an alternative that reduces negative carbon and climate change impacts

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fourth Assessment Report (IPCC 2007). The top three 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 the removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

The Lemon Butte project does not fall within any of these main contributors of greenhouse gas emissions. Forest land would not be converted into a developed or agricultural condition. Forest stands are being retained and thinned to maintain a vigorous forested condition that can continue to support trees and sequester carbon long-term. During scoping it was specifically requested the Forest Service develop an alternative that reduces negative carbon and climate change impacts by (a) deferring harvest of older forests to store carbon and provide biodiversity and connectivity and (b) thin younger stands to increase forest resilience and diversity and connectivity. Since this project does not fall within the main contributors of greenhouse gas emissions, doesn't harvest older forest and is treating young stands, no additional alternative is being considered.

Develop an alternative that uses NWFP recommended buffer widths on all intermittent streams

A commenter requested that we analyze an alternative that uses the full recommended buffer widths on all intermittent streams to prevent excess sedimentation, water temperature increases, and further decreasing down and woody materials. The Lemon Butte Project proposes using a 25'

no-cut buffer on intermittent streams and the suggested alternative would change the no-cut buffer size to 85'. Within the expanded 85' buffer non-commercial activities could occur, such as snag and coarse woody debris creation.

This request for an additional alternative was thoroughly considered by the Interdisciplinary Team, specifically the Forest Hydrologist and Fisheries Biologist. Their conclusion, which was accepted by the Responsible Official, is as follows. Intermittent channels are typically of lesser importance to fish bearing streams than perennial streams. Intermittent streams do not tend to transport large wood down the stream continuum. Large wood in intermittent streams can affect peak flow velocity in the intermittent as well as downstream channels. This is especially true when the surrounding land area dissected by the intermittent stream is managed in a way that decreases hydrologic recovery (HRP) and increases overland and peak flows. The thinning we are proposing is designed to minimize the potential to increase either of these events. Across the watershed we would be treating a very small percentage of intermittent stream riparian acres. Any effect of maintaining an 85 foot buffer vs a 25 foot or slope break buffer (>25 ft) on intermittent channels upon the sediment regime, stream temperatures, and wood routing is immeasurable at the 6th field watershed scale. See the Chapter 3, pages 144-146, for further discussion of the effects of Riparian Reserve thinning.

Develop an economically preferable alternative

Two groups requested that we increase economic viability by treating more acres in the project area. Each group had a different reason for the request.

One group requested that we treat natural stands in and around the prescribed fire area to create a thinned fuel break in order to have a greater landscape scale effect. It was suggested that the additional receipts could then be used to better fund the prescribed burning. The prescribed fire area has been removed from the EA, therefore additional receipts to fund the burn are no longer relevant. Although, pertinent to this request and others about additional receipts, the Lemon Butte Project is within LSR and therefore its goal is to promote the development and maintenance of late-successional forest conditions in existing even-aged stands in LSR through the three purpose and need objectives; treating natural stands would be outside the scope of this project.

The other group requested that we lower the minimum age of a stands to be treated to below 45 years to include the stands they identified in the field as viable and needing treatment, stating that adding these stands would increase the economic viability of potential timber sales. This alternative was eliminated from further study because the stand age of 45 is a silviculturally appropriate cut off age. Although this group identified several stands that could be treated, the majority of 45 year old stands in the project are not ready for treatment. Most of this age cohort will remain on the landscape so these trees can continue to grow and be treated together in the future.

Alternative without one acre gaps

A group requested that we limit or remove one acre gaps from the proposed action. The Lemon Butte Interdisciplinary Team considered this as an alternative, but it was ultimately eliminated from further study for the following reasons. One acre gap sizes are needed to meet the first element of the Lemon Butte's purpose and need, restoring the species and structural composition consistent with natural disturbance regimes. One acre gaps are needed to promote the successful establishment of sugar pine seedlings, see the Restoration of Sugar Pine and Gap Size rational starting on page 52. Sugar pine reforestation is a key design feature of Lemon Butte tied to restoring species composition consistent with natural disturbance regimes. Gap sizes of half acre

and one acre better align with historic fire severity data which show fire events create average openings of 2.3 acres in the planning area, see page 53. This ties to the second half of the purpose and need element, restoring structural composition consistent with natural disturbance regimes. Gaps are also in line with the first principle objective of silviculture treatment in LSRs, which is to "Promote the development of old-growth forest characteristics in young stands, including… *and canopy gaps that enable establishment of multiple tree layers (vertical diversity) and diverse species composition.*" Gaps larger than ¼-acre in extent are subject to Regional Ecosystem Office (REO) review for consistency with Standards and Guidelines (S&Gs) under the Northwest Forest Plan (NWFP). The REO has determined consistency with North West Forest Plan and issued a letter of concurrence dated February 1st, 2016.

The proposed action proposes 46 acres of gaps, 24 of which are one acre gaps. Gaps represent 7% of the treatment acres which is within the 3-10% heavy thin patches required by the South Cascades Late Successional Reserve Assessment (SCLSRA). The team took into consideration limiting the number gaps, especially one acre gaps, and reduced the percentage of gaps after scoping down from the maximum allowed, 10%, to the current 7%. The total acres treated in gaps represent less than 0.001% of the planning area.

Alternative with a reduction of temporary road construction

The Lemon Butte Interdisciplinary Team considered an alternative that would further reduce temporary road construction. Instead of developing a separate alternative, the team approached the proposed action as the alternative with the smallest temporary road construction footprint possible while still meeting the purpose and need.

Road construction required to access units was a key consideration in the early refinement of the proposed action. Many units were eliminated due to the ecological and/or economic cost of the road construction needed to enter those stands being too high. In order to include all the initial units, the project proposal needed to include much more temporary road construction, new permanent system road construction, and more re-opening of previously decommissioned roads. Specifically, 8 units totaling 376 acres, located in the southwest corner of the project area were dropped due to the need to construct 8.3 miles of permanent system roads. This was outside of the scope of the project and not required to meet the purpose and need.

During further refinement of the proposed action the temporary road construction proposed during scoping was reduced from 6.5 miles to 3.25 miles, largely due to the reduction in acres during further stratification. Any additional reduction in road footprints would force many additional units to be dropped from the project. This reduction would be large enough that the purpose and need would not be met.

Alternative treating original proposed action

The original Lemon Butte proposed action included 1,650 acres of commercial treatments. This proposed action was derived from an initial grouping of all stands in the project area within the age cohort of 45-60 years. The result was a large group of stands that were then evaluated for treatment and systematically dropped as needed for various ecological reasons. The remainder of the stands were then included in the proposed action to be further analyzed. During the further analysis of these stands it became clear that some areas within proposed units already met density prescription objectives. Additionally, some of these areas already have small openings with species and structural diversity considered characteristic under a natural disturbance regime. The Deciding Official decided silviculture treatments in these areas would be unwarranted. This resulted in the further stratification of the stands and based on these revisions, the commercial

thin portion of the proposed action dropped to the current 603 acres proposed for commercial treatment.

Alternative 1 – No Action

Under Alternative 1, no thinning, fuel treatment, road reconstruction, or other similar or connected activities would occur. No ground-disturbing activities would take place and no timber would be offered for sale. Future and on-going activities, including road maintenance, recreation use, and noxious weed control would continue to occur.

Alternative 2 – Proposed Action

This alternative is the proposed action described in the scoping process and was designed to meet the purpose and need for the project.

1. Commercially thin approximately 603 acres of stands 45-59 years of age, utilizing a range of silviculture prescriptions that would retain approximately 50 trees per acre (tpa). Gap creation (1/2-acre and 1-acre openings) is proposed for 3-10% of each timber sale unit's individual area to initiate structural diversity and understory vegetation development; all prescriptions are designed to increase growth, health, and vigor of the leave trees and are anticipated to result in approximately 11 million board feet of timber.

    a. Approximately 185 acres of ground-based, or mechanized, logging systems and 418 acres of skyline logging systems would be employed to implement the thinning prescriptions. Mechanized equipment is generally utilized on slopes under 35% and skyline systems over 35% slope. Landings would be used in both the skyline and ground based units. The average landing size would be about 0.50 acres in both skyline and ground-based units.

    b. Wet season logging and haul was identified for approximately 180 acres of skyline units. Haul may occur on designated roads only as described on pages 185-187. Resource concerns would be mitigated by the use of additional PDFs, BMPs, and Mitigation Measures as described in Appendix A.

    c. Generally, felled material down to a six inch diameter top would be yarded and removed from the site and material from six to three inch diameter tops would be brought to the landings. Whole-tree yarding could occur, provided enough slash remains on site to meet temporary spur road obliteration and winterization requirements. Yarded material may be chipped, left on the landing for firewood cutters, processed into biochar, or burned.

    d. The activity fuels, or slash, would be treated on approximately 310 acres, in order to break up continuity of the fuels throughout the timber sale units. Methods of treatment would include grapple piling, hand piling, and springtime prescribed underburning in units 31, 54, & 69 (37.9 acres). Approximately 1.3 miles of hand line would be constructed to support areas of

underburning. Landing piles would be burned. Implementation of these treatments would be subject to a post-harvest fuels assessment.

e. Harvest would occur within Riparian Reserves outside of no-cut buffers. No-cut buffers would be a minimum of one tree height, 180 feet, on each side of stream channels along fish-bearing (class 1 and 2) streams. Non-fish bearing perennial stream (class 3) no-cut buffers would be 85 feet on each side of stream channels, and non-fish bearing intermittent stream (class 4) no-cut buffers would be 25 feet each side of stream channels. Where instability or slope breaks are present, buffers may be widened to protect sensitive riparian areas. Harvest acres within riparian reserves, but outside the established no-cut buffers are estimated as follows:

i. Fish bearing streams (class 1&2): approximately 13 acres

ii. Perennial non-fish bearing streams (class 3): approximately 5 acres

iii. Intermittent, non-fish bearing, streams (class 4): approximately 20 acres

iv. No more than 12 landings would exist within Riparian Reserves. These landings would occur on the outer upslope edges of the Riparian Reserves outside of the no-cut buffers.

2. Non-commercially thinning from below in Unit 71 would occur on 43 acres to promote fire resiliency in the adjacent owl core and also develop connectivity to the surrounding suitable habitat for Northern Spotted Owls.

3. Road Work Implementation: No new permanent system roads would be constructed and all temporary roads would be obliterated after use.

a. <u>New temporary road construction</u>- Approximately 0.5 miles of new temporary road would be constructed to gain access into thinning units, none of which would be located within Riparian Reserve areas or within no harvest buffers.

b. <u>New temporary road construction on previously decommissioned road</u>- Approximately 1.25 miles of new temporary road would be constructed on the existing footprint of previously decommissioned roads to gain access into thinning units. No construction would be located within Riparian Reserve areas or no-harvest buffers. The previously decommissioned roads proposed for use include 3806-495, 3821-060, and 3828-148.

c. <u>Existing temporary road reconstruction</u>- Approximately 1.5 miles of temporary spur routes to gain access into thinning units would be located on the existing footprint of skid roads, fire lines, and abandoned or unclassified roads that were built to access the original harvest units. No construction would be

located within Riparian Reserve areas or no-harvest buffers. Reconstruction would give the Forest Service the opportunity to properly obliterate and hydrologically restore these roads after temporary use.

d. Temporary road obliteration – After use, approximately 3.25 miles of temporary roads would be obliterated with an excavator equipped with a "winged subsoiler" to de-compact soil as needed. Any excavated material, including soil and woody material, would be pulled back over the road. A native forage seed mix would be applied to all subsoiled temporary roads and landings to minimize erosion and the establishment of invasive weeds.

4. System Road Reconstruction- Road reconstruction would include reconstruction to meet standards and guidelines of the Northwest Forest Plan, in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen the risk of erosion (USDA & USDI, 1994; ROD C 32-33), while providing for safe, cost-efficient timber haul.

    a. Road Reconstruction would include: Placement or replacement of surface rock; the replacement of approximately 25 ditch relief culverts; armoring culvert outlets; stabilizing road fills and road shoulders; and the replacement of 15 undersized or deteriorated stream crossings where failure is imminent. Road reconstruction work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

5. Road maintenance- Road maintenance would be implemented in order to meet the Standards and Guidelines of the Northwest Forest Plan which are designed to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (USDA & USDI, 1994; ROD C 32-33), while providing for safe, cost-effective timber haul.

    a. Road maintenance would occur on up to 91 miles of existing National Forest System roads to facilitate log haul. This work would include: brushing roadsides and blading roadbeds; placing or replacing surface rock; cleaning ditches and culverts; falling danger trees to meet OSHA safety requirements; grading and shaping of existing road surfaces; constructing water bars; installation of waterbars and cross ditches; bridge maintenance; and opening existing closed roads and re-closing after use. Work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

    b. Road maintenance would include the use of quarries, stockpiles, and waste disposal sites within the Lemon Butte project area boundary.

6. Similar and connected actions would include the following activities:

    a. Underplanting- Necessary to accelerate development of late successional habitat characteristics, specifically a multi-storied stand structure. Planting would occur on 55.5 acres within ½- and 1-acre gaps and would

utilize native seedling species planted in appropriate landscape positions and growing sites.

b. Sub-soiling and native seeding- All landings, temporary roads, and skid trails, would be subsoiled, covered with slash, and in some cases seeded with native grass seed.

c. Invasive Weed Management- Includes weed management and removal within the project area to be completed over a three year period.

d. Snags/Down Wood- Create snags and coarse woody debris, to enhance wildlife habitat and create natural features on the landscape where there are deficiencies in treated units.

e. Instream Habitat Restoration- Approximately 5 miles of Steamboat Creek has been identified for instream restoration activities. Individual restoration sites would typically occupy up to 0.1 acre per site and be limited to within one potential tree height of the stream banks. In the 5 mile reach up to 50 sites may be selected resulting in approximately 5 acres were activities may occur. Instream restoration activities would include placement of upslope-sourced large wood, placement of large boulder complexes, and placement of riparian-sourced trees into Steamboat Creek within the project area boundary. Methods of placement may include the use of helicopters and ground based equipment. Ground based equipment would be predominantly restricted to existing road prisms using cables to place the instream habitat structures.

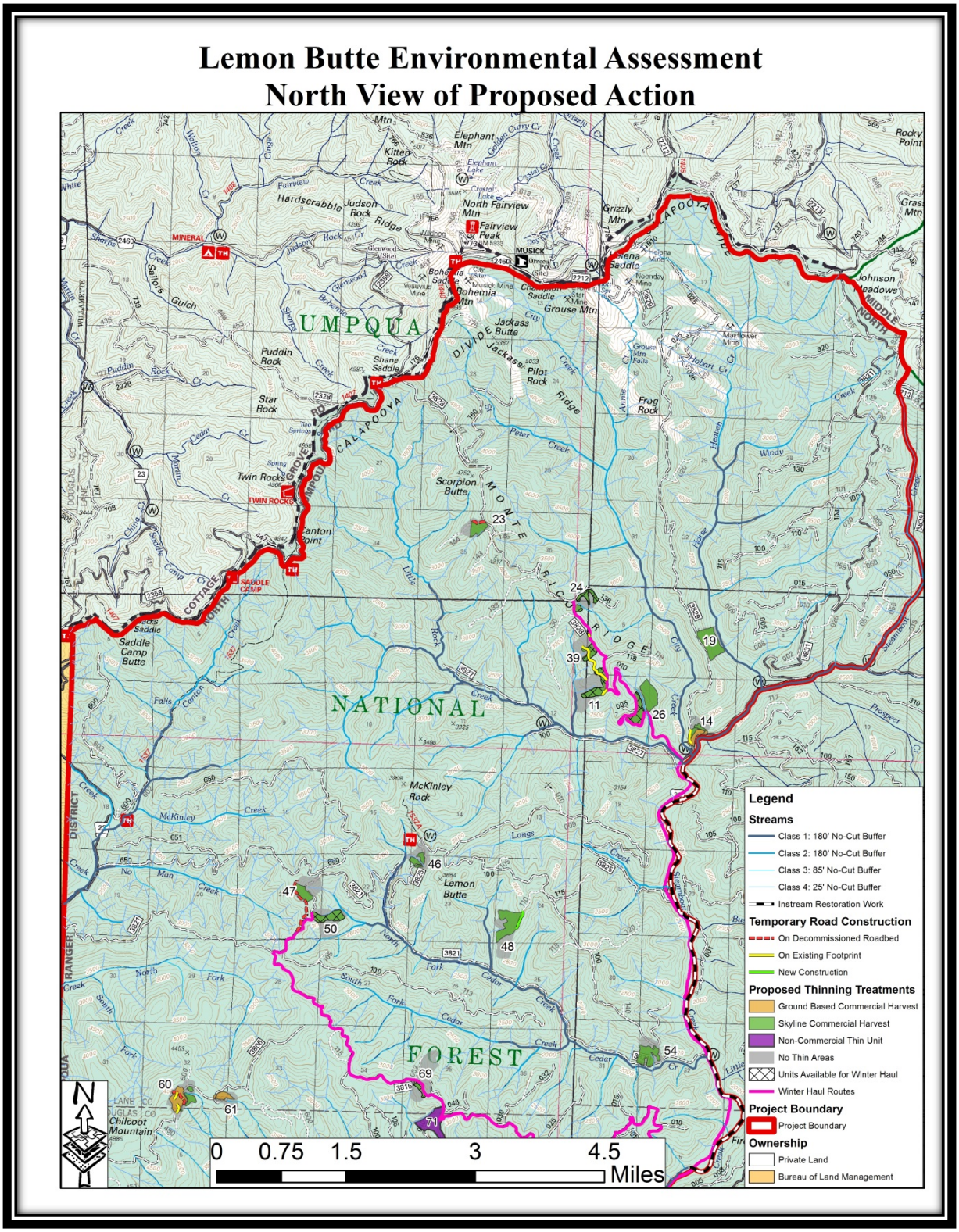


Figure 2. North View of Lemon Butte Proposed Action

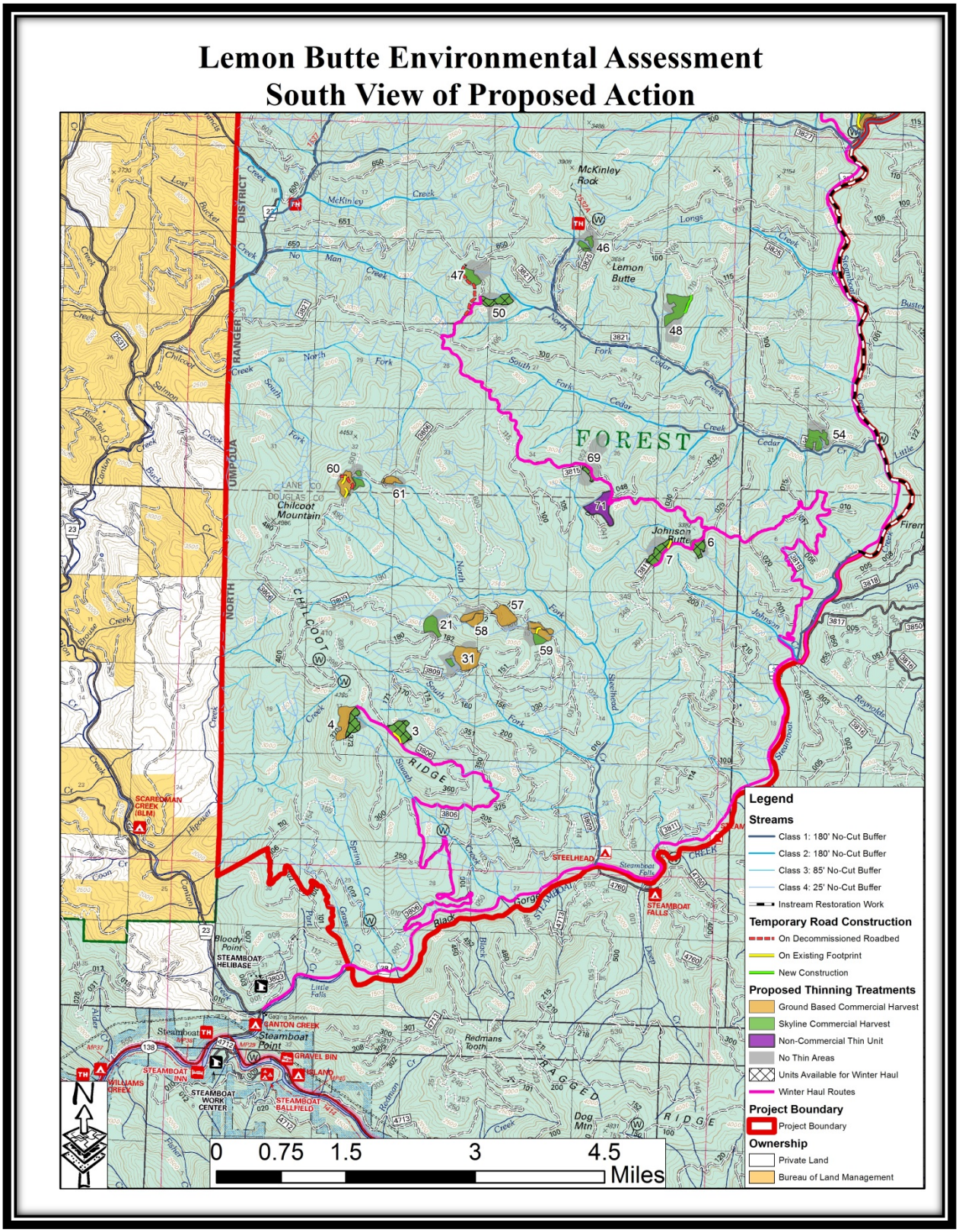


Figure 3. South View of Lemon Butte Proposed Action

Table 1. Proposed Commercial Thin Units Details

Unit	Original Unit Acres	No Thin (acres removed)		Final Unit Acres	Riparian Reserve Acres Treated	Thinng Prescription (acres)	Gap Treatments		Total Volume (mbf)	Acres of Reforestation Within Heavy Thinning & Gap Treatments			Logging System		Fuels Treatment				
		Acres	% Unit Acres			Moderate Thinning (50+ tpa)	# 1/2-acre Gaps	# 1-acre Gaps		Sugar Pine	Incense Cedar	Western Redcedar	Skyline Harvest (acres)	Ground Based (acres)	Grapple Pile (acres)	Hand Pile (acres)	Under-burn (acres)	Handline (miles)	Number of Landings
3	33.7	5.8	17	27.9	0.3	25.9	2	1	549	1	1	0	27.9	0.0		15			5
4	57.8	7.6	13	50.2	0.6	45.2	4	3	979	2	2	1	20.2	30.0	16	11			8
6	27.5	12.2	44	15.3	0.1	13.8	1	1	254	1.5	0	0	15.3	0.0		8			3
7	43.6	19.9	46	23.7	1.0	21.7	2	1	450	1	1	0	23.7	0.0		13			4
11	83.3	56.8	68	26.5	0.8	24.0	3	1	563	2	1	3	26.5	0.0		15			4
14	31.0	14.6	47	16.4	3.7	15.9	1	0	359	0	1	0	6.5	9.9	5	3			3
19	52.7	12.0	23	40.7	5.7	39.2	3	0	1154	0	1	0	40.7	0.0		22			7
21	40.1	20.9	52	19.2	0.7	18.2	2	0	343	0	0	1	19.2	0.0		11			3
23	33.9	18.1	53	15.8	0.7	14.3	1	1	319	1	1	0	15.8	0.0		9			3
24	33.8	18.9	56	14.9	1.0	13.9	2	0	232	1	0	1	14.9	0.0		8			3
26	65.0	12.7	20	52.3	3.0	50.3	4	0	774	1	0.5	2	52.3	0.0		29			9
31	76.2	30.8	40	45.4	2.2	40.9	5	2	754	3	2	1	3.5	41.9	23		3.5	0.3	7
39	43.5	28.9	66	14.6	0.1	13.6	0	1	185	1	1	0	14.6	0.0		8			3
46	35.7	25.3	71	10.4	3.1	9.4	0	1	100	1	1	0	10.4	0.0		6			2
47	49.3	33.9	69	15.4	0.0	14.4	0	1	148	0	0	1	15.4	0.0		8			3
48	74.4	36.0	48	38.4	0.9	35.9	3	1	614	0.5	1	0	38.4	0.0		21			6
50	61.7	40.6	66	21.1	4.7	19.1	0	2	529	0.5	0.5	1	21.1	0.0		12			4
54	48.7	21.6	44	27.1	5.2	25.1	0	2	346	1	0	1	27.1	0.0			27.1	0.71	5
57	35.5	8.2	23	27.3	0.0	24.8	3	1	605	1	0.5	0	0.0	27.3	15				5
58	32.4	11.4	35	21	1.7	18.0	2	1	417	1	1	0	0.0	21.0	12				4
59	45.3	15.5	34	29.8	1.5	26.8	0	3	657	1	1	1	8.0	21.8	12	4			4
60	59.4	26.5	45	32.9	1.0	30.9	2	1	609	1	1	2	8.9	24.0	13	6			4
61	27.5	18.6	68	8.9	0.0	8.4	1	0	164	0.5	0.5	0	0.0	8.9	5				2
69	70.6	63.3	90	7.3	0.0	6.8	1	0	117	0	0	0.5	7.3	0.0			7.3	0.33	2
	1162.6	**560.1**	**48%**	**602.5**	**38.0**	**556.5**	**42**	**24**	**11,220.14**	**22**	**18**	**15.5**	**417.7**	**184.8**	**101.0**	**209.0**	**37.9**	**1.3**	**103.0**
							46 total gap acres			**55.5**	**acres reforestation**								

Comparison of Alternatives

Table 2 compares the alternatives by the elements of the purpose and need and summarizes other actions or effects.

Table 2. Comparison of Alternatives

	Alternative 1 "No Action Alternative"	Alternative 2 "Action Alternative"
Measures that apply to all purpose and need elements or summarize an action		
Acres commercially treated • Skyline (acres) • Ground Based (acres) • Volume Removed (mbf)	0 0 0 0	603 418 185 11,220
Acres non-commercially treated	0	43
Riparian Reserve Acres Treated	0	38
Temporary Road Use (miles) • New temporary Roads • New temporary Roads built on decommissioned road beds • Existing temporary road reconstruction • Temporary road obliteration	 0 0 0 0	 0.5 1.25 1.5 3.25
Restore the species and structural composition consistent with natural disturbance regimes		
Moderate Thin (50-70 tpa) acres treated	0	556.5
Acres of gaps created to initiate structural diversity and understory growth	0	46
Acres analyzed but left untreated (skips)	1,650	560
Acres reforested with native seedlings	0	55.5
Invasive Weed Management (acres)	0	70
Accelerate late seral characteristics in early to mid-seral stands to promote high quality, more resilient wildlife habitat.		
Acres of dispersal habitat maintained	1,163	1,163
Non-commercial acres treated for resiliency adjacent to high quality habitat (acres)	0	43
Snag Creation Acres	0	603
Instream Habitat Restoration (acres)	0	5
Promote the development of a more fire resilient landscape, by reducing fuel loading and continuity, which reduces the probability and effects of large scale wildfires and makes management of fires safer and more effective.		
Activity Fuel Treatments (acres) • Grapple Pile • Hand Pile • Underburn	 0 0 0	 101 209 38
Acres treated that would increase fire resiliency and progress towards a low fire regime condition class • Short term (<10 years) • Long term (>10 years)	 0 0	 38 348

Best Management Practices, Project Design Features, Mitigation and Monitoring Measures

The following measures address the laws, regulations and policies that relate to reducing potential environmental effects. These requirements apply to the action alternative. Project Design Features (PDFs) are defined as actions that:

- avoid the impact all together (such as avoiding harvest on unstable land);
- minimize effects by limiting the degree or magnitude of the action;
- rectify the impact via rehabilitation or restoration activities;
- reduce the impact over time through recurring operations such as road maintenance.

Best Management Practices (BMPs) protect the beneficial uses of water and address water quality objectives as required by the Federal Clean Water Act (USC 2002) and the 1990 Forest LRMP. The BMPs are listed by codes used in the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA, FS-990a, 2012) which is available here: http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

As a summary, "the Forest Service National BMP Program is the agency's nonpoint pollution source pollution control for achieving and documenting water resource protection" (USDA, FS-990a, 2012). The "Implementation and monitoring of these Best Management Practices is the fundamental basis of the Forest Service water quality program to protect, restore, or mitigate water quality impacts from activities on NFS lands" (USDA, FS-990a, 2012). The 2012 National Core BMPs are hereby incorporated by reference.

In this section the PDFs and mitigation measures that are unique, unit-specific mitigations, for the Lemon Butte Project are described. This is not an all-inclusive list; Appendix A contains the full list of all BMPs, PDFs, or mitigation measures that apply to the Lemon Butte Project and should be reviewed at the end of the EA. It is worth noting that the following BMP sections have been modified within recent years for Umpqua N.F. projects and should be carefully reviewed in Appendix A: Chemical Use Management Activities, Road Management Activities, and Mechanical Vegetation Management Activities.

Unit Specific Project Design Features

Wildlife Mitigations

- To protect nesting spotted owls, for proposed and connected actions that create above-ambient noise levels within 60 meters of known spotted owl nesting sites or un-surveyed suitable habitat (i.e. road maintenance, chainsaw use, heavy equipment use, or haul). When possible, do not schedule these activities to occur between March 1 and July 15.
    - These seasonal restrictions apply to units: 3,6,7,11,14,19,21,23,24,26,31,46,48,50,54,60,61
- Unit 48- To reduce impacts to Spotted owls during nesting season, road construction for the temporary road will follow seasonal restrictions (March 1st- July 15th). In addition to this, any trees over 20"DBH that need to be felled during construction will be dropped into the adjacent stand, to the east of the road.

Botanical Management

- In units containing dry unique habitats, units 7, 11, 14, and 50, harvest activities will not occur within these habitats and trees will be directionally felled away from the edges. (Umpqua N.F. LRMP, Unique & Mosaic Forest Plan Amendment).

Vegetation Management

- Reforestation activities would occur in units containing gap prescriptions.

Logging

- Allow for artificial Guyline anchors (Deadmen) in unit 24 if adequate natural anchors (trees and/or stumps) are not available.
- Wet season logging and haul was identified for approximately 180 acres of skyline harvest; units 3, 4, 6, 7, 11, 24, 26, 39, 50 and 69. Haul may occur on designated roads only as described on pages 185-187 of this document. Haul would be subject to contract specifications, Forest Road Rules, and additional PDFs, BMPs, and Mitigation Measures as described in Appendix A.

Monitoring

- **Operations**: Contract administrators would monitor treatments during implementation to ensure contractors are in compliance with their contract. Contract elements monitored would include harvest specifications, bole damage to residual trees, down wood and snag retention, skid trail spacing and use of designated skid trails.
- **Fuels Treatments**: Fire and fuels personnel would monitor fuel loading during and following the fuels treatments. Fuels treatment results will offer data to use in the future.
- **National Aquatic Best Management Practice Monitoring**: The National Best Management Practices Program provides a standard set of core best management practices and consistent documentation of the use and effectiveness of the practices. Post-implementation best management practices monitoring may include review of aquatic management zones, erosion prevention and control measures, cable and ground-based yarding operation effects, and site treatment.
- **Forest Plan Implementation Monitoring:** The Forest Supervisor’s Staff performs annual project monitoring at each Ranger District and compiles the results in the yearly Forest Monitoring Report. Implementation of treatments from this project would be subject to Forest Plan Implementation monitoring. Other implementation monitoring elements may include temporary road decommissioning, snag and large down wood abundance, and any seeding or planting of vegetation.

Chapter 3- Affected Environment and Environmental Effects

Introduction

The Interdisciplinary Team reviewed existing guidance, Forest assessments, relevant literature, and used their professional judgment and knowledge of the Forest to determine how implementation of the proposed alternatives are likely to affect the environment. All discussions are tiered to the Final Environmental Impact Statement (FEIS) of the 1990 Umpqua National Forest LRMP, as amended and the 2005 Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program. This EA incorporates by reference the recommendations and analysis in the 2006 Umpqua Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan. This chapter provides a description of the affected environment in the project area and the expected environmental consequences of the alternatives. The affected environment includes the physical, biological, social, and economic environment and provides the baseline conditions against which environmental consequences are evaluated. This chapter documents analysis prepared by resource specialists.

The expected environmental consequences are disclosed as the direct, indirect, and cumulative effects of implementing the alternatives. **Direct effects** are those caused by the action and occur at the same time and place. **Indirect effects** are those that are a result of the action, but occur later in time or are spatially removed from the activity. **Cumulative effects** are those which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Effects are quantified where possible.

Activities That May Contribute to Cumulative Effects

A wide variety of land use activities have occurred within the project area in the past, continue to occur presently, and may be expected to occur within the reasonably foreseeable future. In 2005 the Council on Environmental Quality issued a memo stating that agencies are not required to “catalogue or exhaustively list and analyze all individual past actions” (CEQ memo, June 24, 2005), therefore, past actions and the activities that are presently occurring on the Forests comprise the existing condition and constitute the baseline for the effects analysis.

The effects analysis is based on reasonably foreseeable consequences under management according to the Umpqua National Forest Land and Resource Management Plan (USDA, 1990 as amended by the NWFP). Reasonably foreseeable future actions are considered those activities, not yet undertaken, that have existing decisions, funding, or proposed actions that are out for public review or comment. Ongoing activities such as road maintenance fluctuate from year to year and an average annual amount was considered for cumulative effects analysis. Table 3 below, summarizes relevant reasonably foreseeable activities that may contribute to cumulative effects of the proposed action and alternatives outlined in Chapter 2.

Table 3. Ongoing and reasonably foreseeable activities in Steamboat 5th field watershed.

Activity	Acres/Miles	Description
Ongoing Activities		
Commercial Thinning	3000 acres	Timber Sales: Rowboat, Sailboat, Lobo, Canoe, Jack, Bloody
Activity Fuels Treatments	1600 Acres	Hand piling, Grapple Piling, Underburning
Ragged Ridge Prescribed Burning	3300 Acres	Natural Stand Underburn
Road Maintenance	To continue as needed	Blading, ditch clean out, and maintenance as budgeted.
Road Decommissioning	Approx. 5 mi	Decommissioning planned through prior NEPA decision within the Steamboat watershed which would remove those elements of a road that reroute hillslope drainage and present slope stability hazards as well as remove culverts, outslope where necessary, subsoil and permanently remove the road from the Forest Transportation System.
Road Maintenance	139 miles	Road maintenance performed by Forest Service and timber sale purchasers including blading and reshaping road surfaces, surface rock placement, brushing, ditch cleaning, slump and slide repair.
Instream Habitat Restoration	3 miles	Large wood placement in Cedar and Little Rock Creeks, specific sites TBD
Invasive Weed Management	To continue as needed	Manual weed management and removal
Snags/ Down Wood Creation	1468	Snag creation within the Rowboat and Sailboat Timber Sale areas.
Private Land Harvest	~ 100 acres/year	Based on harvesting rates of the last decade expect regeneration harvests to average around 100 acres per year but is based on harvesting rates of the last decade expect regeneration harvests to average around 100 acres per year but is highly dependent upon market conditions.
Reasonably Foreseeable		
Fuel Treatment	580 acres	Calapooya Divide EA Proposed Fuels Work

Terrestrial Environment

Forest Vegetation

Forest vegetation management activities include silviculture and fuels treatments designed to approximate the natural range of variability for stand structure, composition, and arrangement across the planning area landscape. These treatments are designed to meet the project purpose and need to promote the development and maintenance of late-successional forest conditions in existing even-aged stands in Late Successional Reserve-222 (LSR) (USDA & USDI, 1994b, C-12). Proposed project activities include silvicultural treatments designed to develop structurally complex stand and landscape structure and species composition within second-growth stands that originated following even-aged management and subsequent planting in the 1950s through the 1970s. A reduction in some natural and activity-generated fuels is an additional beneficial outcome associated with the project.

Regulatory Framework

Land and Resource Management Plan- The vegetation management activities in the Lemon Butte project are consistent with the Umpqua National Forest LRMP as revised under the Northwest Forest Plan and Late Successional Reserve Assessment which superseded the LRMP in most objective areas.

Northwest Forest Plan – Silviculture treatments proposed for the Lemon Butte project are consistent with recommendations in the S&Gs and have two principal objectives:

1. Promoting the development of old-growth forest characteristics in young stands, including large trees, snags, logs on the forest floor, deep tree crowns, and canopy gaps that enable establishment of multiple tree layers (vertical diversity) and diverse species composition; and
2. Preventing large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of this portion of LSR RO-222 to sustain viable populations of forest species (B-5, USDA & USDI, 1994b).

Gap Size - The North Umpqua Ranger District of the Umpqua National Forest has formally requested a review of proposed silvicultural activities associated with the Lemon Butte Project to determine consistency with the Standards and Guidelines (S&Gs) under the Northwest Forest Plan (NWFP). Review of site-specific vegetation management activities that differ from existing exemption criteria for commercial thinning, specifically, gaps larger than ¼-acre in extent is requested. (REO Memorandum #694, as amended by REO Memorandum #801). Specifically, ½- and 1-acre gaps are proposed to both promote successful restoration of native tree species diversity by under-planting sugar pine, incense cedar, and western red cedar, thereby increasing structural complexity in young, stem exclusion Douglas-fir plantations. The REO has determined consistency with North West Forest Plan and issued a letter of concurrence dated February 1st, 2016.

South Cascades Late Successional Reserve Assessment - Proposed silviculture treatments are consistent with SCLSRA direction regarding general density management in LSR and specifically in LSR stands less than 80 years of age by prescribing site-specific density management, snag creation, prescribed fire, underplanting, and down wood recruitment to add complexity at the stand scale.

Consistency with Appropriate Treatments - The SCLSRA, Appendix B, designates appropriate treatments in Late Successional Reserves for reducing fire risk. “Young stand thinning, density management, and/or prescribed fire are all appropriate activities to meet fuel break objectives”(SCLSRA, B-15)

REO Exemption Criteria – Consistency with Density Management Criteria as per the REO Exemption concurrence letter (February 1st, 2106) is fulfilled by adhering to the guidelines:

- No thinning acres: 10% of unit area, minimum.
- Density Management:
  - Light thinning
  - Moderate thinning
  - Heavy thinning (less than 50 tpa) and gap creation (½- and 1-acre): 3-10% of unit area
  - Fuels treatments (including underburning, grapple piling, modified whole-tree yarding, and handpiling).

Additional Consistency Framework Supporting Documents- A detailed description of the terrestrial environment can be found in the Canton Creek (USDA, 1994; USDA & USDI, 1995), Cedar Creek (USDA, 1995), City Creek (USDA, 1996), Lower/Middle Steamboat Creek (USDA, 1999), Lower Steamboat Creek (USDA, 1999), Upper Steamboat Creek (USDA, 1997) Watershed Analyses, and Upper and Lower Steamboat Creek Watershed Analyses Iteration (USDA, 2007). Site-specific field work and analysis for this project produced additional information, which is provided in the following sections.

Analysis Methodology

Two spatial scales are used in the following discussions: (1) the landscape scale; and (2) the stand scale. The landscape scale focuses on large-scale conditions, such as forest vegetation patterns as seen from an airplane over thousands of acres. Satellite imagery and landtype maps were used to characterize vegetation and landforms at the landscape scale. The stand scale refers to areas several to hundreds of acres in size. Stand exams and other field data were used to characterize vegetation conditions at the stand scale. Existing and future conditions were quantified and modeled using this stand exam data and the Forest Vegetation Simulator Model (Dixon, 2013; Keyser, 2013) in conjunction with the Fire and Fuels Extension to the Forest Vegetation Simulator Model (Rebain, 2013), and Stand Visualization System (McGaughey, 2004).

Existing and Desired Landscape Conditions

Existing Landscape Conditions

The Lemon Butte project area is located in the North Umpqua Ranger District of the Umpqua National Forest. The planning area is 64,882 acres and is located within the Steamboat Creek 5th field watershed approximately 25 miles east of Glide, Oregon. It sits within Lane and Douglas Counties in portions of Townships 23, 24, and 25 South, Ranges 1 and 2 East, of the Willamette Meridian. Figure 4 below provides a map of the planning area.

The planning area has mixed ownership of 98% Forest Service and 2% private land. Lemon Butte project activities would only occur on Forest Service land, which is identified as 100% Late Successional Reserves, including Riparian Reserves, within the Western Cascades physiographic province of the 509,000-acre Late Successional Reserve RO-222 (USDA & USDI, 1994b, C-12). Existing landscape conditions in the Lemon Butte planning area was broadly classified in terms of landtype associations, vegetation successional stage and forest type using raster data (LEMMA, 2013; LANDFIRE, 2013), 2012 National Agriculture Imagery Program (NAIP) aerial imagery, and landtype maps. Successional stage and forest type classifications were subsequently validated using field reconnaissance, aerial imagery, landtype maps, and stand exam data analyses.

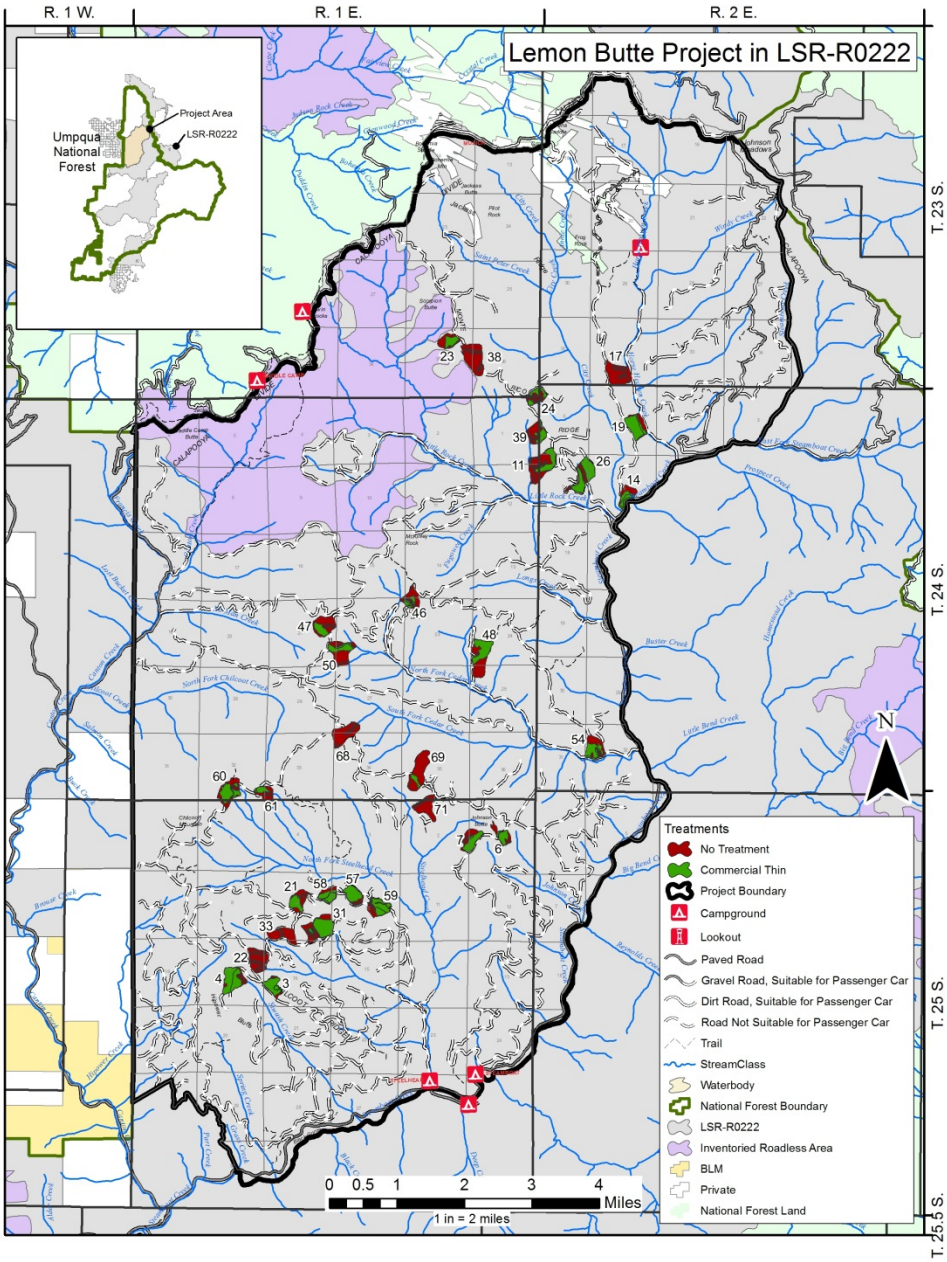


Figure 4. Location of Lemon Butte LSR Plantation Thinning Project area within LSR 222.

Existing Landtype Associations Characterizing the Lemon Butte Planning Area

Landtype association maps were used to characterize the Lemon Butte planning area in terms of vegetation and fire behavior associated with differences in elevation, slope, and aspect. Landtype maps were derived using digital elevation models (DEMs) with elevation, slope, gradient, and slope position attributes to model key relationships between plant series, climate, topography, and fire regimes. This classification strategy tiers to the Aquatic Conservation strategy for maintaining natural disturbance regimes at a landscape scale. Characterizing the planning area landscape using landtype maps informs the development of appropriate treatment strategies that are consistent with the range of natural variability for the landscape.

The Lemon Butte planning area is characterized by the Gentle Mountain Slope landtype association (18%), which has upper slope areas with few barriers to fire spread and with historic evidence of large patches of stand replacement fire, and Gentle Valley Bottoms (13%), areas characterized by surface fire and limited amounts of crown fire, representing the most likely refugia from fire at low elevations (Figure 2). The Steep Terrain landtype area (54%) are areas dominated by steep slopes where fire intensity is generally greater and stand replacing fire events more frequent. The Western Cascades – DF/SF Landtype (12%) is similar to the Steep Terrains Landtype topography with lower tree densities mixed with patchy mountain meadows and upland grassy prairie openings. Douglas-fir and silver fir are more predominant species types than in Steep Terrains which has more mixed conifer types. There are no units for the Lemon Butte project located in the High Willows Landtype which makes up 3% of the project area.

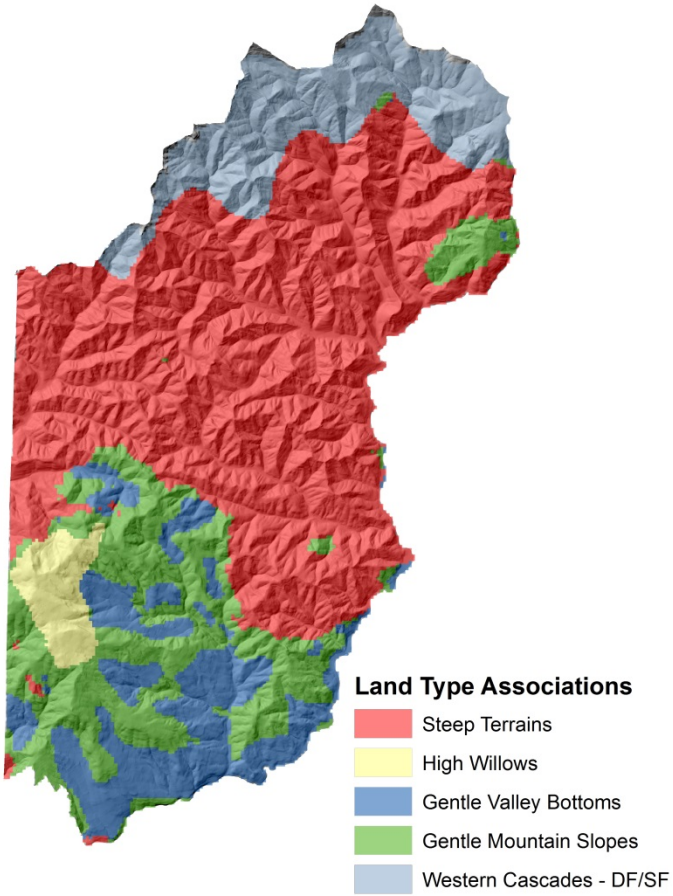


Figure 5. Landtype Associations characterizing Lemon Butte planning area landscape

Existing Forest Successional Stages and Forest Types

Forest age classes that develop following a major disturbance, such as stand-replacing wildfire or clearcutting, are used to characterize current conditions across the landscape:

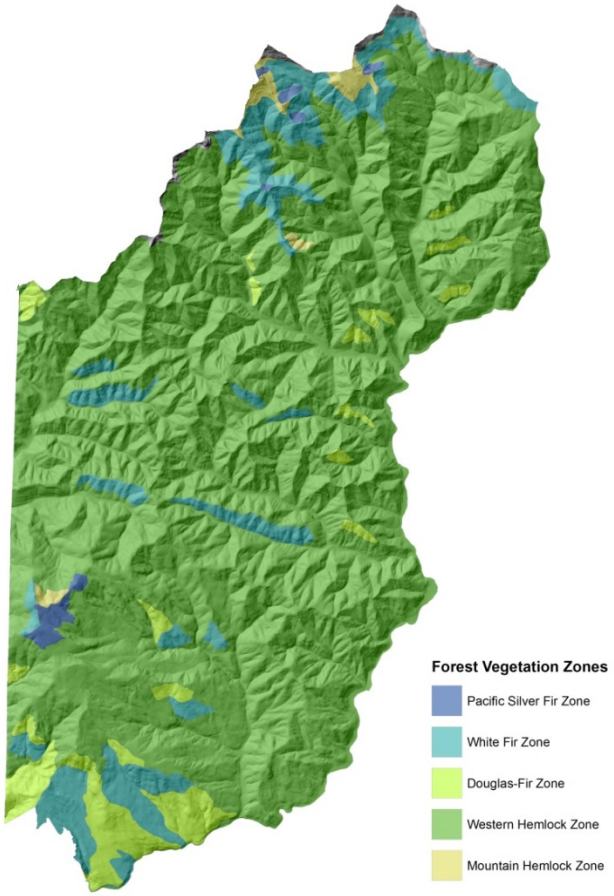
1. Early seral: Young stand with an open canopy. Stand age is generally less than 30 years, but can be older, especially in the high-elevation, cold/dry sites where canopy closure is delayed 10 to 20 years or more on average.
2. Stem exclusion: Stand with full site occupancy, where new species do not appear and some present species are dying due to competition or understory shading. Stand age is generally from 40 to more than 100 years, the average tree diameter is about 10" dbh, and canopy cover is ≥53%.
3. Mature: Stand where trees reach their maximum height potential. Stand age is generally from 80 to 150 years, the average tree diameter is 10 to 19" dbh, and canopy cover is ≥53%. This stage includes the "understory re-initiation stage", where the understory develops in response to small openings in the canopy (Oliver and Larson, 1996) and the "transition stage", defined in the Northwest Forest Plan as transitioning toward late seral.
4. Late seral: Stand with overstory trees dying in an irregular fashion and with understory trees filling the gaps. Stand age is generally more than 150 years, average tree diameter is ≥20" dbh in low-elevation, mixed conifer stands, and conifer canopy cover is ≥70%. Late seral includes the "shifting gap" stage (USDA/USDI, 1994a).

The Lemon Butte planning area is located primarily within three forest vegetation zones (Figure 6) including the Western Hemlock Zone (84% of planning area), White Fir Zone (9% of planning area), and Douglas-fir Zone (5% of planning area). At high elevations, the planning area also includes small inclusions of the Mountain Hemlock Zone (1% of planning area) and Pacific Silver Fir Zone (less than 1% of planning area). Detailed descriptions of forest vegetation zones can be found in the Lower Steamboat Creek Watershed Analysis (USDA, 1999), Upper Steamboat and Lower Steamboat Creek Watershed Analysis iteration (USDA, 2007).

Until the last few decades of the 20th century, the planning area landscape was largely covered by contiguous, late-successional forests with scattered patches of early to mid-successional forests resulting from stand replacement fires. Late-successional forest was concentrated in the gentle, moister terrains and high elevation sites. This patchy distribution of late successional forest consisted of numerous smaller patches in the steep and dry land units while the middle and southern portion of the planning area landscape was characterized by larger patches, indicative of high severity fires. Riparian forest patterns were well defined and showed large sections of riparian forests having been burned through. Overall, contiguous late-successional forest covered the majority of the watershed through time.

Since the early 1920s, fire suppression has altered how fire affects the landscape by greatly reducing the frequency of high-severity, stand replacement fires. In addition, over the last 50 years, road construction, development of infrastructure, residences, and timber harvesting have collectively caused major changes to the planning area landscape, shifting forest vegetation patterns from their natural range of variability. At the landscape scale, the patch size and spatial arrangement of existing forest vegetation conditions are departed from reference conditions predicted by FRCC1 data (Hann and Strohm, 2003). Specifically, the spatial arrangement, patch size, and contiguity of forest successional stages across the planning area has been shifted from historical patterns by past forest management involving staggered clearcut harvests in the 1950s through 1980s and through fire suppression. Late-successional forest that historically occurred in large, contiguous blocks in gently-sloping valley bottom fire refugia now is fragmented into small patches and is distributed across the landscape in all landtype associations. In addition, large, unfragmented blocks of older forest are located in uncharacteristically steep terrain where risk of stand replacement fire is high. The exclusion of fire also has helped shape current vegetation patterns, resulting in increased fuel loads and increased density of understory vegetation.

Figure 6. Forest vegetation zones in the Lemon Butte planning area



Analysis of 1936 historic forest vegetation maps and reference condition data from the Fire Regime Condition Class (FRCC) Interagency Handbook (Hann and Strohm, 2003), indicates that approximately

[1] Fire Regime Condition Classes (FRCC) are qualitative (low, moderate and high), ecological measures describing the degree of departure from historical fire regimes, based on alterations of ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings (Schmidt et al. 2002).

57% of the planning area's landscape was covered by late seral forest vegetation, 24% by stem exclusion, and 12% by early seral vegetation, while mature vegetation comprised just 6% of the planning area. Non-forested portions of the planning area (land not conducive to conifer establishment, such as land dominated by rock and water) covered 1% of the planning area. In comparison, the existing distribution of forest vegetation across the Lemon Butte planning area is predominantly in the late seral stage at 39%, early seral comprises 29%, then the mature successional stage makes up 17% of the landscape, stem exclusion 14%, and non-forested areas covered 1% of the planning area (Figure 7).

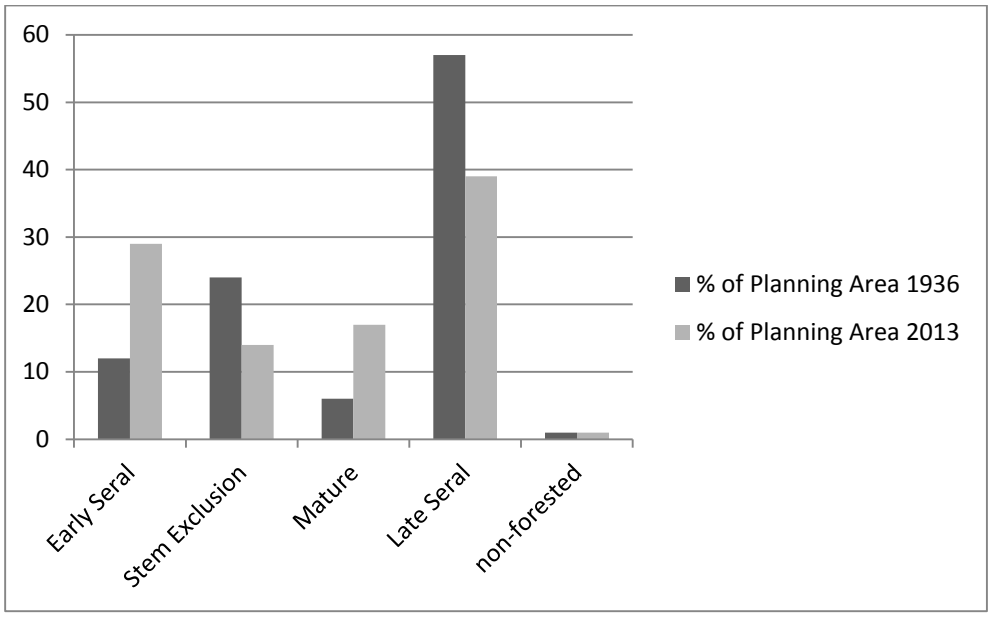


Figure 7. Historic and current distribution of forest successional stages across the Lemon Butte planning area landscape.

Existing vegetation conditions in the Lemon Butte planning area are more fragmented with lower inter-patch connectivity and contain less late seral forest and less stem exclusion forest, relative to reference conditions. Current late-successional forest is more fragmented by small, discontinuous stand initiation and stem exclusion stage patches, relative to historic conditions (Figure 8).

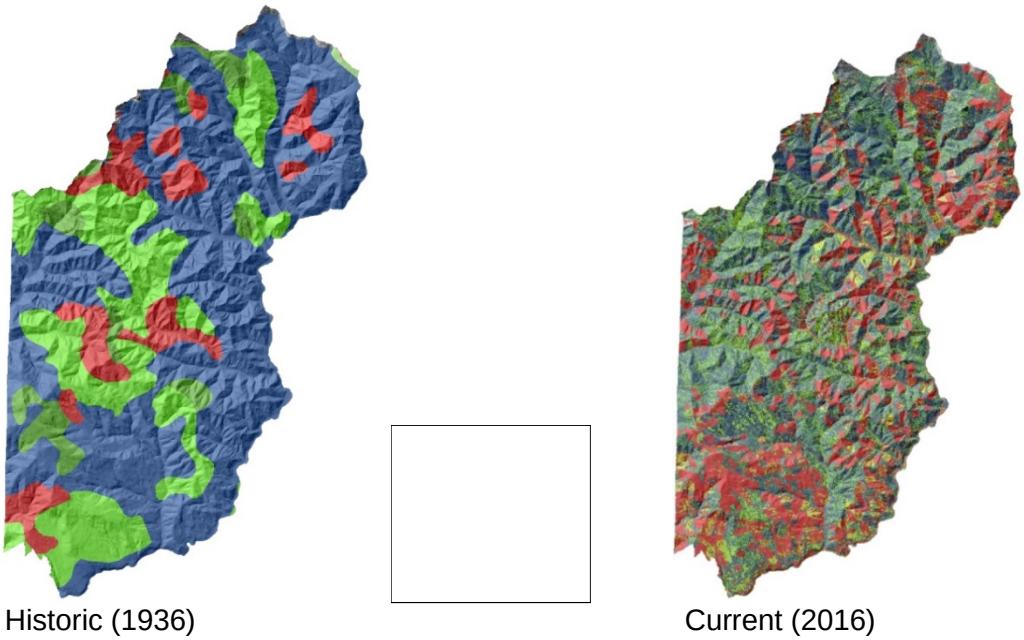


Figure 8. Historic (1936) and existing forest vegetation successional stages across the Lemon Butte planning area landscape.

Existing Natural Disturbance

The primary drivers of ecological and natural disturbance processes within the Lemon Butte planning area include fire, Armillaria root disease (*Armillaria obscura*), laminated root rot (*Phellinus sulphurascens*), Douglas-fir beetle (*Dendroctonus pseudotsugae*), mountain pine beetle (*Dendroctonus ponderosae*), fir engraver beetle (*Scolytus ventralis*), and flathead fir borer (*Melanophila drummondi*). Other active disturbance agents include wind, annosus root disease (*Heterobasidion annosum*), black stain root rot (*Leptographium wageneri*), Schweinitzii root and butt rot (*Phaeolus schweinitzii*), red ring rot (*Phellinus pini*), brown crumbly rot (*Fomitopsis pinicola*), and dwarf mistletoe (*Arceuthobium* species).

Disturbance effects resulting from fire range from light underburns, which may not be readily apparent a few years after the fire, to stand-replacing events, in which most plants are killed by the fire. In contrast, insects and pathogens persist at endemic levels across most of the planning area, producing frequent, small disturbances affecting several to hundreds of trees. Depending on stand condition and disturbance event, these disturbance agents can create forest openings (gaps) ranging from very small (individual tree scale), to moderate (up to a few acres in size, as with root disease pockets; p. 86, SCLSRA; USDA, 1998), to very large (stand-replacing fire at the landscape scale; pp. 73-88, SCLSRA; USDA, 1998). The planning area experiences a mean fire return interval ranging from 11 to 126 years (mean=42 years) and is represented by fuel models 8 and 10. Fire severity data indicates that stand-replacing fire events create openings averaging 2.3 acres (range 0.0001-69.6 acres) in the planning area, specifically, and 3.7 acres (range 0.0009-1,078 acres) in the Umpqua National Forest portion of LSR RO-222, generally. Wildfire history data for the Umpqua National Forest and USDA Forest Service Region 6 Forest and Grassland Health Aerial Detection Survey data (http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/insects-diseases/) indicate that natural disturbance agents between the years 2003 to 2013 have resulted in tree mortality on over 2811 acres within the Lemon Butte planning area (Figure 9). Specifically, six wildfire events have resulted in tree mortality on 527 acres, small lightning strikes caused 686 acres of disturbance mortality, while insects have resulted in tree mortality on 1543 acres and damage from black bears has resulted in tree mortality on 55.4 acres within the planning area between 2003 and 2013.

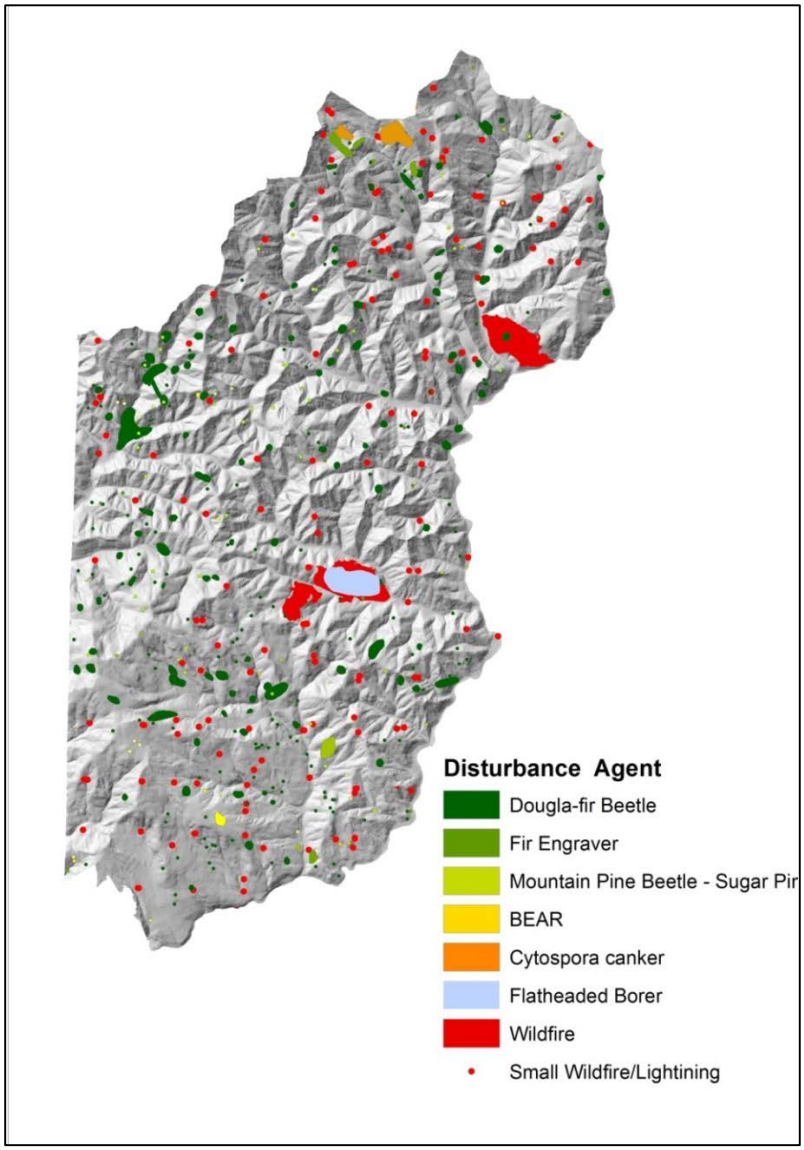


Figure 9. Lemon Butte planning area natural disturbance and tree mortality agents

Desired Landscape Conditions

Desired future conditions (DFCs) describe the desired composition, structure, and arrangement of forest vegetation and are developed by integrating information from multiple temporal scales (including past, present, and future time scales) and spatial scales (including landscape, forest stand, and forest plot spatial scales). Past, or reference, conditions serve as a model of functioning ecosystems and provide insight into the natural processes shaping vegetation patterns within the range of natural variability (Landres et al., 1999; Keane et al., 2009) as well as potential future conditions resulting from climate change (USDA, 2008, 2010a, and 2010b; Kurz, et al., 2008; Körner and Basler, 2010). This approach represents a way to identify the degree of departure from the natural range of variability in present-day landscapes and identify specific departures from reference conditions that might be modified through management.

Proposed silvicultural and fuels treatments targeting DFCs for the Lemon Butte planning area landscape were developed using recommendations provided in the ROD (USDA & USDI, 1994a), S&Gs (USDA &

USDI, 1994b), SCLSRA (USDA, 1998), LRMP (USDA, Umpqua NF, 1990), Canton Creek (USDA, 1994; USDA & USDI, 1995), Cedar Creek (USDA, 1995), City Creek (USDA, 1996), Lower/Middle Steamboat Creek (USDA, 1999), Lower Steamboat Creek (USDA, 1999), Upper Steamboat Creek (USDA, 1997) Watershed Analyses, and Upper and Lower Steamboat Creek Watershed Analyses Iteration (USDA, 2007) and the Revised Spotted Owl Recovery Plan (USDI, 2011). The SCLSRA and watershed analyses document an overabundance of densely-stocked second-growth stands and recommend the use of commercial thinning, pre-commercial thinning, and prescribed fire in these managed stands to shift landscape patterns towards desired reference conditions. Key management recommendations describing desired landscape conditions follow:

South Cascades Late Successional Reserve Assessment Recommendations

The 1998 South Cascades Late Successional Reserve Assessment (SCLSRA; USDA & USDI, 1998) provides the management framework and context for vegetation management projects within approximately 721,000 acres of Late Successional Reserve land allocations. These management recommendations apply to the 509,000-acre Late Successional Reserve (LSR) RO-222 where the Lemon Butte planning area is located.

Treatment criteria to enhance late seral conditions describe the objectives of these treatments are to place stands on the path to produce late seral structures, to increase the size of what will eventually become late seral blocks, to reintroduce previously native tree and plant species, and to produce large wood as quickly as possible for recruitment into streams (SCLSRA, p. 121). The SCLSRA states that density management objectives in stands under 80 years of age are to place or keep stands on the path to produce or enhance late seral structures as soon as possible and recommends:

- Prioritizing areas with large amounts of early and mid-seral stands for treatment to accelerate development of late-successional structure.
- Using density management (pre-commercial thinning) incorporating variable-spacing to advance species and structural diversity of stands less than 25 years old.
- Prioritizing areas in the upper 1/3 slope position to reduce fuels and increase fire resiliency.

Watershed Analyses Recommendations

The Lower Steamboat Creek Watershed Analysis (USDA, 1999) and its 2007 iteration (USDA, 2007), identified multiple landscape-scale management recommendations based on the natural range of variability resulting from local disturbance processes (Landres et al., 1999). As such, these management recommendations tier to key disturbance processes shaping specific landtype areas and include:

1999 Lower Steamboat Watershed Analysis:

- Thin in mid-seral stands to accelerate the development of late-successional tree characteristics. Thin using variable spacing to achieve complex vegetative structure needs, maintain full live crown ratios, develop large branch diameters, and develop thick, fire-resilient bark (use wide spacing in some areas to maintain high growth rates to develop large diameter trees as soon as possible and also incorporate areas of no thinning);
- Maintain or develop intermediate canopy layers in managed stands by thinning;
- Release desirable hardwoods and shrubs in mid-seral stands to maintain diversity; and
- Interplant shade-tolerant conifers, such as western red cedar, in riparian areas.

2007 Lower Steamboat Watershed Analysis Iteration:

- Prescribe thinning and fuel reduction treatments in stem exclusion stands to improve the fire resiliency of the mature stands of the future.
- Reduce the current amount of landscape fragmentation by enlarging patches to approximate the acreage of historic large-scale disturbance events. Treat groups of adjacent patches simultaneously to accelerate structural development and ultimately lower the effects of fragmentation. The desired future pattern of stand initiation and stem exclusion patches would be more variable than today's pattern and would include patches hundreds of acres in size.
- Thin plantations located in vicinities of relatively un-fragmented late successional forest in order to accelerate large tree development.
- At the stand scale, focus vegetation treatments in the stem exclusion and mature stages to restore missing species and structural diversity.
- Use variable density thinning and fuel reduction to create a mosaic of vegetation and fuels in the future that is more like historic conditions. Design treatments that diversify the homogeneous, management-related stand structure in plantations. Recreate a mosaic of fuel conditions characteristic of a moderate severity fire regime. Vary treatments at both the stand and landscape scale to restore these historic patterns. Prioritize treatments in stands less than 80 years old (commercial thinning) and young stands less than 25 years old (pre-commercial thinning).
- Reduce stand replacement risk in areas that border older stands and owl cores.
- In Gentle Valley Bottoms, thin stem exclusion patches adjacent to late-successional patches in order to accelerate stand development and decrease fragmentation; apply thinning treatments and create small canopy gaps in early seral, stem exclusion, and mature structural stages in order to restore species and structural diversity characteristic of a mixed severity fire regime; and, where appropriate, initiate an uneven-aged management regime in order to culture a shade tolerant understory layer.
- In Gentle Mountain Slopes, apply thinning, canopy gap creation (up to 2 acres), and underburning to restore structural and species diversity in areas of stem exclusion and mature stands; and focus thinning and fuel treatments in the gentle mountain slope landscape areas where partial stand replacement fire played a more active role and where treatments can lower risks to adjacent steeper terrain.
- In Steep Terrains, manage stands to maintain even-aged characteristics; and, manage all forest stages to improve resiliency to fire by opening canopies and raising canopy base heights.

2007 Upper and Lower Steamboat Creek Watershed Analyses Iteration 1.1 2007

-Recommendations to Meet Objectives Listed in the LSRA

At the landscape-scale, the stem exclusion stage presents three specific opportunities that meet the South Cascades Late-Successional Reserve Assessment (USDA/USDI, 1998) recommendations and desired conditions:

- Thinning and fuel reduction in stem exclusion stands will improve the fire resiliency of mature stands of the future.

- Many stem exclusion stands are in gently-sloping landscape areas where it is desirable to advance late-successional conditions. Late-successional vegetation in both of the gentle landscape areas is currently at the low end of the range of variability.

- Many stem exclusion stands are located along ridge tops in gentle mountain slopes that border the large, steep landscape area in Upper Steamboat currently occupied by a large, late-successional forest block. Gentle-sloping ridgetops are a strategic fuelbreak location along the edge of this large area of steep terrain (USDA /USDI, 1998). Reducing fuels along this edge would be the first step in a strategy for either reintroducing fire or allowing wildland fire use in the Late Successional Reserve.

General Recommendations

- Reduce the current amount of landscape fragmentation by enlarging patches to approximate the acreage of historic large-scale disturbance events. Treat groups of adjacent patches simultaneously to accelerate structural development and ultimately lower the effects of fragmentation. The desired future pattern of stand initiation and stem exclusion patches would be more variable than today's pattern and would include patches hundreds of acres in size.

- Thin plantations located in vicinities of relatively unfragmented late successional forest in order to accelerate large tree development.

- Identify areas where blocking up acreage will facilitate thinning and prescribed fire use at a larger scale to setup a more economical and efficient operation for future fire use.

- At the stand scale, focus vegetation treatments in the stem exclusion and mature stages to restore missing species and structural diversity. In existing late-successional stands that have experienced substantial ingrowth, apply treatments to reduce understory density and to increase resilience to stand replacement fire.

- Use variable density thinning and fuel reduction to create a mosaic of vegetation and fuels in the future that is more like historic conditions. Design treatments that diversify the homogeneous, management-related stand structure in plantations. Recreate a mosaic of fuel conditions characteristic of a moderate severity fire regime. Vary treatments at both the stand and landscape scale to restore these historic patterns. Treatments in stands less than 80 years old (commercial thinning) and young stands less that are 25 years old (pre-commercial thinning) are priorities.

- Reduce stand replacement risk in areas that border older stands and owl cores.

In general, the desired future condition for the Lemon Butte planning area landscape is to approximate the composition, structure, and arrangement of forest vegetation within the historic range of variability (Landres et al., 1999; Lindenmayer & Franklin, 2002), with structurally and compositionally complex, fire-resilient stands imbedded within the planning area landscape. Desired future landscape conditions include shifting landscape patterns back to more natural conditions, reflecting the larger contiguous vegetation patches, increased species complexity enhanced stand vigor, and reduced fire hazard characteristic of reference conditions. This objective of maintaining a complex mosaic of vegetative structural diversity and pattern would be achieved by varying harvest treatments across the landscape consistent local disturbance processes. The desired landscape condition would have larger, contiguous age-class patches compared to today's pattern and would restore the late-successional forest to historic refugia in the gently-sloping areas of the landscape. Desired patch sizes would be larger to approximate historic fire disturbance that previously covered thousands of acres. This desired pattern of vegetation patches would align with a spatially heterogeneous pattern similar to that produced by local natural

disturbance processes (pp. 73-88, SCLSRA; USDA, 1998) while increasing stand resilience to potential future disturbance events (Kohm & Franklin, 1997; Franklin et al., 2002). This complex spatial and structural pattern also would be consistent with SCLSRA and watershed analyses recommendations as well as Objective 1 of the Aquatic Conservation Strategy, which calls for the restoration of the diversity and complexity of landscape-scale vegetation pattern and grain.

Existing and Desired Stand Conditions

Existing Stand Conditions

Previous clearcutting and subsequent planting of Douglas-fir (*Pseudotsuga menziesii*) in the Steamboat watersheds, along with fire exclusion has created dense, even-aged stands in both uplands and riparian areas that are now in the stem exclusion stage of structural development (Oliver and Larson, 1996). These second-growth stands lack the structural and species diversity they would otherwise have if exposed to natural successional pathways, such as fires (Zenner, 2005). Historically, sugar pine trees were naturally abundant in the planning area on south through west aspects and were maintained by the historical fire regime. Today, sugar pine (*Pinus lambertiana*) is underrepresented within the planning area landscape and is declining due to competition related to dense planting of Douglas-fir, fire exclusion, and occurrence of white pine blister rust (*Cronartium ribicola*). Dense stand stocking also leads to *heavy inter-tree competition*, resulting in decreased tree and stand vigor, low growth rates, and potentially restricted development of some desired riparian habitat characteristics, such as large-diameter trees that may ultimately be recruited as large down wood to streams. Additionally, dense stocking reduces stand resistance to wind and fire damage (Poage and Tappeiner, 2002).

Stands proposed for silvicultural treatments within the project area include relatively homogeneous, even-aged, Douglas-fir stands ranging from 48 to 58 years old (Table 4). These stem exclusion stands were established following even-aged harvest in the 1950s through 1970s and subsequent planting. Relative to historic conditions, existing stands are characterized by limited species diversity and reduced structural complexity, with few legacy habitat components, such as large snags, large downed wood, and “wolf trees” (Spies & Franklin, 1991). In contrast to historic stem exclusion stand development patterns, plantations in the planning area are growing at much higher densities and experiencing pronounced inter-tree competition (Figure 7). Dominant trees in today’s old-growth stands developed from young stands growing at stand densities averaging 40 to 50 trees per acre (tpa), thus allowing trees to sustain high growth rates during the first 50 to 100 years and facilitating the early development of late-successional characteristics such as fire-resilient, large diameter trees with deep crowns and with less self-thinning than managed stands experience today (Poage & Tappeiner, 2002; Tappeiner et al., 2007).

While some of these stands could develop old-growth characteristics without silvicultural intervention, current stocking and structure of most of these stands were established to produce high timber yields, not to provide for the development of old-growth forests. Research addressing silvicultural strategies for advancing late seral structure in young, managed stands suggests that, in the absence of active management, these young plantations would likely ultimately transition to and climax as shade-tolerant, *Tsuga* (hemlock)-dominated stands (Zenner, 2005). Even with fire suppression, these stands also would eventually be affected by wildfire, likely stand-replacing wildfire, due to accumulated fuel loads and layered canopies of fire-intolerant understory vegetation (Zenner, 2005). These densely-stocked young plantations also may not develop into old-growth structure over time if they are too densely stocked to allow development of the vertical and horizontal structural differentiation characteristic of existing old-growth stands (Tappeiner, et al., 1997). The developmental pathways and subsequent stability of densely-stocked young plantations also may be compromised if high densities persist through pivotal growth periods when height- to diameter ratios develop and establish (Wilson & Oliver, 2000). Thinning in young

coniferous stands also may contribute to the development of a diverse understory differing in successional status, growth form, and structure, thus enhancing ecosystem resilience (Ares et al., 2010).

Table 4. Stand summary data for proposed Lemon Butte project.

Stand	Acres	Age	Elevation (ft)[2]	Aspect	Landtype Association[3]	Plant Association Group	Potential Vegetation[4]
3	33.7	58	3500	SW	GMS	White Fir Zone, Rhododendron	WF
4	57.8	57	4000	E/SE	GMS	White Fir Zone, Oregongrape	WF
6	27.5	56	2900	SE	ST	White Fir Zone, Rhododendron	WH
7	43.6	56	2800	W	ST	White Fir Zone, , Oregongrape	WH
11	83.3	55	2600	W/SW	ST	Douglas-Fir Zone, Salal, Oregongrape	WH
14	31.0	55	2100	S	ST	Douglas-Fir, Canyon Live Oak, Poison Oak	WH
19	52.7	54	2600	NE	ST	White Fir Zone, Oregongrape, Whipplevine	WH
21	40.1	54	3500	SW	GVB-GMS	White Fir Zone, Rhododendron	WF
23	33.9	53	3800	SW	GMS	Western Hemlock Zone, Rhododendron	WH
24	33.8	53	3300	SW	ST	White Fir Zone, Rhododendron	WH
26	65.0	53	2500	SE/SW	ST	Douglas-Fir, Canyon Live Oak, Poison Oak	WH
31	76.2	53	3300	SE	GMS	White Fir Zone, Rhododendron	WH
39	43.5	52	2900	SW	ST	Douglas-Fir, Canyon Live Oak, Poison Oak	WH
46	35.7	50	2800	W	ST	White Fir Zone, Rhododendron	WH
47	49.3	50	3100	E	ST	White Fir Zone, Rhododendron	WH
48	74.4	50	2600	W	ST	Douglas-Fir, Canyon Live Oak, Poison Oak	WH
50	61.7	50	2800	NE/SE	ST	White Fir Zone, Rhododendron	WH
54	48.7	50	2400	S	ST	Douglas-Fir, Canyon Live Oak, Poison Oak	WH
57	35.5	50	2600	NE	GVB	White Fir Zone, Rhododendron	WH

[2]Average elevation reported (feet).
[3] Landtype Associations: GVB=Gentle Valley Bottoms; GMS=Gentle Mountain Slopes; ST=Steep Terrains.
[4] Potential Natural Vegetation Zones: The vegetation that would be present under climax conditions if the site were allowed to grow, undisturbed by fire, insects, diseases, flood, wind, erosion, or humans. Represents the theoretical steady state condition in vegetation composition characterizing the site potential that would result after approximately 500 years without disturbance: WF=white fir; WH=western hemlock.

Stand	Acres	Age	Elevation (ft)[2]	Aspect	Landtype Association[3]	Plant Association Group	Potential Vegetation[4]
58	32.4	50	3000	NE	GVB-GMS	White Fir Zone, Rhododendron	WH
59	45.3	50	2700	N	GMS-GVB	White Fir Zone, Rhododendron	WH
60	59.4	49	4300	E	GVB	Pacific Silver Fir, Vinemaple, Vanillaleaf	WF
61	27.5	49	4100	E	GMS	White Fir Zone, Oregongrape, common prince's pine	WF
69	70.6	48	3200	NE/SW	GMS	Douglas-Fir, Salal, Rhododendron, Oregongrape	WH
71	43.0	48	3100	E	ST/GMS	White Fir Zone, Rhododendron	WH

[2]Average elevation reported (feet).
[3] Landtype Associations: GVB=Gentle Valley Bottoms; GMS=Gentle Mountain Slopes; ST=Steep Terrains.
[4] Potential Natural Vegetation Zones: The vegetation that would be present under climax conditions if the site were allowed to grow, undisturbed by fire, insects, diseases, flood, wind, erosion, or humans. Represents the theoretical steady state condition in vegetation composition characterizing the site potential that would result after approximately 500 years without disturbance: WF=white fir; WH=western hemlock.

Desired Stand Conditions

Desired future conditions (DFCs) for stands in the Lemon Butte planning area incorporate information from past, or reference, conditions that provide insight into the natural processes shaping stand vegetation patterns within the range of natural variability (Landres et al., 1999). Silvicultural and fuels treatments proposed for planning area stands in the planning area were designed to target these identified DFCs and to bridge the gap between existing and desired stand conditions. Ecological restoration objectives were drawn directly from specific objectives relevant to the Lemon Butte planning area as identified in the *2007 Upper and Lower Steamboat Creek Watershed Analyses Iteration 1.1 2007*the Lower Steamboat (USDA, Umpqua NF, 1999) analyses and the South Cascades Late Successional Reserve Assessment (USDA and USDI, 1998).

In general, the desired future condition for stands in the Lemon Butte planning area is to approximate the composition, structure, and arrangement of forest vegetation within the natural range of variability at the stand scale, shifting stand composition and structure back to more natural conditions (Kerr, 2012). Desired future conditions within planning area stands include: multi-species and multi-layered assemblages of trees; moderate- to-high accumulations of large logs and snags; moderate-to-high canopy closure; moderate-to-high numbers of trees with physical imperfections; and moderate-to-high accumulations of fungi, lichens, and bryophytes (B-5, USDA & USDI, 1994b).

Proposed Silvicultural Treatments: Commercial Thinning and Fuels Treatments

Treatments were designed to achieve DFCs by accelerating the development of the young planning area stands into multi-layered stands with large trees and diverse plant species, and structures that may, in turn, maintain or enhance species diversity (S&Gs B-6, USDA & USDI, 1994b). Treatments were developed using recommendations in watershed analyses, the Umpqua National Forest Land and Resource Management Plan (USDA, Umpqua NF, 1990), and the South Cascades Late Successional Reserve Assessment (USDA and USDI, 1998). Historical (LANDFIRE, 2011) and current imagery (NAIP), field

reconnaissance formal stand exams, and Forest Vegetation Simulator modeling (Reinhardt & Crookston, 2003) also were used to develop detailed prescriptions for each planning area unit.

Proposed silvicultural activities are consistent with SCLSRA direction for density management in LSR and specifically in LSR stands less than 80 years of age by prescribing site-specific density management, snag creation, prescribed fire, underplanting, and down wood recruitment to add complexity at the stand scale (SCLSRA, pp. 125-127; USDA, 1998). This site-specific array of proposed treatments is designed to create a complex mosaic of conditions across the project landscape. Commercial thinning is prescribed to open up the canopy, thereby increasing the structural and compositional diversity and hastening the transition of treated stands to stands with mature forest characteristics (p 113; USDA, 1998). Emphasis is placed on initiating uneven-age and two-age mature stand structure while using planting and canopy gaps to diversify homogeneous plantations. Silvicultural and fuels treatments have two principal objectives:

1. Promoting the development of old-growth forest characteristics in young stands, including large trees, snags, logs on the forest floor, deep tree crowns, and canopy gaps that enable establishment of multiple tree layers (vertical diversity) and diverse species composition; and

2. Preventing large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of this portion of LSR RO-222 to sustain viable populations of forest species (B-5, USDA & USDI, 1994b).

Proposed silvicultural treatments utilize thinning from below to shift 603 acres of even-aged, stem exclusion Douglas-fir plantations towards a development trajectory of greater structural and species complexity and function. The proposed action prescribes commercial thinning in the stem exclusion stage portions of the planning area landscape where the density of young stands is currently the highest. Treatments are designed to increase growth, health, and vigor of the leave trees remaining in the stand; restore stand density, and species and structural diversity to those considered characteristic under a natural disturbance regime; and reduce hazardous fuel loads and improve stand resiliency to wildfire. Ecological benefits would include hastened development of late-successional structure and function, including development of multi-layered stands, legacy habitat components (e.g., large trees, abundant large snags and downed woody material, and wolf trees), increased vertical and horizontal heterogeneity, structural complexity and species diversity. Thinning from below is proposed to allow light to penetrate the currently relatively uniform canopy and stimulate understory growth of desired tree, shrub, and herbaceous species. In general, thinning from below would retain the largest diameter overstory trees and advance residual tree growth. Thinning also would increase both horizontal and vertical structural diversity within stem exclusion stands. Following thinning, stem exclusion stands would have reduced stand density and broader distribution of tree sizes; thus a low thinning would set the stage for a more uneven distribution of large trees in the future. Trees in the stem exclusion stands would respond with rapid growth after thinning because of the reduced tree density.

Density management objectives would be achieved by commercially thinning approximately 603 acres retaining approximately 50 trees per acre (tpa). Gap creation and subsequent planting of native species, including sugar pine, incense cedar, and western red cedar is proposed to increase structural complexity and to facilitate understory development (Coates and Burton, 1997). Proposed treatments are designed to increase diversity within relatively uniform stands of Douglas-fir by including areas of variable spacing using one of three thinning densities, depending upon site-specific resource objectives with no thin areas (skips) and gaps nested within the intervening thinned forest matrix as follows. (See Table 5):

- No thinning acres: 10% of unit area, minimum. Applied to portions of all treatment units to achieve objectives related to wildlife habitat, thermal and visual cover, riparian shade, unique habitats, slope instability, and merchantability.

- Density Management:
    - Moderate thinning (50-70 tpa)
    - Gap creation (½- and 1-acre): 3-10% of unit area to achieve objectives related to maximizing individual trees development, understory vegetation development, and initiation of structural diversity.
    - Fuels treatments (including underburning, grapple piling, modified whole-tree yarding, and handpiling).

Similar and connected actions associated with the Proposed Action are designed to accelerate the development of multi-storied, late-successional forest structure, and manage for reduced fire risk over time. Vegetative similar and connected actions include reforestation and a non-commercial thin.

Reforestation: Following implementation of silviculture and fuels treatments, selected gaps would be underplanted with sugar pine and incense cedar seedlings to increase structural complexity in young, stem exclusion Douglas-fir plantations, and increase species diversity in former plantation stands. Western red cedar also would be planted adjacent to riparian areas in appropriate landscape position. Planting seedlings in gaps for diversity and structure would extend 1 to 1 ½ tree lengths into the surrounding stand to take advantage of the increased sunlight due to the edge effect. This would increase the total reforested acres up to 55.5 acres depending on actual conditions following completion of thinning.

The main goal is to support old-growth forest characteristic development by increasing diversity and increasing structure by introducing new age cohorts (planting and natural regeneration for vertical structure) and variable density thinning (shifting canopy cover to vary the amount of sunlight reaching the understory, for horizontal structure). These are all methods to achieve the goals of: 1) Promoting the development of old-growth forest characteristics in young stands and, 2) Preventing large-scale disturbances by fire, wind, insects, and diseases. (B-5, USDA & USDI, 1994b).

Unit 71 - Non-Commercial Thinning: 43 acres of non-commercial thinning within unit 71 is recommended to reduce current and future fire fuels loading next to an LSR4 owl core as well as to restore stand density, species diversity, and promote the structural development of young, previously managed stands. Non-commercial Thinning would occur following the completion of all commercial thinning activities. The thinning of Unit 71 would follow Pre-Commercial Thinning (PCT) thinning guidelines to select for diversity species and density, with additional standards for hazard fuels reduction and slash removal/reduction. The projected method of slash reduction would be handpiling and burning.

Marking guidelines would specify retention of minor tree species, including sugar pine, western white pine (*Pinus monticola*), incense cedar (*Calocedrus decurrens*), western redcedar (*Thuja plicata*), and Pacific yew (*Taxus brevifolia*), suitable to landscape area. Legacy habitat components, such as snags and downed wood would be retained following treatment to maintain legacy wildlife habitat. Hardwood tree species, such as bigleaf maple (*Acer macrophyllum*), also would be retained during implementation where appropriate to maintain habitat and biodiversity hotspots for wildlife species associated with hardwoods (Spies and Duncan, 2009).

Restoration of Sugar Pine and Gap Size

Shade Tolerance: Sugar Pine is considered an Intermediate Shade Tolerance Species. Release from shade allows juvenile sugar pines to increase in diameter twice as quickly as its common associates. (Burns, 1990)

Current canopy closure in the Lemon Butte treatment units reaches 95-100%. This is much higher than the conditions needed to support the intermediate shade conditions that support the pine species historically found in the project area. In order to develop the conditions necessary for Sugar Pine to thrive, thinning of the canopy down to 60-75% canopy closure is required. These canopy closure levels then must be maintained by periodic prescribed fire to replicate natural light conditions. Restoring and maintaining natural historic canopy cover levels is crucial to attaining the natural stand dynamics and functions needed to achieve a sustainable ecosystem balance in the Steamboat Watershed.

Edge Effect: The edge effect of a large gap provides the light conditions that favor Intermediate Shade Tolerant species. A ½ acre gap (83 ft. radius) within a stand having an average height of 100 feet tall, would get very little direct sunlight over the entire gap area. Only the very north portion of the gap would get direct sunlight over the course of a day. The ½ gap creates very little Intermediate Shade in forest types with tall tree species. A one acre gap (118 ft. radius) would have much more Intermediate Shade along the periphery of the gap and also have more light penetrating sideways into the uncut trees that border the gap. Morning and evening sunlight would reach far into the surrounding stand and create the conditions favorable for Intermediate Shade Tolerant Species such as Sugar Pine. (Poulson et al., 1989) This is also the reason the acres of reforestation for the Lemon Butte project (55.5 acres) are greater than the gap created acres (46 acres). The Moderate thinning prescription for most Lemon Butte project stands aims at creating Intermediate Shade Tolerant conditions over the general stand area with Gaps as another additional technique. (Yamamoto, 2000) But the gaps must be large enough to allow that extra light to penetrate for a long enough time throughout the day (Duncan, 2002).

Gap size: Depending on stand condition and disturbance event, disturbance agents can create forest openings (gaps) ranging from very small (individual tree scale), to moderate (up to a few acres in size, as with root disease pockets; p. 86, SCLSRA; USDA, 1998), to very large (stand-replacing fire at the landscape scale; pp. 73-88, SCLSRA; USDA, 1998). The planning area experiences a mean fire return interval ranging from 11 to 126 years (mean=42 years) and is represented by fuel models 8 and 10. Fire severity data indicates that stand-replacing fire events create openings averaging 2.3 acres (range 0.0001-69.6 acres) in the planning area, specifically, and 3.7 acres (range 0.0009-1,078 acres) in the Umpqua National Forest portion of LSR RO-222, generally.

Old growth trees on the Umpqua can reach 200-250 feet in height. The radius of a one acre gap is 118 ft. If one 200 foot tree falls and it has a canopy spread 100 feet across, that tree would make roughly a ½ acre gap. Two trees falling, equals, approximately, a one acre gap. If the falling tree knocks down other trees the gap would be even larger. Large trees equal large gaps. This rational is reinforced by gap size research from fire and tree disease data that was used during the project analysis. (stand-replacing fire at the landscape scale; pp. 73-88, SCLSRA; USDA, 1998).

Gap Leave Trees: During harvest of the gap areas, the stems that will not be cut, both live and dead, will be intentionally bunched together where feasible to form small islands of remnant structure as refugia for small mammals, amphibians, and other species. These refugia patches, or “Leave Groups”, will consist of 1-10 live trees and will include trees greater than 20 inches dbh, standing legacy snags and hardwood leave species including pacific yew, and large Down Woody Debris when possible. Existing snags will remain unless they pose a safety hazard for working crews. Disturbance of large Down Woody Debris will be minimized to the extent possible and still utilize safe conventional harvest techniques. Gaps will not be uniform or circular. Edges will be uneven and gap shape will conform more to the natural contour of the site than a specific geometric shape. The goal is to replicate a natural disturbance gap dynamic.

Diversity Seedling Planting for Five Needle Pine Blister Rust: A major threat to high elevation white pines and their ecosystems is a non - native fungus (*Cronartium ribicola*) that causes the disease white pine blister rust. Mortality is particularly heavy in Western White Pine, Sugar Pine, Limber Pine and

Whitebark Pine (Safiya et al., 2003). Sugar Pine is a species that has been identified as disappearing from the Umpqua National Forest as a result of Douglas-fir ingrowth and overcrowding due to lack of historic wildfire thinning caused by fire suppression over the last 50+ years. Planting blister rust resistant Sugar pine seedlings would restore species diversity to the Lemon Butte project area in the short term and introduce resistant genetics into the population so the likelihood of Sugar Pine sustaining itself long term in the future ecosystem is higher (Sniezko, 200).

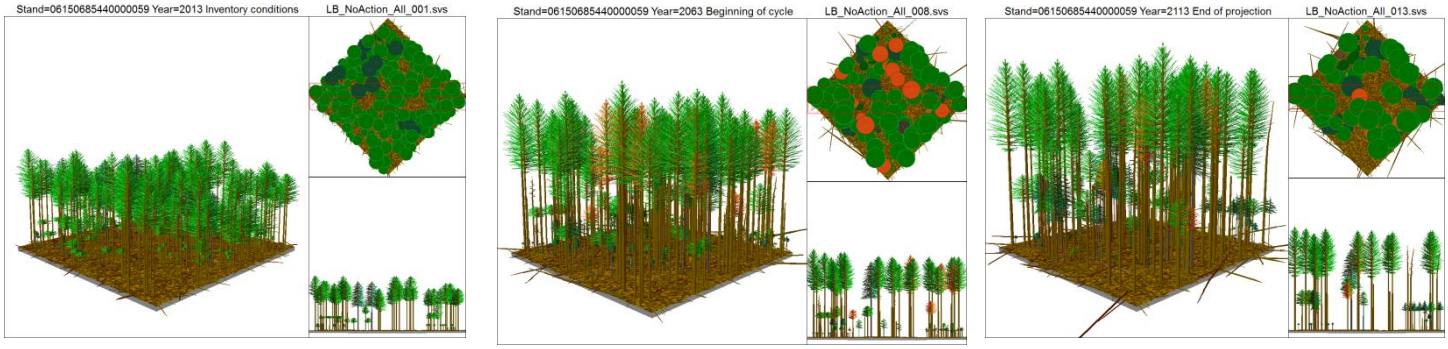
Specific Prescription Guidelines for Variability, Diversity and Structure

1. Leave all trees greater than or equal to 20” DBH (23” stump height diameter; SHD).
2. Leave or cut trees which are joined at the base would be treated as one tree; or, when a leave tree is within 2 feet of one or more trees (at ground level) leave all trees in the group. These trees have roots so intertwined that removal of one may cause damage to the other(s). This would count as a clump.
3. Leave all existing snags unless they represent an unavoidable safety hazard during logging operations.
4. Leave Pacific yew (*Taxus brevifolia*) trees unless they represent an unavoidable safety hazard during logging operations.
5. Douglas-fir, true fir, and western hemlock are the desired species for removal, in order of preference. Favor minor tree species (species other than Douglas-fir, true fir, western hemlock) for retention, retaining the largest diameter trees with high live crown ratios.
6. Uniform spacing is not required and is not desired. Spacing may be varied by +/- 20% as necessary.
7. **Gap Creation Specifications:**
    - In units specifying creation of gaps, prioritize gap locations where there is existing evidence of root disease, within existing mortality pockets, and/or where Douglas-fir constitutes the primary species (do not locate gaps in portions of units with high conifer species diversity or with significant pine or minor species component).
    - Prioritize ½-acre gap placement adjacent to riparian areas.
    - Prioritize 1-acre gap placement on south- to west-facing slopes.
    - Do not create gaps around legacy snags.
    - Identify a center tree then demarcate the gap boundary (using a 83.3-foot cutting radius for half-acre gaps and a 117.8-foot cutting radius for one-acre gaps) while leaving irregular edges, where possible.
8. **Pine Release Specifications**
    - Release all live sugar pine, western white pine, and ponderosa pine trees greater than 8” DBH (11” SHD with blister rust stem cankers on no more than 10% of the bole (no cankers are preferred). Dead tops on mature trees are acceptable if the crown ratio is 20% or greater.
    - To achieve release, remove smaller trees within a specified radius of large diameter pines with a release circle radius equal to one foot for every one inch of breast height diameter of retained tree. Release circle radius is measured from a six-inch stump height of the retention trees.

Table 5. Prescriptions for Lemon Butte LSR Plantation Thinning project units.

Unit	Total Unit Acres	No Thin		Commercially Treated Acres	Riparian Reserve Acres Treated	Thinning Prescription		Gap Treatments Heavy thinning < 50 tpa			Total Volume (mbf)	Acres of Reforestation Within Heavy Thinning & Gap Treatments		
		Acres	%Unit Acres			Moderate Thinning (50 - 70 tpa)	%Unit Acres	# 1/2-acre Gaps	# 1-acre Gaps	%of Treated Unit Acres		Sugar Pine	Incense Cedar	Western Redcedar
3	33.7	5.8	17	27.9	0.3	25.9	77	2	1	7	549	1	1	0
4	57.8	7.6	13	50.2	0.6	45.2	78	4	3	10	979	2	2	1
6	27.5	12.2	44	15.3	0.1	13.8	50	1	1	10	254	1.5	0	0
7	43.6	19.9	46	23.7	1.0	21.7	50	2	1	8	450	1	1	0
11	83.3	56.8	68	26.5	0.8	24.0	29	3	1	9	563	2	1	3
14	31.0	14.6	47	16.4	3.7	15.9	51	1	0	3	359	0	1	0
19	52.7	12.0	23	40.7	5.7	39.2	74	3	0	4	1154	0	1	0
21	40.1	20.9	52	19.2	0.7	18.2	45	2	0	5	343	0	0	1
23	33.9	18.1	53	15.8	0.7	14.3	42	1	1	9	319	1	1	0
24	33.8	18.9	56	14.9	1.0	13.9	41	2	0	7	232	1	0	1
26	65.0	12.7	20	52.3	3.0	50.3	77	4	0	4	774	1	0.5	2
31	76.2	30.8	40	45.4	2.2	40.9	54	5	2	10	754	3	2	1
39	43.5	28.9	66	14.6	0.1	13.6	31	0	1	7	185	1	1	0
46	35.7	25.3	71	10.4	3.1	9.4	26	0	1	10	100	1	1	0
47	49.3	33.9	69	15.4	0.0	14.4	29	0	1	6	148	0	0	1
48	74.4	36.0	48	38.4	0.9	35.9	48	3	1	7	614	0.5	1	0
50	61.7	40.6	66	21.1	4.7	19.1	31	0	2	9	529	0.5	0.5	1
54	48.7	21.6	44	27.1	5.2	25.1	52	0	2	7	346	1	0	1
57	35.5	8.2	23	27.3	0.0	24.8	70	3	1	9	605	1	0.5	0
58	32.4	11.4	35	21	1.7	18.0	56	2	1	10	417	1	1	0
59	45.3	15.5	34	29.8	1.5	26.8	59	0	3	10	657	1	1	1
60	59.4	26.5	45	32.9	1.0	30.9	52	2	1	6	609	1	1	2
61	27.5	18.6	68	8.9	0.0	8.4	31	1	0	6	164	0.5	0.5	0
69	70.6	63.3	90	7.3	0.0	6.8	10	1	0	7	117	0	0	0.5
Totals	**1162.6**	**560.1**	**48%**	**602.5**	**38.0**	**556.5**	**48%**	**42**	**24**	**7%**	**11,220**	**22**	**18**	**15.5**

2016 **B. 2069** **C. 2119**



No Action Alternative in 2013 (a), 2063 (b), and 2113 (c).

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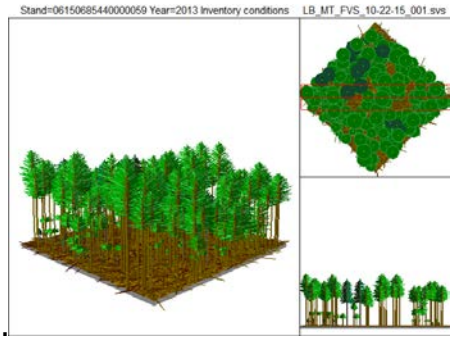

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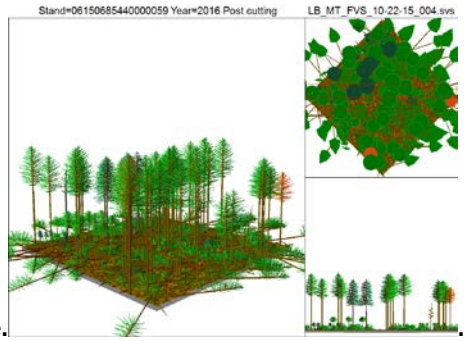

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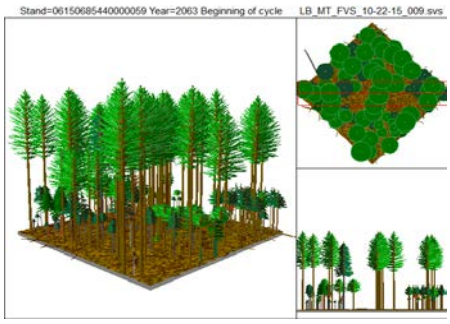

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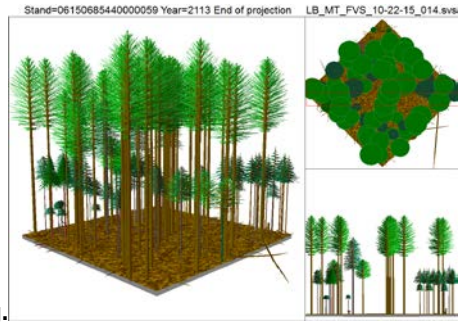
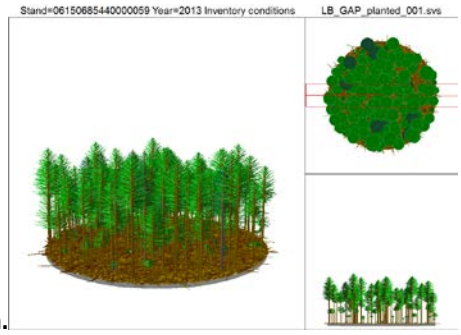


Moderate Thinning Prescription (50 tpa) in 2013 (d), 2013 post harvest (e), 2063 (f), and 2113 (g).

h.



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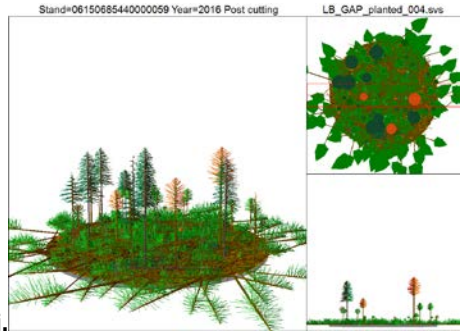
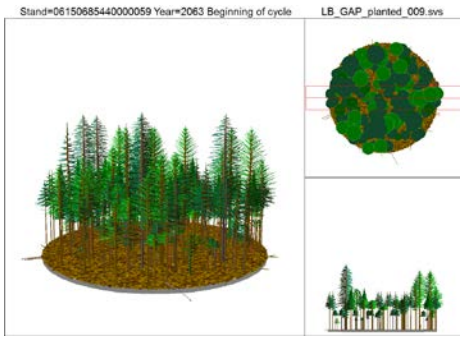
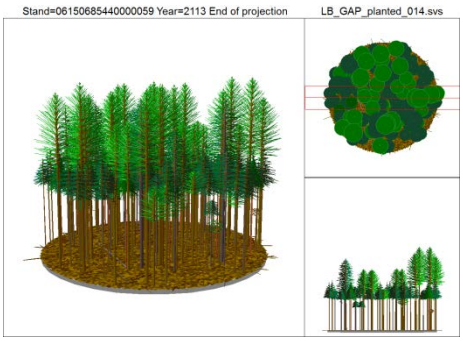


j. 

k. 

Gap Prescription in 2016 (h), 2013 post harvest (i), 2063 (j), and 2113 (k).

Figure 2 (a-k): (a-c) Representative stand conditions for No Action; (d-g) Moderate Thinning prescription (50 tpa); (h-k) Gap prescription (less than 50 tpa). DFCs are represented by 2119 stands. All prescriptions include a 20" diameter at breast height (dbh) upper diameter limit.

Direct and Indirect Effects

Direct effects are those that are triggered immediately as a result of implementation at the stand scale. Indirect effects are those that would occur within the treatment areas and at the landscape scale over 30 to 50 years, the timeframe required for canopy closure following proposed silvicultural and fuels treatments (Figure 7).

The purpose of the Lemon Butte project is to promote the development and maintenance of late-successional forest conditions in existing even-aged stands in LSR (USDA & USDI, 1994b, C-12). Proposed project activities include silvicultural (commercial thinning and fuels treatments) designed to develop structurally complex stand and landscape structure and species composition within second-growth stands that originated following even-aged management and subsequent planting in the 1950s through the 1970s. Project treatment objectives are to shift relatively homogeneous, even-aged, Douglas-fir plantations towards developing a heterogeneous combination of stand conditions appropriate to landscape position, slope, aspect, elevation. A mosaic of thinning intensities and fuel treatments would restore the variability of stand structure characteristic of a moderate severity fire regime. Silvicultural treatments are designed to be implemented in the short-term in order to achieve long-term structural and compositional objectives for stands within the planning area landscape. Two-layer stands and multi-age stand structure would be the desired and expected condition fifty years after implementation of the proposed treatments.

In Alternative 1 (No Action), no commercial thinning, gap creation, underplanting, or non-commercial thinning would occur. No direct effects on forest vegetation occur. However, since Alternative 1 would forgo the opportunity to accelerate the development of late-successional forest structure and habitat, Alternative 1 would adversely affect both structural development and fuel conditions by maintaining stands longer in the stem exclusion successional stage and of exclusively Douglas-fir species forest type.

In Alternative 2, commercial thinning, gap creation, underplanting, and non-commercial thinning is proposed to manage stand density and advance the development of late-successional forest structure and habitat.

Table 6. Summary of direct and indirect effects to forest vegetation.

Treatment	Effect on Forest Vegetation	Primary Effect (Beneficial/Adverse)	Duration (Years)	Treatment Acres By Alternative	
				1	2
Commercial Thinning	Lower stand densities and canopy closure/Variable tree density at landscape and stand scales	Beneficial: Improved species and structural diversity.	30-50	0	603
	Lower amount of snags and down wood/Larger diameter trees and snags	Beneficial: Large snags created/accelerated growth of larger leave trees. Adverse: Loss of suppression-related mortality in suppressed and intermediate small-diameter trees.	30	0	603
½-Acre and 1-Acre Gaps	Individual tree release and added growth.	Beneficial: Accelerated growth of dominant tree in gap center and improved structural diversity within stands.	30-50	0	46
	Trees planted	Beneficial: Accelerated age class and species diversification within stands and across landscape.	30-50	0	55.5
Non-Commercial Thinning	Lower tree density and reduced canopy closure.	Beneficial: Accelerated growth of retention trees and improved species diversity.	30-50	0	43

Landscape Scale Effects on Vegetation

Direct and indirect effects of proposed treatments for the action alternative, including the effects of skips and gap creation, are disclosed at both the landscape and stand scale. At the landscape scale, the action alternative proposes thinning forest stands, which would alter stand structure but not change the seral stage, which then would alter landscape patterns. Effects to vegetation are predominantly beneficial because thinning creates a more open structure and canopy, proportional to thinning acres Table 6.

Alternative 1 would result in no direct changes to existing conditions, compared to the action alternative because no treatments would be done. Stands would remain densely stocked, the development of stem exclusion stands would be delayed, the advancement of late seral habitat would be delayed across the landscape, and structural and species diversity would not be enhanced under the current dense stand conditions. Thus, Alternative 1 would adversely affect both structural development and fuel conditions by maintaining stands in the stem exclusion successional stage. Overall, Alternative 1 would have no direct effects on the landscape, but would have the indirect effect of delaying development of late-successional forest habitat within young Douglas-fir plantations in LSR and increasing risk of stand-replacement fire and loss of late-successional forest, which would be noticeable at the landscape scale.

Stand Scale Effects on Vegetation

Proposed treatments that would directly affect forest vegetation at the stand scale involve commercial thinning, non-commercial thinning, gap creation, no thinning areas, and fuels treatments.

Commercial thinning would reduce tree density and create more open stands in order to accelerate individual tree growth. Seral stages would be maintained or advanced over time. In 30 to 50 years, stands would have developed more mature forest structure with two or more canopy layers and higher densities of large trees (>24” DBH) in the over-story (Figure 7). Douglas-fir would still dominate the species composition but the understory of naturally-regenerated seedlings and planted sugar pine, incense cedar, and western red cedar would continue to develop and create structural heterogeneity and layering.

Alternative 2 stand-scale effects are beneficial, as the treatments reduce stand density, increase species diversity, and move the stands toward the desired future conditions of developing late-successional structure and complexity while increasing fire resiliency.

Alternative 1 would result in no direct changes to existing conditions, compared to the action alternative, because no treatments would be done. Stands would remain densely stocked, the development of stem exclusion stands would be delayed, the advancement of late seral habitat would be delayed across the landscape, and structural and species diversity would not be enhanced under the current dense stand conditions. Thus, Alternative 1 would adversely affect both structural development and fuel conditions by maintaining stands in the stem exclusion successional stage. This effect would be greatest in the proposed treatment units where silvicultural and fuels treatments are proposed, where young Douglas-fir dominates, and where fuel loads are high. Overall, Alternative 1 would have no direct effects on stands, but would have the indirect effect of delaying development of late-successional forest habitat within young Douglas-fir plantations in LSR and increasing risk of stand-replacement fire and loss of late-successional forest.

Landscape-Scale and Stand-Scale Effects of Skips and Gap Creation

Acres of unthinned forest (skips) and acres of gap creation (Table 5) were the metrics identified to track effects of alternatives in meeting the project purpose and need of promoting the development and maintenance of late-successional forest conditions in existing even-aged stands in LSR (USDA & USDI, 1994b, C-12).

Table 7. Summary of proposed unthinned acres (skips) and gap creation acres in the Lemon Butte planning area units.

	Alternatives:	
	1	2
Unthinned acres (skips)	1163	560
Thinned acres	0	603 commercially 43 non-commercially
Gaps (acres)	0	46
Underplanting (acres)	0	55.5

Alternative 2 would have more direct and indirect beneficial effects on development of late-successional structure because it proposes 46 acres of gap creation and 55.5 acres of subsequent underplanting of native conifer species than Alternative 1 (Table 7). Alternative 2 would leave 560 acres unthinned, contributing to the horizontal and vertical stand structure that is the purpose of Variable Density Thinning. Therefore, relative to Alternative 1, Alternative 2 better meets the purpose of advancing the development of late seral conditions in currently relatively homogenous, even-aged, and young, Douglas-fir plantation stands.

Alternative 1 would have no effect to existing conditions as no commercial thinning or gap creation with subsequent underplanting would occur and all 1163 acres analyzed would remain unthinned. Young, even-aged Douglas-fir plantation stands would remain densely stocked, stand growth and development would be slowed as inter-tree competition increased, and structural and species diversity would be maintained at low levels until a major disturbance event occurred (Zenner, 2005).

Cumulative Effects to Vegetation at the Landscape and Stand Scales

Past harvesting and associated road building in the Lemon Butte planning area have increased the fragmentation, decreased the connectivity, and shifted the distribution of late successional forest habitat on the landscape. When considering past and foreseeable future activities, the proportion of mature and late-successional forest would remain relatively stable and would begin to increase over time. Existing forest fragmentation resulting from previous clearcuts and past wildfires is expected to decrease as these acres begin to transition from the stem exclusion stage into the mature forest condition and blend back into the surrounding unmanaged forests. This reduced fragmentation is expected to become increasingly noticeable within the next 30 years.

At the landscape scale, Alternative 2 would beneficially impact the planning area landscape, as all proposed treatments are designed to enhance the development of late-successional forest habitat. Implementation of Alternative 2 would have beneficial cumulative impacts relative to the accelerated development of desired late-successional conditions over time when combined with other vegetation projects across the landscape. Following consideration of the incremental

impacts of the project, when added to past, present, and reasonably foreseeable future actions, there would be no negative long term cumulative impacts associated with Alternative 2. The proposed activities and connected actions thus represent a positive contribution to vegetative conditions in the planning area.

In contrast, Alternative 1 would have no meaningful cumulative impacts on vegetation within the planning area as no silviculture or fuels treatments would occur. However, forgoing treatment would maintain an increasing risk of stand-replacement fire into the future. Future stand-replacement fires would likely cause a reduction of late-successional forest and an increase in stand initiation stage greater than that resulting from activities associated with the action alternatives.

At the stand scale, previous harvesting has occurred in all units currently proposed for treatment. Alternative 2 would have a cumulative beneficial effect to the health of the residual stand, as treatments would reduce competition to the remaining stems allowing more access to light, water and nutrients; resulting in an increased development of the crown ratio, increase in bole diameter growth, increase in root development and mass, and increased wind and snow firmness as the bole diameter increases more rapidly over time. Alternative 2 would have beneficial cumulative impacts of accelerating individual tree health, resulting in accelerated stand growth and quicker stand development into the mature forest stage desired for Old Growth conditions.

Alternative 1, on the other hand, would continue to maintain the stand for a longer period in an over-crowed, stem exclusion state with suppressed stems with small crown ratios, limited root mass and high levels of down and dead fuels. Little recruitment of desired diversity species would occur and an island of planted of Douglas-fir would slowly develop over an extended time period, unless a wildfire or wind/snow event resulted in a stand replacement disturbance, further postponing the stand's development into an Old Growth state.

The negative effects of abandoned clear-cut forestry (Alternative 1) can be remediated by the beneficial cumulative effects of stand thinning (Alternative 2), by increasing the health of individual remaining trees in the stand and increasing growth rates toward the mature/late succession stage.

Wildlife

Regulatory Framework

Land and Resource Management Plan- Within the Umpqua National Forest LRMP there are many standards and guideline that pertain to wildlife. Those relevant to the Lemon Butte Project include Forest Management Indicator species (MIS), a more in depth analysis of these 8 species are included in this document. In addition to MIS species the Umpqua LMRP also includes standards in guidelines for species listed on the Regional Forester's Sensitive Species List. An analysis of those species is included in the "Threatened and Sensitive Wildlife Species" section below. The vegetation management activities in the Lemon Butte project are consistent with the Umpqua National Forest LRMP as revised under the Northwest Forest Plan and Late Successional Reserve Assessment which superseded the LRMP in most objective areas.

Northwest Forest Plan- Within the Northwest Forest Plan (NWFP) there are several standards and guidelines that apply to wildlife. Survey and Manage is one of those standards and guidelines and is intended to mitigate actions for species associated with old growth habitat. The Lemon Butte project proposes to treat stands less than 80 years old, this falls under the "Compliance with the modified injunction of October 11, 2006" otherwise known as the Pechmen Exemptions. In addition to the Pechmen Exemptions, which includes instream restoration, the 2011 Settlement Agreement with Judge Coughenour included fish and wildlife habitat restoration projects as being exempt from Survey and Manage. In the 2001 Record of Decision and Standards and Guidelines for Survey and Mange includes mitigations for Snag Retention Species. The analysis for these species is in this document under the "ROD Identified Snag Retention Species" section.

The Endangered Species Act (ESA)- As is required under section 7 in the ESA; this project has been submitted for consultation with U.S Fish and Wildlife Service (USFWS).

The International Migratory Bird Treaty Act- Executive Order 13186 (66 Fed. Reg. 3853, January 17, 2001)"Responsibilities of Federal Agencies to Protect Migratory Birds" - This Executive Order 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. This Executive Order also requires federal agencies to develop Memorandum of Understandings (MOU) with the FWS to conserve birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. The Forest Service has completed, and is currently implementing, their MOU's with the USFWS.

Spotted Owl Recovery Plan- The 2011 revised Northern Spotted Owl Recovery Plan includes recovery criterion and 33 recovery actions. There are recovery actions that apply to the Lemon Butte Project and the discussion of consistency with the recovery plan can be found in the "Threatened and Sensitive Species" section.

Spotted Owl Critical Habitat Final Rule 2012- U.S Fish and Wildlife released a final rule designating critical habitat for Northern Spotted Owl. The Lemon Butte Project area contains large portions of critical habitat. The proposed action is consistent with Recovery Action 6 and a detailed analysis of the effects to critical habitat can be found in the "Northern Spotted Owl" section under "Threatened and Sensitive Species" section.

Bald Eagle and Golden Eagle Protection Act- This act was enacted, primarily to prohibit "take" of eagles without a permit from the Secretary of the Interior, but also to protect eagles from human impacts. For this reason part of the definition of "take" includes disturb. This means "*to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."* This project is consistent with this act because there is no proposed activities within bald eagle or golden eagle habitat. Also there are no known (past or present) nests within the project area.

Threatened and Sensitive Wildlife Species

This section covers species recognized under the federal Endangered Species Act, and species recognized as sensitive by the Forest Service. Federally listed species require consultation with the U.S. Fish and Wildlife Service before project implementation. No such requirement exists for sensitive species.

The Forest Service Manual (FSM 2672.4) requires a biological evaluation to determine potential effects of proposed ground-disturbing activities on sensitive species. This evaluation analyzes the alternatives and discusses the potential effects on the population or its habitat within the area and on the species as a whole. It also makes recommendations for removing, avoiding, or compensating for adverse effects. In addition, the Umpqua National Forest's Land Management Plan standard and guidelines for wildlife (USDA 1990) states:

> "Any management activity that would negatively affect plant or animal species listed on the Regional Forester's Sensitive Species list, or their habitat would be modified to either avoid (preferable) or minimize the impact. Activities would not be permitted if they would result in the loss of a colony or subpopulation that is important in the natural distribution of the species. "

A pre-field review was performed to determine which sensitive species are most likely to be impacted by the proposed alternatives. Impact or effect determinations are made on each species based on this review. If an impact or effect is anticipated, further analysis and discussion of the direct, indirect and cumulative effects is provided in the following sections. Unless identified otherwise, the analysis area for wildlife species is the extent of 6th field subwatersheds within which activities are proposed.

Effects are classified as direct, indirect, or cumulative. Direct effects are defined as those effects that would occur immediately as a result of implementation. Indirect effects are those that would typically occur over longer time periods. Cumulative effects are the effects of the alternatives that would incrementally add to other past, present, or reasonably foreseeable activities that may result in additive effects to the various species.

Table 8. Threatened and Sensitive Wildlife on the Umpqua National Forest, North Umpqua RD from Regional Foresters Revised List, January 2015.

Common Name	Scientific Name	Habitat Description and Information
Johnson's hairstreak	*Callophrys johnsoni*	Late successional conifer forests; larvae feeds on dwarf mistletoe (Arceuthobium) growing on pine and other conifers; documented on the North Umpqua Ranger District (NURD).

Common Name	Scientific Name	Habitat Description and Information
Coronis fritillary	*Speyeria coronis coronis*	Wide-ranging in many habitats; larvae feed on violet; suspected on Umpqua National Forest (UNF).
Gray Blue Butterfly	*Plbejus podarce klamthensis*	The species is noted as being tied closely to suitable meadow habitat, with little straying from these wet, herbaceous conditions; documented on NURD
Western Bumblebee	*Bombus occidentalis*	Open grassy areas, urban parks and gardens, chaparral and shrub areas, mountain meadows. Documented on the Umpqua NF
Mardon skipper	*Polites mardon*	Isolated populations in grassy lowlands or subalpine meadows; rocky serpentine meadows; larvae feed on grasses; suspected on the Umpqua National Forest.
Siskiyou short-horned grasshopper	*Chloealtis aspasma*	Grasslands; Siskiyou mountains; suspected on the UNF.
Oregon Shoulderband	*Helminthoglypta hertleini*	Rocky areas with deciduous leaf litter and/or woody debris, generally adjacent to areas with grass or herbaceous vegetation. Documented on Tiller Ranger District.
Travelling Sideband	*Monadenia fidelis celeuthia*	Low elevation, somewhat dry and open forest terrain. It can be found in basal talus and rock outcrops with oak and maple overstory component. Documented on Tiller Ranger District
Chase (Siskyou) Sideband	*Monadenia chaceana*	Lower reaches of major drainages, in talus and rock slides, under rocks and woody debris in moist conifer forests, and in shrubby areas in riparian corridors. Documented on Tiller Ranger District.
Broadwhorl tightcoil	*Prisiloma johnsoni*	Can be found in very moist and diverse forest sites. Sites include abundant ground cover, conifer or hardwood overstory. Documented on Roseburg BLM district.
Siskiyou Hesperian	*Vespericola sierranus*	Riparian associated species, found in perennially moist habitat. Spring seeps and deep leaf litter along streambanks and under debris and rocks. Documented on Tiller Ranger District.
Crater lake tightcoil	*Pristiloma arcticum crateris*	Perennially wet areas in mature conifer forests within 33 feet of open water. Generally in areas that remain under snow for long periods in the winter. Documented on the DLRD.
Foothill yellow-legged frog	*Rana boylii*	Ranges from northwest Oregon to Baja California. Found near streams and rivers. Low gradient reaches with sun-exposed bedrock and gravel/cobble substrates. Documented on NURD and Tiller Ranger Districts (TRD).
Oregon spotted frog	*Rana pretiosa*	Marshes, lakes and ponds with warm shallow water; Ranges from sea level to 5,000 ft elevation; suspected on the Umpqua, but not documented on Diamond or Lemolo Lakes in over 5 years of surveys.
Western Pond Turtle	*Actinemys marmorata*	Inhabits marshes, ponds, lakes or slow-moving portions of rivers and streams. Large amounts of emergent logs, vegetation or rock are needed for basking and cover. Documented on all districts on the UNF.
Red-Necked Grebe	*Podiceps grisegena*	Winters on the Pacific and Atlantic oceans, breeds on freshwater lakes. Consistently breeds only at Klamath Lake. One summer record for Diamond Lake (1931); extremely rare in winter away from the coast; would be a rare migrant on DLRD.
Horned Grebe	*Podiceps auritus*	Freshwater lakes and ponds larger than 18 acres, with shallow margins and emergent vegetation. Strongest Oregon nesting

Common Name	Scientific Name	Habitat Description and Information
		habitat association along lake and pond shorelines and islands. Documented on the Umpqua NF
Northern spotted owl	*Strix occidentalis caurina*	Old growth conifer forests or younger forests with old growth remnant structures such as large trees, snags and down wood.
Bufflehead	*Bucephala albeola*	Nest in tree or snag cavities near high Cascade lakes and ponds. Uncommon spring migrant and common fall migrant. Nesting has been documented on DLRD, Winters on TRD.
Black swift	*Cypseloides niger*	Aerial; forages over forests and open areas. Nests behind waterfalls in wet cliffs. Forages over several square kilometers, and larger. Documented occurrence on NU and DLRD.
American peregrine falcon	*Falco peregrinus anatum*	Vertical rock cliffs with ledges or potholes. Often nests near prominent riparian habitat such as rivers or wetlands. Documented eyries on NURD, DLRD, and TRDs.
Yellow Rail	*Coturnicops noveboracensis*	Wet meadows and freshwater marshes. Considered a very local summer resident of the Klamath Basin and a vagrant elsewhere. Suspected on the Umpqua
Lewis's Woodpecker	*Melanerpes lewis*	Open pine forests and oak woodlands near water; Primary cavity excavator; Migrant in Douglas county; documented on Diamond Lake RD an Tiller RD
White-headed Woodpecker	*Picoides albolarvatus*	Open ponderosa pine stands or mixed conifer forests dominated by ponderosa pine; primary cavity excavator; Permanent resident in upper reaches of Umpqua River basin. Documented on the Umpqua NF
Purple Martin	*Progne subis*	Aerial feeding habitat generalist, found in open areas and prefer open water source nearby foraging habitat; Rare breeder in Douglas county (Sutherlin, Canyonville); suspected on the Umpqua
Bald eagle	*Haliaeetus leucocephalus*	Nest on cliff face ledges or large trees in close proximity to large bodies of water. Documented nesting on DLRD, winters on TRD and NURD.
Harlequin duck	*Histrionicus histrionicus*	Swift, rocky, large streams or rivers. Nest under rock overhangs, vegetation or streamside debris. Late spring migrant or summer visitor. Documented on North Umpqua, Diamond Lake, and Tiller Ranger Districts.
Pacific pallid bat	*Antrozous pallidus pacificus*	Open, arid habitats, oak and ponderosa pine forests. Roosts in caves, mines, man-made structures, trees and snags. Ground feeder. There are no records for this species on the Forest; however it is documented in Douglas County.
Pacific fringed myotis	*Myotis thysanodes vespertinus*	Uses caves, mines, buildings, bridges, trees and snags. Aerial feeder, but can glean from foliage and ground. Critical habitat is maternal roosts. Documented on NURD and TRD.
Townsend's big-eared bat	*Corynorhinus townsendii*	Uses caves for breeding and hibernaculum. Documented nursery colony on the NURD.
Pacific fisher	*Martes pennanti*	Late-successional forests. Associated with riparian areas. Large dead wood important, dens usually within cavities of large trees and snags. Documented on DLRD and TRD
Wolverine	*Gulo gulo*	Remote, high elevation subalpine and alpine forests to above timberline. Found in a variety of habitats. Suspected on the Umpqua
Sierra Nevada Red Fox	*Vulpes vulpes necator*	High elevation, open conifer woodlands and mountain meadows near tree line. Documented on Diamond Lake RD

Table 9. Threatened and Sensitive species evaluated and those which are omitted from further analysis.

Common Name	Habitat present/adjacent?	Rationale for omission	Is impact expected?	Loss of viability or trend?
Federally Threatened, Endangered, and Proposed				
Northern Spotted Owl (Threatened)	Yes	N/A	Yes – see discussion	No, see discussion
Fisher	Yes	N/A	Low Potential-see discussion (MIIH)	No
Sensitive Species Evaluated				
Common Name	**Habitat present/adjacent?**	**Rationale for omission**	**Is impact expected?**	**Loss of viability or trend?**
Lewis' Woodpecker	Yes	N/A	NI	No
White-Headed Woodpecker	Yes	N/A	MIIH	No
American Peregrine Falcon	Yes	N/A	NI	No
Johnson's Hairstreak	Yes	N/A	NI	No
Fisher	Yes	N/A	Low Potential-see discussion (MIIH)	No
Fringed Myotis	Yes	N/A	MIIH	No
North American Wolverine	Yes – transient habitat only	N/A	Low Potential-see discussion (MIIH)	No
Western Bumblebee	Yes	N/A	NI	No
Townsend's Big-Eared Bat	Yes	N/A	MIIH	No
Species Omitted from Further Analysis				
Sierra Nevada Red Fox	No	No habitat	NI	No
Pallid Bat	No	No habitat	NI	No
Bald Eagle	Yes	No impacts to habitat	NI	No
Black Swift	No	No Habitat	NI	No
Bufflehead	No	No habitat	NI	No
Harlequin Duck	No	No habitat	NI	No
Horned Grebe	No	No habitat	NI	No
Red-Necked Grebe	No	No habitat	NI	No
Yellow Rail	No	No habitat	NI	No
Purple Martin	No	No habitat	NI	No

Common Name	Habitat present/adjacent?	Rationale for omission	Is impact expected?	Loss of viability or trend?
Foothill Yellow-Legged Frog	Yes	No impacts to habitat	NI	No
Oregon Spotted Frog	No	No habitat	NI	No
Pacific Pond Turtle	No	No habitat	NI	No
Coronis Fritillary	No	No Habitat	NI	No
Crater Lake Tightcoil	No	No Habitat	NI	No
Chace(Siskiyou) Sideband	Yes	No impacts to habitat	NI	No
Travelling sideband	No	No Habitat	NI	No
Deschutes sideband	No	No Habitat	NI	No
Broadwhorl tightcoil	No	No Habitat	NI	No
Siskiyou Hesperian	No	No Habitat	NI	No
Oregon Shoulderband	No	No habitat	NI	No
Gray-Blue Butterfly	No	No Habitat	NI	No
Mardon Skipper	No	No Habitat	NI	No
Siskiyou Short-Horned Grasshopper	No	No Habitat	NI	No
MIIH- May Impact Individuals or Habitat **NI –No Impact**				

Northern spotted owl (*Strix occidentalis caurina*)

Status: Threatened

Existing Condition-For the purpose of this analysis "Project Area" refers to the Lemon Butte Project Boundary, whereas "Action Area" refers to the area that has been delineated using one provincial median annual home range around proposed actions. This project falls within the Oregon Cascades physiographic province which has a survey radius of 1.2miles.

The NSO (northern spotted owl) project area for the Lemon Butte Project covers about 50,297 acres, of which 30,149 acres (59%) are currently suitable nesting, roosting, and foraging habitat (NRF) for the Northern Spotted Owl (NSO). There are 22 NSO home ranges within the action area, all home ranges are above the 40% NRF threshold and all but 3 core use areas are above the 50% threshold for NRF.

Approximately 62% of the project area is within 2012 critical habitat (31,307 acres), Western Cascades South Sub Unit 5.There are no current surveys for owls within the action area. Due to the lack of recent survey data, spotted owl activity centers and home ranges within the action area have been estimated using historic owl sites from previous surveys. That analysis resulted in an estimate of 22 spotted owl home ranges/territories located around activity centers based on known historic within the action area.

The action area is approximately 60% suitable habitat and 28% dispersal. Many of the stands proposed for treatment are even-aged and lack the structural diversity to make them quality habitat for spotted owls. In addition to general lack of diversity within stands, overstocked plantation stands can pose a fire risk to adjacent owl habitat, and can contribute to large scale, high intensity fires.

As a result of federal listing, a separate analysis has been prepared for the spotted owl and supplied to the U.S. Fish and Wildlife Service (Biological Assessment for Lemon Butte Project). This document includes a detailed, thorough and exhaustive analysis describing the current conditions and project effects of the Lemon Butte Alternative 2.

Direct and Indirect Effects -The Lemon Butte IRR project proposes commercial timber harvest and associated connected actions identified in Chapter 2. None of the proposed timber harvest occurs within nesting/roosting/foraging (NRF) habitat. Alternative 2 proposed actions would result in approximately 603 acres of dispersal habitat being impacted by commercial harvest and 43 acres of non-commercial thinning, of this amount 46 acres of gap treatment would result in canopy closures dropping below the 40% level which would constitute dispersal habitat loss. However these gaps do not exceed 10% of the total stand, these gaps would not change owl utilization of these stands as dispersal habitat. These gaps will contribute to an increase in foraging opportunity for owls by increasing available forage for some prey species. The proposed action alternative will maintain dispersal habitat, which should allow owls to continue to use these stand as dispersal. In addition to the proposed thinning, this project proposes instream restoration within a 5 mile stretch of Steamboat Creek. This activity is "Not likely to Adversely Affect" because these activities are not likely to affect the spotted owls ability to utilize the habitat for nesting, foraging or roosting.

These direct impacts to northern spotted owl habitat are summarized in the following table:

Table 10. Direct impacts to northern spotted owl habitat*.

	Alternative 1	Alternative 2
Existing acres of NRF in Action Area	30,149	30,149
Acres NRF Removed	0	0
Acres of NRF Remaining in Action Area	30,149	30,147
% NRF Remaining	100%	100%
% of Analysis Area in NRF	60%	60%
Acres NRF Degraded	0	0
Existing Dispersal Only Habitat	14,136	14,136
Acres Dispersal Only Habitat Removed	0	46
Acres of Dispersal Only Habitat Remaining	14,136	14,069
% Dispersal Only Habitat Remaining	100%	99%
% of Analysis Area in Dispersal Only Habitat	28%	28%

*The proposed project may also have direct effects on NSOs through noise generating disturbances within close proximity to both known NSO activity centers and spatially suitable habitat that may support nesting owls. It is expected that some potential disturbance activities would occur during the March 1 through September 30 NSO breeding season. Activities occurring after the critical breeding period (March 1 through July 15) may disturb the NSO, but are not likely to disrupt NSO reproductive success because the identified buffers and restrictions from the programmatic disturbance letter of concurrence (USFWS 2009, TAILS 13420-2009-I-0070) are being applied.

The Biological Assessment for the project also includes more information on the potential impacts to spotted owl prey species including flying squirrels, woodrats, red tree voles and mice. In summary, proposed treatments are expected to have short-term impacts, due to the reduction of canopy cover. These impacts are expected to decrease as treated stands develop additional understory structure and overall stand complexity. While the No Action alternative would have no

impacts to spotted owl prey species, Alternative 2 would have these impacts in relation to their comparative acreage of treatment, which for this project is approximately 603 acres.

Effects to Critical Habitat – In December of 2012, the USFWS released a final rule designating critical habitat for the northern spotted owl (USFWS 2012). The action area for Lemon Butte contains 31,307 acres of revised critical habitat, most of which falls within the Western Cascades South sub unit 5.The final rule states, *"In general, prescriptions (e.g., vegetation management, prescribed fire, etc.) that apply ecological forestry principles to address the restoration and conservation of broader ecological processes in areas where this is needed, while minimizing impacts to structurally diverse or mature and old forest that does not require such management can be compatible with maintaining the critical habitat's essential features in the long term at the landscape scale" (USFWS 2012, p. 71882*). The final rule also states that, *"This rule is different from previous designations of northern spotted owl critical habitat in that we are recommending a "hands on" approach to forest management within critical habitat. We encourage land managers to consider active management of forests that balance short-term impacts with long-term beneficial effects, which ultimately supports long-term conservation of the northern spotted owl" (USFWS 2012a, p. 72014).* Alternative 2 proposes treatment which would result in 46 acres of downgraded dispersal habitat through gap creation. However these gaps would not exceed 10% of the total stand and therefore would not reduce the functionality of the stand as dispersal habitat. Although gap creation may have short-term impacts to critical habitat, they would have long-term beneficial impacts through improved structural diversity and heterogeneity in stands that are treated.

Consistency with the Recovery Plan - In July of 2011 the revised recovery plan for the Northern Spotted Owl was finalized (USDI 2011). The Recovery Plan included four Recovery Criteria and 33 Recovery Actions, of which 3 Recovery Actions apply to the Lemon Butte Project.

> **Recovery Action 6: 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 will benefit spotted owl recovery. (p. III-19).**

The Lemon Butte project is entirely within LSR and is designed to accelerate the development of structural complexity and biological diversity within the treated stands. Therefore the project is consistent with this recovery action.

> **Recovery Action 10 - Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population.**

Recovery Action 10 goes on to suggest that in unsurveyed owl habitat (like the Lemon Butte IRR project) the USFWS and Forest Service should work together to minimize impacts to potential spotted owl sites. All known owl home range and core use areas are at or above threshold levels for amounts of suitable habitat and would remain as such post treatment. Therefore the Lemon Butte IRR project is consistent with Recovery Action 10.

Cumulative Effects - Past timber harvest, wildfire, wildfire suppression, and infrastructure developments have all had an influence on the availability of spotted owl habitat conditions found today. In general, the total amount of such habitat is expected to be reduced from pre-European settlement times. As was stated in the existing condition section, the owl analysis area is delineated using a 1.2 mile radius around historic owl sites as well as proposed activities. Activities that may impact spotted owls include Rowboat timber sale, Sailboat Timber sale and

Lobo Stewardship sale, however USFWS concurred that these effects; “May effect, but not likely to adversely affect”(USFWS reference# 1-15-07-I-0131 . These sales are very similar to Lemon Butte in their treatment and objectives and do not downgrade dispersal or NRF. Effects to spotted owl are disturbance only. A more in depth discussion can be found in the Biological Assessment for the Tugboat EA. Of these sales Rowboat and Sailboat will likely finish harvest activities before this analysis is complete, post-harvest activities including snag creation and fuels treatments will continue however those activities are subject to seasonal restrictions and disturbance to owls will be outside of critical breeding period and therefor very minimal.

Proposed commercial thinning on Cottage Grove ranger district; specifically Quartz and Caldip, were considered however these projects are outside of the analysis area and therefore not included in this analysis. For the scope of this project cumulative effects of ongoing activities is “May Effect but is not likely to adversely affect”.

Effects determination – Alternatives 1 is the No Action alternative and has no identified direct, indirect or cumulative effects. This alternative would have “No Effect” to the spotted owl. Alternative 2 includes activities that would address stand conditions in dispersal habitat. Proposed units with gap treatment would not exceed 10% of the units, this would not reduce the functionality of the stands and would result in increased diversity within the stands and overall quality of habitat for spotted owls. In addition to the proposed commercial harvest, the proposed noncommercial unit is intended to reduce fuel loading in the stand that is directly adjacent to a LSR4 owl core. Even aged, overstocked stands can pose a risk to adjacent older stands by creating intense fire conditions that lead to crown fires and consumption of large woody debris. These effects can reduce the quality of owl habitat and contribute to the reduction of structural complexity in older stands or loss from stand replacing fires. Proposed underburning in three of the commercial units is intended to address fuel loading following harvest. Fire managers will utilize the spring burn window to maintain a low intensity burn, and reduce the likelihood of large woody debris and snags being consumed during the underburn. The proposed underburn accounts for approximately .003% of the watershed. Alternative 2 “May Effect but is not likely to adversely affect” spotted owls.

Johnson's hairstreak (*Callophrys johnsoni*)

Existing Condition - Preferred habitat is late successional and old-growth coniferous forests that contain mistletoes of the genus *Arceuthobium* (dwarf mistletoes). The Johnson's hairstreak is considered to be an old-growth obligate butterfly. The species lays its eggs on mistletoe and the larvae feed on all exposed parts of the host plant. Adults feed on flower nectar (including Oregon grape, Pacific dogwood, ceanothus, pussy paws, and *Rubus* species) and nectar of the mistletoe. This species is believed to spend most of its time high in the canopy, only occasionally coming down to the forest floor. Range is local and scarce throughout Pacific Northwest. A detailed summary of habitat associations, life history traits, range/distribution etc. are documented in a species fact sheet on the Forest Service-Bureau of Land Management Pacific Northwest Interagency Special Status /Sensitive Species Program website: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/20050906-fact-sheet-johnsons-hairstreak.doc. The species has been documented within the analysis area. The closest occurrence to any proposed activities is over a mile away.

Direct and Indirect Effects – The no action alternative has no proposed activities within suitable Johnson's hairstreak potential habitat. None of the stands proposed for treatment in the action alternative are over 80 years of age. Alternatives 2 would have no direct or indirect effects to the amount of available Johnson's hairstreak habitat available within the analysis area.

Cumulative Effects – Past timber harvest, road construction and wildfire have all had negative effects on the amount of available Johnson's hairstreak habitat within the project area. There are no other scheduled activities that would affect Johnson's hairstreak habitat.

All project alternatives would have "No Effect" to the Johnson's hairstreak butterfly.

Peregrine Falcon (*Falco peregrinus anatum*)

Existing Condition - Peregrine falcons are rather large birds of prey which forage primarily upon other bird species. Habitat elements needed by peregrines include large cliff faces for nesting and areas with abundant bird populations for foraging sites. Within each falcon nest sites there are three nest protection zones; primary, secondary and tertiary. The primary zone is important for nest protection and habitat used for extensive foraging, this zone is where activities are seasonally restricted in order to minimize impacts to peregrines during the breeding period. Seconday and tertiary zones may also have seasonal restrictions usually only for high –intensity activities such as blasting or large helicopters. The analysis area contains two peregrine falcon nests, Chilcoot and Part Creek. All proposed actions are within the tertiary zone. Habitat modification within the Chilcoot tertiary zone is 270 acres which is 1% of the total falcon zone. Part Creek falcon zone has 78 acres of modification which is .04%.

Direct and Indirect Effects – Alternative 1 retains all conditions in their current state and has no direct or indirect effects. Alternative 2 incorporate seasonal restrictions where needed to minimize disturbance of peregrine falcon nests. Alternative 2 also includes harvest prescriptions which call for gap creation within the 1.5 mi zone around both the Part Creek and Chilcoot nests. These gaps represent less than 1% of each nest zone; so existing levels of pole aged stands are retained. All alternatives comply with direction in Prescription C3-I.

Cumulative Effects - Disturbance activities at identified nests include road use, recreational hiking and rock climbing and Forest management and administrative duties. These actions are expected to follow past trends in the foreseeable future. Past regeneration harvest, wildfire and infrastructure developments (roads, rock quarries, helibase) are the principle activities that reduced the amount of area pole aged or larger forest stands within 1.5 mile nest zones. There are no other planned or scheduled activities within the peregrine falcon 1.5 mile nest zones that would combine with action alternatives to produce further cumulative effects.

All alternatives would have “No Effect” to the peregrine falcon.

Lewis’ woodpecker *(Melanerpes lewis)* and White-headed woodpecker *(Picoides albolarvatus)*

Existing Condition - These woodpeckers are found in open habitats, favoring low canopy closure forest with open understories. The Lewis woodpecker inhabits open ponderosa pine forest, open riparian woodlands dominated by cottonwood, or pine forest that have been logged or burned. It may also inhabit oak or oak/dry coniferous forests. Food items include free-living (not wood boring) insects, acorns, other nuts and fruits (Tobalske 1997). The white-headed woodpecker is most often associated with large diameter, old growth pines and open canopies. In our area it favors ponderosa pine and sugar pine due to the high value seed production of these species. (Garret, Raphael and Dixon 1997).

Potential habitat was mapped as drier site plant series (Douglas-fir) with low canopy closure canopy closures (from 11-40%) on south aspects. Regeneration harvest units with low canopy closure due to recent harvest were omitted. Only areas at least 10 acres in size are considered as suitable habitat for these species. The closest occurrence of both species is over 25 miles away from the project area.

Direct and Indirect Effects – Alternative 1 is the No Action alternative and would have no direct or indirect effects. Alternative 2 proposed activities are all plantation thinning which are not within mapped, potential habitat for these species, therefore there would be no direct or indirect effects to habitat for this species.

Cumulative Effects – Past timber harvest, road building and wildfire have all influenced the amount of potential Lewis' and white-headed woodpecker habitat in the analysis area. In general, current conditions are considered to be below historic levels where frequent fires likely maintained more open canopied forest stands on southerly slopes. All alternatives avoid direct or indirect effects to potential habitat and would have "No Effect" to Lewis' or white-headed woodpeckers.

Townsend's big-eared bat *(Corynorhinus townsendii)*

Existing Condition - Townsend's big-eared bat is a widely distributed species along the west coast, with isolated populations in the central and eastern US. Within this range, it occupies a wide variety of habitat types, including coniferous forests, deserts, prairies and agricultural area. The key habitat feature appears to be the presence of cave or cave-like features for roosting and rearing young. Reports also exist of solitary individuals (likely males) utilizing buildings, bridges rock crevices and hollow trees for roosting by non-breeding or non-wintering individuals. This species is a moth specialist with over 90% of its diet composed of lepidopterans and forage primarily in riparian areas. It may cover large distances while foraging at night, with records of some foraging flights over 150 kilometers (93 miles) (Piaggio 2005). This species has been documented on the North Umpqua District.

The analysis area contains one known maternal cave, this cave is over half a mile away from the nearest proposed unit. Rock crevices, bridges and snags can be found throughout the analysis area, as can forest openings and open-canopied forest where foraging may be more efficient. The entire project area can be considered to be providing foraging opportunities under, within or above any available tree canopy.

Direct and Indirect Effects – Alternative 1 is the No Action alternative and retains current vegetative structural conditions. This alternative has no associated direct or indirect effects. Alternative 2 proposes commercial timber harvest in stands under 80 years old. Proposed units are younger plantations with small size diameters and fewer defect characteristics that make them unlikely candidates for roost trees. Negative direct impacts to roosting habitat are therefore discountable. These treatments would result in lower stocking rates and more open residual stands which are expected to create better foraging opportunities for aerial insect gleaners like the big-eared bat.

Cumulative Effects – Past regeneration harvest, commercial thinning, and prescribed fire have all influenced the availability and quality of snag and foraging habitat for the Townsend's big-eared bat. Each produced some loss of hollow trees for roost site, but also generated foraging advantages.

Alternative 1 has no identified direct, indirect or cumulative effects and would have "No Effect" to the Townsend's big-eared bat. Alternative 2 "May Effect" habitat conditions through short-term improvements to foraging opportunities in newly created open canopied stands and long-term benefits to large diameter tree development. These impacts are not expected to yield a trend toward federal listing or loss of species viability.

Fringed myotis *(Myotis thysanodes)*

Existing Condition - As with other bats, there is little known about this species habitat requirements or life history in the state of Oregon. It has been classified as a cave dweller, but records also exist of it utilizing human structures (attics, abandoned structures). Habitat types associated with known roost locations include old-growth Douglas fir and riparian areas with western yew, Port Orford cedar and big-leaf maple (Verts and Carraway 1998).

There is only one known cave within the project area, a maternal roost of Townsend's big-eared bat, but the analysis area does contain old growth Douglas-fir and riparian habitats that would provide roosting opportunities. As identified for the Townsend's big-eared bat, the entirety of the analysis area could be utilized for foraging.

Direct and Indirect Effects – Alternative 1 retains current habitat conditions and has no identified direct or indirect effects. Alternative 2 proposes commercial thinning of young stands and neither alternative would have any direct or indirect effects to Fringed myotis habitat.

Cumulative Effects – Past, present and planned future activities for fringed myotis foraging habitat conditions are the same as those identified in the Townsend's big-eared bat cumulative effects section.

Alternative 1 has no identified direct, indirect or cumulative effects and would have "No Effect" to Fringed Myotis. Alternative 2 "May Effect" habitat conditions through short-term improvements to foraging opportunities in newly created open canopied stands and long-term benefits to large diameter tree development. These impacts are not expected to yield a trend toward federal listing or loss of species viability.

Wolverine (*Gulo gulo*)

Existing Condition - Important habitat elements for wolverine are an adequate forage base and large areas of security habitat which are free from human disturbance. Wolverines are far-ranging scavengers and in the Lemon Butte analysis area the principle forage item would likely be natural or hunting induced big game carcasses.

Direct and Indirect Effects – Alternative 1 is the No Action alternative and retains the existing forage base and seclusion habitat conditions as they currently exist. There are no direct or indirect effects related to this alternative. Alternative 2 proposes 603 acres of commercial thinning, including 46 acres of gap creation. These treatments are expected to have a direct, but short-term benefit to black-tailed deer and Roosevelt elk that comprise the majority of the wolverine forage base in the project area. Additional information on these effects to deer and elk can be found in the Management Indicator Species, deer and elk section of this document. Alternative 1 has no changes to the forest road network and no changes to the current level of seclusion habitat This alternative would have a lower level of short-term forage improvement for deer and elk as compared to Alternative 2. But like Alternative 2, this alternative proposes no change to the forest road network and retains current levels of seclusion habitat.

Cumulative Effects – Past land use activities (including timber harvest, infrastructure development, recreational development, road building, prescribed burning, etc;) have greatly influenced wolverine habitat conditions in the analysis area. Regeneration timber harvest, coupled with the effects of fire (both wildfire and prescribed burning), have produced positive effects to big game habitat conditions and populations. Conversely, roadbuilding, recreational development, road building and other actions have resulted in increased human use and decreased availability of seclusion habitat. Many of these same activities are still ongoing today. As this analysis was being completed, the forest Travel Management Plan Subpart B was completed. The Travel Management Plan eliminated cross-country travel and produced minor changes in Forest Transportation use. These differences are not considered to be of a degree large enough to meaningfully change the quality of the analysis area as potential wolverine habitat. The large degree of road access and human activity ultimately provide marginal habitat conditions for wolverine.

Alternative 1 has no direct or indirect effects and would have "No Effect" to overall wolverine habitat conditions. Alternative 2 would provide minor improvements to the big game forage base and reduce disturbance by limiting off road travel to existing disturbance. Both alternatives would have "beneficial impacts" to wolverine habitat quality in the analysis area

Western Bumblebee (*Bombus occidentalis*)

Existing Condition- The western bumblebee has a large range in the western U.S and western Canada. This species was once common throughout its range but has since declined dramatically in central California, western Oregon and Western Washington. This species is a generalist and plant association at this time is largely unknown, however they have been observed foraging on *ceanothus, lupinus, cirsium* and *rubus*. In the Lemon Butte project area bumble bees have been observed foraging along roads and open areas. The closest occurrence of western bumblebee is over 25 miles away.

Direct and Indirect Effects- Alternative 1 proposes no new actions that would have any effect on western bumblebees directly or indirectly. Alternative 2 proposes commercial thinning plantation stands less than 60 years of age. These stands have a dense canopy cover with little understory and provide poor habitat for pollinator species. Along with commercial thinning, Alternative 2 also proposes 46 acres of gap creation. These gaps would provide short term habitat for many pollinator species by increasing the amount of light that reaches the understory and allowing herbaceous flowering plants to grow.

Cumulative Effects - Over stocked plantation stands and fire exclusion has contributed to the decline in early seral habitat that is important to pollinators.

Alternative one would have no direct, indirect or cumulative effects to western bumblebee. Alternative 2 would have short term beneficial effects to western bumblebee.

Migratory Bird Treaty Act and Landbird Analysis

Existing Condition - Federal land management agencies are required by treaty and executive order to consider the effects of their land management activities on a variety of bird species.

The Migratory Bird Treaty Act of 1918 (MBTA).

Implements various treaties and conventions between the U.S., Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the act, it is unlawful to pursue, hunt, take, capture (or kill) a migratory bird except as permitted by regulation (16 U.S.C. 703-

704). The regulations at 50 CFR 21.11 prohibit the take, possession, import, export, transport, sale, purchase, barter, or offering of these activities, or possessing migratory birds, including nests and eggs, except under a valid permit or as permitted in the implementing regulations (Director's Order No. 131). A migratory bird is any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual life cycle.

The U.S. Fish and Wildlife Service (FWS) is the lead federal agency for managing and conserving migratory birds in the United States; however, under Executive Order (EO) 13186 all other federal agencies are charged with the conservation and protection of migratory birds and the habitats on which they depend. In response to this order, the Forest Service has implemented management guidelines that direct migratory birds to be addressed in the NEPA process when actions have the potential to negatively or positively affect migratory bird species of concern.

Executive Order 13186 (66 Fed. Reg. 3853, January 17, 2001)"Responsibilities of Federal Agencies to Protect Migratory Birds"

This Executive Order 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. This Executive Order also requires federal agencies to develop Memorandum of Understandings (MOU) with the FWS to conserve birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. The Forest Service has completed, and is currently implementing, their MOU's with the USFWS.

Forest Service & FWS Memorandum of Understanding (MOU)

The purpose of this MOU is, "to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the Parties, in coordination with State, Tribal, and local governments."

Under the MOU the Forest Service Shall:

> Address the conservation of migratory bird habitat and populations when developing, amending, or revising management plans for national forests and grasslands, consistent with NFMA, ESA, and other authorities listed above. When developing the list of species to be considered in the planning process, consult the current (updated every 5 years) FWS Birds of Conservation Concern, 2008 (BCC), State lists, and comprehensive planning efforts for migratory birds. Within the NEPA process, evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority risk factors. To the extent practicable:
>
> a. Evaluate and balance long-term benefits of projects against any short- or long-term adverse effects when analyzing, disclosing, and mitigating the effects of actions.
> b. Pursue opportunities to restore or enhance the composition, structure, and juxtaposition of migratory bird habitats in the project area.
> c. Consider approaches, to the extent practicable, for identifying and minimizing take that is incidental to otherwise lawful activities, including such approaches as:
> 1. Altering the season of activities to minimize disturbances during the breeding season;
> 2. Retaining snags for nesting structures where snags are underrepresented;
> 3. Retaining the integrity of breeding sites, especially those with long histories of use and;

4. Giving due consideration to key wintering areas, migration routes, and stop-over habitats.
5. Minimizing or preventing the pollution or detrimental alteration of the environments utilized by migratory birds whenever practical by assessing information on environmental contaminants and other stressors relevant to migratory bird conservation.

PIF Bird Conservation Regions (BCR'S)

Bird Conservation Regions (BCRs) are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. BCR's are a hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC). The CEC framework comprises a hierarchy of 4 levels of eco-regions. At each spatial level, spatial resolution increases and eco-regions encompass areas that are progressively more similar in their biotic (e.g., plant and wildlife) and abiotic (e.g., soils, drainage patterns, temperature, and annual precipitation) characteristics. The Umpqua falls within BCR 5 (Northern Pacific Forest) and the BCR 5 species, habitats and their occurrence on the Umpqua are displayed in Table 11.

Table 11. Bird of Conservation Concern in the Bird Conservation Region 5, Northern Pacific Rain forest.

Bird Species	Preferred Habitat	Present on the Umpqua	Potential Impact from Project
Yellow-billed Loon	Winters along the coast from AK to Baja CA. Transients can be found on inland bodies of water.	No	No
Marbled Godwit (nb)	Prefer coastal mudflats, sandy ocean beaches, wet margins of large reservoirs or brackish lakes and sewage ponds.	No	No
Red Knot (Roselaari ssp.) (nb)	Found along the coast foraging in open estuarine tide flats, inland on margins of sewage ponds & at larger brackish lakes.	No	No
Short-billed Dowitcher (nb)	A bird of wet mud or shallow water with underlying mud. Common in tidal mudflats and adjacent shallow water.	No	No
Aleutian Tern	Primarily pelagic, coming to land only to nest and roost.	No	No
Caspian Tern	Found in marine, coastal estuarine, salt marsh brackish and freshwater habitats near large bodies of water. Often nests on islands in rivers and salt lakes.	No	No
Arctic Tern	Found offshore migrating along the coast, rarely near land.	No	No
Marbled Murrelet	Found in nearshore (within 5 km) waters and within 50 miles inland in old growth forest stands.	No	No
Kittlitz's Murrelet	Alaskan species.	No	No
Black Swift[1]	Nests on ledges or shallow caves in steep rock faces and canyons, usually near or behind waterfalls and sea caves. Forage over forests and open areas in montane habitats.	Yes	No

Bird Species	Preferred Habitat	Present on the Umpqua	Potential Impact from Project
Rufous Hummingbird[1]	Found in a variety of habitats, most likely in brushy areas with flowers and forests with a well-developed understory.	Yes	Potentially
Allen's Hummingbird	Found in narrow, moist coastal fog zones in open areas of coastal scrub. Nest in nearby wooded areas.	Yes	No
Olive-sided Flycatcher[1]	Open conifer forests (< 40 % canopy cover) and edge habitats where standing snags and scattered tall trees remain after a disturbance.	Yes	Potentially
Willow Flycatcher (non listed subspecies)	Associated with riparian shrub dominated habitats, especially brushy/willow thickets. In SE WA also found in xeric brushy uplands.	Yes	Potentially
Horned Lark (Strigata ssp.) (ESA candidate)	Open fields with short herb dominated ground cover < 31 cm tall and patches of bare ground.	Yes	No
Oregon Vesper Sparrow (Affinis ssp.)	Lightly grazed pastures with scattered shrubs and grass height < 30-60 cm) high	Yes	No
Western Grebe (nb)	Marshes with open water and on lakes and reservoirs supporting emergent vegetation.	Yes	No
Laysan Albatross (nb)	Nests on ledges or shallow caves in steep rock faces and canyons, usually near or behind waterfalls and sea caves. Forage over forests and open areas in montane habitats.	No	No
Black-footed Albatross (nb)	Pelagic, far offshore seabird	No	No
Pink-footed Shearwater (nb)	Pelagic offshore seabird	No	No
Red-faced Cormorant	Alaskan species	No	No
Pelagic Cormorant (pelagicus ssp.)	Year round nearshore marine and estuarine habitats, on ledges and vertical cliffs, on rocky islands and headlands.	No	No
Bald Eagle (delisted species)	Associated with large bodies of water, forested areas near the ocean, along rivers, and at estuaries, lakes and reservoirs.	Yes	No
Northern Goshawk	A habitat generalist that prefers to nest in mature forests with large trees on moderate slopes with open understories.	Yes	No
Peregrine Falcon (delisted species)	Wide range of habitats, nests on cliff ledges, bridges, quarries.	Yes	No
Black Oystercatcher	Rocky shores and sand/gravel beaches along the coast.	No	No
Solitary Sandpiper (nb)	Small and partly wooded patches of water, and high altitude bogs and wet meadows	No	No
Lesser Yellowlegs (nb)	Migrates through east of the Cascade crest. A wader of shallow pools often found near mudflats on seasonally flooded fields and small isolated ponds.	Maybe	No

Bird Species	Preferred Habitat	Present on the Umpqua	Potential Impact from Project
Whimbrel (nb)	Migrating through coastal estuarine mud flats and on sandy ocean beaches. Inland on fields or mud flats around lakes and ponds.	No	No
Long-billed Curlew (nb)	Short-grass or mixed-prairie habitats with flat to rolling topography. Also found in agricultural fields.	No	No
Hudsonian Godwit (nb)	Rare migrant along the west coast.	No	No

nb= non breeding within this BCR,
[1]species are also focal species identified in Altman and Alexander 2012.

The Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington list of focal species (2012) and BCC species list for the project area was reviewed. Those species and habitats that are within the project area are incorporated and effects disclosed in this analysis. Table 12 displays a list of focal landbird species identified in the 2012 PIF habitat conservation plan on the Umpqua National Forest that are known or likely to be present in the Planning Area and could be affected by the proposed actions.

Table 12. Landbirds identified as Focal Species by the Partners In Flight document "Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington" version 2.0 by Altman and Alexander 2012.

Forest Stage	Habitat Attribute	Focal Species	Potential Impact from Project
Old-Growth/Mature Forest (Multi-Layered/Late-Successional)	Large snags	Pileated Woodpecker	No
	Large trees	Brown Creeper	No
	Deciduous canopy/sub-canopy trees	Pacific-slope Flycatcher	No
	Mid-story tree layers	Varied Thrush	No
Mature/Young Forest (Multi-Layered/Understory Reinitiating)	Closed canopy	Hermit Warbler	No
	Open mid-story	Hammond's Flycatcher	No
	Deciduous understory	Wilson's Warbler	
	Forest floor complexity	Winter Wren	No
Young/Pole Forest (Understory Reinitiating/Stem Exclusion)	Deciduous canopy trees	Black-throated Gray Warbler	Yes
Sapling/Seedling Forest (Stand Initiation/Early Successional)	Residual canopy trees	Olive-sided Flycatcher	Yes
	Snags	Northern Flicker	Yes
	Deciduous shrub layer	Orange-crowned Warbler	Yes
Unique Forest Habitats or Conditions	Mineral springs	Band-tailed Pigeon	No
	Wet meadows	Lincoln's Sparrow	No
	Alpine grasslands	American Pipit	No
	Waterfalls	Black Swift	No
	Nectar-producing plants	Rufous Hummingbird	No
	Large hollow snags	Vaux's Swift	No
	Landscape mosaic forest	Blue (Sooty) Grouse	No
Klamath Mountains Mixed Conifer/Mixed Conifer-Hardwood Forests	Pine-oak canopy/subcanopy trees	Purple Finch	No
	Dense shrub understory	Nashville Warbler	No
	Shrub-herb interspersion understory	Hermit Thrush	No
	Forest canopy edges	Western Tanager	No
	Montane brushfields	Fox Sparrow	No
	Post-wildfire	Lazuli Bunting	No

Direct and Indirect Effects - Alternative 1 is the No Action alternative and would have no direct or indirect effects to any of the landbird species referenced above. Alternative 2 includes thinning, including gap creation or heavy thinning, which would have potential effects identified in the following tables:

Table 13. Alternative 2 Impacts to Pertinent Landbird Species

Landbird species	Effects of Alternative Implementation
Rufous hummingbird	Commercial thinning, notably gap creation and areas of heavy thinning, are expected to result in increased development of shrub and herbaceous flowering species. This habitat impact is expected to yield a positive, indirect effect.
Olive-sided flycatcher	Only areas of gap creation or heavy thinning prescriptions (46 acres) are expected to result in habitat areas with canopy closures below 40% desired by this species. Given the small size and scattered distribution of this acreage, it is unlikely these impacts will produce any increased utility of the area by olive-sided flycatchers.
Willow flycatcher	Riparian thinning is included in this alternative but the small scale and widely scattered distribution makes it unlikely that it will produce environmental effects large enough to influence willow flycatcher use of the project area.
Black-throated gray warbler	Commercial thinning activities, together with potential broadleaf tree planting, have the potential to yield increased amounts of deciduous canopy trees. This would have an indirect and beneficial impact to the black-throated gray warbler.
Northern flicker	The effects of alternative activities to snag habitat is further detailed in the coarse wood analysis section of this assessment. In summary, this alternative initiates activities that will hasten development of large diameter trees and snags which will yield direct and indirect beneficial effects.
Orange-crowned warbler	The commercial thinning activities of this alternative will produce short-term decreased canopy closures which will allow corresponding development of the deciduous shrub layer. This will produce an indirect, beneficial effect to the orange-crowned warbler.

Cumulative Effects – Past timber harvest, infrastructure development, wildfire and timber management activities have all had effects to certain habitat characteristics identified as being utilized by this broad and inclusive species grouping. Current land use practices including non-commercial timber culture activities, prescribed burning, recreational use and infrastructure maintenance are all planned or foreseeable within the analysis area. None, when viewed cumulatively with Lemon Butte activities, are anticipated to yield changes to overall habitat conditions outside those considered in the preceding analysis.

All alternatives are compliant with current agency direct and objectives for landbird species. All alternatives are expected to continued viability for those species currently found within the analysis area.

Wildlife Survey and Manage Species

Survey and manage is a standard and guideline within the NWFP that is intended to mitigate impacts of land management actions on species that are closely associated with late-successional or old-growth forests and whose long-term persistence is a concern. With the exception of the red tree vole (*Arborimus longicaudus*) and great grey owl (*Strix nebulosa*), all wildlife survey and manage species that are relevant to this project, were added to the Regional Forester's Sensitive Species List and are addressed in the sensitive wildlife species section. Proposed project activities for all alternatives fall within the *"Compliance with the modified injunction of October 11, 2006"*.

> *This project falls within one of the four exemptions listed in the October 11, 2006 modified injunction NEA v. Rey; specifically:*

a. Thinning projects in stands younger than 80 years old:

b. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;

c. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and

d. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

(NEA v. Rey, C04-0844_p, Stipulation (Dkt No. 109 at 2-3)"

All alternatives avoid activities in late-successional or old growth habitats favored by these species. All alternatives are expected to provide for continued persistence of these species and are compliant with Survey and Manage direction and objectives.

Umpqua Forest Plan Management Indicator Species

The Umpqua Land and Resource Management Plan (Forest Plan) contains 8 Management Indicator Species: Northern spotted owl, pileated woodpecker, pine marten, bald eagle, peregrine falcon, Roosevelt elk, black-tailed deer, and "cavity nesters". The northern spotted owl is a federally listed species, and the bald eagle and peregrine falcon are Forest Service Region 6 Sensitive species. Agency direction requires that Threatened, Endangered and Sensitive (TES) species receive special consideration in land management decisions. These species are also included in the wildlife Biological Evaluation (BE) prepared for this project.

Table 14. Umpqua National Forest Management Indicator Species, the habitats for which they are an indicator and their presence within the analysis area.

Species	Habitat Indicator	Presence within the analysis area
Northern spotted owl	Mature/Old growth habitat	Yes
Pileated woodpecker	Mature/Old growth habitat	Yes
Pine marten*	High elevation mountain hemlock/lodgepole pine	Unlikely
Bald eagle*	None/Special management	Unlikely
Peregrine falcon	None/Special management	Yes
Blacktail deer and Roosevelt elk	Big game winter range	Yes
Primary cavity excavators	Snag Habitat	Yes

*Management indicator species without indicator feature or presence in analysis area (pine marten and bald eagle) are not discussed further in this MIS analysis.

Throughout further analysis of Management Indicator Species, the historical and current forest-wide baseline values are obtained from the *Management Indicator Species on the Umpqua National Forest Habitat Assessment 2012* (MIS Habitat Assessment) document (Chapman, J.

2012) prepared by the Forest Wildlife Biologist. This document is incorporated into this analysis by reference.

Northern spotted owl

Existing Condition

Northern spotted owls are residents of mature and old growth forests. In addition to being selected as indicators for mature forests in the Forest Plan, they also are listed as a Threatened species under the Endangered Species Act and a Region 6 Sensitive species. Additional information on the spotted owl in relation to its designation as a Threatened species can be found in the Biological Assessment that has been prepared for this project as part of required consultation procedures. Information in relation to its designation as a sensitive species can be found in the wildlife Biological Evaluation prepared for the project. As a Forest Plan Management Indicator Species, the analysis for this species would focus on the mature forest indicator habitat for which it was selected. Average home ranges in our area are considered to be within a 1.2 mile radius of nest or activity center locations. Twenty-two historic home ranges lie within proposed treatment areas. The cumulative footprint of these twenty-two home ranges comprises the action area for spotted owls as a MIS. This analysis area totals 50,297 acres, within which 30,149 acres (60%) are mapped as suitable nesting/roosting/foraging habitat (NRF).

On the Umpqua Forest as a whole, there are 685,718 acres of identified NRF habitat. The available mature forest within the identified analysis area for this species represents about 4% of the total of such habitat on the Forest. There is little recent information available on spotted owl population trends on the Forest. However as part of monitoring for the Northwest Forest Plan, there has been ongoing demography work being done in eleven demographic study areas in Washington, Oregon and northern California. The three closest demographic study areas to the Umpqua (Tyee, Klamath and South Cascades study areas) have stationary population trends over the last 23 years (1985-2008) of monitoring while the rest of the demographic study areas in Oregon and Washington have declining population trends (Figure 3). This, in conjunction with the increase in modeled habitat as compared to 1990 Forest Plan estimates indicate that the northern spotted owl on the Umpqua NF are doing better in terms habitat and population trend than most Forests in Region 6.

Direct and Indirect Effects of Alternatives

Alternative 1 is the No Action alternative and would retain all existing habitat within the analysis area in present conditions. Alternative 2 proposes commercial thinning in mapped dispersal habitat only. Proposed treatments are within plantations less than 80 years of age, so it considered likely that these treatment areas do not have the multiple canopy layers and abundant snag and down wood levels to provide optimal spotted owl habitat conditions. Treatment would include thinning as well as gaps. These gaps would be planted to create diversity within these even-aged Douglas-Fir dominated stands. These treatments would benefit owls by adding structural diversity within the canopy.

Cumulative Effects

Past timber harvest, wildfire and road building have all reduced the amount of available mature and old growth habitat in the analysis area.

All alternatives retain enough mature forest habitats to meet Forest Plan objectives for habitat availability and provide for continued species viability within the project area and across the

Forest. All alternatives comply with Forest Plan direction and objectives for the northern spotted owl. Ongoing activities in the analysis area are limited to dispersal habitat and are subject to seasonal restrictions, therefore cumulative effects to spotted owls are “May Effect, but not likely to adversely affect”.

Pileated woodpecker

Existing condition

Pileated woodpeckers may forage in forests as young as 40 years of age, but require stands at least 70 years of age for roosting and nesting (ODF&W 1992). Pileated woodpecker habitat at the Forest scale is identified as mature/old growth habitat (greater than 80 years as mapped via landsat imagery). Habitat for primary cavity excavators, such as woodpeckers and sapsuckers, consists of dead or defective trees (snags) of the proper size and in adequate numbers to support breeding birds. Habitat for pileated woodpeckers includes old growth/mature habitat. It was believed that primary cavity excavators would survive on the Forest providing that at least 20% of the potential habitat is retained and well distributed across the Forest (USDA 1990). The Oregon Department of Fish and Wildlife criteria for Forest planning suggested a 60 percent level for snag habitat. More recent information suggests higher levels are needed (Mellen et al. 2009). This yields a total of 501,297 acres of mapped pileated woodpecker habitat on the Umpqua Forest.

Various studies of pileated woodpeckers have found home ranges to be from 500-1,200 acres (Bull, E and R.Holthausen 1992 and Mellen, K., E.Meslow and R.Mannan 1992).

Proposed treatments occur across a broad area, so the effects analysis boundary for this species is established at the sub watersheds in which treatments may occur. This results in a 63,221 acres analysis area for the pileated woodpecker.

Based upon the baseline forest available habitat, there are 39,272 acres of suitable pileated woodpecker habitat in the project area. Project area pileated woodpecker habitat comprises approximately 8 percent of the total pileated woodpecker habitat on the Forest.

Information contained within the latest Forest Monitoring report (2010 DRAFT) indicates that population trends for the six Breeding Bird Surveys included show a mixture of results;. Two routes showed increasing trends, two showed decreasing trends and two showed stable populations. Due to the large proportion of the Forest land base that is suitable habitat for this species, the pileated woodpecker population is expected to be stable across the Forest.

Direct and Indirect Effects of Alternatives

None of the alternatives treat mature or old growth habitat. Within the treated stands, snag levels are expected to decrease during and immediately following treatment, however snags are expected to increase over time as these stands develop more structure, characteristic of old growth. In addition, snag creation following treatment would mitigate loss of snag habitat immediately following treatment. Alternative 2 would no direct effects to pileated woodpecker habitat. Indirect effects to snag availability and development of even-aged stands would be beneficial in the long term.

Cumulative Effects

Past timber harvest, road construction, and wildfires have all contributed to an overall decline in the amount of available habitat for pileated woodpeckers. The only other activity occurring

within the analysis area that may affect habitat for pileated woodpeckers is snag creation within the Rowboat timber sale area. This project is likely to benefit all cavity excavators by increasing snags within harvested units.

All alternatives retain enough suitable habitats to provide for continued species viability within the project area and across the Forest. All alternatives comply with Forest Plan direction and objectives for pileated woodpeckers, therefore cumulative effects for Pileated woodpeckers are "no effect"

Peregrine falcon

Existing condition

The peregrine falcon is both a Forest Service Sensitive species as well as an Umpqua Land and Resources Management Plan (LRMP) Management Indicator Species. Information and analysis on peregrine falcons as a Forest Service species has been evaluated previously in this analysis. The species was identified in the Umpqua LRMP as an MIS species because it was listed as Endangered under the ESA at the time the Forest Plan was finalized in 1990. The species was delisted in 1999, but it is still protected under the Migratory Bird Treaty Act. The Forest Plan monitoring plan (Chapter V of the Umpqua Forest Plan) calls for annual monitoring of all known Peregrine Falcon sites, and to report the number of active nests. At the time of the decision for the Forest Plan (1990) there were seven known nesting pairs (FEIS Chapter 3 p. 84), and in 2011 there are now 16 known nesting pairs on the Forest that have fledged 183 young since 1990. The Umpqua is now considered a source population for peregrine falcons in southwestern Oregon, and the peregrine reproduction has been increasing with numbers of eyries detected, as well as number of young fledged. Therefore peregrine populations on the Umpqua are being maintained at a viable level, with a positive trend in population.

Forest Plan direction (Prescription C3-I) for the peregrine falcon includes guidance relative to seasonal closures and management of age class diversity within 3 miles of nest locations. Seasonal restrictions for Peregrine Falcons would be incorporated as needed for both action alternatives.

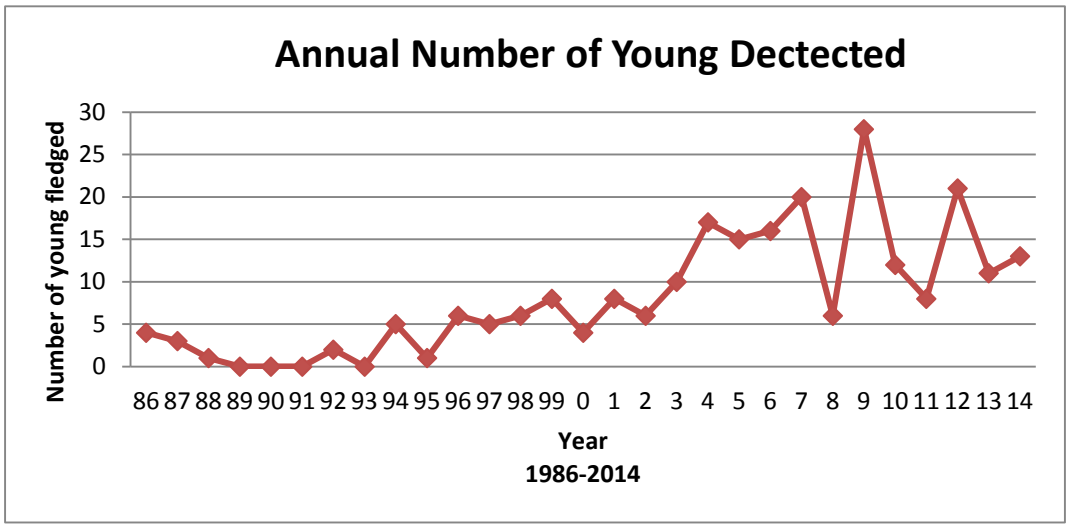


Figure 10. Peregrine Falcon reproduction on the Umpqua National Forest from 1990-2014.

Direct, Indirect, and Cumulative Effects of Alternatives

Alternative 1 is the No Action alternative which has no direct or indirect effects to peregrine falcon habitat conditions. As detailed previously in the Sensitive species section, Alternative 2 incorporates seasonal timing restriction where necessary and retain adequate levels of pole aged or larger stands within 3 miles of the nest location. As a result, these action alternatives would have no identified direct, indirect effects or cumulative effects.

All alternatives are compliant with Forest Plan direction and contribute to viable populations both within the analysis area and on the Umpqua Forest.

Roosevelt elk (Cervus elaphus) and Black-tailed deer (*Odocoileus hemionus columbianus)*

Existing condition – Roosevelt elk and black-tailed deer were selected as Management Indicator Species as they are an important socio-economic species (USDA 1990). Elk and Black-tailed deer were chosen as MIS species to ensure emphasis of winter range habitat management achieved through forage and cover production on land used or suitable for occupancy by deer and elk. Certain areas of the forest were identified as big game winter range under the Umpqua LRMP (USDA1990). Designated as "Management Area 11", these areas were designed to provide for big game winter range habitat and timber production consistent with other resource objectives. These areas are generally south facing slopes, below 3500 feet in elevation and less than 70% slope. Foraging habitat is identified in the Umpqua National Forest Plan as well as the Oregon Department of Fish and Wildlife (ODFW) management plan as the limiting factor in the Cascades. The Forest Plan has several standards and guidelines that apply to elk and deer (big game) winter range. Relevant S&Gs that apply to this project include the use of a habitat effectiveness model ("A Model to Evaluate Elk Habitat in Western Oregon" or similar model) to compare the impact of various alternatives on big game habitat (LRMP IV-38) and direction for management of deer and elk winter range areas described in Forest Plan Prescription C4-I. The Lemon Butte IRR Project is located within the southern portion of the Indigo Game Management Unit. Information on population trends as envisioned for MIS species monitoring is included in the MIS habitat assessment

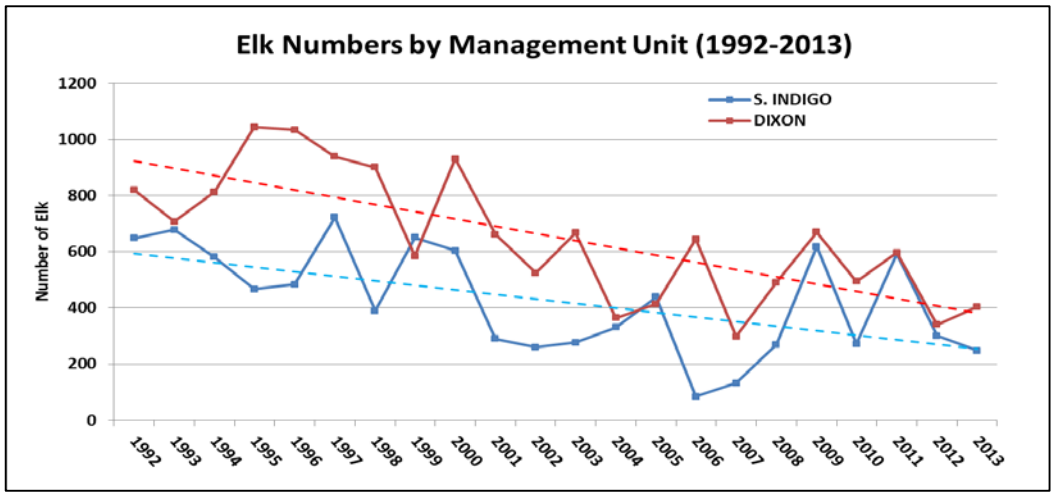
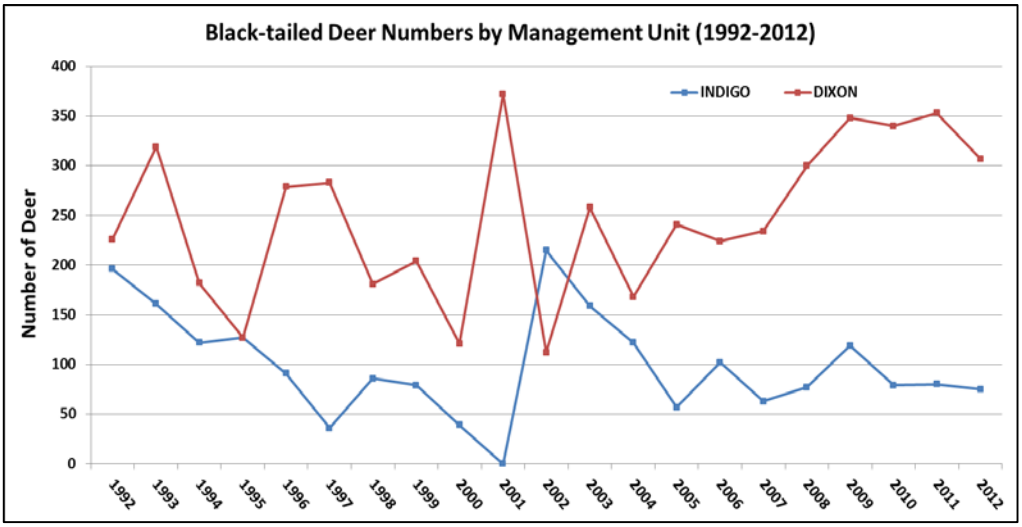


Figure 11. Elk numbers by management unit for wildlife management units that occur on the Umpqua National Forest from 1992-2013*.

Figure 12. Black-tailed deer numbers by management for wildlife management units that occur on the Umpqua National Forest from 1992-2012*.



*These are not population numbers, but results from spotlighting surveys conducted by the Oregon Department of Fish and Wildlife.

In general black-tailed deer numbers appear to be stable or slightly declining, and Roosevelt elk population numbers are declining.

In addition to population trend monitoring, the Forest Plan includes specific objectives and standards that relate to deer and elk habitat management. A single Forest-wide standard applies to important big game areas:

> *#17. When planning timber sales in important big game areas, a habitat effectiveness model ("A Model to Evaluate Elk Habitat in Western Oregon" or similar model) would be used to compare the impact of various alternatives on big game habitat.*

Black-tailed deer and Roosevelt elk were also selected as Management Indicator Species to monitor winter range habitat conditions. Forest-wide, there are 208,066 acres of designated winter range. Proposed treatments occur within winter range of 7 subwatersheds. These affected subwatersheds constitute the project analysis area for big game. Within this analysis area there are 34,492 acres of designated winter range. This means that the designated winter range within the analysis area is 13% of that available on the Forest.

Direct and Indirect Effects– The forest-wide standard calls for use of a habitat model in important winter range areas such as the Lemon Butte Project area. For the Lemon butte project, the Model to Evaluate Elk Habitat in Western Oregon (Wisdom, M. J. et al 1986) was used. The model evaluates cover and forage spacing, cover quality, open road density and forage habitat quality to yield a numerical value between 0 and 1 to illustrate the quality of habitat conditions.

Alternative 1 is the No Action alternative which has a habitat effectiveness index (HEI) of .54. The HEI model describes this rating as "Viable". Alternative 2 proposes 603 acres of commercial thinning in plantations including and 46 acres of gaps. These activities yield very slight changes to the cover and forage spacing quality variable in the HEI index. There is very little project level changes to the open road network. Alternative 2 activities yield a post-project HEI value of .55. The 46 acres of gaps would create short term foraging opportunities for both deer and elk.

Cumulative Effects – Past timber harvest, road building, infrastructure development, wildfires, fire suppression, and prescribed burning activities have all contributed to the current conditions for deer and elk in the analysis area. Past regeneration timber harvest, wildfires, and prescribed burning have all had beneficial impacts to habitat quality for these species. Road building, infrastructure development and fire suppression have had negative impacts. . Additionally the forest had completed a Travel Management Plan but has not published a Motorized Vehicle Use Map. Changes from the previous travel management plan are minimal and are not expected to have any impacts to deer and elk.

In the 1990 Umpqua Forest Plan, black-tailed deer and Roosevelt elk winter range habitat components was envisioned to be managed largely through an intensive regeneration timber management strategy. With the incorporation of the Northwest Forest Plan and Northern Spotted Owl Recovery Plan and Recovery habitat, this initial Forest Plan strategy has been constrained to the point where attaining and maintaining these desired habitat conditions is not considered possible with current land allocations. Given these conditions, all alternatives are determined to be compliant with current agency direction and guidance with regard to Roosevelt elk and black-tailed deer. Both species are expected to remain viable within the analysis area with all alternatives.

This project is expected to have beneficial cumulative effects to the improvement of forage for deer and elk within the Steamboat 5th field watershed. The proposed action in addition to the

ongoing thinning projects in the watershed would overall contribute to the improvement of forage by utilizing small-scale canopy reductions and regeneration of favorable forage species.

Cavity Nesters

Existing Condition –

As a group, "cavity nesters" were identified as a Forest Plan Management Indicator Species for wildlife species requiring standing dead trees. For the cavity nester analysis snag density requirements for two species will be used: the hairy woodpecker for smaller diameter snags (10-20" dbh), and the pileated woodpecker for larger snags (greater than 20" dbh). Hairy woodpeckers can utilize snags as small as 10 inches in diameter at breast height (Thomas 1979). This source also cites territory size for the hairy woodpecker at 25 acres.

In an intensive study conducted in northeastern Oregon, nesting pileated woodpeckers usually sought out the largest available snags for cavity excavation, with a strong preference for snags greater than 22 inches in diameter at breast height (Bull 1987). Other studies indicate average diameter of nest trees to be 30 or 31 inches, with a minimum size considered to be 20 inches dbh (Shroeder 1982). Bull (1987) noted that foraging occurred on down wood, standing snags and live trees in relatively equal amounts. While feeding on downed wood, a preference for material between 10 and 20 inches was observed. While foraging on standing trees, a preference for trees over 20 inches was also observed.

In the forestwide Management Indicator Species habitat assessment for the Umpqua Forest (Chapman 2012), the Forest plan objective of 60% potential populations is identified along with snag density size and values to meet this objective. For the hairy woodpecker this objective is 1.15 snags per acre greater than 10" dbh, and for the pileated woodpecker the objective is .04 snags per acre greater than 20" dbh. A total of 857,196 acres of suitable cavity nester habitat was identified for the Forest. For primary cavity excavators, the analysis area is considered to be the extent of commercial thinning acreage. The 1,048 acres for Alternative 2 then constitutes approximately 0.1% of the available primary cavity excavator habitat on the Forest.

Direct and Indirect Effects of Alternatives –

Alternative 1 is the No Action alternative and would retain current snag levels within the analysis area at 1.45 >10" and .01 per acre >20". Alternative 2 proposes commercial thinning which is expected to impact snag levels for cavity nesters in several ways. Some loss of standing snags can be expected through thinning and burning operations as well as through felling of danger trees. Timber yarding and activity fuel treatments, however, are also expected to create additional new snags as the result of treatment mortality. In addition snag creation following harvest would help mitigate loss snags during operations. This would result in a direct loss in snag habitat in the short term, however levels are expected to increase in the long term and provide higher quality habitat for cavity nesters.

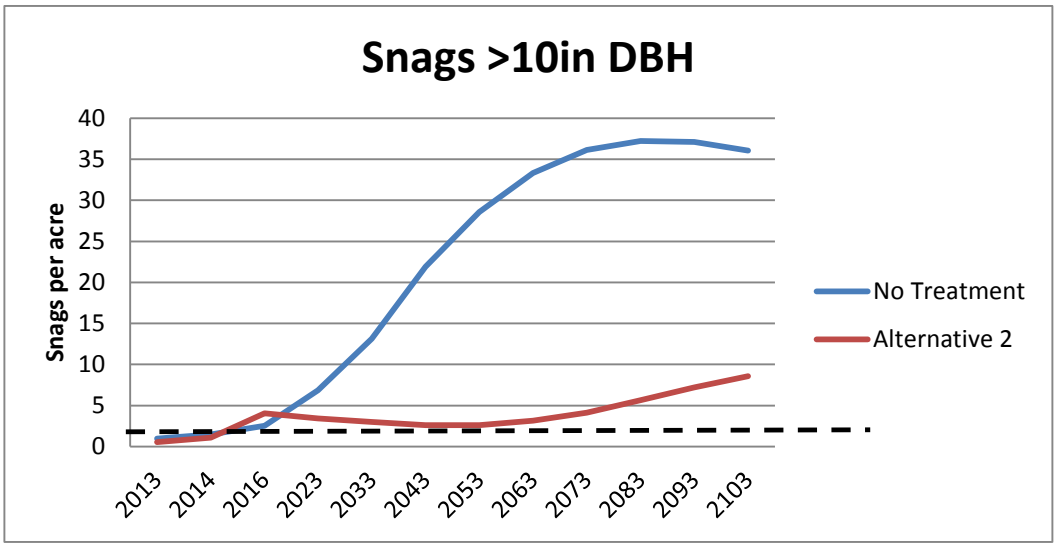


Figure 13. Density for snags 10”-19.9”dbh. The projected snag availablity is over a 87 year period from treatment year.

As described above the forest management indicator species, the hairy woodpecker requires 1.14 snags per acre over 10” DBH. Currently our proposed units are below the threshold as indicated by the dashed black line, however during harvest and immediately following levels of snags are expected to increase. Loss of snags during harvest would be mitigated by creating snags during operations and also by artificial snag creation following harvest.

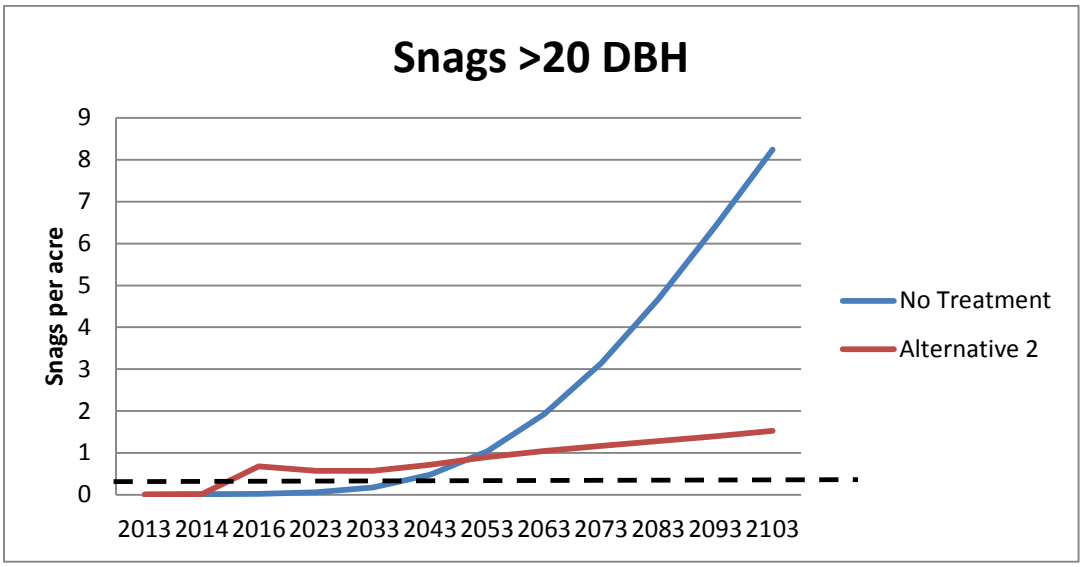


Figure 14. Density for snags 20”dbh and over. The projected snag availablity is over a 87 year period from treatment year.

Pileated woodpeckers are also a forest management indicator species. They require a range of snag sizes, however large snags over 20" are very important. As indicated by the dashed black line pileated woodpeckers require 0.04 snags per acre over 20”dbh. Current conditions are below this tolerance level, however given the previous silvicultural treaments within these stands, trees

over 20” were generally cut down and could not contribute to snag densities within the stand. Following the proposed treatment snags over 20” are expected to increase as trees become larger over time.

Cumulative Effects –Past timber harvest, wildfire, fire suppression and infrastructure development have all had an influence on snag levels within the analysis area. Reasonably foreseeable activities that may combine with Lemon Butte Project effects include the Rowboat timber sale, Sailboat and Lobo Stewardship and road maintenance. Following timber harvest Rowboat, sailboat and Lobo have snag creation associated with harvested units. Based upon past snag creation activities, the net effect is expected to be an overall increase in standing snag numbers. Snag habitat loss from road maintenance activities is considered to be of very minor relevance when compared to these other actions in the analysis area. Snag retention for all alternatives exceeds levels envisioned in the Forest Plan. All alternatives provide for continued viable populations of primary cavity excavators for the project area and the Umpqua National Forest.

The Lemon Butte project when combined with the above activities would contribute to a beneficial cumulative effect for cavity excavators.

Northwest Forest Plan Snag Retention Species

White-headed Woodpecker (*Picoides albolarvatus*)
Black-backed Woodpecker (*Picoides tridactylus*)
Pygmy Nuthatch (*Sitta pygmaea*)
Flammulated Owl (*Otus flammeolus*)
The 2001 Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer and other Mitigation Measures Standards and Guidelines also includes mitigation measures for the white-headed woodpecker, black-backed woodpecker, pygmy nuthatch and flammulated owl.

Existing Condition –

These 4 species of cavity nesters were included in the Northwest Forest Plan ROD with snag retention guidelines designed to enhance viability. Black-backed woodpeckers are residents of lodgepole pine forests or mixed conifer forests with a lodgepole pine component at elevations at or above 4,500 feet. There are no such suitable high elevation lodgepole stands within the analysis area. No further analysis for this species is conducted. On the other hand, the project area does contain dry site Douglas-fir habitat, which may be inhabited by white-headed woodpeckers, pygmy nuthatches and flammulated owls. In these habitats, management objectives call for at least 0.6 snags per acre be retained with the minimum size being 15 inches dbh. Silvicultural information indicates that stands within the project treatment units currently are well below this snag habitat objective with .07 large (20 inch or greater diameter) per acre.

Direct and Indirect Effects - These species were included in the Northwest Forest Plan to ensure retention of adequate snag habitat to provide nesting sites for 100% of potential populations. Additional information on large snag values is included in the Cavity Nesters portion of the Management Indicator Species analysis detailer earlier in this assessment. All alternatives start off with larger snag availability below the .6 snags per acre, but achieve and maintain above this value at essentially the same point in time (approx. 2029). Alternative 1 provides snag habitat as the result of natural mortality from resource competition, insects and disease. Alternatives 2 would have reduced levels of natural mortality in the short-term, but

would also have compensatory snag increased as the result of harvest operations, activity fuels treatments and active snag creation.

Cumulative Effects - Past timber harvest, infrastructure development, wildfire and forest succession have all influenced snag availability within the analysis area. Planned and foreseeable activities aside from the Lemon Butte treatments that may influence snag numbers in the analysis area include Rowboat, Sailboat and Lobo timber sales. These thinning projects are expected to overall improve stand conditions and provide quality habitat in addition to larger snags that would develop over time.

All alternatives would retain adequate snag amounts to meet ROD snag retention guidelines and cumulative effects to snag retention species would be beneficial.

Coarse Wood Analysis

Standing snags and down wood are important habitat components for a variety of wildlife species. These habitat components are evaluated with a coarse wood analysis for the subwatersheds with proposed activity.

Existing Condition – Coarse woody debris (CWD) is defined here as standing dead trees (snags) and large down woody debris (≥6" diameter). These physical structures provide essential habitat components for many species of terrestrial wildlife.

There is only one relevant Forest Plan standard that addresses snag or down wood retention for the proposed project. This is Wildlife Habitat/Threatened, Endangered or Sensitive Species standard #18: "When possible, wildlife trees (snags and green culls) would be left standing in areas of timber harvest. This habitat would be in addition to that provided by implementing the snag habitat prescriptions" (p.IV-38).

The Forest plan also includes two other standards (#1 and 2, p. IV-36) that speak to down woody material, but these standards apply to regeneration harvest prescriptions. None of the alternatives propose regeneration harvest.

Although there are few relevant standards or guidelines in the Forest Plan and Northwest Forest Plan land allocations, it is recognized that management of coarse wood debris components is an important aspect of vegetative treatments. An additional source of information on coarse woody debris management is DecAID (Marcot, et al. 2002). Treatment areas fall within the Westside Lowland Conifer –Hardwood Forest habitat type and small-medium tree structural condition. The DecAID planning tool also allows land managers to establish snag and down wood management objectives based upon statistical analysis of the reference data. The tool includes preset tolerance levels of 30%, 50% and 70%. These preset tolerance levels may be thought of as low/medium/high abundance ratings with the 50% tolerance level being the statistic mean or average of the reference data. DecAID benchmarks at the 50% tolerance level for this habitat type and structural stage are outlined in the table below. The 50% tolerance level was identified as the analysis benchmark considering the extensive degree of recent regeneration timber harvest in the analysis area.

Table 15. DecAID Coarse Wood Debris Levels at the 50% Tolerance Level

CWD Category	Range	50% tolerance Level
Snags 10+"/acre	4.2 – 5.2	4.7
Snags 20+"/acre	0 – 7.6	3.8
Down wood (% ground cover)	1.3 – 3.2	2.25

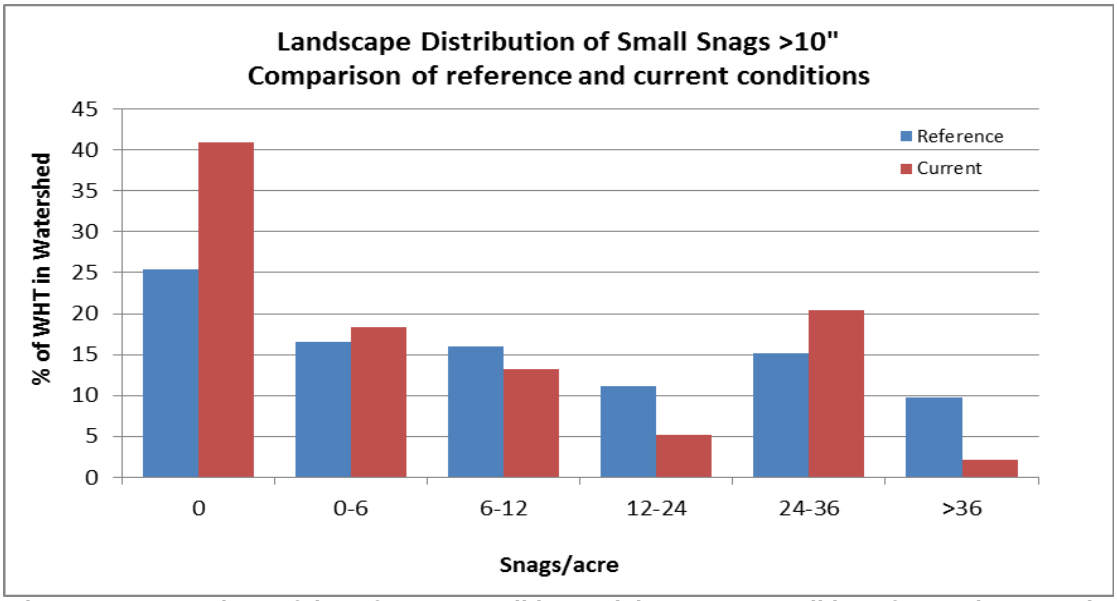


Figure 15. Comparison of the reference condition and the current condition of Steamboat Creek watershed. Landscape distribution of snags/acre ≥10" dbh as derived from 2012 GNN Data for Lemon Butte Project as compared to unharvested plots in WLCH_OCA Habitat type.

The Landscape distribution was done on the 5th field watershed scale. Reference conditions for Steamboat watershed show that about forty percent of the watershed had 0 snags per acre (>10"dbh), which is an increase from reference conditions, and slightly lower portions of snags per acres in most other categories. The higher portions in 24-36 snag per acre is likely due to stem exclusion and small fires.

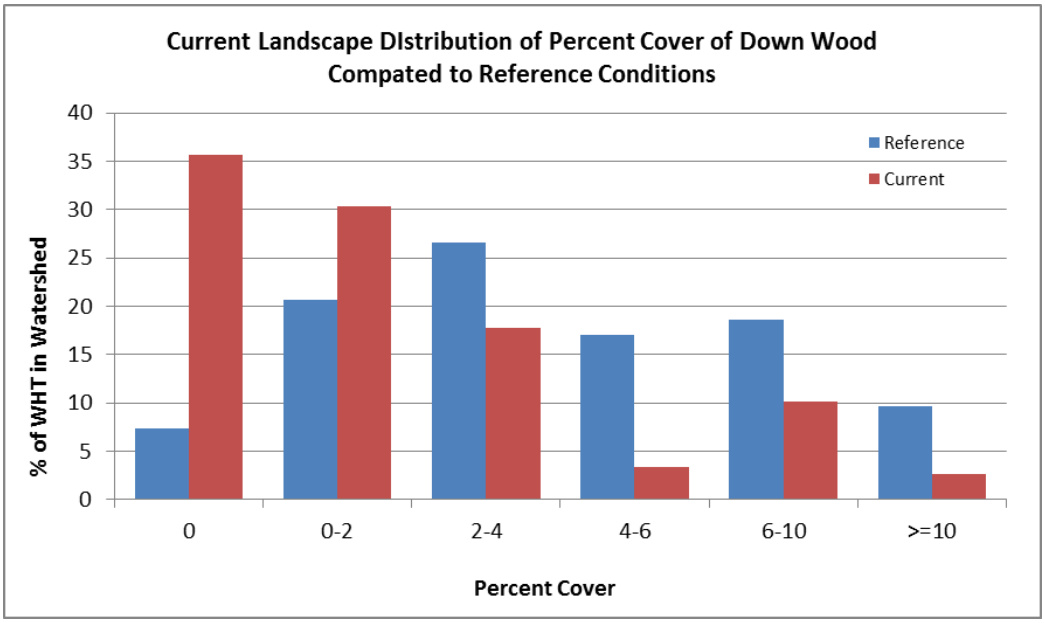


Figure 16. Percent cover of down wood in of Steamboat Creek watershed as derived from 2012 GNN Data for Lemon Butte Project as compared to unharvested plots in WLCH_OCA Habitat type

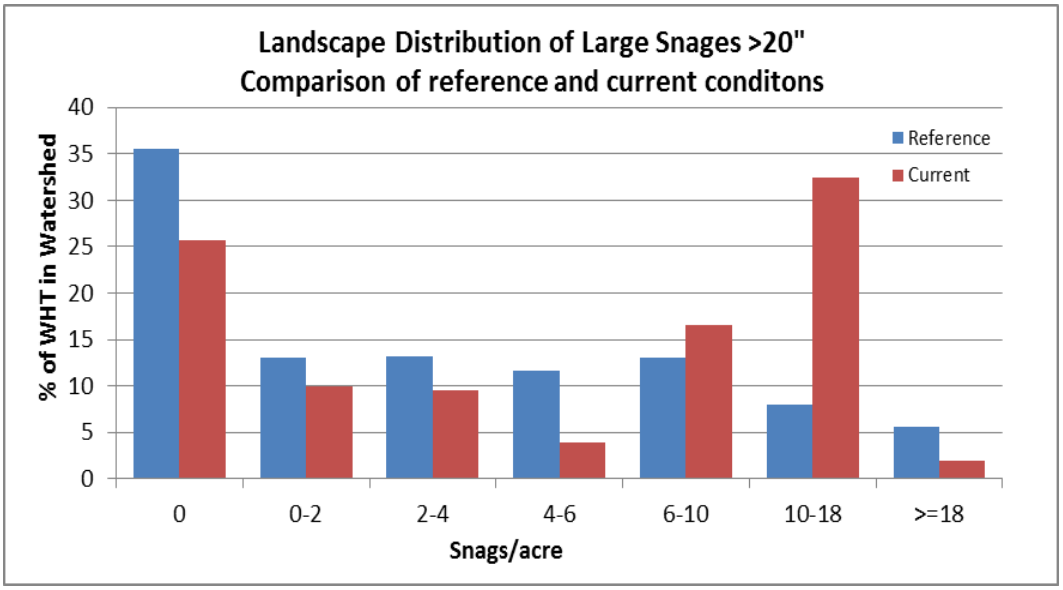


Figure 17. Comparison of the reference condition and the current condition of Steamboat Creek watershed. Landscape distribution of snags/acre ≥20" dbh as derived from 2012 GNN Data for Lemon Butte Project as compared to unharvested plots in WLCH_OCA Habitat type

Current conditions show that over thirty-five percent of the watershed has 0 percent cover. Compared to reference conditions Steamboat watershed has very low down wood cover.

Direct and Indirect Effects – As described previously in the pileated woodpecker and cavity nesters analysis project activities are expected to have both beneficial and negative effects to coarse wood debris categories. The No Action alternative would have no direct or indirect effects to coarse woody debris. Direct impacts to coarse woody debris from Alternative 2 include felling of hazard snags along road ways and within area that may pose a danger to those working in the area.

Cumulative Effects – Past activities and events that have influenced coarse wood debris categories within the watershed are the same as described earlier in the pileated woodpecker and "cavity nester" sections (timber harvest, wildfire, fire suppression and infrastructure development). Reasonably foreseeable activities that may combine with Lower Steamboat Project effects include the Ragged Ridge prescribed burning activities and road maintenance. All of these are small in scale and are not expected to yield any detectable difference in coarse wood debris category amounts projected for the watershed.

Botany

Unique Habitats

Unique habitats are non-forested openings that vary in size from 1 to 75 acres and include meadows, hardwood stands, wetlands, ponds, caves, cliffs, and rock outcrops (USDA Forest Service 1990). They are important due to their high value for wildlife and plants and their scarcity in the forest environment (Ch. 2 FEMAT 1994, USDA Forest Service 1990, USDA, Umpqua NF, 1995). Approximately 85% of the plant species diversity of the Western Cascades is found in non-forested habitats (Hickman 1976) which make up about 3% of the Umpqua National

Forest. Similarly, these unique habitats are utilized by 87% of the local wildlife for primary breeding and feeding purposes (USDA, Umpqua NF, 1995).

Existing and Desired Conditions - Unique Habitats

Unique habitats in the Steamboat Creek Watershed include wet and dry meadows, rock outcrops, shrub fields, ponds, and some hardwood stands. Unique habitats currently account for 0.9% (approx. 602 acres mapped) of the approximate 65,000-acre Lemon Butte planning area. There are approximately 26 acres of unique areas mapped within or immediately adjacent to project units (Table 1) and of these unique areas, there are 2.3 acres of unique habitats as defined by the Umpqua National Forest LRMP (USDA Forest Service 1990) located within the treatment units. These openings range from 1 to 13.4 acres in size.

The Lower Steamboat Creek Watershed Analysis (USDA, 1999) identified that unique habitats in the watersheds represent a small percentage of the total area, 3.4%, yet represents approximately 90% of the biological diversity. These habitats are highly susceptible to naturally occurring disturbances and human mediated activities such as road building, invasive weeds, conifer encroachment and timber harvests. Changes associated with these activities have the potential to alter the microclimate, hydrological processes, soil composition, and vegetation characteristics of the unique habitat and the adjoining forested stands.

Dry habitats in the Steamboat and Canton Creek drainages are usually associated with shallow soil types that can have a high solar exposure. Fire exclusion has resulted in the gradual succession of meadow openings to closed-canopy forest. This is most evident in and around the perimeter of dry meadows on south- and west-facing slopes where Oregon white oak (*Quercus garryana*), canyon live oak (*Q. chrysolepis*), madrone (*Arbutus menziesii*) and chinquapin (*Chrysolepis chrysophylla*) have been overtopped by conifers. In addition, large ponderosa and sugar pines that are often associated with these openings thrive under open conditions but are now crowded with young Douglas-fir and white fir.

There are smaller wetland features scattered throughout the units that also provide hydrological function and wildlife benefit but do not meet the prescription standards of the LRMP (Umpqua LRMP IV-200). Wetland habitats in or adjacent to units mostly consist of graminoid-dominated meadows, with some seeps and ponded water, surrounded by shrub thickets or dry forb meadows. Evidence of historic fire maintenance of these habitats is less evident although occasional fire would certainly have occurred.

The desired condition of all unique habitats is to maintain or improve vegetative composition and structure of the unique habitats for the benefit of wildlife (Umpqua LRMP IV-200). For wetlands there is the additional objective of maintenance of water tables in accordance with Objective 7 of the Aquatic Conservation Strategy.

Table 16. Proposed Activity Units adjacent to Unique Habitats

Unique Habitat	Unit Location	Acres	Buffer Size (feet)
Dry Meadows	7	2.0	0
and Rocky Areas	11	13.4	0
	14	7.7	0
	50	3.3	0
	Total Acres	26.4	

Direct and Indirect Effects - Unique Habitats

Direct effects are those that would occur within unique habitats or their immediate surroundings during implementation. Indirect effects are those that could occur later in time or beyond the immediate area of the proposed activities.

Alternative 1 would result in no direct effects to unique habitats because no activities would occur in or near them. Under the action alternative, there would be no direct or indirect effects to the wetland areas, which are not classified as unique habitats due to prescription requirements, because they would be buffered from timber harvest operations and partial harvest of trees in the units are not anticipated to alter ground water levels. Indirect effects, such as the introduction of invasive weeds into these areas would be mitigated for (Appendix A). While mitigation might greatly reduce the probability of the impacts within these areas, the effect may not be entirely eliminated through these actions.

During alternative development unique habitats were removed from the unit perimeters and as such, only the buffers of the unique habitats reach into the existing treatment units. See Table 16 for the list of dry meadows and rocky openings adjacent to units. Under the action alternative, thinning would occur only within the buffer areas, adjacent to the habitat; thinning would not occur in the unique habitat itself therefore there would be no direct or indirect effects to the dry meadows and rocky openings. Under the action alternative there would be a potential to have an indirect adverse effect due to the potential for increased weed invasion into the unique habitats and thinned buffer, particularly those immediately adjacent to roads. This potential would be reduced, although probably not entirely eliminated by the mitigation measures (Appendix A).

Cumulative Effects - Unique Habitats

The scope of analysis for cumulative effects to unique habitats is the planning area. Past clearcut harvesting and road building activities have resulted in alteration of wetland hydrology, introduction of invasive weeds, increased sediment input to wetlands, and conversion of ecotonal communities into conifer plantations. Increased sediment into the wetland areas may have resulted in loss of open water and accelerated succession to relatively dry plant communities. Because there would be minimal direct or indirect effect anticipated from proposed activities in the unique habitats any adverse cumulative effects associated with the action alternative would be minimized through the user of mitigation measures (Appendix A).

Aquatic Conservation Strategy - Unique Habitats

As disclosed above in this Unique Habitat section, no measurable impacts to the wetlands are expected from any of the proposed activities in the action alternative including road work, thinning, burning, or yarding activities. As such, there would be no measurable effect upon water tables associated with project's wet areas so wet areas would remain unaltered and wet, consistent with ACS Objective 7.

Invasive Plants/Noxious Weeds

Existing and Desired Conditions - Invasive Plants/Noxious Weeds

The health of native plant communities throughout the Pacific Northwest is at risk by noxious weeds and other invasive plants. Introduced plant species thrive in their new ecosystems for various reasons including a lack of natural predators, change in disturbance regime, adaptations for growing on nutrient-poor soils, and allelopathic (plants with natural chemical pesticides or herbicides) abilities. As a result, many weeds are capable of out-competing native plants,

ultimately altering the structure and lowering the diversity of native plant communities. The frequency of fire can also be altered by noxious weeds in ways that are detrimental to natural ecosystems (Brooks et al. 2004, Harrod and Reichard 2001, Keely 2001). Further, different soil organisms predominate under different kinds of vegetation. Replacement of native plant communities with invasive species can be expected to change soil microbial populations and nutrient cycling processes.

Most weeds take advantage of disturbed areas such as roadsides, trails, logged units, burns, rock quarries, mined sites and areas around human structures. Established populations serve as sources for further dispersal, especially along roads, power line, and trail corridors. Roads are considered the first point of entry for invasive species into a landscape, and roads serve as corridors along which invasive plants move farther into the landscape. Logging, construction equipment and off-road vehicles have the potential to transport weed seed beyond roadsides to the disturbed soil that they concurrently generate. Invasive plant seed can also be moved by wind, water, animals, and humans.

The increase of invasive plant introductions on the Umpqua National Forest is directly related to expanding weed populations on nearby federal, state, and private lands. Populations of extremely aggressive species such as spotted knapweed, meadow knapweed, and rush skeletonweed have become roadside weeds on frequently traveled highways in Oregon and along arterial roads in the Umpqua and adjacent national forests. The greatest risk of human-caused noxious invasive plant introduction into the proposed units is from seed-contaminated vehicles and equipment traveling through the planning area.

The Umpqua National Forest has classified its invasive plants into four categories: high priority species (Forest Rating A) for which treatment of all known sites is a priority, lower priority species (Forest Rating B) which are generally too widespread for control to be feasible, detection species (Forest Rating D) which are surveyed for and would become high-priority if found, and other weeds of interest (Forest Rating O). The noxious weeds known to occur on the North Umpqua Ranger District of the Umpqua National Forest are presented, by category, in Table 17.

Table 17. Noxious Weed List for the North Umpqua Ranger District

Common Name	Scientific Name	Lemon Butte Planning Area
High-Priority Species (Forest Rating A)		
False brome	*Brachypodium sylvaticum*	Yes
Italian Thistle	*Carduus pycnoephalus*	No
Diffuse knapweed	*Centaurea diffusa*	No
Spotted knapweed	*Centaurea stroebe ssp. Micranthos*	Yes
Tocalote, Malta thistle	*Centaurea melitensis*	No
Yellow starthistle	*Centaurea solstitialis*	No
Spotted Knapweed	*Centaurea stoebe ssp. micranthos*	Yes
Rush Skeletonweed	*Chondrilla juncea*	No
French broom	*Cytisus monspessulana*	No
Portugese Broom	*Cytisus striatus*	No
Scotch Broom	*Cystisus scoparius*	Yes
English Ivy	*Hedera helix*	Yes
Yellow Toadflax	*Linaria vulgaris*	No

Common Name	Scientific Name	Lemon Butte Planning Area
Yellow floating heart	*Nymphoides peltata*	No
Sulfur Cinquefoil	*Potentilla recta*	No
Gorse	*Ulex europaeus*	No
Lower-Priority Species (Forest Rating B)		
Meadow Knapweed	*Centaurea debeauxii spp. thuillieri*	Yes
Bull Thistle	*Cirsium vulgare*	Yes
Canada Thistle	*Cirsium arvense*	Yes
Yellow archangel	*Lamiastrum galeobdolon*	No
St. Johnswort	*Hypericum perforatum*	Yes
Himalayan Blackberry	*Rubus armeniacus*	Yes
Tansy Ragwort	*Senecio jacobaea*	Yes
Medusahead rye	*Taeniatherum caput-medusae*	Yes
Other Weeds of Interest (Forest Rating O)		
Common burdock	*Arctium minus*	No
Poison hemlock	*Conium maculatum*	No
Oxeye Daisy	*Chrysanthemum leucanthemum*	Yes
Chicory	*Cichorium intybus*	Yes
Wild Carrot	*Daucus carrota*	Yes
Foxglove	*Digitalis purpurea*	Yes
Common Teasel	*Dipsacus fullonum*	Yes
Sweet Pea	*Lathyrus latifolius*	Yes
Reed canarygrass	*Phalaris arundinacea*	No
Curly pondweed	*Potamogeton crispus*	No
Black locust	*Robinia pseudoacacia*	No
Common tansy	*Tanacetum vulgare*	Yes
Periwinkle	*Vinca major*	Yes

Invasive plant surveys for the Lemon Butte Timber Sale were conducted in 2014. There are approximately 165 acres of priority noxious weeds known from the 65,000-acre planning area (>0.002%), 62 acres of which are located in or adjacent to planned units, with the majority of those acres being located along major haul routes. Scotch broom is by far the most common priority weed species with approximately 20 acres being present adjacent to planned units. Major seed sources within the planning area are being actively managed. The Scotch broom in and adjacent to the planning area would be targeted for removal and subsequent control, if needed and as funded, as outlined in the Botany Mitigation Measures in Appendix A (see the project file for a map of these weed occurrences).

Lower-priority invasive species are nearly ubiquitous in the planning area along roads and disturbed openings. Of particular concern in the Steamboat and Canton Creek drainages are the presence of Himalayan blackberry, meadow knapweed, and the spreading of Tansy Ragwort throughout the planning area. In addition to the previously mentioned lower-priority species, Canada thistle located in proximity to wetland habitats in the various drainages pose a threat to these areas.

Canada thistle is an aggressive, colony-forming competitor that can alter wetland ecology, but is a B-listed noxious species in Oregon because it is so widespread and difficult to eradicate. Tansy Ragwort is also a B-listed noxious species in Oregon and there is an ongoing effort to minimize the spread of this weed in the Steamboat and Canton Creek drainages. Other lower-priority species such as Himalayan blackberry and meadow knapweed would be targeted within the sale areas for eradication.

The desired condition for the watershed and planning area is to be free of priority invasive plant infestations and to maintain native plant communities that are resilient to the introduction and spread of all invasive plants. Disturbed areas, such as rock quarries and waste disposal areas would be maintained free of invasive weeds to the degree practicable.

Relevant Standards and Guidelines - Invasive Plants/Noxious Weeds

Forest Service Region 6 issued a Record of Decision (ROD) in October 2005, for the Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement. The 2005 ROD added a set of standards to Forest Plans (USDA, Forest Service 2005). Lemon Butte TS is consistent with this because several of the standards that are pertinent to this project are incorporated into the Botany Mitigation Measures in Chapter 2.

We are consistent with the Umpqua National Forest LRMP, amended in 2003 (USDA, Umpqua NF 2003), with the following relevant standards and guidelines because they are included in our mitigation measures as listed below:

- Integrated weed management prevention and treatment strategies would be used to treat noxious weeds within the constraints of laws, policies and regulations and to meet Forest Management objectives. Methods may include manual (mowing, clipping, grubbing), biological, heated steam, competitive seeding, competitive planting, solarization, prescribed fire, grazing, chemical, or other applicable methods designed to control and/or eradicate the noxious weed. Biological controls tested and sanctioned by the US Department of Agriculture would be allowed to occur. Manual control methods within disturbed sites, such as along roads, trailheads, landings and within administrative sites would be allowed at any time.
- Require all ground disturbing machinery to be washed prior to entering and leaving the Forest, using the appropriate timber sale contract provisions and construction contract requirements.
- Require the use of certified-weed-free seed for all revegetation projects.
- Revegetate disturbed sites as soon as practical using native species unless there is no immediate resource concern and the site is anticipated to revegetate naturally to native species to desired cover standards.

Direct, Indirect, and Cumulative Effects - Invasive Plants/Noxious Weeds

Alternative 1, the no-action alternative, would not result in any direct effects because ground disturbing activities with the potential to encourage new noxious weed invasions would not occur. Invasive plant management would take place subject to district priorities and funding

Roads indirectly affect weed spread by creating habitat for invasive weeds and providing corridors for movement of weeds. The absence of any road work under Alternative 1 would result in no road-related direct effects upon invasive plants. Alternative 2 proposes to construct 1.75 miles of temporary road; 0.5 miles would be new temporary roads and 1.25 miles of

temporary roads would be constructed on decommissioned roadbeds. Alternative 2 proposes to reuse 1.5 miles of existing temporary roads. Under the action alternative these roads would be subsoiled and seeded to native species after the sale, contingent upon funding. The majority of the areas where the temporary roads would be constructed currently have only scattered low-priority weeds present with the exception being Unit 11 which has some Scotch broom located within the vicinity of the temporary roads being built. These low-priority weeds may increase in abundance immediately subsequent to road construction but should decrease with competitive seeding and native plant recovery. The higher-priority Scotch broom sites would be targeted for treatment to benefit from the competitive seeding in order to better manage the native species. In the absence of seeding, these weeds would be anticipated to compete with and consequently retard native species recovery. Temporary road obliteration and re-vegetation, along with the application of required weed prevention measures during timber sale operations and post-harvest monitoring, should mitigate the potential for weed invasion of the temporary roads.

Timber harvest, fuels reduction and prescribed fire activities all have the potential to directly affect weed spread under the action alternative by vehicles and equipment carrying weeds and seeds to areas being disturbed. Most of the priority weed sites are located on designated haul routes, which could directly facilitate the spread of weed propagules. The overall potential for weed spread would largely be mitigated for through application of the Standards and Guidelines.

Weed spread and colonization would be indirectly facilitated by removing competing vegetation and disturbing the soil in the timber harvest units to create additional habitat which is more susceptible to invasion. This is particularly acute where vegetation is removed immediately adjacent to the primary dispersal corridors (i.e. roads) which tend to have more weed diversity and abundance. Landings would be expected to become occupied by weeds if left untreated. This would be partially mitigated by: treating known sites prior to timber harvest and fuels management activities (and continuing to manage the known sites); subsoiling and seeding temporary roads, landings and skid trails adjacent to landings; and post-project monitoring to detect and treat invasive weeds before they can establish. The amount of mitigation that would occur would be dependent upon available funding. If weed mitigation is not funded, or funding is delayed, there would be the potential for weed infestations to become established that would be much more expensive to manage over the long-term.

Cumulative impacts for this project are analyzed at the planning area scale. Numerous activities including historic sheep grazing, timber harvest, road building, recreation, and burning/fuels treatments, have contributed to bringing in weed seed and creating soil and vegetative conditions conducive to weed invasion. Because temporary roads would be subsoiled and revegetated, there would be no cumulative impact of additional roads in the planning area under either of the action alternatives. The proposed mitigation measures and ongoing weed management activities are anticipated to reduce the potential for weed colonization and proliferation. Thinning would result in a short-term increase in some low-priority weeds such as St. Johnswort and possible tansy ragwort. Sites of other low-priority species of particular concern, such as Canada thistle, are proposed to be treated. All high-priority species would be managed so the cumulative effect of the proposed actions in conjunction with past, ongoing or anticipated activities would be minimal.

Threatened, Endangered, and Sensitive Botany Species

Biological Evaluation - Threatened, Endangered, and Sensitive Botany Species

This Biological Evaluation evaluates potential impacts to Threatened, Endangered, or Sensitive (TES) vascular plants, lichens, and bryophytes from the Lemon Butte Timber Sale Project. It is Forest Service policy to "ensure that Forest Service actions do not contribute to loss of viability of any native or desired plant or contribute…trends toward Federal listing of any species" (FSM 2672.41).

There are currently 38 vascular plant species, 11 fungi, three lichens, and 25 bryophytes listed as Sensitive on the Umpqua National Forest (Table 45). There are two species known or suspected to occur on the Forest that are listed under the Endangered Species Act. *Lupinus sulphureus ssp. kincaidii* (Kincaid's lupine) is listed as Threatened and has been documented on the Tiller Ranger District. *Plagiobothrys hirtus* (rough popcorn flower*)* is listed as Endangered and occurs primarily in the vicinity of Sutherlin in northern Douglas County but has not been documented on the Forest to date.

Pre-field Review - Threatened, Endangered, and Sensitive Botany Species

A pre-field review was conducted to determine which rare species are likely to be in the proposed project area or impacted by the activities related to the proposed action. Closed-canopy plantations proposed for commercial thinning under the action alternative represent generally poor suitable habitat for most rare plant species. The only two species that have been documented within the project area are North Umpqua kalmiopsis and Thompson's mist-maiden. North Umpqua kalmiopsis (*Kalmiopsis fragrans*) occupies openings in young stands and is found in rocky openings. Previously known occurrences of North Umpqua kalmiopsis are located in the vicinity of Chilcoot Mountain, adjacent to the 3806 road, and are removed from any treatment activities. Thompson's mist-maiden is typically found in vernally moist seeps on rock outcrops in fully open to partially shaded sites. The one know population located within the project area is far removed from any treatment activities.

The extent of instream restoration activities would include the placement of large wood, placement of large boulder complexes and tree lining activities along Steamboat Creek. This habitat is primarily riparian and includes both aquatic and emergent vegetation, disturbed roadsides, and both early- and late-seral forests. Pre-field review noted that there are no known populations of vascular or non-vascular species within the instream restoration activities associated with this portion of the action alternative.

Unique habitat features within units such as wetlands and rock outcrops along with old-growth relicts such as large, well-decayed logs and large trees represent the best potential habitat for numerous species. Species that were determined to have potential habitat are noted in Table 18.

Field Reconnaissance - Threatened, Endangered, and Sensitive Botany Species

Intuitive controlled[5] surveys were conducted throughout the 2014 field season by Forest Service botanist Bryan Benz. Non-suitable habitats in the units were field verified from appropriate vantage points or during travel between suitable potential habitats. Botany surveys complied with

established protocols (USDA Forest Service and USDI Bureau of Land Management 1997 &1999; Derr *et al.* 2003a; and Derr *et al.* 2003b). Field surveys did not discover any new site of any sensitive species. Field surveys were not conducted during 2014 for the instream portion of the proposed action. Due to the nature and site specificity requirements needed for instream log placement and boulder placement, the District botanist would be consulted with and conduct surveys if the site specific habitat warrants the survey. Surveys would be conducted prior to any instream restoration activities being implemented and would be noted in the project record. This analysis discusses the potential risk for species that are expected to have habitats within the instream restoration portion of the project along with other portions of the proposed action.

Because of the unique biology of fungi, pre-project surveys are not considered to be a reliable conservation tool. The vegetative component of fungi is composed of a network of thread-like, underground cells called hyphae, which collectively are referred to as the mycelium. The mushroom is the fruiting body of the organism, somewhat like an apple on an apple tree. Mushrooms for most species occur unpredictably and may go years without fruiting. To reliably determine species presence on a given site would require multiple surveys in the fall and spring over several years. Conservation of sensitive fungi species on Forest Service lands entails management of known sites, targeted surveys based on regional priorities and consideration of habitat elements for fungi during project planning. The proposed project area is traversed so that all major habitats and topographic features have been investigated. Identified suitable habitats receive a complete survey.

Table 18. Project Effects Assessment for Threatened, Endangered & Sensitive Plants

Taxa Group and Species	Potential Habitat	Species Present	Project Effects	
Threatened or Endangered Plants			**Alt 1**	**Alt 2**
Lupinus sulphureus ssp. kincaidii	No	No	NE	NE
Plagiobothrys hirtus	No	No	NE	NE
Bryophytes				
Anastrophyllum minutum	No	No	NI	NI
Andreaea schofieldiana	No	No	NI	NI
Blepharostoma arachnoideum	Yes	No	NI	NI
Bryum calobryoides	No	No	NI	NI
Calypogeia sphagnicola	No	No	NI	NI
Cephaloziella spinigera	No	No	NI	NI
Codriophorus depressus	Yes	No	NI	MIIH
Encalypta brevicollis	Yes	No	NI	NI
Encalypta brevipes	Yes	No	NI	NI
Entosthodon fascicularis	Yes	No	NI	NI
Gymnomitrion concinnatum	No	No	NI	NI
Harpanthus flotovianus	No	No	NI	NI
Helodium blandowii	No	No	NI	NI
Lophozia gillmanii	No	No	NI	NI
Marsupella emarginata var. aquatica	Yes	No	NI	MIIH
Meesia uliginosa	No	No	NI	NI
Polytrichastrum sphaerothecium	No	No	NI	NI
Porella bolanderi	Yes	No	NI	NI
Schistostega pennata	Yes	No	NI	NI
Schofieldia monticola	No	No	NI	NI

Splachnum ampullaceum	No	No	NI	NI
Tetraphis geniculata	Yes	No	NI	NI
Tomenthypnum nitens	No	No	NI	NI
Trematodon asanoi	No	No	NI	NI
Tritomaria exsectiformis	No	No	NI	NI
Lichens				
Lobaria linita	Yes	No	NI	NI
Pseudocyphellaria mallota	Yes	No	NI	NI
Ramalina pollinaria	No	No	NI	NI
Fungi				
Boletus pulcherrimus	Yes	N/A	NI	MIIH
Cortinarius barlowensis	Yes	N/A	NI	MIIH
Dermocybe humboldtensis	No	N/A	NI	MIIH
Gastroboletus vividus	Yes	N/A	NI	MIIH
Gymnomyces fragrans	Yes	N/A	NI	MIIH
Pseudorhizina californica	Yes	N/A	NI	MIIH
Ramaria amyloidea	Yes	N/A	NI	NI
Ramaria spinulosa var. diminutiva	Yes	N/A	NI	MIIH
Rhizopogon exiguous	Yes	N/A	NI	MIIH
Rhizopogon inquinatus	Yes	N/A	NI	MIIH
Stagnicola perplexa	Yes	N/A	NI	MIIH
Vascular Plants				
Adiantum jordanii	Yes	No	NI	NI
Arabis suffrutescens var. horizontalis	No	No	NI	NI
Arnica viscosa	No	No	NI	NI
Asplenium septentrionale	Yes	No	NI	NI
Botrychium pumicola	No	No	NI	NI
Calamagrostis breweri	No	No	NI	NI
Calochortus umpquaensis	No	No	NI	NI
Carex crawfordii	Yes	No	NI	NI
Carex diandra	No	No	NI	NI
Carex lasiocarpa var. americana	No	No	NI	NI
Carex nardina	No	No	NI	NI
Carex vernacula	No	No	NI	NI
Collomia mazama	Yes	No	NI	NI
Cypripedium fasciculatum	Yes	No	NI	NI
Elatine brachysperma	No	No	NI	NI
Eucephalus vialis	Yes	No	NI	MIIH
Frasera umpquaensis	No	No	NI	NI
Gentiana newberryi var. newberryi	No	No	NI	NI
Iliamna latibracteata	Yes	No	NI	NI
Kalmiopsis fragrans	Yes	Yes	NI	NI
Lewisia columbiana var. columbiana	Yes	No	NI	NI
Lewisia leana	No	No	NI	NI
Ophioglossum pusillum	Yes	No	NI	NI
Pellaea andromedifolia	No	No	NI	NI
Perideridia erythrorhiza	No	No	NI	NI
Pinus albicaulis	No	No	NI	NI
Poa rhizomata	Yes	No	NI	NI

Polystichum californicum	Yes	No	NI	NI
Romanzoffia thompsonii	Yes	No	NI	MIIH
Rotala ramosior	No	No	NI	NI
Scheuchzeria palustris var. americana	No	No	NI	NI
Schoenoplectus subterminalis	No	No	NI	NI
Utricularia minor	No	No	NI	NI
Utricularia ochroleuca	No	No	NI	NI
Wolffia borealis	No	No	NI	NI
Wolffia columbiana	No	No	NI	NI

NE - No Effect (Applies only to Threatened and Endangered species.)

NI - No Impact (Applies to Forest Service Sensitive species.)

MIIH - May Impact Individuals or Habitat but will not likely contribute towards Federal listing or cause a loss of viability to the population or species.

WOFV - Will impact individuals or habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

BI - Beneficial impact.

Threatened or Endangered Plants

There is no suitable habitat for either species that are listed under the Endangered Species Act. Kincaid's lupine occurs in low-elevation upland prairies and is primarily known from Willamette Valley grasslands although there are isolated occurrences documented throughout the Umpqua basin. Rough popcornflower is confined to low-elevation wetlands in the vicinity of Sutherlin in northern Douglas County. There are no known sites of either species near the planning area. Because there is no suitable habitat in or near any of the proposed activities under the action alternative there would no direct, indirect or cumulative effects to either species. Therefore there would be "No Effect" to either listed species resulting from activities in any alternative.

Sensitive Botany Species

North Umpqua kalmiopsis

North Umpqua kalmiopsis (*Kalmiopsis fragrans*), is a rare perennial shrub found in a narrow band of rocky habitat on the North Umpqua Ranger District on the Umpqua National Forest. North Umpqua kalmiopsis is a low lying shrub in the heath family (Ericaceae) that produces bright pink, relatively large flowers. Potential threats to this species include fire, over-collection, and disturbance due to timber harvest activities. There are only 19 occurrences of North Umpqua on the Umpqua National Forest with only one known occurrence located within the Lemon Butte Timber Sale Project area. The one population of North Umpqua Kalmiopsis is far removed from any of the thinning areas and associated activities within the project area.

Direct, Indirect, and Cumulative Effects – North Umpqua kalmiopsis

Alternative 1 would have no direct effects to North Umpqua kalmiopsis since ground disturbing activities would not occur near these populations. The action alternative would not have any direct or indirect impacts to the Chilcoot Mountain populations of North Umpqua kalmiopsis because they are far removed from any activities occurring as a result of this project. Because the action alternatives would not cause any adverse direct or indirect effects there would be no cumulative effects from the action alternatives.

Eucephalus vialis

Eucephalus vialis is a tall herbaceous perennial rising from a thickened woody stem with a showy flower that is characterized with many disk and ray flowers. This species inhabits coniferous

forests at elevations between 500 feet and 6,600 feet. Although *E. vialis* can be found in all stages of forest succession it appears to prefer habitat that has been historically sustained by frequent fire return intervals that create open forest conditions. There are no known occurrences on the Umpqua National Forest but it is expected to occur as there is a known population on adjacent BLM lands.

Alternative 1 would have no direct or indirect effects to *E. vialis* since instream restoration activities would not occur and there are no known populations of this species within the project area. Alternative 2 proposes to conduct instream restoration along a five mile stretch of Steamboat Creek. Individual restoration sites would be limited to 0.1 acres per site with a maximum of 50 sites located along the five mile stretch for a total of five acres of potential disturbance. This size is further reduced for this terrestrial species as the impact for each site would be restricted to the zone of influence from removal of an individual tree or placement of the trees onto the forest floor. Because we have no known sites of this species in the vicinity, the suitable habitat for this species appears to be relatively broad based such that most suitable habitat as we understand it is not occupied, and the foot prints is very small so the likelihood of this species being present is very small. If it were present and not mitigated, there would be potential for adverse impact under the action alternative but, because the area is so small and the habitat so marginal it May Impact Individuals or Habitat but will not likely contribute towards Federal listing or cause a loss of viability to the population or species. On the other hand, since this species often occupies partially disturbed areas, the small openings generated could actually provide improved habitat if there was a seed source or seed bank to take advantage of the opening. Since there are no known occurrences in the immediate vicinity this is not anticipated.

Past activities in the Steamboat Creek may have influenced the availability of quality habitat for this species. Although there would be minimal direct or indirect effects to this species or habitat, the cumulative effects under the action alternative “May Effect” this species through cumulative degradation of the environment through future and past logging activities, fuel treatments (may benefit), and other instream restoration work.

Romanzoffia thompsonii

Romanzoffia thompsonii, or Thompson’s mist-maiden, is a diminutive, early-blooming annual vascular plant of vernally moist seeps on rock outcrops in fully open to partially shaded sites (Helliwell 1998). Threats to the species include alteration of hydrology from activities such as road-building, water diversions, groundwater pumping and development of rock quarries, and habitat degradation by invasive species. There are at least 40 known sites across the Umpqua National Forest with one site being documented within the planning area but far removed from any treatment sites.

Direct, Indirect, and Cumulative Effects – *Romanzoffia thompsonii*

Alternative 1 would have no direct, indirect, or cumulative effects to the known *R. thompsonii* population because the site is located outside of timber harvest units and not associated with temporary road building. There would also be no effect under alternative 1 for the instream restoration activities since no activity would occur and due to there being no know populations occurring within this portion of the proposed action. Alternative 2 proposes to conduct instream restoration along a five mile stretch of Steamboat Creek. Individual restoration sites would be limited to 0.1 acres per site with a maximum of 50 sites located along the five mile stretch for a total of five acres of potential disturbance. This size is further reduced for this terrestrial species as the impact for each site would be restricted to the zone of influence from removal of an individual tree or placement of the trees onto the forest floor. Because we have no known sites of

this species in the vicinity of the instream restoration activities, the suitable habitat for this species is terrestrial and the most suitable habitat as we understand it is not occupied, and the foot prints is very small so the likelihood of this species being present is very small. If it were present and not mitigated, there would be potential for adverse impact under the action alternative but, because the area is so small and the habitat so marginal it May Impact Individuals or Habitat but will not likely contribute towards Federal listing or cause a loss of viability to the population or species.

Past activities in the Steamboat Creek may have influenced the availability of quality habitat for this species. Although there would be minimal direct or indirect effects to this species or habitat, the cumulative effects under the action alternative "May Effect" this species through cumulative degradation of the environment.

Codriophorus depressus

Codriophorus depressus is a rare bryophyte that form mats on rocks in perennial or intermittent streams between 400 and 11,000 feet in elevation. Known threats that would be detrimental to this species result from upstream activities that cause siltation. Additional damage to this species would result in activities where abrasion or removal of the moss occurs. There are no known sites occurring on the Umpqua National Forest but the instream restoration portion of the Lemon Butte TS project presents potential habitat for this species.

Direct, Indirect, and Cumulative Effects – *Codriophorus depressus*

Alternative 1 would have no direct or indirect effects to *C. depressus* since instream restoration activities would not occur and there are no known populations of this species within the vicinity of these activities. Alternative 2 proposes to conduct instream restoration along a five mile stretch of Steamboat Creek. Individual restoration sites would be limited to 0.1 acres per site with a maximum of 50 sites located along the five mile stretch for a total of five acres of potential disturbance. Because we have no known sites of this species in the vicinity, the suitable habitat for this species appears to be relatively broad based such that most suitable habitat as we understand it is not occupied, and the foot prints is very small so the likelihood of this species being present is very small. If it were present and not mitigated, there would be potential for adverse impact under the action alternative but, because the area is so small and the habitat so marginal it May Impact Individuals or Habitat but will not likely contribute towards Federal listing or cause a loss of viability to the population or species.

Past activities in the Steamboat Creek may have influenced the availability of quality habitat for this species. Although there would be minimal direct or indirect effects to this species or habitat, the cumulative effects under the action alternative "May Effect" this species through cumulative degradation of the environment.

Marsupella emarginata var. aquatica

Marsupella emarginata var. aquatic is a strictly aquatic perennial moss that is visible and identifiable when the substrate is accessible. This species is typically found subalpine and montane situations where there is relatively fast moving water and rocky bottoms. Threats are known to occur when there are changes in the stream hydrology which could lead to a decline of the population.

Direct, Indirect, and Cumulative Effects – *Marsupella emarginata var. aquatic*

Alternative 1 would have no direct or indirect effects to *M. emarginata var. aquatic* since instream restoration activities would not occur and there are no known populations of this species within the vicinity of this area. Alternative 2 proposes to conduct instream restoration along a five mile stretch of Steamboat Creek. Individual restoration sites would be limited to 0.1 acres per site with a maximum of 50 sites located along the five mile stretch for a total of five acres of potential disturbance. Because we have no known sites in the vicinity and the suitable habitat is typically above 5,000 feet in elevation the likelihood of this species being present is very small. If it were present and not mitigated, there would be potential for adverse impact under the action alternative but, because the area is so small and the habitat so marginal it May Impact Individuals or Habitat but will not likely contribute towards Federal listing or cause a loss of viability to the population or species.

Past activities in the Steamboat Creek may have influenced the availability of quality habitat for this species. Although there would be minimal direct or indirect effects to this species or habitat, the cumulative effects under the action alternative "May Effect" this species through cumulative degradation of the environment.

Fungi

There are no known sensitive fungi sites within the Lemon Butte Timber Sale Project area. The described suitable habitat for most rare fungi species is very general and not yet well understood. Although data published on the habitat requirements for rare fungi is only broadly described (Aurora 1986, Castellano et al. 1999, Castellano et al. 2003, Exeter et al. 2006), modeling performed by York and Helliwell (2007) indicates that there is suitable habitat for *Ramaria amyloidea.*

Nine of the eleven Sensitive fungi belong to the ectomycorrhizal (ECM) functional guild. ECM fungi are most abundant and diverse in areas with well-developed surface litter and organic material and a higher density of large-diameter trees with greater canopy closure (Amaranthus *et al* 1994, Meyer *et al*. 2008, Smith *et al* 2005). Because the described suitable habitat for these species is general in nature modeling did not show habitat but there would be potential for these species to be found within the project area. No populations were discovered during field surveys.

The two remaining Sensitive fungi are saprobic, meaning their mycelia reside in the litter and downed wood which they feed on, and therefore are also more likely to occur in areas with well-developed surface litter and organic debris. The Lemon Butte TS provides potential habitat for these two species but none were discovered during field surveys.

Direct, Indirect, and Cumulative Effects - Fungi

Under Alternative 1, there would be no direct adverse effects to Sensitive fungi due to the lack of ground disturbing activities. Recent research has demonstrated that thinning stands rather than clearcutting can preserve much or most of the fungal biomass and diversity. Luoma et al. (2004) evaluated the effect of various patch and dispersed retention timber harvest patterns on ectomycorrhizal fungi in Western Oregon (including the Umpqua NF). They determined that leaving only 15% basal area in harvest units (in either an aggregated or dispersed pattern) reduced mushroom and truffle production during the three years following the treatments. However, the retention of 40% of the green trees in a dispersed pattern led to no consequential drop in the fall mushroom or truffle standing crop. This is consistent with Luoma et al. (2006) that report that ectomycorrhizal species richness drops sharply outside the dripline of individual trees following harvest but was largely retained within the dripline. Norvell and Exeter (2004) also determined

that light and moderate thinning had little effect on ectomycorrhizal fungi diversity. Under the action alternative, reduction of basal area within treatment units are not expected to drop below 40% with the average being closer to 57% of basal area being retained in any of the units.

However, Gomez et al. (2003) did find that thinning substantially reduced sporocarp frequency in the Northern Oregon Coast Range and that retention of coarse woody debris was important in maintenance of some hypogeous species. In this study, approximately 33-50% of the trees were retained in the harvest units. The majority of the stands in this project would be reduced to below 50% but all stands would be above 41%.

Similarly, Carey et al. (1999) reported a short-term reduction of epigeous fungi but suggest that the small-scale of their study and retention of native understory shrubs effectively mimics natural processes. Each of these studies evaluated only the short-term response of timber harvest on fungi and most studies only considered sporocarp production as an indicator of fungal abundance and diversity.

Past clearcut harvest would have contributed to a cumulative decline in fungi species associated with older forests due to soil compaction, disruption of duff and large decaying logs and loss of older host trees for mycorrhizal species. Based on the above cited literature, the relatively light thinning prescription and retention of down wood in the units would probably retain most or all of the pre-harvest fungal diversity. Therefore the potential for one of the sensitive species being present and being directly or indirectly impacted by timber harvest is low while the potential for rapid recovery to pre-harvest diversity and abundance is good. For these reasons, activities proposed under the action alternative "may impact individuals or habitat but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species" for those sensitive species of fungi with potential habitat within the project area. There would be "no impact" to the remainder of the fungal species.

Survey and Manage Species

- On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Sherman, et al.*, No. 08-1067-JCC (W.D. Wash.), granting Plaintiffs' motion for partial summary judgment and finding NEPA violations in the *Final Supplemental to the 2004 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines* (USDA and USDI, June 2007).
- The Lemon Butte Timber Sale Project is consistent with the Umpqua National Forest District Resource Management Plan/Forest Land and Resource Management Plan as 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* (2001 ROD).
- The Lemon Butte Timber Sale Project applies a 2006 Exemption from a stipulation entered by the court in litigation regarding Survey and Manage species and the 2004 Record of Decision related to Survey and Manage Mitigation Measure in *Northwest Ecosystem Alliance v. Rey*, No. 04-844-MJP (W.D. Wash., Oct. 10, 2006). Previously, in 2006, the District Court (Judge Pechman) invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain categories of activities from the Survey and Manage standards and guidelines, including both pre-disturbance surveys and known site management. Also known as the Pechman Exemptions.

"Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

e. Thinning projects in stands younger than 80 years old:

f. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;

g. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and

h. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

The 2006 Pechman Exemptions remain in force: The Lemon Butte Timber Sale Project meets Exemption A and Exemption D. Both exemptions apply because the project entails thinning only in stands less than 80 years old.

Survey and manage Species

There were no known Survey and Manage species found within the Lemon Butte Timber Sale Project area.

Direct, Indirect, and Cumulative Effects

Because there were no known Survey and Manage species found within the project area there would be no direct impact upon any species under Alternative 1.

Under the action alternatives, future substrate for a number of Survey and Manage species would be indirectly enhanced by thinning which would generate potential habitat more rapidly than not thinning. However, this benefit may be minimal since the habitat is only marginal throughout most of the treatment areas for a number of Survey and Manage species. Because there were no known Survey and Manage species found within the project area, activities proposed under the action alternative would not impact individuals or habitat or cause a loss of viability to the potential populations or species. Therefore, the action alternative would have no direct or indirect effects due to absence of any known Survey and Manage species. The action alternative would not cause any adverse cumulative effects to any potential habitat since there are no direct or indirect effects.

Fire and Fuels

This section addresses the benefits and limitations of fuels treatments with in the project area.

Regulatory Framework

The Lemon Butte EA is consistent with the Umpqua N.F. Land and Resource Management Plan (LRMP). In the LRMP, Fire and Fuels are addressed in Chapter 1, II-128, III-68 and IV-65. Standard and guidelines are addressed in Chapter 2, IV-92; specifically S&G's 4, 5, and 11 are most relevant to this project. These sections framed the analysis for the Lemon Butte Fire and Fuels section discussion and the creation of Project Design Criteria.

Under the Umpqua National Forest Fire Management Plan, the Lemon Butte project falls within FMU 010 LSR/FS/Cascades. Fuel treatments within this project follow guidelines with the plan including "Ecosystems are restored and maintained consistent with land uses and historic fire regimes, prescribed fire and mechanical fuel treatments" and "Increase the number of acres treated annually by prescribed fire and mechanical treatment to meet hazardous fuels reduction objectives." This project also follows additional recommended guidelines such as minimizing impacts of suppression activities near spotted owl nest sites.

The Lemon Butte EA is also consistent with additional fire/fuels standards and guidelines under the NWFP.

Existing and Desired Conditions

The Steamboat Creek 5th field Watershed Analysis (WA) area includes the sub-watersheds of Canton Creek, Lower Steamboat Creek, Middle Steamboat Creek, Steelhead Creek, Upper Steamboat Creek, Big Bend Creek, and Steamboat Creek Headwaters that encompass the Lemon Butte Project planning area, which provide a meaningful landscape-scale context for discussing fire and fuel conditions and includes a detailed discussion of the reference, existing, and desired future landscape conditions. The Lower Steamboat Watershed Analyses (1999) are incorporated by reference.

Prior to fire suppression and intensive timber harvesting, wildfire was the major disturbance shaping the forests of the western Oregon Cascades (Agee 1993, Morrison and Swanson 1990, Teensma 1987). The role wildfire plays in an ecosystem is described in terms of a fire regime. Fire regimes are classified at various scales often encompassing specific mountain ranges or similar climatic areas. Fire regimes are generally a function of fire severity and frequency. In forested ecosystems, high severity fire regimes are defined as having infrequent high severity fires (greater than 100 years between fires) that generally kill most trees in a forest stand (Agee 1993). Moderate severity fire regimes have infrequent fires (25-100 years) that are often partial stand-replacement fires and include areas of high and low intensity (USDA, Umpqua NF, 1999).

Historical fire patterns seen in the 1946 photos were similar to those described in other Western Cascades studies (Morrison and Swanson 1990 and Van Norman 1998). Areas within the moderate severity regime (steeper, more dissected, lower elevation landscapes) experienced more frequent wildfires (17 to 30 year return intervals) that were normally low to moderate in severity and occasionally torched out small groups of trees, which create patches of even-aged stands. These patches usually occurred in the mid to upper slopes, ridge tops and tops of steep draws. Forest canopies along larger-order streams were more intact and experienced mostly low to moderate severity fires (USDA, Umpqua NF, 1999).

Currently, the watershed is considered to be a moderate severity fire regime that is showing signs of transitioning to a high severity regime (USDA, Umpqua NF, 1999). The moderate fire regimes of the watershed have been gradually been replaced with uncharacteristically high fire severity regimes, primarily due to fire exclusion. Increasing surface fuel loads as well as high density canopy cover are creating conditions that make stands more susceptible to stand replacement fire. Fire has not been allowed to burn as a natural ignition (resource benefit fire) within the planning area, nor has it been re-introduced to the watershed as a planned ignition (prescribed fire), except for burning slash after logging.

For a full discussion on desired future conditions refer to the Vegetation Management Section (page 36). In general, the desired future condition is to have late seral stands that can be maintained on a landscape scale. Silviculture and fuels treatments were designed to achieve DFC's by accelerating the development of these stands and shifting stand composition back to more natural conditions.

Fuel Models

Fuels are classified by vegetation type, fuel size, fuel loading, and potential fire behavior. Fuel loading is the amount of fuel available for combustion and can be described using models that can help predict fire behavior of a certain area. These models are called Fire Behavior Prediction System (FBPS) Fuel Models[6] (FM) and are assigned numeric values. The table below describes the four fuel models relevant to the Lemon Butte Project.

Table 19. Description and Associated Fire Behavior of Fuel Models (current & predicted) in the Lemon Butte project area.

Fuel Model	Description and Associated Fire Behavior
Fuels Model 8	Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, lodgepole pine, spruce, fir and larch. Slow-burning ground fires with low flame lengths are generally the case although the fire may encounter and occasional "jackpot" or heavy fuel concentration that can flare up. Only the under severe weather conditions involving high temperatures, low humidity's and high winds do these fuels pose fire hazards.
Fuel Model 10	Fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger fuels or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuels situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease ridden stands, wind thrown stands, over mature situations with deadfall, and aged light thinning or partial-cut slash.

[6] Fuel Model (FM) 8 is defined as having < 5 tons/acre of 0-3" surface fuels and is the desired condition of second growth stands; FM 10 has between 5-12 tons/acre of 0-3" surface fuels and is the current condition of most stands in the planning area. FM 11 is defined as having < 11.5 tons/acre of 0-3" surface fuels; this fuel model is representative of light to medium logging slash, which would occur in harvest areas that receive no slash treatment.

Fuel Model 11	Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here. The less-than-3-inch material load is less than 12 tons per acre. The greater-than-3-inch is represented by nor more than 10 pieces, 4-inch in diameter, along a 50-foot transect.
Fuel Model 12	Rapidly spreading fires with high intensities capable of generating firebrands can occur. When fire starts, it is generally sustained until a fuel break or change in fuels is encountered. The visual impression is dominated by slash and much of it is less than 3 inches in diameter. The fuels total less than 35 tons per acre and seem well distributed. Heavily thinned conifer stands, clearcuts, and medium or heavy partial cuts are represented. The material larger than 3 inches is represented by encountering 11 pieces, 6 inches in diameter, along a 50-foot transect.

About 45% of the planning area is considered to be a Fuel Model 10 (primarily the existing late-successional stands). Another 35% is considered Fuel Model 8, with the remaining 15% a Fuel Model 11. The majority of the units are currently considered to be Fuel Model 8.

Fire behavior models indicate that if a wildfire did occur in a Fuel Model 8, fire behavior could be expected to produce 1 - 2’ flame lengths (Figure 18) and rates of spread from 1 to 6 chains per hour (Figure 19). Whereas , in a Fuel Model 10, initial attack suppression forces (two engines staffed with three person crews and a one hour time delay) would be inadequate to contain the fire, as fire behavior can be expected to be 6 to 22 chains per hour with flame lengths of 2 to 7 feet. When flame lengths exceed 4 feet, the fire is too intense for direct attack on the head of the fire with hand tools, and handline alone cannot be relied on to hold the fire. The modeling illustrates the relative level of fire risks that exist within the larger Lemon Butte planning area and demonstrates the potential benefits of treating activity created fuels to maintain harvest units in a Fuel Model 8.

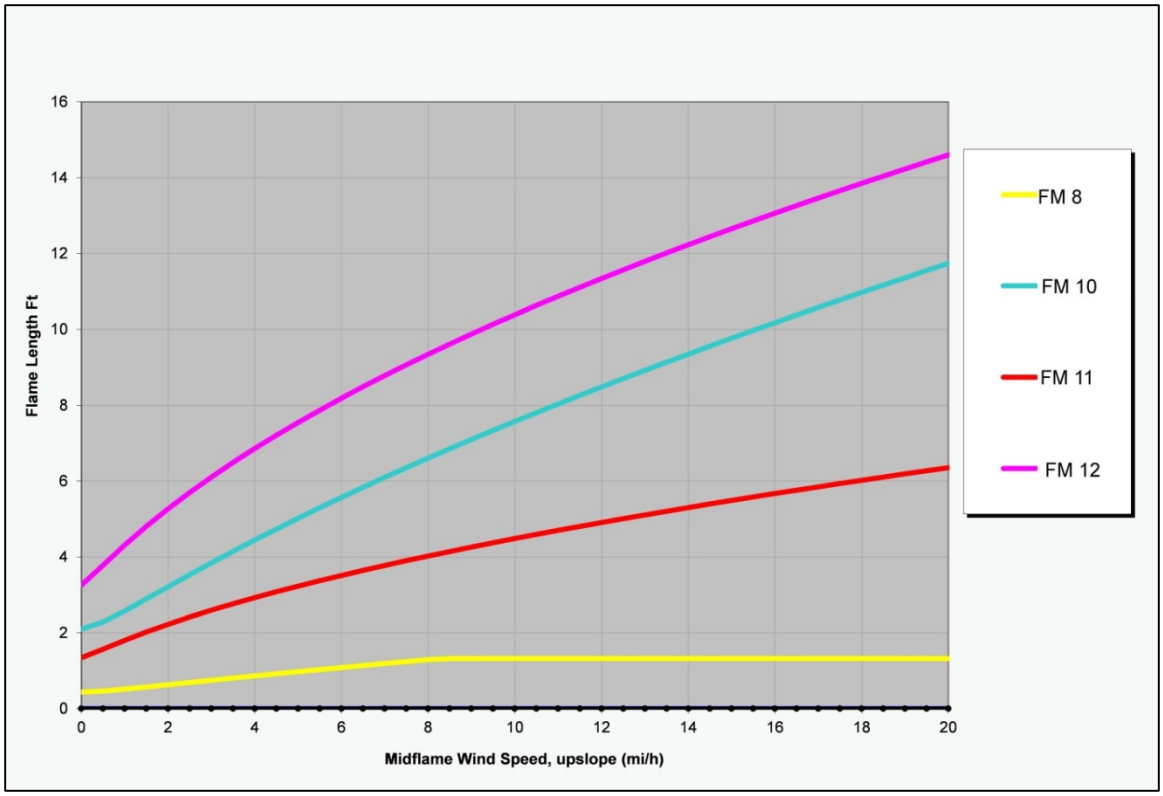


Figure 18. Flame Length for typical Fuel Models (current and predicted) within planning area.

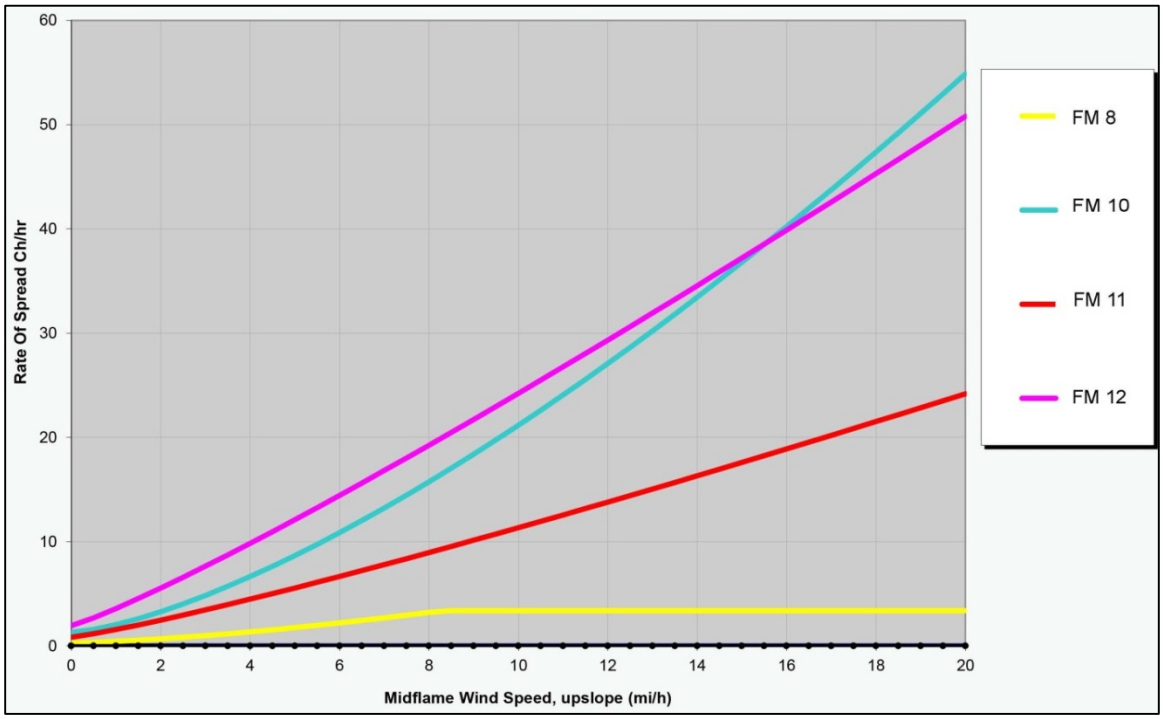


Figure 19. ROS for typical Fuel Models (current and predicted) within planning area.

Fire Regime Condition Class

Fire regime condition classes[7] (FRCC) are coarse-scale measures of the degree of departure from the natural fire regime (Agee 1993). This departure results in changes to one or more of the following ecological components: vegetation characteristics; fuel composition; fire frequency, fire severity and pattern; or other associated disturbances processes. Departure is measured in three broad classes: low (FRCC 1), moderate (FRCC 2) and high (FRCC 3) departure from the natural or historical regime. Low departure is considered to be within the natural range of variability, while moderate and high departures are outside of that range. In FRCC 2 and 3, one or more fire return intervals have typically been missed due to fire exclusion. Areas of high departure increase the risk of losing key ecosystem components due to fire effects.

Historically, the sub-watersheds included in the project boundary have been prone to both small and large size fires. The watersheds have experienced many low intensity fires as well. The small fires were kept in check due to the moisture regime for the area and/or the time of season that the fires occurred. Fires that typically started here spread very little and those that did spread in the understory were not detectable from the aerial photos. Multiple influences have affected fire's role within the watershed including the following: (1) fire suppression, which limits the acres burned within the watershed, converts stands toward more fire intolerant species, and increases fuels within late-succession/old growth stands; (2) previous harvest activity practices, which broke up stand continuity at a landscape scale and changed stand structure and plant communities; and (3) construction of road systems, which to some degree provides barriers for fire spread; provides direct access to fire starts, and provides access to the public potentially increasing human ignitions. Currently, the watershed is considered to be a moderate severity fire regime this is showing signs of transitioning to a high severity regime (Lower Steamboat Creek Watershed Analysis, p. F11).

Direct and Indirect Effects

Effects analysis for planning area units were determined using field data, model output from BehavePlus, professional opinion, and discussions with local fire managers with extensive experience in the planning area. The environmental effects discussed below display how fuel loadings, fire behavior characteristics, and fire effects would differ between Alternatives over time.

Under Alternative 1 there would be no management entry in Lemon Butte units, thus there would be no direct impacts to fire and fuel loads from this alternative. However, this lack of activity would allow additional fuels to accumulate within the units over time (fuel conditions would be similar to FM 11 or FM 12). Trees in these stands would continue to grow more in height than in diameter. Self-thinning of the stands would occur, therefore increasing mortality. The small dead tree component of stands would increase, causing an increase in surface fuel loadings. High stand densities and low level limbs (ladder fuels) within the stands would provide an avenue for fire spread into the crowns. Thus, if allowed to accumulate, these fuels could potentially contribute to high intensity fires in areas that historically supported low to moderate intensity fires.

[7] The use of FRCC in planning is a requirement of the 2003 Healthy Forest Restoration Act (HFRA); it allows agencies to compare landscapes based on a standardized nation-wide process.

Therefore, the indirect effect in Alternative 1 through a lack of action has the potential to result in an overall reduction in stand resiliency to fire until the slash decomposes, increased fire behavior and more severe fire effects to vegetation, soils, etc. in the planning areas over time.

Activities proposed under Alternative 2 have potential direct and indirect impacts on fuels. This alternative would thin and remove trees from the stand, thus reducing canopy continuity and the potential for crown fire spread. Generally, stands would be thinned using the same silvilculture prescriptions and would use almost identical fuel treatments[8] to address the activity-generated fuels. This alternative would treat fuels by either piling & burning or underburning designated acres as detailed in the proposed action summary, Table 1, from Chapter 2.

Alternative 2 would create 46 acres of gaps that are ½ or 1-acre in size. Slash in those gaps would be treated based on scheduled unit treatment (i.e. piled, under burned, or no treatment).

The direct effects of the various fuel treatments that include burning in the action alternative would be to immediately separate (break up) and lower 0-3” surface fuels to levels that would reduce future potential fire behavior, thereby increasing stand resiliency to fire over time, as the trees grow larger and increase in bark thickness. The action alternative would have a direct effect for all activity treatments by consuming surface fuels that include portions of the litter, duff, 0-3” material, >3” material. underburning would also reduce the herb and shrub components. The majority of the Douglas-fir leave trees would average around 15” diameter, which is a diameter with a bark thickness (approximately ¾-1”) that creates a successful barrier to expected ground fire burning effects, such as heat per unit area and fire duration. The resulting stand would have fuel conditions similar to a FM 8. Future fires would be less intense because of lower fuel loads; fires would likely burn in the understory, with pockets of torching, and would resemble fires that would normally burn in a moderate severity fire regime. Should a high severity wildfire occur within the first 10 years after harvest, only the stands with underburning would effectively lower the risk of stand replacement fires.

With many areas adjacent to NRF habitat or known historic spotted owl activity centers, approximately 75% of the original acres designated underburning, fuels treatments needed to be reevaluated in order to comply with wildlife seasonal restrictions and area disturbance. These acres that were ideal for underburning were located in units with skyline operations, but with the steepness of slopes machine piling was not feasible. Hand piling concentrated areas of fuels in these units became the suitable alternative. Although underburning is the ideal fuels treatment method, piling concentrated fuels in both skyline and mechanical units remains an effective treatment especially with an increase presence of whole tree yarding as the preferred logging method. This consists of bringing the whole tree to the landing sites instead of processing the cut within the unit. Compared to other methods, such as cut to length, the fuel loading left with in whole tree yarding units has decreased. Even with this method, fuel loads would see an increase in concentrated areas after thinning and would overall not have the same beneficial effect as areas with treatment prescribed. The majority of the acreage prescribed for no fuel treatment is located in the areas of units where whole tree yarding has successfully decreased fuel loads.

The thinning and removal of trees would reduce canopy continuity, which over the long term, even stands that did not receive fuel treatment would be more resilient to being replaced by a crown fire. This is because thinning separates interlocking crowns and increases the distance

[8] Fuels treatment prescriptions for this alternative was designed to reduce the risk and effects of fire in the fuels created by harvest activities.

between shrub and understory trees, as well as changes the canopy base height and crown bulk density.

Recent publications have shown that such treatments can effectively lower fire hazard, which not only affects fire behavior at the site, but can affect fire behavior in larger surrounding areas (Peterson et al, 2004). Alternative 1 would not contribute to this beneficial cumulative effect of reducing fuels across the landscape, as no treatment would occur.

Over time, proposed thinning and fuels treatments under Alternative 2 are expected to have multiple beneficial impacts. Implementation of fuel treatments in thinned stands would establish a fuel profile that would contribute to cost effective and safer fire suppression operations in the area. Thinning and fuels treatment are also expected to reduce the amount of tree mortality in these stands in the event of a wildfire by reducing ground and ladder fuels and tree density.

Table 20.Summary of fuel treatment effects by Alternative.

Treatment type	Alt. 1	Alt. 2	Effects
Underburn acres	0	37.9	Beneficial - reduced 0-3" surface fuels both for the short-term (up to 5 years) and the long-term (greater than 5 years) and increased stand resiliency to potential wildfire effects from a future fire. Adverse –emissions potential into Class I airsheds and/or smoke sensitive receptors for a short period of time. Potential for fire escape if conditions (i.e. weather, fuel moistures) change. Higher costs to implement and impacts from building handline[9] surrounding treatment areas.
Piles & Burn acres	0	310	Beneficial - reduced 0-3" surface fuels both for the short-term (up to 5 years) and the long-term (greater 5 years) and increased stand resiliency to potential wildfire effects from a future fire. Adverse – emissions potential into Class I airsheds and/or smoke sensitive receptors for a short period of time. Potential for fire escape if conditions (i.e. weather, fuel moistures) change.
Thinning & No Fuel Treatment acres	0	254.6	Beneficial - Reduction of standing fuel and separation of crown layers. Short and long-term effect of reducing crown fire potential. Long-term benefit of increased fire resiliency against crown fire. Adverse - short-term increase in the 0-3"surface fuels with an increased risk for higher intensity fires effects during future wildfires.

A connected action of wildlife snag creation would occur through the use of fire and through other methods such as girdling. These snags would be retained on the landscape as wildlife habitat and are not expected to present a hazard for torching or fire spread due to the space between the snags and the residual trees. A non-commercial thin silviculture treatment is proposed in unit 71, (for more discussion on this see the silviculture section). Once completed accumulated slash would be hand piled and burned under the same specifications of activity generated fuels in commercially thinned units. Benefits to treating fuels in this unit will be the same as in commercial treatments, reduction in fuel loading and decreased fire risk, as discussed

[9] Handline construction involves exposing mineral soil (two foot width) along the perimeter of the area to be underburned. Alternative 2 proposes to construct about 1.3 miles of handline.

in the above paragraphs. Additionally, the promotion of fire resiliency in the area will benefit nearby owl cores (for more discussion on benefits to wildlife habitat see wildlife section).

Cumulative Effects

The analysis area for fuels is the Steamboat Creek 5th field Watershed Analysis Area. As previously described past harvest, road building and fire suppression in recent decades has moved portions of the watershed away from historic stand conditions and fire regimes. Ongoing and future activities such as commercial and precommercial thinning would reduce stand densities and address activity-generated fuels and thus are expected to make a positive contribution toward the condition of the watersheds relative to fire risks. Potential impacts of the no action alternative would not contribute direct, indirect, or cumulative effect of reducing fuels across the landscape, as no treatment would occur. This action would allow the landscape to continue to move away from an ideal fire regime condition class and towards higher fuel models, thus increasing fire risk and severity. Under Alternative 2 the impacts on the fire and fuels resource are primarily beneficial. Although it would also have short term adverse effects on increased fuel loadings in units not receiving fuel treatments after harvest, these effects are outweighed by the benefit of increased crown spacing and reducing potential crown fire spread. These direct and indirect effects, when combined with ongoing and reasonably foreseeable actions, would contribute to a beneficial cumulative impact on the landscape by moving fuels conditions towards a FM 8, increasing stand resiliency and finally reducing the probability and adverse effects of large scale wildfires.

Air Quality and Smoke Management

Standards for ambient air quality[10] are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter and other pollutants produced by both prescribed burning and wildfire[11]. Although smoke from wildfire is considered a natural event by the EPA's Natural Events Policy (air quality standards do not apply), smoke generated from prescribed burning must meet federal and state air quality standards set forth in the Clean Air Act (CAA) (section 160). All activities associated with this project would be implemented to meet standards in the CAA.

The Forest Service is required to file a burn plan with Oregon Department of Environmental Quality (ODEQ) and would comply with the strict standards for air quality. ODEQ would not provide approval for burning when atmospheric conditions exist that may result in an inversion or other atmospheric conditions that would cause air quality violations. ODEQ strictly regulates burning; as such, there is very little likelihood that the effects to air quality from any action alternative would exceed air quality standards, even when combined with other burning and pollution sources.

Regional Haze Rule was designed by the EPA to call on states to establish goals for improving visibility in mandatory Class I areas and to develop long term strategies for reducing emissions of air pollutants that cause visibility impairment to these areas. At this time, Oregon does not yet have a State Implementation Plan (SIP) to deal with regional haze or visibility impairment so no standards currently exist. However, the importance of visibility in these areas, such as nearby

[10] Ambient air quality is defined under the Clean Air Act of 1963 as the air quality outside of industrial site boundaries.
[11] Although prescribed burning affects air quality in ways similar to wildfire, it offers some advantages over wildfire. Prescribed burning plans are developed and implemented to minimize impacts on the airshed by the consideration of atmospheric conditions, season of burn (e.g., burning is restricted between July 1 to September 15 under the Oregon Visibility Protection Plan), fuel and duff moisture, diurnal wind shifts, ignition techniques and rapid mop-up.

Crater Lake National Park, is recognized and burn prescriptions would be designed to minimize potential for smoke intrusion in these areas.

Since prescribed burning is not a stationary source of pollutants and because no burning associated with this project is within a non-attainment area, Prevention of Significant Deterioration, and the conformity provisions (see glossary) of the CAA are not applicable.

Other air quality impacts that may occur related to prescribed burning include: temporary and localized loss of aesthetic qualities due to visibility reduction, reduced visibility on highways and roads causing potential safety issues, health problems for sensitive people (i.e. asthma), and human discomfort. These impacts may occur at pollutant levels that are within air quality standards. Smoke impacts to safety, human health or visibility that occur within air quality standards are termed “nuisance smoke”.

The closest smoke sensitive areas[12] are Oakridge (26 miles north) and Roseburg (45 miles west). The closest Class I Airsheds (see glossary) are Diamond Peak Wilderness (about 8 miles to the northeast) and Crater Lake National Park (about 15 miles to south souteast). Although Wilderness areas within the Umpqua National Forest are not a designated Class I Airsheds, the importance of air quality in these areas is recognized and impacts would be avoided. Although not designated as smoke sensitive areas, the Toketee Ranger Station and surrounding compound may experience transient smoke for a period of time in the evening hours when diurnal wind patterns carry smoke down canyon. The resort and campground near Lemolo Lake is within a few miles of the planning area. Burn prescriptions would be designed to minimize the potential for impact to visitors in these areas.

Climate Change

For the Lemon Butte Project, the Forest Service proposes a commercial thin of 603 acres, and non-commercially thin 43 acres of stands 45-59 years of age. Residual stands will retain approximately 50 % of the original stand based on canopy cover, depending on stand characteristics. (Average current overstory canopy cover is 88 %, with treatments reducing this cover to 45 %.) Gap creation (1/2-acre and 1-acre openings) is proposed for 3-10% of each timber sale unit’s individual area to initiate structural diversity and understory vegetation development. The activity fuels, or slash, would be treated on approximately 310 acres, in order to break up continuity of the fuels throughout the timber sale units. Methods of treatment would include grapple piling, hand piling, and springtime prescribed underburning in units 31, 54, & 69 (37.9 acres). Additionally, this project proposes to non-commercially thin 43 acres, and treat 310 acres of activity fuels within Late Successional Reserve 222. This scope and degree of change would be minor relative to the amount of forested land being treated, as these harvest units represent 0.9% of the 64,882 acre project area or 0.6% of the Steamboat Creek watershed (104,820 acres).

Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet’s lower atmosphere (IPCC 2013). Considering emissions of GHG in 2010 was estimated at 49 ± 4.5 gigatonnes[13] globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions.

[12] Smoke Sensitive Areas are areas designated by the state board of forestry, in consultation with the Department of Environmental Quality, that is provided the highest level of protection under the smoke management plan because of its past history of smoke incidents, density of population or other special legal status

[13] A gigatonne is one billion metric tons of CO_2; equal to about 2.2 trillion pounds.

Therefore, at the global and national scales, this 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 global greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%.
- Forestry and other land uses – 12%

There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014; Smith et al., 2014; FAOSTAT, 2013). The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000). The Lemon Butte Project does not fall within any of these main contributors of greenhouse gas emissions. Forested land will not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. US forests sequestered 757.1 megatonnes[14] of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western US. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which will have major effect on these forests' role in the carbon cycle (Joyce et al. 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al. 2014). Here specifically, the project proposes to use thinning and prescribed fire to increase resilience to wildfire, drought, insects and disease. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al. 2007). This project falls within the types of options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al. 2014). The proposed action reflects the rationale behind these recommendations because fuel treatments will reduce ground and ladder fuels, thus lowering flame lengths, and canopy fuel treatments will reduce the likelihood of sustaining crown fires.

Timber management projects can influence carbon dioxide sequestration in four main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided

[14] A megatonne is one million metric tons of CO_2; equal to about 2.2 billion pounds.

deforestation), (3) by manipulating existing forest cover (managed forests), and (4) through transferring carbon from the live biomass to the harvested wood product carbon pool. Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects like the proposed action that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration.

Soil Productivity

The maintenance of soil productivity during forest management activities is critical to maintaining a healthy forest. Consequently, soil productivity is addressed in the Umpqua Land and Resource Management Plan (LRMP) with several standards and guidelines. The primary focus of this analysis centers on past and predicted soil disturbances and the maintenance of ground cover.

Regulatory Framework

The most relevant standards and guidelines from the Umpqua Land Resource Management Plan (LRMP) related to soil productivity (USDA Umpqua NF 1990a) include:

Soil Productivity S&G #1, p IV-67: Requires that the combined total amount of unacceptable soil conditions in proposed activity areas (compaction, displacement of surface soil and severe burning) would not exceed 20 percent, including areas in roads and landings.

Soil Productivity S&G #2, p IV-68, S&G #13, p IV-71: Requires maintenance of effective ground cover to prevent loss of topsoil through erosion.

Soil Productivity S&G #3, p IV-68: Requires maintenance of ground cover for surface organic material (defined as litter, duff and wood) to maintain long-term soil productivity of the site.

Soil productivity S&G # 4, 5, 10, 11, and 12 and other Northwest Forest Plan requirements also apply and are described in this section or are listed as best management practices, project design features, management requirements and monitoring in Chapter Two.

Soil Suitability - Exceptions to harvesting only on suitable (regeneration) lands shall be documented during NEPA (S&G #6, LRMP IV-44).

Soil Productivity Standards and Guidelines and Best Management Practices were developed to limit management related impacts to soil tilth, soil carbon, surface organic matter, and large woody material to a level that provides protection of the soil hydrology, soil biology and flora and fungi, soil stability and erosion, and soil fertility.

Existing and Desired Conditions

The planning area is 64,882 acres and is located within the Steamboat Creek watershed approximately 25 miles east of Glide, Oregon. Previous clearcutting and reforestation practices in these watersheds, along with the exclusion of fire over the last several decades has created dense, second-growth forest stands in both uplands and riparian areas that are now in the stem exclusion stage of development and lacking species diversity. Past timber harvest activities in the Lemon Butte planning area utilized a combination of highlead, skyline, tractor and helicopter yarding methods. Highlead logging was used in the through the 1950s and 1960s on steeper slopes over forty percent. Unlike current cable logging (skyline logging) systems which suspends logs off the

ground, there was little if any suspension in highlead resulting in deep furrowing of the slopes, severe soil displacement, and intercepted ground water. Generally, all non-merchantable material remained on-site, accumulating in large concentrations in swales and the lower third of steeper harvest units and in streams. Following harvest during this period prescribed fires to reduce this fuel concentration often resulted in relatively high intensity fall burns that left the upper slopes bare.

Around 1975, skyline logging systems were primarily used to harvest the moderate to steeper slopes in Lemon Butte, greatly reducing the soil disturbance to three percent or less of the harvest area, as well as reducing soil compaction. The effects of tractor yarding were reduced after 1985 by restricting ground skidding to designated skid trails over approximately 18% to 20% of the area harvested. During this period, skid trails were designated away from streams and saturated soils.

Soil interpretations for the planning area were made using the Umpqua Soil Resource Inventory (SRI, USDA 1976), field review, and further refined with GIS (Table 21). The SRI inventory provides landscape-scale soils information on broadly mapped areas (average size = 250 acres) that have distinctly unique geology, landform and soils that affect the growth and development of forest vegetation. A broad Landtype association interpretation was provided from recent work by Oregon State (Noller, Jay S. 2012). This information was reviewed for each landform and provides useful information for sale planning. The geology of Lemon Butte is associated with rock units of the Western Cascades, consisting of a complex mixture of highly fractured volcanic basalt (ridge and sideslope), weathered volcanic tuffs and breccia (dormant earthflows), and massive to fractured weather shallow intrusive rhyodacite (ridge and sideslopes).

Table 21. Steam and road densities by landforms making up the Lemon Butte Planning Area.

Geomorphic Land Unit	Planning AREA %	Stream Density mi/mi^2	Road Density mi/mi^2	Dominate Erosion Risk
CIRQUE BASIN MOUNTAINS Units: no proposed harvest Dominant Landtypes: 31,46,47	6%	10.3	3.9	low to high
DISSECTED HUMMOCKY MOUNTAINS Units: 3,4,21,31,,57-61 Dominant Landtypes: 24,47,45,16	26%	7.9	4.4	low to moderate
FACETED MOUNTAINS Units: 6,7,11,14,19,23,24,26,39, 46-48,50,54,69,71 Dominant Landtypes: 46	68%	7.6	3.2	high

Cirque Basin Mountains: Six percent of the planning area and none of the proposed harvest or fuel treatments would occur on the moderately steep, very shallow to moderately deep cirque basin mountain landforms ranging from 3,500 to 5,000 feet in elevation. Soil temperatures range from frigid (cool) to cryic (cold) retaining a snow pack through most winters. This landform is characterized by predominately Miocene and Oligocene undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt/andesite. The landform is dominated by low groundwater storage capacity and low water transmission resulting in flashy watersheds with high peak-flows and low summer

flows. Stream flow ranges from neutral to strongly acidic resulting in an expected culvert life ranging from 15 to over 25 years. Drainage patterns are strongly expressed (10.3 stream miles per square mile) with incised channels. Mass wasting hazard is rated stable to moderately unstable in clearcuts and roads (0.001 unstable acre per acre of landform identified). Surface water erosion potential is variable ranging from low to high, with high ravel potential on steep slopes. Fifteen percent of the cirque basin mountain landforms in the planning area were identified as very dry habitat with skeletal or very shallow soil. The Douglas fir site class rating is generally considered to range from very low to low (1 to 2). Brush competition can be very high where the forest floor is opened up to light. Grass competition is generally low. Windthrow hazard ranges from low to moderate.

Dissected Hummocky Mountains: Twenty-six percent of the planning area, 34 percent of the harvest and fuel treatments would occur on the gentle to moderately steep, very shallow to moderately deep dissected hummocky mountain landforms ranging from 2,600 to 4,300 feet in elevation. Soil temperatures range from mesic (warm) to frigid (cool) with a transitional snow pack through the winter. This landform is characterized by predominately Miocene and Oligocene undifferentiated basaltic lava flows and tuffs. The landform is dominated by high groundwater storage capacity and water transmission over forty-eight present of the area resulting in watersheds with low to moderate peak-flows and high base-flows resulting in sustained summer flows throughout most years. Stream flow ranges from moderate to strongly acidic resulting in a relatively low culvert life ranging from less than 15 to 20 years. Drainage patterns are strongly expressed (7.9 stream miles per square mile) with incised channels. Mass wasting hazard is rated stable to moderately unstable in clearcuts and roads (0.004 unstable acre per acre of landform identified), with shallow rapid landslide hazards in the steeper incised headwalls and deep seated dormant earthflows on gentle to moderately steep surfaces. Surface water erosion potential is variable ranging from low to moderate, with high ravel potential on steep slopes over sixty percent. Less than one percent of the dissected hummocky mountain landforms in the planning area were identified as very dry habitat with skeletal or very shallow soil. The Douglas fir site class rating is generally considered to range from low to moderate (2 to 3). Brush competition can be moderate where the forest floor is opened up to light. Grass competition is generally very high. Windthrow hazard is low.

Faceted Mountains: Sixty-eight percent of the planning area sixty-six percent of the harvest and fuel treatments, and all of the larger controlled burn would occur on moderately steep to steep, very shallow to moderately deep faceted mountain landforms ranging from 2,100 to 2,800 feet in elevation. Soil temperatures range from mesic (warm) to frigid (cool) with a transitional snow pack through the winter. This landform is characterized by predominately Miocene and Oligocene undifferentiated sedimentary and volcaniclastic rocks. The landform is dominated by low groundwater storage capacity and low water transmission resulting in flashy watersheds with high peak-flows and low summer flows. Stream flow ranges from neutral to moderately acidic an expected greater than 25-year culvert. Drainage patterns are strongly expressed (7.6 stream miles per square mile) with incised channels. Mass wasting hazard is rated stable to very unstable in clearcuts and roads (0.017 unstable acre per acre of landform identified), with shallow rapid landslide hazards in the steeper incised headwalls. Surface water erosion potential is predominately high, with severe ravel potential on steep slopes. Sixteen percent of the faceted mountain landforms in the planning area were identified as very dry habitat with skeletal or very shallow soil. The Douglas fir site class rating is generally considered to range from very low to low (1 to 2). Brush competition can be moderate where the forest floor is opened up to light. Grass competition is generally very high. Windthrow hazard is moderate.

Desired Condition

The desired condition for soils is to keep cumulative impacts (legacy and proposed) of compaction and displacement to less than 20% of the treatment area and to maintain at least 70% to 85% effective ground cover of stable surface organic material for soil productivity and erosion control.

The desired condition for compacted surfaces would be to effectively restore hydrologic infiltration and permeability. All landings not immediately associated with a permanent road, skid trails (2 or more passes), and temporary roads used by the purchaser would be subsoiled to a minimum depth of 20 inches. Ripping that does not lift and effectively fracture the soil without turning it over, and/or scarifying that does not reach the minimum depth of 20 inches would be considered an unacceptable treatment. When machines are used to pile slash, soil restoration and piling operations would be implemented together in a single pass with equipment that is suited for both operations (i.e. excavator with a combination subsoiler and brush-rake attachment). All skid trails and landings used by the purchaser (landings not associated with the permanent road prism) shall be subsoiled and effectively covered with slash (minimum 80% coverage with a 2-inch minimum to 6-inch maximum depth).

The Lemon Butte planning area is encompassed by six watershed analysis areas, including Canton Creek (USDA, 1994; USDA & USDI, 1995), Cedar Creek (USDA, 1995), City Creek (USDA, 1996), Lower/Middle Steamboat Creek (USDA, 1999), Lower Steamboat Creek (USDA, 1999), Upper Steamboat Creek (USDA, 1997) Watershed Analyses, and Upper and Lower Steamboat Creek Watershed Analyses Iteration (USDA, 2007). These watershed analyses document densely-stocked second growth stands in the planning area and recommend the use of thinning and prescribed fire in these managed stands to move landscape patterns toward reference conditions. The project area also was identified in the 2011 Upper Steamboat Watershed Action Plan, which recommends the use of prescribed fire to reduce the probability and effects of a large wildfire.

Approximately 185 acres of ground-based, or mechanized, logging systems and 418 acres of skyline logging systems would be employed to implement the thinning prescriptions. Mechanized equipment is generally utilized on slopes under 35% and skyline systems over 35% slope. Landings would be used in both the skyline and ground based units. The average landing size is 0.50 acres in skyline units and 0.50 acres in ground-based units.

Road Work Implementation: No new permanent system roads would be constructed and all temporary roads would be obliterated after use.

New temporary road construction- Approximately 0. 5 miles (1.1 acres) of new temporary road would be constructed to gain access into thinning units, none of which would be located within Riparian Reserve areas or within no harvest buffers.

New temporary road construction on previously decommissioned road- Approximately 1.25 miles of new temporary road would be constructed on the existing footprint of previously decommissioned roads to gain access into thinning units. No construction would be located within Riparian Reserve areas or no-harvest buffers. The previously decommissioned roads proposed for use include 3806-495, 3821-060, and 3828-148

Existing temporary road reconstruction- Approximately 1.25 miles (3.3 acres) of temporary spur routes to gain access into thinning units would be located on the existing footprint of skid roads, fire lines, and abandoned or unclassified roads that were built to access the original harvest units.

Approximately 0.1 mile (0.2 acres) of these would be located within Riparian Reserve areas; none would be located in no-harvest buffers. Reconstruction would give the Forest Service the opportunity to properly obliterate and hydrologically restore these roads.

Temporary road obliteration – After use, approximately 3.25 miles (8.7 acres) of temporary roads would be obliterated with an excavator equipped with a “winged subsoiler” to de-compact soil as needed. Any excavated material, including soil and woody material, would be pulled back over the road. A native forage seed mix would be applied to all subsoiled temporary roads and landings to minimize erosion and the establishment of invasive weeds.

Sub-soiling and native seeding- All landings, temporary roads, and skid trails, would be subsoiled, covered with slash, and in some cases seeded with native grass seed. All temporary roads, landings, and skid trails that are not further needed for project implementation would be obliterated and erosion control measures in place. Erosion control, at a minimum, would include water bars and ground cover at 80% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71). Temporary roads, landings, and skid trails still needed to complete project implementation would be winterized with all erosion control measures in place, and barricaded or blocked. Erosion control, at a minimum, would include water bars and ground cover at 25% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71).

System Road Reconstruction- Road reconstruction would include reconstruction to meet standards and guidelines of the Northwest Forest Plan, in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen the risk of erosion (USDA & USDI, 1994; ROD C 32-33). All road construction and reconstruction work would occur within the normal operating season.

Road Reconstruction would include: Placement or replacement of surface rock; the replacement of approximately 25 ditch relief culverts; armoring culvert outlets; stabilizing road fills and road shoulders; the replacement of 15 undersized or deteriorated stream crossings. Road reconstruction work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

Road maintenance- Road maintenance would be implemented in order to meet the Standards and Guidelines of the Northwest Forest Plan which are designed to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (USDA & USDI, 1994; ROD C 32-33). Road maintenance work exceeding 75 yd^3 per miles would not occur outside the normal operating season (November 1 through May 31).

Road maintenance would occur on up to 91 miles of existing National Forest System roads to facilitate log haul. This work would include: brushing roadsides and blading roadbeds; placing or replacing surface rock; cleaning ditches and culverts; falling danger trees to meet OSHA safety requirements; grading and shaping of existing road surfaces; constructing water bars; installation of waterbars and cross ditches; bridge maintenance; and opening existing closed roads then re-closing after use. Work would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

Road maintenance would include the use of quarries, stockpiles, and waste disposal sites within the Lemon Butte project area boundary.

Direct and Indirect Effects

The direct and indirect effects are discussed at the scale of the 65,000 acres located within the Steamboat Creek watershed. Approximately 3,470 acres were assessed for treatment. Of that, Alternative 2 would prescribe “no treatment” on 2,867 acres (83%) of the assessed acres. Commercial thinning would occur on approximately 603 acres utilizing a range of silvicultural prescriptions. Direct effects would occur immediately as a result of thinning, fuels treatment, and road work while indirect effects would occur in the future as a result of minor modifications to risks of potential wildfire.

Under Alternative 1, legacy soil displacement and compaction would remain unchanged at around 811 to 832 acres of legacy disturbance including systems roads, abandoned roads that we are aware of, skid trails and landings (Table 22). Overall, legacy compaction in units previously tractor logged averaged 25% to 30% compaction within the tractor logged areas. The action alternative would re-use 1.5 miles (approximately 3.3 acres) of existing and abandoned temporary roads and landings. Approximately 1.25 miles (approximately 2.7 acres) of newly constructed temporary roads would occur on decommissioned road beds. Approximately 0.5 miles of new temporary road on previously undisturbed soil would be constructed.

For the most part skid trails and landings would utilize the existing foot print, however approximately 3 to 4 additional acres of new disturbance would be expected to help facilitate relocating some to better placed locations.

The project design features for compaction using subsoiling and fill pull back would have the direct effect of reducing surface water runoff, improving water infiltration, and decreasing the risk of erosion and sediment delivery. Alternatives 2 would subsoil and cover all temporary roads, landings, and skid trails used by the purchaser as a normal operating procedure. This would treat roughly 10 to 11 acres of soil disturbance and have the potentially to move compacted soils towards a more acceptable condition with increased infiltration and permeability. Compaction could be reduced by as about 1% of the know legacy compaction, whereas approximately 802 to 821 acres of untreated legacy compaction would remain as a long-term effect (>50 years) of past practices occurring in this soil texture class. De-compacting damaged soil through subsoiling temporary roads, landings, and skid trails and covering with slash would increase the soil’s permeability, and help disperse surface water runoff to decrease erosion delivery potential. Following harvest and subsoiling, all units in the action alternatives would meet soil standards and guidelines for acceptable levels of soil disturbance (<20% unacceptable soil conditions) for both compaction and effective ground cover, thus complying with soils S&G #1 and erosion risk S&G #2 (LRMP pp 67-68). Full recovery of soil productivity on these sites is a biological process that takes time (10+ years).

Table 22. Unacceptable soil disturbance estimates for Lemon Butte EA.

	Alternative 1	Alternative 2
Existing Skid Trails and Landings (acres)	28 to 48	28 to 48
Permanent Forest Roads (acres)	777	777
Abandoned Roads (acres)	7	7
New Skid Trails and Landings (acres)	0	3 to 4
Existing Temporary Roads (acres)	0	3.3
New Temporary Roads (acres)	0	1.1
Temporarily Reopened Roads (acres)	0	2.7
Potential Severely Burned Soil (fuels)	0	18
Soil Restoration (acres)	0	10 to 11
Total Unacceptable Soil Conditions (acre)	811 to 832	820 to 839
	Estimated change	+0.8% to +1.1%

Yarded material may be chipped, tops stacked separately and left on the landing for firewood cutters, processed into biochar, or burned. Logging slash, would be treated on approximately 310 acres, in order to break up continuity of the fuels throughout the timber sale units. Methods of treatment would include grapple piling, hand piling, and areas of prescribed underburning. Approximately 1.3 miles of hand line would be constructed to support areas of underburning. Landing piles would be burned. Implementation of these treatments would be subject to a post-harvest fuels assessment and the chip market.

Hand pile and burn would expose an average 7% mineral soil and consume about 4% of the duff layer depth. Specification for hand piling directs that piles be well-constructed and covered which helps ensure that these pile burn quickly and completely. Hand pile burning phase and smoldering would be expected to minimal resulting in a low intensity-short duration burn resulting in a low severity burn. Hand piles are expected to cover between 2% to 8% of the treated area. Approximately 0% to 25% of the area covered in piles would be expected to be in a detrimentally unacceptable soil condition from high severity burning (Forest Service 1997). Under Alternative 2, hand piling 209 acres would be expected to result in between 0 to 1 acres of severely burned soil.

Machine pile and burning would expose an average 30% mineral soil. All machine piling operations would be implemented within the normal operating period (June 1 through October 31) when soils are dry. Equipment would be operated on skid trails or on top of slash therefore, increases in unacceptable soil disturbances (soil displacement and compaction) are expected to be minimal (<1% or the treated area). Machine piling would result in piles that are both less compacted than landing piles and stacked higher with much narrower base. Less fuel would be consumed in a long duration – high intensity burn than typically occurs with burning landing piles. Machine piles are expected to cover 15% of the treated area. Approximately 40% to 70% of the area covered in piles would be expected to be in a detrimentally unacceptable soil condition from high severity burning (Forest Service 1997). Under Alternative 2, machine piling 101 acres would be expected to result between 6 to 11 acres of severely burned soil.

Under burning would be expected to expose 4% to 12% (p=0.5) mineral soil when in prescription and consume about 30% to 50% of the duff and litter layer (Forest Service 1997). Early season (spring to early summer) or late fall burning would lessen burn intensity and duration primarily by reducing the 0-3 inch fuels and leaving the majority of the duff and litter layer and larger wood material intact. Soils would be less likely to reach lethal temperature (60ºC), with minimal consumption (approximately 1.5 inches) of litter when in prescription (First Order Fire Effects Modeling). Assuming worst case scenario where all bare soil would be in a detrimental condition, under Alternative 2, underburning 38 acres would be expected to result between 4 to 11 acres of severely burned soil.

Landing piles burns generally result in long duration – moderate to high intensity burns resulting in severely burned soils over most of the burn area. Landing piles tend to be densely compacted and of mixed fuel classes making the material difficult to utilize once it has been piled. Whole-tree yarding can result in huge slash piles at the landings. Under Alternative 2, tops would be required to be piled in separate piles. This prescription would reduce the size class and pile size of the compacted landing piles to be burned. I would also provide a opportunity for alternative use of the larger pole size material, such as for firewood or biochar production. Assuming one landing pile for every 15 acres Alternative 2 would be expected to result in between 0.5 to 1.5 acres of severely burned soils on the landing. However these acres are included as part of the 3 to 4 acre estimate for landings and skid trails (Table 22).

Where under burning occurs, cumulatively, harvest and fuel treatments would maintain more than 88% to 96% or more effective ground cover. Effective ground cover is defined as all herbaceous or stable dead woody materials, synthetic materials and rock fragments >0.75” diameter that cover the surface of the ground and prevent soil surface erosion (LRMP IV-68). Minimum ground cover recommendations have been prescribed to address both the risk of soil erosion (LRMP IV-68 S&Gs #2 and #3) and the need to maintain soil organic matter for long-term site productivity.

The combined effects of harvest, landings, and fuels treatment would potentially expose soil over about 12% of tractor harvest unit acres and 2 to 3 percent of skyline units. The amount of potential disturbance anticipated to occur under the Lemon Butte alternatives would be considered acceptable for maintaining long-term soil productivity (LRMP IV-68). The action alternatives are expected to result in little to no effect on soil carbon. Therefore disruption of natural processes would not be expected to occur under any of the action alternatives.

The No Action Alternative would continue to lead to crowded continuous canopy stand conditions that increase the risk of sustained crown fire across the planning area. Both canopy and surface fuel loadings are such that in more extreme weather situations increases in fire intensity can be anticipated, and both riparian and upland areas could be affected.

Surface fuel loadings would remain high and continue to grow at a slow, steady rate. Varying size classes would be added to the forest floor from needle cast, falling branches, wind throw and dead or diseased trees. Until tree growth is such that lower limbs are shed, trees in the planning area would continue to provide ladder fuels for fires to torch into crowns and contribute to crown fire conditions; many of the trees currently have branches extending to the ground. The brush layer would also continue to provide a means for fire to transition from the ground to the canopy. Fire starts may also spread to or from the adjacent private lands with relative ease. A wildfire in an untreated area would be somewhat difficult to contain and control.

Efforts to increase forest productivity to meet the growing demand for wood products have raised questions about the long-term sustainability of some intensive forest management practices (Fox, 2000). Intensifying harvest removals and biomass utilization (such as whole-tree harvesting) may greatly increase the biomass yields from a given site. However, when compared with conventional bole-only and whole-tree harvesting removes a disproportionate quantity of nutrients relative to the gain in biomass, because of the high nutrient concentrations in foliage, branches and bark. This, along with some intensive site preparation practices, has aroused concern that the depletion of organic matter and nutrients resulting from either intensive harvesting or slash removal practices may cause a reduction in soil quality and subsequent stand productivity. Factors affecting the magnitude and duration of nutrients made available through thinning would include the degree of canopy removal, the degree of forest floor and mineral soil disturbance, the distribution and retention of standing dead trees and coarse woody material, the nature and intensity of site preparation operations. Thinning reduces total stand biomass but increases the growth of the remaining trees (Karlsson 2006).

While numerous studies have documented a gradual increase in total N leaching over the first few years following harvest (Dahlgren and Driscoll, 1994, Katzensteiner, 2003). However, Edomonds (1980) found nitrogen to be less mobile in Douglas-fir ecosystems due to the high carbon to nitrogen ratio in the slash and microbial and fungal immobilization of nitrogen. Phosphorous began leaching from slash during the first 3 months but also became immobile in the soil through fungal immobilization. Other leachates such as calcium (24 months) and manganese (after 2 years) become immobilized through cation exchange processes in the soil but not through fungal immobilization.

Most nitrogen leaching pulses have been shown to return to pre-harvest levels by the third year (Briggs et al., 2000, Hornbeck et al., 1990, and Katzensteiner, 2003). On this site, total nitrogen concentrations did not reach maximum values until the fall of the third year following harvest, and nitrogen concentrations continued to remain elevated relative to those observed in the non-cut stand into the sixth year. These observed trends are likely due to numerous site-specific characteristics, including the high-productivity level of the site, total nitrogen content of the soil, soil mineralogy and differing climatic regimes of Pacific Northwest compared with those of the Northeastern USA (Briggs et al., 2000, Dahlgren and Driscoll, 1994). In Australia Eucalyptus plantations Shammas et al. (2003) found after 12 months, 16% of the total nitrogen, 19% or the total calcium, and most of the phosphorous had been leached from the logging slash.

Relative to the total nitrogen pool in mineral soil to a depth of 80 cm, the observed flux in nitrogen via soil solution would represent a small loss. Strahm (2005) found the cumulative quantity of nitrogen leached to a depth of 1.0 m over 3 years was a small percentage (BO = 1.5%, TP = 0.6% and FS < 0.1%).

Under the action alternative, felled material down to a six inch diameter top would be yarded and removed from the site and material from six to three inch diameter tops would be brought to the landings. Whole-tree yarding could occur, provided enough slash remains on site to meet temporary spur road obliteration and winterization requirements. Yarded material may be chipped, left on the landing for firewood cutters, processed into biochar, or burned. Logging slash would remain onsite for at least one season to dry, which would also allow for nutrient leaching from the slash into the soil. Needle cast and fine fuels not piled and left on site would leach nutrients.

Carbon (standing and down woody material, litter, soil organic matter) is a critical element to site productivity and soil development. Most plant available nutrients are retained by the organic

fraction in the upper ten inches of forest soils. Fine roots and mychorrizal fungi activity occurs at the litter-soil interface and in the surface two inches of soil. Fine root development plays an important role in soil carbon sequestration (Swank and Webster 2014, Lal 2005) and long-term soil fertility. Forest soils that are low in organic matter are also less productive. Increased carbon storage in forest soils can be achieved through forest management including site preparation, and fire management. Soil most sensitive to losses in effective ground cover would be the dry site soils that are shallow and skeletal.

The risk of wildfire would be a potential indirect effect of maintaining fine fuels and litter. Under Alternative 1 a future wildfire would potentially reduce the effective ground cover by 40% to 60%. This would increase the possibility for erosion and would potentially reduce long-term site productivity on less resilient sites such as portions of the steep side slopes with shallow soils. Under Alternatives 2 the potential risks from wildfire would remain the same over most of the acres analyzed in the Lemon Butte planning area while providing a reduction in risk over 310 acres (5% of the planning area).

Under the worst case scenario all predicted soil disturbances created under Alternatives 2 would meet all long-term soil productivity standards and guidelines. There would be no adverse direct, indirect, or cumulative effects to soil productivity outside an acceptable range and associated with proposed or connected actions.

Cumulative Effects

The Lemon Butte planning area is in a mixed severity fire regime dominated by soils that are relatively resilient to disturbance. The action alternative is within the parameters of acceptable disturbance (Soil S&G 1, 2, and 3, LRMP p. IV67-IV68) and therefore would not add to any past soil impacts that result in any adverse cumulative effects to soil.

Considering recent and foreseeable activities in the Steamboat and Middle North Umpqua subwatersheds, there would be a minor cumulative net beneficial effect to long-term soil productivity. Other sales that have been implemented in the subwatershed in the past ten years have addressed existing levels of legacy compaction, including decommissioning and subsoiling. In addition, fuel treatments have resulted in low impact, low intensity, and short duration burns that result in acceptable levels of soil disturbance (USDA Forest Service 1998) while reducing the future potential wildfire risk.

The action alternative, along with other present, recent past and reasonably foreseeable timber sale thinning and fuels management activities within the Steamboat watershed may potentially reduce the risk of severe wildfire effects to soils and result in a beneficial cumulative effect. Conversely, because Alternative 1 has the potential to result in severe soil effects from a wildfire, it may continue to add to adverse soil impacts in Lemon Butte but because there is no action taken, no cumulative effects can occur.

As Nitrogen (N) is often viewed as a limiting nutrient for plant growth in these ecosystems, it is important to place the N leaching losses observed in this study in the context of subsequent stand productivity. As leaching rates in the bole-only and whole-tree treatments would potentially be different in periods during the third and fourth growing season and then decreased with time in such a manner that there would be very little difference from the No-Action Alternative by the fifth growing season (Strahm et al. 2005), nor would foliar nitrogen levels (Roberts et al., 2005).

Aquatic Environment

The Proposed Action and its relationship to the aquatic environment were assessed in this section. Concerns were raised during the scoping process over the impacts of thinning within riparian reserves. This issue was considered during the development of the project design features and BMPs. The aquatic effects related to this issue are disclosed in this section. The results of watershed analyses are presented, a description of the existing condition and the important physical and biological components of the Aquatic Conservation Strategy (ACS) are discussed, and conclusions are presented regarding how Alternative 2 moves existing conditions toward desired conditions in terms of the nine ACS objectives, which include:

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

2. 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.

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

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

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

6. Maintain and restore instream 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.

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

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

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

Hydrology

Applicable Watershed Analysis Recommendations

The following recommendations are not exhaustive but include a relevant subset of recommendations from three Watershed Analyses that address water resources. These recommendations mention road decommissioning, however, under this analysis, the Forest Service is not proposing any permanent road construction or decommissioning. In implementing the Action Alternative, 0.5 miles of new temporary roads, approximately 1.25 miles of new temporary roads on previously decommissioned road, and reconstruction of 1.5 miles of existing temporary spur roads are necessary. Following use, all temporary roads would be decommissioned and hydrologically restored.

1999 Lower Steamboat Watershed Analysis:

- Thin in mid-seral stands to accelerate the development of late-successional tree characteristics: i.e., vary thinning spacing to accommodate complex vegetative structure needs (wide spacing in some areas to maintain high growth rates to develop large diameter trees as soon as possible vs. areas of no thinning); maintain full live crown ratios; develop large branch sizes and thick bark, etc.;
- Release desirable hardwoods and shrubs in mid-seral stands to maintain diversity;
- Maintain or develop intermediate layers in managed stands by thinning;
- Reduce compaction where practical in former harvest areas within the riparian area.

2001 Middle North Umpqua Watershed Analysis:

- Utilize variable spacing by species that prescribes different levels of retention between the riparian and terrestrial environments.
- Interplant shade-tolerant conifers such as western red cedar and hardwoods such as Oregon ash in riparian areas.
- Re-establish aquatic and riparian connectivity by using appropriately-sized culverts or by placing natural-bottom culverts.
- Restore forest health (stand and landscape) through pre-commercial and commercial thinning, timber harvest and the use of prescribed fire.
- Prescribe thinning activities in previously harvested stands adjacent to fish bearing streams in order to accelerate development of large trees for stream shading and coarse wood. Coordinate with road decommissioning if possible. Use the project level planning process to determine stream reaches to thin.
- Restore compacted soils on sites within refugia habitat to augment water infiltration where current and past harvest has altered soil conditions on over 40% of the site.

2007 Steamboat Creek Watershed Analysis:

- Along perennial streams, apply silvicultural treatments such as thinning, activity fuel treatments, and/or prescribed underburns outside the primary shade zone when it is determined that such activities can benefit effective shade and other riparian functions over the long term (UDDA/USDI, 2005), thus meeting the long-term objectives of the Aquatic Conservation Strategy. Treatments within the primary shade zone such as thinning and

prescribed fire may be considered when a site specific analysis shows no risk of temperature increases to listed reaches.

- Along intermittent streams, apply silvicultural treatments such as thinning, activity fuel treatments, and/or prescribed underburns when it is determined that such activities can benefit the long-term objectives of the Aquatic Conservation Strategy. Variable-width, no treatment buffers would be identified where stream bank, bed, or adjacent up slope stability is a concern and to lower sediment delivery associated with certain types of yarding. The size of such no treatment buffers should be prescribed based on site-specific conditions and in the context of the proposed silvicultural prescription and logging system. Where overall channel stability and sediment delivery are verified not to be a concern, maximizing the amount of restorative treatment and lowering the long-term hazard of stand-replacement fire along streams is the desired outcome. Treatments that occur where no buffer is needed would maximize the restorative benefits and lower the chances of more severe wildfire effects along streams.

Water Quality

The Clean Water Act (1972) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop a Total Maximum Daily Load (TMDL) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

A suite of TMDLs were approved by the Department of Environmental Quality for the Umpqua Basin in 2007. However, not all pollutants were adequately addressed in these plans and thus remain on the list of impaired waters. Regardless of whether an impaired waterbody has an approved TMDL established (303(d); Category 4) or one is still needed (303(d); Category 5), the waterbody is still classified as Water Quality Limited for not meeting applicable state water quality standards.

Beneficial Uses of Water

The relevant inclusive beneficial uses of the North Umpqua River and its tributaries as determined by the Oregon Department of Environmental Quality (2003) are: Public Domestic Water Supply, Private Domestic Water Supply, Industrial Water Supply, Irrigation, Livestock Watering, Fish & Aquatic Life, Wildlife & Hunting, Fishing, Boating, Water Contact, Recreation, Aesthetic Quality, and Hydro Power.

Relevant Standards and Guidelines – Water Quality

The relevant standard and guidelines are specifically from the Umpqua Land Resource Management Plan (1990).

- Water Quality/Riparian Areas S&G #6, p IV-60: Directional felling methods would be used to meet riparian objectives and protect water quality during timber harvest (e.g.; Timer Sale Contract Clause C6.51 and C6.41).
- Water Quality/Riparian Areas S&G #12, p IV-63: The application Best Management Practices (BMP's) for the protection of water quality and beneficial uses (e.g.; aquatic life or wildlife and hunting) would be monitored on ground disturbing activities.

- Watershed Cumulative Effects and Water Quality, S&G #1, p IV-64: The beneficial uses of waters must be identified and management activities planned so they would not interfere with or be injurious to the beneficial uses of adjacent and downstream waters.
- Watershed Cumulative Effects and Water Quality, S&G #2, p IV-64: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Existing and Desired Conditions – Water Quality

The desired conditions for streams within the planning area are to ensure their compliance with all applicable Water Quality Management Plans and maintain water quality for all beneficial uses. The following table details relevant water quality limited stream reaches that may be affected by the proposed Lemon Butte Project (Table 23).

Table 23. Water quality limited waters associated with the Lemon Butte Project.

Stream	River Mile	Pollutant	Season	Criteria	Beneficial Uses
Canton Creek	0 to 16.5	Temperature	Year Around (Non-spawning)	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Core cold water habitat.
Cedar Creek	0 to 1.9	Temperature	Summer	Rearing: 17.8 C	Anadromous fish passage; Salmonid fish rearing.
City Creek	0 to 6.6	Temperature	Summer	Rearing: 17.8 C	Anadromous fish passage; Salmonid fish rearing.
Horse Heaven Creek	0 to 6.3	Temperature	Summer	Rearing: 17.8 C	Salmonid fish rearing; Anadromous fish passage.
Little Rock Creek	0 to 6.6	Temperature	Summer	Rearing: 17.8 C	Salmonid fish rearing; Anadromous fish passage.
North Umpqua River	0 to 68.9	Temperature	Year Around (Non-spawning)	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Core cold water habitat.
Steamboat Creek	0 to 6.1	Dissolved Oxygen	Summer	Cold water: Not less than 8.0 mg/l or 90% of saturation	Anadromous fish passage; Salmonid fish rearing.
Steamboat Creek	0 to 6.1	pH	Summer	pH 6.5 to 8.5	Anadromous fish passage; Water contact recreation; Salmonid fish spawning; Resident fish and aquatic life; Salmonid fish rearing.
Steamboat Creek	6.1 to 10.9	pH	Summer	pH 6.5 to 8.5	Resident fish and aquatic life; Anadromous fish passage; Salmonid fish rearing; Water contact recreation; Salmonid fish spawning.

Steamboat Creek	10.9 to 23.4	pH	Summer	pH 6.5 to 8.5	Salmonid fish spawning; Salmonid fish rearing; Resident fish and aquatic life; Anadromous fish passage; Water contact recreation.
Steamboat Creek	0 to 10.9	Temperature	September 1 - June 15	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Salmon and steelhead spawning
Steamboat Creek	0 to 23.4	Temperature	Year Around (Non-spawning)	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Core cold water habitat.
Steelhead Creek	0 to 4.8	Temperature	Summer	Rearing: 17.8 C	Salmonid fish rearing; Anadromous fish passage.

Note: All of these waters are classified as Category 4a, Water Quality Limited with an approved TMDL, under the 2007 Umpqua Basin TMDL (**http://www.deq.state.or.us/wq/assessment/rpt2010/results.asp**).

Direct Effects – Water Quality

The Lemon Butte Project is in compliance with the Clean Water Act and the Water Quality Management Plans derived from the Umpqua Basin TMDL (Turner et al., 2006). All proposed activities are subjected to evaluation under the Northwest Forest Plan, the Aquatic Conservation Strategy and other associated Water Quality Restoration Plans. By implementing and monitoring water quality related best management practices the probability of degrading waters within the planning area or downstream is minimized and should result in no direct effects to public health relating to water quality.

Indirect Effects – Water Quality

Under the Action Alternative, the proposed activities may indirectly benefit water quality by potentially reducing the extent and/or severity of wildfires. High intensity wildfires and emergency fire management have the potential to degrade water quality through increased runoff and erosion, accelerated nutrient inputs and through chemical spill or misapplications. The proper decommissioning of existing temporary roads, through subsoiling and channel restoration, following their reconstruction and use for this project would likely have a long-term, measurable net benefit at the site scale.

Indirect effects to water quality under the no action alternative are potentially elevated due the risk of high severity wildfires within the project area. Wildfire and fire management activities can result in increased stream water temperature, stormflows, and erosional processes/rates (Neary et. al. 2005). However, since the timing of catastrophic wildfire and its effects are somewhat unpredictable, wildfire is not a reasonably foreseeable future activity and therefore the No Action Alternative would have no indirect effects to water quality.

Cumulative Effects – Water Quality

Past harvesting of perennial stream shade occurred up until about the 1980's on the Forest Service land within the watershed. Loss of stream shade had contributed to elevated stream temperatures and pH in planning area streams. However, those areas harvested prior to the early 1980's now have trees that functionally shade the streams. For example, the 7 day average maximum daily water temperature within Cedar Creek has dropped from 75 degrees in 1972 to 65 degrees in 2008 (USDA Forest Service, 2013). All past, present, and reasonably foreseeable activities were

considered in this analysis (Table 3). Ongoing vegetation treatments maintain no-cut buffers and thereby protect stream temperature. Both the Action Alternative and the No Action Alternative would protect the effective shade along perennial streams. Therefore, no cumulative temperature effect would occur that would affect downstream Beneficial Uses in either alternative.

Streamflows

The streamflow regime of the Lemon Butte Planning Area is influenced by Western Cascades geology. In general, the streamflow record from the gaging station near the mouth of Steamboat Creek downstream of the planning area demonstrates that winter flow for the Steamboat Creek Watershed responds quickly to storm precipitation during the winter causing rapid runoff, which sharply contrasts with the very low summer flows (Figure 20).

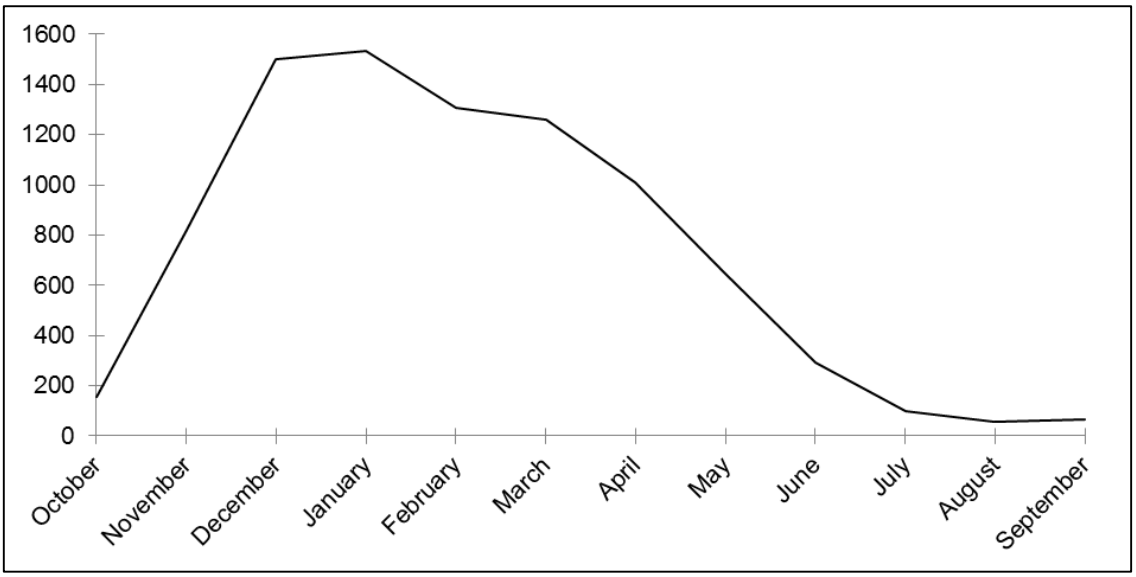


Figure 20. Steamboat Creek mean monthly stream flow measured in cubic feet per second (ft^3/s) from 1957-2013

Relevant Standards and Guidelines – Streamflows

The relevant standards and guidelines from the Umpqua LRMP related to streamflow include: Watershed cumulative effects and water quality, S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Watershed cumulative effects and water quality, S&G 4: Beneficial uses of water and aquatic habitat (water quality) would not be degraded by increased peak flows caused by canopy removal from timber harvest, road construction, and related activities.

Existing and Desired Conditions – Streamflows

The desired condition is the protection of flow regimes in keeping with ACS objective 6, while moving stem exclusion forest stands toward the desired range of natural variability.

The planning area is mostly within the transient snow zone, between 2,000 to 5,000 feet in elevation, where winter peak flows play a significant role in shaping a stream's character. Within this zone, warm rains that fall on accumulated snow can cause rapid snowmelt leading to peak flow events. Studies within the Upper Willamette sub-basin (with characteristics similar to the

Lemon Butte planning area) have shown that 88% of floods with a return period of greater than 6 years were associated with rain-on-snow events (Harr 1979, Christner 1981). Sizeable canopy openings can result in greater snow accumulation and more rapid snowmelt compared to locations lacking large canopy openings.

The forest canopy has a major influence on snow accumulation, distribution, and melt rate. As such, the Umpqua Forest Plan requires an analysis of forest canopy conditions when any canopy-removing activity is proposed (standard and guideline 4, listed above). An area is considered fully recovered when the canopy closure is 70% (USDA, Umpqua NF, 1990). An overall hydrologic recovery of 75% or greater within a drainage would maintain current peak flows and dampens adverse change to physical channel condition and associated factors such as water quality and fish habitat. Statistically discernible increases in peak flows have occurred when greater than 25% of smaller drainages have been clear-cut harvested and included roads; that is, the hydrologic recovery was less than 75% (Jones and Grant 1996, Thomas and Megahan 1998). Conditions below the 75% hydrologic recovery value (i.e. lower levels of hydrologic recovery) need further evaluation for potential peak flow cumulative effects from rapid snowmelt during rain-on-snow storms (following S&G 4).

The hydrologic recovery percentages within the eleven Lemon Butte analysis area stream catchments are currently greater than the 75% threshold. The current hydrologic levels are displayed in Table 24; aerial imagery and previous activity data were used to determine hydrologic recovery.

Table 24. Hydrologic Recovery Percentage (HRP) analysis results for stream catchments within the Lemon Butte Project area.

Subwatershed	Stream Catchment	Catchment Area (Acres)	Current Hydrologic Recovery % (HRP)	Expected Hydrologic Recovery % after Proposed Treatment
Headwaters Steamboat Creek	City Creek	6439.49	89.00	88.42
	Horse Heaven Creek	7820.00	91.20	90.50
	Little Rock Creek	9784.62	97.88	96.89
Upper Steamboat Creek	Cedar Creek	6822.56	86.71	84.77
Middle Steamboat Creek	Johnson Creek	1172.10	97.34	96.15
Lower Steamboat Creek	Siwash Creek	1432.69	94.08	91.84

Steelhead Creek	North Fork Steelhead Creek	4255.17	96.29	93.35
	South Fork Steelhead Creek	2239.65	93.12	88.33
	Steelhead Creek	1334.51	97.60	94.17
Upper Canton	McKinley Creek	1306.60	98.32	98.32
	No Man Creek	1339.00	97.05	97.04

In addition to reducing canopy cover by displacing forest vegetation, roads can alter peak flow regimes. Studies have shown that forest roads on steep slopes intercept subsurface flow and expedite its arrival as surface flow to stream channels through road ditch networks, either directly when ditches connect to streams, or by gully formation from ditch relief culverts. This effect is greater on mid-slope roads, and roads with greater distance between ditch relief drainage, as more water is concentrated. This concentration is more likely to form a gully which can carry surface water directly to a stream rather than infiltrating into soil and becoming subsurface flow again (Montgomery 1994, Wemple, Jones and Grant 1996, Jones 2000).

Indirect Effects and Cumulative Effects

Peak flows represent an indirect effect rather than a direct effect. To adequately evaluate potential peak flow response the Umpqua Forest Plan (USDA, Umpqua NF, 1990) recommends analysis areas of at least 1,000 acres, see Table 24.

The hydrologic recovery analysis of snow accumulation and melt within thinning units is based on research completed on the Umpqua and Gifford Pinchot National Forests. This research indicated that a shelterwood canopy, which provides about 15% canopy cover, can generate about 60% greater snowpack runoff than mature forest (Storck, Kern and Bolton 1999) at the site scale.

The analysis for the Action Alternative assumes at least a combined 40% canopy recovery condition for proposed thinning units with 40-100 trees per acre and no recovery for canopy gaps. These conservative assumptions allowed for a margin of safety in the analysis to address scale difference from the original study (site response versus larger area) and treatment differences (heavy versus light thinning).

Under the Action Alternative, the proposed silvicultural treatments would increase the potential for snow accumulation in created gaps and in the thinned areas where overall canopy closure acre is less than 70%. However, the remaining leave trees in the thinned areas would break up the flow of warm wind across the gaps and buffer the snowpack from rapid snowmelt during rain-on-snow events. Because of the thinning treatment and the recovery of past harvesting, the resulting reduced hydrologic recovery level in the planning area would remain above the level of concern at the drainage, subwatershed and watershed scales.

In the Steamboat Watershed, approximately 3,000 acres of commercial thinning treatments are either being implemented under the Lobo, Tugboat, and Lower Steamboat Environmental Analyses or are proposed under the Lemon Butte Project (Table 3). The largest combined acreage would occur in the Lower and Middle Steamboat subwatersheds where 3-4% of the subwatersheds would be thinned. The combined loss of canopy from the proposed thinning and the current recovery of past harvesting would slightly reduce the hydrologic condition less than 1% at the watershed and 3-4% at the subwatershed scales. However, at neither of these scales, would thinning reduce the hydrologic recovery below 75%.

Therefore, the hydrologic recovery would maintain current peak flows and avoid adverse change to physical channel conditions and associated factors such as water quality and fish habitat (consistent with S&Gs 2 and 4, listed above). No cumulative peak flow effect is expected under the action alternative when considering past, present, or reasonably foreseeable future activities.

The Action Alternative would result in less risk of stand replacement fire in the steeper slope positions, which is a long-term beneficial effect to maintaining peak flows. If wildfire occurs in the planning area, the thinning, fuel treatments, and fire breaks under the Action Alternative would make the stands within the planning area more resilient to wildfire and help to reduce potential soil burn severity and intensity. Additionally, future wildfire under the Action Alternative is more likely to create smaller pockets of stand replacement fire compared to the no Action Alternative. Furthermore, increasing structural and species diversity in the proposed treatment stands would make them resilient to disease and drought. Thus, the Action Alternative reduces the risk of future peak flow increases and the potential negative impacts to the beneficial uses of water compared to the no action alternative.

Stream Channels

Streams in the planning area are primarily affected by roads that cross or that exists near them, by the age of the adjacent forest which provides bank stability and large wood input, and by the effects of disturbance such as floods and fire. The impact to streams from the various forms of road work is disclosed in this section.

Relevant Standards and Guidelines – Stream Channels

The relevant standard and guidelines are specifically from the Northwest Forest Plan (1994).

- RF-2e: For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow.
- RF-3a: Meet ACS objectives by reconstructing roads and associated drainage features that pose a substantial risk.
- RF-3c: Meet ACS objectives by closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects considering short-term and long-term transportation needs.

Existing and Desired Conditions – Stream Channels

Stream channels within the Lemon Butte Planning Area can be best characterized as pool-riffle or step-pool streams that are generally of moderate gradient (5-10%). Most streams in the Steamboat and Middle North Umpqua Watersheds and in the Lemon Butte planning area have experienced impacts from stream cleanout (removal of wood from the channel) and riparian forest clearcutting

during earlier decades of timber harvest and impacts from roads (USDA, 1997; 1999). Large wood is an important feature of a healthy aquatic ecosystem; an indicator of aquatic habitat complexity and resilience. The mean density of large wood in reference streams on the Umpqua National Forest is 55 pieces per mile. Because winter flows are so high in these watersheds, three of the most severely compromised wood-related functions are over-wintering habitat for aquatic fauna, organic matter and nutrient retention for aquatic insect communities, and gravel retention for pool formation and fish spawning.

Channels should be stable at stream crossings and flow regimes should be within the range to support aquatic life and riparian function. The Forest Service continues to be very active with the instream restoration program. The instream restoration work was designed under the 2005 Steamboat Creek Watershed Restoration Project. Additional instream restoration planning was initiated for Middle North Umpqua Watershed in 2013.

Direct Effects – Stream Channels

Under the Action Alternative, there may be additional localized soil compaction. As a result of soil compaction, rill erosion is occurring on existing temporary road footprints. These areas of localized compaction divert water and incise the surface during episodes of precipitation and increase erosion and sedimentation. When feasible, temporary roads were designed over these existing surfaces so that they can be properly subsoiled and hydrologically restored following their use. The Lemon Butte Project does not propose any new permanent systems roads. Approximately 0.5 miles of new temporary roads would be constructed and 2.75 miles of temporary roads over existing footprints would be reconstructed. All temporary road construction/reconstruction would be obliterated and hydrologically restored following the implementation of the proposed activities, thus minimizing the long term effects associated with sediment delivery to channels. Activities were thoughtfully designed so as to avoid impacts to channel stability. This is accomplished through no-cut buffers and by limiting stream crossing during harvest activities. In order to further protect stream channels and minimize sediment delivery, the Lemon Butte Project also proposes up to 91 miles of road maintenance that includes: grading, shaping, and rocking of road surfaces; constructing, removing, and replacing water bars; repairing and improving drain dips; installing stream crossing and ditch relief culverts. The Action Alternative has a net benefit to stream channels through the implementation of road maintenance and subsoiling 3.25 miles of existing temporary road footprints.

Instream habitat projects within the project area are expected to contribute towards improving stream channel geomorphology, function, and habitat. Minor short term disturbance of stream bed and banks is expected to occur until the stream adjusts to the addition of large wood or boulders.

Indirect Effects – Stream Channels

Under the no action alternative, new channels may eventually develop on existing temporary roads that were not hydrologically restored, thus modifying the hydrologic regime of project area. These existing roads have already altered the hydrologic regime; some of the roads still have culverts, many of which are damaged or plugged. Additionally, some of the road maintenance wouldn’t occur unless a failure was imminent or after a failure. Under the Action Alternative channels along new and existing temporary roads may have to be temporarily modified, causing some instability. Additionally, following subsoiling and channel restoration during the removal of temporary roads, channels would be less stable until the native seed secures the substrate. However, these effects are not anticipated to be neither significant nor long-lasting.

Cumulative Effects – Stream Channels

Many stream channels in the planning area were modified by management activities over the past 70 years. Streams were moved, flow regimes modified and connectivity often completely lost. Streams were cleared of large woody debris for decades; that large wood provided habitat and served to dissipate energy. For the last two decades the Forest Service has implemented several restoration projects in the planning area to place wood back into streams, restore cannels, improve stream crossings and improve stream/riparian connectivity. However, anytime there is instream work there a risk of reduced channel stability until the project site is revegetated and stabilized. If the work is done properly, this can take several months to a year. The short-term effect is shared by multiple projects currently being implemented in the Steamboat Creek and Middle North Umpqua Watersheds. According to Table 3 there are a number of ongoing activities within the Steamboat 5th field watershed relating to vegetation management, hazardous fuels, fish and wildlife habitat improvement, and roads. All of these activities have the potential to reduce channel stability over the short term at the site-scale. However, all of the activities would either help restore channels, make them more stable and resilient to large disturbances and therefore result in no cumulative effects. Under the no action alternative, stream channels lacking habitat complexity would continue to be more susceptible to large scale disturbance until natural stream morphological processes have caught up.

Riparian Reserves

Riparian areas are water dependent systems that consist of lands along, adjacent to, or contiguous with streams, rivers, and wetland systems. Riparian ecosystems are the ecological links between uplands and streams, and terrestrial and aquatic components of the landscape. Many riparian areas have wetlands associated with them. While riparian areas are defined primarily on the basis of their proximity to streams and rivers, wetlands occur wherever the water table is usually at or near the surface, or where the land is at least seasonally covered by shallow water.

The riparian reserve land allocation was established in the Northwest Forest Plan as part of the Aquatic Conservation Strategy (USDA/USDI, 1994). This riparian reserve analysis is based on the guidance in the Northwest Forest Plan which, in general, is defined for this analysis as one site potential tree height on non-fish bearing streams (either perennial or intermittent) and two site potential tree heights on fish bearing streams. A site potential tree height is the average maximum height of the tallest dominant tree that is 200 years or older for a given area. The height of site potential trees in the planning area has been established at 180 feet.

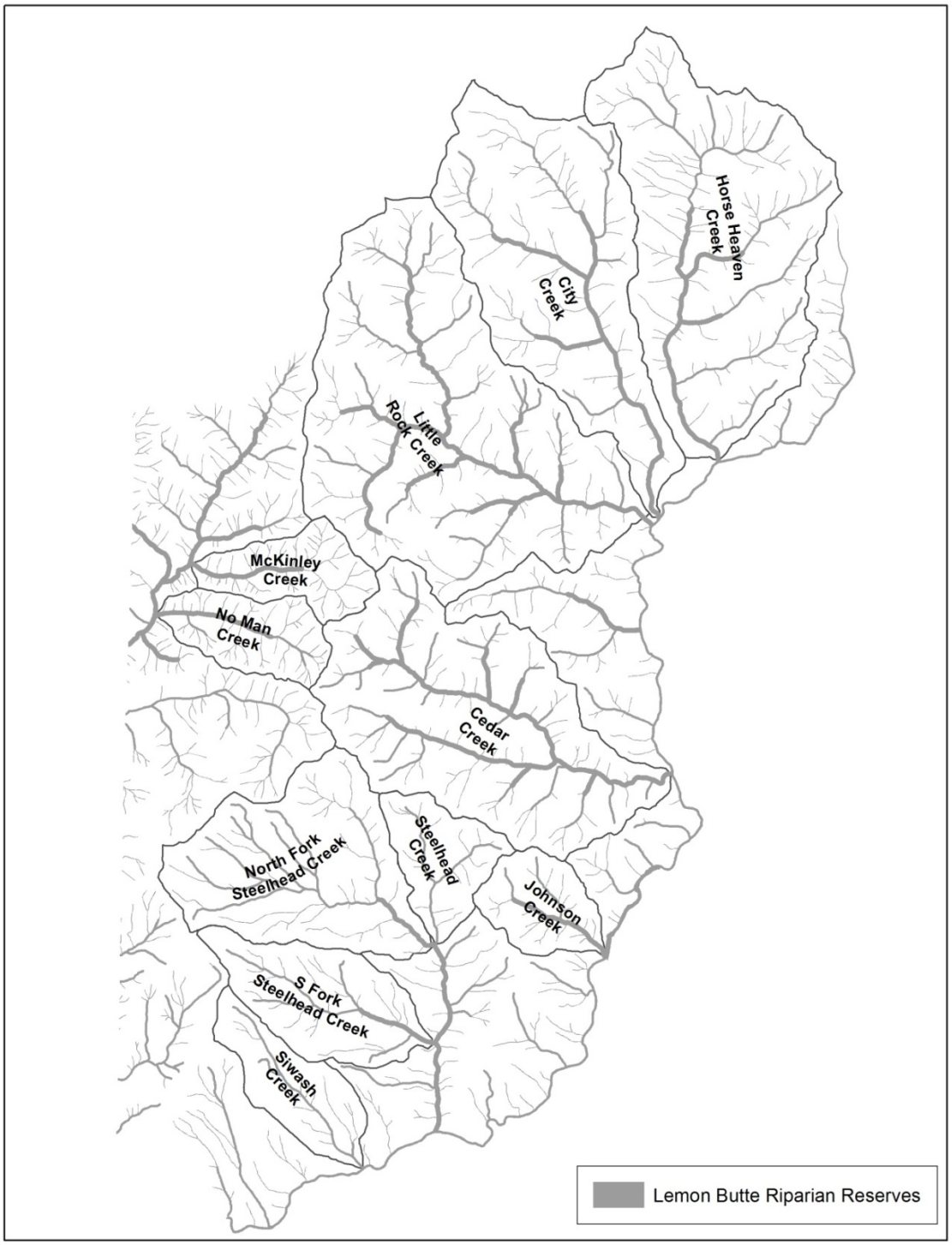


Figure 21 Overview of Riparian Reserves in the Lemon Butte Planning Area

Relevant Standards and Guidelines – Riparian Reserves

The Standards and Guidelines for riparian areas (as per the 1990 Umpqua National Forest LRMP) and Riparian Reserves (as per the1994 Northwest Forest Plans) specifically related to the Lemon Butte alternative includes:

- Umpqua LRMP C-2-VIII, IX, X: Prohibit timber harvest and site preparation…except to meet riparian objectives. Yarding corridors are permitted at designated locations with full log suspension over the streambank and protected vegetation. Corridors must minimize disturbance to riparian vegetation and meet riparian objectives. Incorporate activities that minimize both prescribed fire and wildfire damage to riparian vegetation.
- Northwest Forest Plan TM-1 (c): Prohibit timber harvest except where silvicultural practices are applied to control stocking, to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.
- Northwest Forest Plan FM-1: Design fuel treatments to meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression could be damaging to long-term ecosystem function.
- Northwest Forest Plan FM-4: Design prescribed burning and prescriptions to contribute to attainment of Aquatic Conservation Strategy objectives.
- Northwest Forest Plan RF-2a: For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing road and landing locations in riparian reserves.

Existing and Desired Conditions – Riparian Reserves

The Lemon Butte Planning Area has approximately 17,100 acres of Riparian Reserves, of which 38 acres would be treated (≤0.01%). Riparian Reserves would be protected with no cut buffers as described in the proposed action. Riparian Reserves are defined by the Northwest Forest Plan (USDA/USDI, 1994). During initial project design, potential treatment units were avoided or dropped from detailed analysis after preliminary field work suggested that their Riparian Reserves could not be effectively managed and still meet the objectives of the Aquatic Conservation Strategy. Therefore, Riparian Reserve thinning in the proposed units is needed to meet the objectives of the Aquatic Conservation Strategy while minimizing the potential for adverse effects.

In the Lemon Butte Planning Area approximately 45% of Riparian Reserve areas and 14% of the established no cut buffers were historically clearcut. These clearcut riparian reserves are Douglas-fir plantations presently in the stem exclusion stage. These stem exclusion stands are very dense and lack diversity due to the selection of Douglas-fir over other species during planting and pre-commercial thinning. If left untreated many stands are on a track to develop as closed, homogeneous stands that do not represent desired conditions for either the Late Successional Reserve or Riparian Reserve land allocations.

Roads in riparian areas have the potential to limit shade and deposition of large wood and debris to streams and riparian areas over long time periods since permanent roads are long-term features. Approximately 2% of the no cut buffers within the project area have roads collocated. There are also several miles of existing non-system roads that were used to harvest stands that may never have been properly decommissioned. The Lemon Butte Project proposes to reuse some of these existing temporary roads and properly decommission them following the proposed thinning activities. No new temporary roads would be built within riparian reserves for this project.

The desired future conditions for the Lemon Butte Planning Area are generally to approximate the composition, structure, and arrangement of forest vegetation within the natural range of variability at the stand scale, shifting landscape patterns back to more natural conditions, reflecting the larger contiguous vegetation patches, restoring the health, vigor, and historic

composition of native pine species, and reduced fire hazard characteristic of reference conditions. Specifically, the desired future condition for functioning riparian areas is to preserve and enhance the structure and species composition to maintain and/or achieve water quality standards for Beneficial Uses as described in our Water Quality Management Plans derived from the Umpqua Basin TMDL (2006). Additionally, riparian areas would provide quality aquatic and terrestrial wildlife habitat.

Direct Effects – Riparian Reserves

The direct effects to riparian forest conditions are defined as those occurring within the confines of the riparian reserve over the course of one to two decades.

Under the Action Alternative, the construction of temporary roads within riparian reserves would result in short-term impacts to riparian forest conditions by disturbing soil, vegetation, and changing localized habitat conditions at the site scale. The Action Alternative also would result in losses of small-sized organisms, habitat, and site productivity at the immediate site of the road prisms. The duration of these impacts are expected to last up to a decade. The roads would be subsoiled following use and some of the displaced wood and duff would be pulled back across the roads facilitating a quicker recovery from the impacts. Additionally, the disturbed areas would be revegetated using a native seed mix.

Under the Action Alternative, neither the gaps nor the general thinning surrounding such gaps are expected to exert unusual or extraordinary impacts to riparian forest conditions, since these activities simulate moderate severity fire, which lowers tree density and creates pockets of dead trees and openings, under the natural disturbance regime (Zenner, 2005). In contrast, under the no action alternative, the absence of disturbance would maintain the stem exclusion stage and delay the development of late successional stand structures for many decades (Andrews et al., 2005).

Riparian thinning, an issue raised during scoping, would result in effects to riparian conditions under the Action Alternative. The ground-based logging (loader, mechanized, and cut-to-length) would exert the most direct impact to riparian reserves due to soil and vegetation disturbance when compared to skyline logging[15]. Whenever possible, skyline thinning systems were designed adjacent to Riparian Reserves to minimize potential undesirable effects. Soil disturbance results in a loss of site productivity, and vegetation clearing results in habitat modification. The actual amount of disturbance expected with the ground-based logging would be about 1/10 of the total ground-based thinning acres (185 acres) because skid trails typically affect about 10% of the area logged with ground-based systems. With the cut-to-length logging system, soil disturbance is lower compared to other ground based logging, because the equipment operates on top of a bed of tree branches that are laid in front of the machine as it works through the stand (USDA, Forest Service 2003). The tree branches provide a cushion resulting in less displacement and compaction of soil, but vegetation clearing is still an impact.

Mitigation measures to minimize impacts from ground based logging include limiting the density of skid trails, restricting equipment entry to no closer than 50 feet from stream channels or outside of the no-cut buffers, whichever is greater, and subsoiling skid trails after use. These measures are detailed in the Project Design Features and Best Management Practices section, are

15 Post-treatment monitoring of timber sales has revealed that the amount of disturbed soil varies by logging system with helicopter logging typically disturbing less than 1% of the surface of a given harvest unit, skyline logging disturbing up to about 4%, and ground-based logging disturbing about 10% of the surface of a harvest unit (USDA Forest Service, 1997).

included in the Action Alternative and function to lower the extent and intensity of the impacts disclosed above.

Under the no action alternative, no soil disturbance or vegetation removal from logging or activity fuel burning would occur, thus no organisms would be killed, no bare soil would be exposed, and no productivity losses would occur in riparian reserves. Additionally, under the no action alternative, Riparian Reserves proposed for thinning would remain in a homogenous, stem exclusion stage for decades and be at higher risk of large scale disturbance. Furthermore, under the no action alternative the homogenous stands proposed for treatment would continue to move toward the desired conditions and key ecosystem components, such as diverse riparian habitat but at a much slower rate. In summary, these disclosed indirect adverse effects to riparian forest conditions can be expected to occur under the no action alternative. The magnitude of these effects at the site-scale in relation to the planning area and the broader Steamboat watershed are inconsequential. This is because both the extent and the duration of these impacts (as described above) are predicted to be low.

Indirect Effects – Riparian Reserves

The indirect effects to Riparian Reserve forests are those that would occur within the Riparian Reserves of the harvest units over the long-term (continue for more than two decades), or that would occur beyond the immediate treatment areas.

Under the no action alternative, more, smaller diameter trees would be available for snag and down wood recruitment in areas outside no-harvest buffers, when compared to the Action Alternative, but it would take longer for larger diameter trees to become available for snags and down wood. Thinning under the Action Alternative would lower snag and down wood recruitment rates compared to the no action alternative, by removing trees that would die from suppression mortality. The majority of the snag recruitment loss would be from smaller-sized trees because suppression mortality typically kills smaller, suppressed trees rather than the larger dominant trees, please see the wildlife section for more snag information. However, both species and structural diversity would increase through the selection and harvest of dominant species (Douglas fir) while retaining minor species.

In order to preserve riparian function and meet all objectives of the Aquatic Conservation Strategy, no-cut buffers were established. It is important to mention that many activity units were initially designed to stay out of Riparian Reserves, thus negating the need for no-cut buffers along these streams. However, some Riparian Reserves were included in the units because initial assessments identified a net benefit from treatment. The large wood recruitment loss to perennial stream channels would be largely mitigated by the minimum 85-180 foot no-harvest buffers (85 feet buffer for non-fishing bearing perennial streams and 180 feet for fish bearing perennial streams), since most of the wood that naturally recruits to streams comes from within the first 65 feet of the stream (Murphy and Koski, 1989; McDade et al. 1990, Johnston et al. 2011). Although habitats and habitat quality would be diminished by the loss of smaller-sized trees, the extent of the proposed thinning is not expected to result in riparian species population declines. There would be some acceleration of larger wood available to channels, especially intermittent ones, due to release of remaining trees. Although small wood plays an important role in structure and function of small streams, large wood can accumulate more sediment, last longer and is more likely to remain stable during floods, than smaller wood (Bilby and Ward, 1989; Montgomery et al., 2003). Larger diameter wood is also necessary for meeting requirements of many wildlife species (Keisker, 2000)(see Wildlife section). Any net loss or gain of wood recruitment to

channels would likely be immeasurable at the site or landscape scale with the proposed no-harvest buffers.

The Action Alternative would result in long-term beneficial effects to Riparian Reserve forest structure and composition with the development of more desired riparian. As such, under the Action Alternative, NWFP S&G TM-1 (c) would be met because the silvicultural practices applied to control stocking in the selected Riparian Reserves contribute to meeting the desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Over time, the commercial thinning would also result in Riparian Reserves attaining structural characteristics and species compositions more consistent with the desired reference condition. These beneficial effects would gradually improve habitat connectivity for riparian dependent species that rely on late-successional forest conditions. The magnitude of these beneficial effects from the Action Alternative is slight since only a small portion of the Riparian Reserve land allocation in the planning area would be treated and the rate at which these effects would accrue over time is gradual.

Cumulative Effects – Riparian Reserves

It is reasonably foreseeable that there would be 580 acres of fuels treatments associated with the Calapooya Divide fuels project near the treatment units in the Lemon Butte Planning Area. These areas would be subject to Best Management Practices including special management of riparian areas. Therefore, the response is anticipated to be localized and likely immeasurable even at the site-scale. Previous harvest has degraded the character and function of some of the Riparian Reserves within the Steamboat Watershed. However, the silvicultural prescriptions, project design features and BMPs are specifically designed to maintain and/or enhance the character of Riparian Reserves within the Lemon Butte Planning Area and therefore would not adversely contribute to previous losses or cumulative effects.

Aquatic Conservation Strategy

The Record of Decision for Northwest Forest Plan (USDA/USDI, 1994) developed an Aquatic Conservation Strategy (ACS) to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy. A variety of tactics to accomplish these goals and objectives incorporated four primary components: Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

These four components are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. The Lemon Butte Project is consistent with the Aquatic Conservation Strategy and the following discussions show how the activities proposed in the Action Alternative conform to the nine ACS objectives. The watershed (5th field) is the typical scale of analysis for the Aquatic Conservation Strategy.

Objective #1 - Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

- The Proposed Action would not affect the distribution, diversity, and complexity of watershed and landscape-scale features. The proposed activities would have no measurable adverse effects to the system at the watershed level. The proposed activities would work to restore, at

the site-scale, aquatic systems by simulating or encouraging the development of stand structures and species compositions consistent with the reference disturbance regime.

Objective #2 - 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.

- There are no activities in the Proposed Action that would interrupt drainage network connections. All wetlands, flood plains and functional riparian areas would be adequately preserved from thinning through no-cut buffers. Additionally, all management proposed in the Riparian Reserve is specifically designed to restore the structure and species composition in a manner consistent with the reference disturbance regime. There would be no measurable effects from the activities, as proposed, at the watershed or landscape scale.

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

- The proposed activities would maintain the physical integrity of the aquatic system through no-cut buffers. The Proposed Action would work to restore the aquatic system, at the site-scale, by implementing prescriptions that are designed to restore the activity units to the desired reference condition. Additionally, stands would be made more resilient to disturbances and would be better suited to host frequent low-intensity fires, thus minimizing the potential for the aquatic system to be impacted by a high severity fire.

Objectives #4 and #5 - Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

- The Lemon Butte Project is in compliance with the Water Quality Management Plans derived from the Umpqua Basin TMDL (2006). The proposed activities are subject to evaluation under the Northwest Forest Plan, the Aquatic Conservation Strategy and other associated Water Quality Restoration Plans. Effective shade would be maintained within the proposed activity units by adhering to the no-cut buffers. Therefore, there would be no measurable increases in temperature and no other Beneficial Uses would be adversely affected.

Objectives #6 and #7 - 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 Action Alternative would not have a measurable effect to in-stream flows at the watershed scale. Nor would it affect the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands. (See the HRP analysis under the Streamflows section for more detail).

Objective #8 - Maintain and restore the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion,

and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

- The Action Alternative would not have measurable effects to species composition and structural diversity of plant communities in riparian areas and wetlands at the watershed scale. At the site-scale, the Action Alternative is specifically designed to remove off-site species and restore the forest structure and species composition in portions of Riparian Reserves. Under the No Action Alternative, species compositions and structural diversity of plant communities in riparian areas would continue as a departure from desired reference conditions.

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

- The project would maintain habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species at the watershed scale. At the site-scale, the Action Alternative is specifically designed to remove off-site species and restore the forest structure and species composition in portions of Riparian Reserves.

Wetlands and Floodplains

This is an evaluation of wetlands and floodplains for the Lemon Butte Project. This evaluation meets the intent outlined in Executive Orders 11988 and 11990 in the Forest Service Manual 2527.

Wetlands are generally areas inundated by surface or groundwater frequently enough to support vegetation that requires saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, springs, seeps, bogs, wet meadows, mudflats, natural ponds, and other similar areas. Legally, federal agencies define wetlands as possessing three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. The three technical characteristics specified are mandatory and must all be met for an area to be identified as a wetland. Hydrophytic vegetation is defined as plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic (without oxygen) conditions in the upper part of the soil profile. Generally, to be considered a hydric soil, there must be saturation at temperatures above freezing for at least seven days. Wetland hydrology is defined as permanent or periodic inundation, or soil saturation to the surface, at least seasonally (Cowardin, 1979).

Findings

All wetlands and flood plains within the Lemon Butte Project planning area are excluded from active management. If any previously unknown wetlands or floodplains are found during project activities, these wetlands would be buffered to mitigate any potential effects associated with the proposed activities. There would be no direct, indirect, or cumulative effects to wetlands or flood plains as a result of the Action Alternative.

Methodology

Wetlands were initially identified through a review of the National Wetlands Inventory data that were derived from selectively field validated remotely sensed data. The presence of the wetlands identified in this project was validated during the field reconnaissance in preparation for analyses

and disclosure. Due to the relatively steep and dissected gorge of the North Umpqua River and the rapidly draining soils associated with the area, standard floodplain of 30 feet (total) was applied to all perennial streams. This estimate is based on field observations.

Information Search

A review of previous analyses revealed that no floodplain mapping had been conducted for project area. The basis for the flood plain evaluation was derived from detailed field investigations. Wetlands were previously mapped and recorded as unique habitats. The location, extent and character of these wetlands were validated and refined through detailed field investigations associated with this project proposal.

Floodplain Evaluation

On-site values are generally related to wildlife and fish habitat, recreation, and the natural functioning of these watersheds to provide water for domestic livestock, wildlife, and irrigation downstream. Natural erosion rates are low and all streams are generally stable and functioning.

There are no known wetlands, surface ponds or lakes on lands proposed for thinning. Based on my professional judgment supported by detailed field investigations of the project area, the proposed activities are consistent with Executive Orders 11988 and 11990 and implementing regulations and Forest Service Manual direction.

Fisheries

Existing Condition

The Lemon Butte planning area is encompassed by six watershed analysis areas, including Canton Creek (USDA, 1994; USDA & USDI, 1995), Cedar Creek (USDA, 1995), City Creek (USDA, 1996), Lower/Middle Steamboat Creek (USDA, 1999), Lower Steamboat Creek (USDA, 1999), Upper Steamboat Creek (USDA, 1997) Watershed Analyses, and Upper and Lower Steamboat Creek Watershed Analyses Iteration (USDA, 2007). These watershed analysis documents provide detailed descriptions of fish habitat in the planning and surrounding areas and are incorporated by reference into this document. The following paragraphs summarize key information regarding habitat conditions relevant to the Lemon Butte Vegetation Management Project (Figure 22).

Upper and Lower Steamboat Creek

Habitat Conditions

Stream surveys of Steamboat Creek and its major tributaries indicate that these stream channels are predominantly bedrock dominated. Steamboat Creek, in the Action Area, exhibits an overall lack of large wood but has a relatively high proportion of pool habitat by area and generally has normal pool frequencies (Table 25) at the watershed scale. The Steamboat Creek watershed is approximately 145,000 acres, with 98% of its land base managed by the Forest.

The Steamboat watershed and many of its tributaries exhibit large changes from historic conditions with respect to levels of Large Woody Debris (LWD), flow regime, riparian vegetation, fine sediment levels, streambank stability, low flow channel widths, water temperatures, velocity refuge, habitat connectivity and substrate particle size distribution (USDA 1995, Roper 1995, Dose and Roper 1994). These habitat parameters have been degraded as a

result of land management activities. Some of these same parameters are likely to have had negative effects on the survival and distribution of anadromous and resident salmonids and other native fishes in the watersheds.

Over the last several decades, watershed restoration activities have begun to address these degraded conditions. Road improvements and decommissioning, fish passage upgrades, instream habitat restoration, upland restoration, and Forest fuels reduction projects have all moved the condition of the watershed towards a properly functioning condition.

Table 25. Descriptions and physical characteristics of main stem Steamboat Creek reaches.

Main Stem Steamboat Creek Habitat Characteristics								
Reach	Reach Description	Reach Length	Reach Gradient	% Pool	Dominant Substrate	# Pieces Wood/ Mi	# Pools per Mi	Expected # Pools/Mi
1	From mouth up to Steamboat Falls	6.4 mi	1%	54%	Boulders	0.8	10	12 - 17
2	From Stmbt Falls to mouth of Big Bend Ck.	4.7 mi	0.76%	39%	Bedrock	0.6	11.5	10 - 13
3	From Big Bend Creek to Horse Heaven Ck.	8.3	1%	55%	Bedrock	3.3	14	11-15

The ranges of “Expected # Pools/Mile” displayed in Table 25 were derived per reach on the basis of normal pool frequency being every 5-7 channel widths for mid to high order channels such as Steamboat Creek (Leopold et al. 1964 as cited by Rosgen 1996).

Overall, Steamboat Creek falls into the natural range of variability for pool frequency, though Reach 1 of Steamboat Creek falls slightly below the expected pool frequency (Table 25). Reach 1 may fall below the expected range because this reach contains Black Gorge, an approximately 3 mile stretch of the creek where channel morphology differs from the majority of main stem Steamboat Creek, in which pools occur every 5-7 channel widths. Adult summer steelhead have been using many of the same pools for over-summering for thousands of years as evidenced by past archeological investigations within the watershed. These investigations seem to suggest that these pools have been stable through time and resistant to pool filling.

The lack of large wood is a key limiting factor of aquatic habitat in the lower and middle reaches of Steamboat Creek. Since Steamboat Creek is a confined higher order stream channel, we would expect large wood loading within the active channel to be less than that in lower order tributaries. However, even in large streams, large wood is an important component to add channel complexity along channel margins, in side channels, at heads of point bars, and at heads and margins of islands. This wood plays a critical role in providing over-wintering habitat for salmonids as well as spring and summer habitat for salmonid fry. Large wood is crucial to

retaining fine organic matter and thereby trapping nutrients and providing substrate for aquatic macroinvertebrate communities.

Knowing exactly how much large wood "should" be present in higher order main stem channels is nearly impossible to determine because pristine stream and river systems of this size on which to base a comparison are rare to nonexistent along the Pacific coast (Bisson et al. 1987). Primary processes of large wood input to a 6th order or higher stream include transport from upstream, erosional bank cutting, blow down, streamside debris avalanches, earthflows, or debris torrents from tributaries (Bisson et al. 1987). In main stem Steamboat Creek, several of these processes have been reduced or arrested by management activities including timber harvest, riparian roads, and riparian trail systems.

Excessive fine sediment can have negative impacts to salmonid spawning success. Fine sediment can fill interstitial spaces of spawning gravels and suffocate incubating eggs or pre-emergent fry. In 2001, a composition analysis of spawning gravels was conducted on the main stem of Steamboat Creek and several representative tributaries. Spawning areas targeted were those used by steelhead trout. The analysis indicated that fine sediment was not a limiting factor within the Steamboat Creek Watershed (Pentec Environmental, 2001).

Side Channel Habitats

Side channels are very important aquatic habitats. They tend to be areas of sediment and large wood deposition, fine organic matter and nutrient retention, aquatic insect production, and over wintering for fish and other vertebrates (Bustard and Narver 1975, Swales et al. 1986, Gregory et al. 1991).

Side channels are relatively uncommon habitat features in the Steamboat Watershed but offer high quality complex aquatic habitat for a multitude of aquatic species where they occur. They provide unique off-channel habitats characterized by lower water velocities relative to the main channel. During low flows, some side channels become dry or have isolated pools, which provide good habitat for various aquatic organisms.

During summer 1998, the main stem of Steamboat Creek was inventoried to identify large side channel habitats. Side channels greater than 600 feet in length were categorized as "large" due to their inherent depositional features and potential to provide amounts of over-wintering habitat for aquatic vertebrate species including fish and salamanders. Over the entire 18 mile main stem, ten large side channel sites were identified based on a combination of field and air photo inventory. A cumulative total of approximately 1.7 miles (10% of total stream length) of the main stem has large side channel habitats associated with it.

Virtually all these side channels were formed by localized wide stretches of Steamboat Creek controlled at the downstream ends by bedrock nick points. These are places where bedrock outcrops or side slopes on both sides of the creek converge to disperse water into the wider upstream areas. This dispersal of water, combined with relatively lower water velocities associated with high water going through the wider channel sections, allows deposition of sediments to form bars and islands.

Smaller side channels ranging from approximately 150-300 feet in length were observed but not documented on the inventory. While these shorter areas have some potential to provide high flow velocity refugia and sediment/nutrient retention, the channel width tends to be more constrained in these shorter sites, so their potential was judged to be minor compared to larger side channels.

Channel Morphology Trends

Much of the channel morphology of the main stem Steamboat Creek consists of bedrock, forced pool-riffle, and plane-bed morphologies. Pool-riffle channels have an undulating streambed that occurs as a sequence of gravel/cobble bars, pools, and riffles. This morphology manifests itself as a rhythmic series of laterally alternating pools and riffles. Forced pool-riffle channels are those whose features are forced by the presence of large wood or large boulder/bedrock formations in the channel margin, which facilitates development of a gravel bar and forces the channel to move laterally off the bar.

Plane-bed channels are characterized by long stretches of relatively planar channel bed that may have occasional channel spanning rapids or boulder steps (Montgomery and Buffington, 1993). Plane-bed channel reaches generally lack pools and obstructions in the channel thus making them generally less complex aquatic habitat. Plane-bed channel reaches occur naturally in stream channels in some unknown proportion but are more common in Steamboat Creek. However, Montgomery and Buffington (1993) describe that pool-riffle reaches forced by the presence of large wood could metamorphose into plane-bed reaches upon removal of large wood or other stream channel complex. Past clearcut riparian timber harvest, riparian road building, and stream cleanout along Steamboat Creek and its tributaries have resulted in low wood counts and simplified aquatic habitat.

Tributary Streams

Tributary streams in the action area are important to the overall health of the aquatic ecosystem for numerous reasons. As indicated in the table below, tributaries in the 6th field sub-watersheds provide valuable resident and anadromous fish spawning and rearing habitat. Fish bearing streams only make up a small amount of the perennial stream miles in the action area. Both fish bearing and non-fish bearing streams provide a ready supply of prey items and a constant supply of cool water into mid-summer. These become important sources of cool water as warmer weather and solar input heat the water in the open channel types of the lower and middle reaches of Steamboat Creek.

Table 26. Miles of fish-bearing stream by sub-watershed in the Action Area.

Subwatershed	Steelhead	Cutthroat / Rainbow	Chinook	Coho
Lower Steamboat	*30	*42	*12	*1
Upper Steamboat	*20	*20	*0	0
Steelhead Ck.	1.5	5.5	0	0
Cedar Ck.	6	11	0	0
Little Rock Ck.	6.8	9.2	0	0
City Ck.	3.5	5.2	0	0
Horse Heave Ck.	3.3	3.0	0	0
**Canton Creek	N/A	N/A	N/A	N/A

* Mainstem Steamboat Creek.
** Portions of 2 ridgetop units (<20ac) are proposed for harvest in the Canton Creek Watershed. Based upon the ridgetop location and disconnect from streams, no impacts to fisheries resources are expected from this activity, concluding analysis for this Watershed.

Large wood is an important feature of a healthy aquatic ecosystem and can be a strong indicator of aquatic habitat complexity and resilience.

The mean density of large wood in reference 3rd order streams on the Umpqua National Forest is 55 pieces/mile compared to 24 - 34 pieces/mile in analysis area fish bearing streams that have been surveyed. This identifies the general lack of large wood in fish-bearing streams of the analysis area.

The lack of large wood in the action area streams indicates that many of the functions associated with large wood are compromised to some degree in 3rd order and larger streams. Because winter flows are so high in this watershed, three of the most severely compromised functions are availability of over-wintering habitat for aquatic fauna, lack of fine organic matter and nutrient retention to fuel aquatic insect communities, and lack of sediment retention to retain gravels for aquatic insect and salmonid spawning habitat.

Smaller 1st and 2nd order streams vary widely in the amount of wood that is present in their channels. This is primarily due to past land management activities, mainly past clear cut timber harvest. Most of these streams have experienced some degree of recovery over the last six decades since the stands were clear-cut.

Stillwater Sciences Inc. (1998) suggested that the combination of large wood removal from streams and the 1964 flood eliminated sediment storage capacity in 3rd and 4th order channels and caused scour of these channels to bedrock, a condition which persists today in many streams.

Instream restoration activities, riparian large wood management, and providing for no cut stream side buffers during timber harvest activities has allowed for large wood levels to begin to recover.

Aquatic Species Present

There are four fish species and two aquatic mollusk species that have special status on the Umpqua National Forest:

Oregon Coast (OC) Coho salmon (Federally listed as threatened under ESA) - Oregon Coast Coho salmon (*Oncorhynchus kisutch*) use the lower one mile of main stem Steamboat Creek for spawning, rearing, and migration. Coho salmon distribution is absent from the fish-bearing tributaries that enter Steamboat Creek.

Oregon Coast (OC) steelhead trout (FS Sensitive) – Oregon Coast steelhead trout (*O. mykiss*) use Steamboat Creek and most major tributaries in the watershed for spawning, rearing, and migration. Steelhead distribution extends far beyond the planning/project area boundary. Steelhead trout are known to occupy Steelhead, Johnson, Cedar, Longs, Little Rock, City, and Horse Heaven Creeks within the planning area. The other smaller tributaries in the planning area do not offer suitable habitat for steelhead.

Pacific Coast (PC) chum salmon (FS Sensitive) – Pacific Coast chum salmon (*O. keta*) are not known to occur in the North Umpqua Sub-basin. Chum salmon are located approximately 180 miles downstream of the planning area in the Pacific Ocean.

Umpqua Chub (FS Sensitive) - The Oregon chub (*Oregonichthys crameri*) is endemic to the Umpqua River Basin (the mainstem Umpqua River, South Umpqua River, and to a lesser extent North Umpqua River). Habitat selection by the chub is moderate to slow flowing water (runs and channel margins). Past surveys have not identified Umpqua Chub in the vicinity of the planning area.

Rotund Lanx (FS Sensitive) - The rotund lanx (*Lanx subrotuna*) is known to occur on the Umpqua National Forest. The rotund lanx is a small freshwater limpet and the current distribution appears to be scattered and localized in small areas of the North Umpqua River, portions of the South Umpqua and its major tributaries above Roseburg including Cow Creek. The rotund lanx is found in unpolluted rivers and large streams at low to moderate elevations. They prefer highly oxygenated, swift-flowing streams with stable cobble, boulder or bedrock substrates. They are not typically found where aquatic macrophytes and epiphytic algae occur. Surveys have not been conducted in the planning area but suitable habitat can be found in the planning area.

Western Ridged Mussel (FS Sensitive) – The Western ridged mussel (*Gonidea angulata*) is suspected to occur on the Umpqua National Forest, and although suitable habitat exists, no documented sites are known to occur within the North Umpqua and Steamboat watersheds. Western ridged mussels occur in streams of all sizes and are rarely found in lakes or reservoirs. They are found mainly in low to mid-elevation watersheds, and do not often inhabit high elevation headwater streams where western pearlshells can be found. They often share habitat with the western pearlshell throughout much of the Pacific Northwest. They are more tolerant of fine sediments than western pearlshells and occupy depositional habitats and banks. They can withstand moderate amounts of sedimentation, but are usually absent from habitats with unstable or very soft substrates. Lack of information on life history, reproduction, and ecology of western ridged mussels hinders effective conservation and management.

In addition to the species of special status listed above, Oregon Coast spring Chinook salmon also occupy Steamboat Creek adjacent to the Lemon Butte Vegetation Management project area.

Oregon Coast (OC) spring Chinook salmon - Spring Chinook adults return in late spring and spend the summer in the deep pools of the entire mainstem of the North Umpqua River and to a lesser degree, deep pools of Steamboat Creek. They spawn in the low to moderate gradient reaches utilizing larger spawning substrate than the other salmonids. Chinook use in Steamboat Creek extends from the mouth upstream about 10 miles to its confluence with Big Bend Creek. Chinook use in Steamboat Creek is extremely limited, with very few fish migrating into the basin. Juvenile spring Chinook use the tributaries of the mainstem North Umpqua and to a lesser degree, the confluence area of Steamboat Creek, as a thermal refuge during the low flow, warm water period.

Pacific Green Sturgeon- Pacific Green Sturgeon *(Acipenser medirostris)* are not known to occur in the North Umpqua Sub-basin. Green sturgeon are located approximately 180 miles downstream of the planning area in the Pacific Ocean.

Eulachon- Eulachon *(Thaleichthys pacificus)* also known as smelt are not known to occur in the North Umpqua Sub-basin. Eulachon are located approximately 180 miles downstream of the planning area in the Pacific Ocean and the Umpqua River estuary.

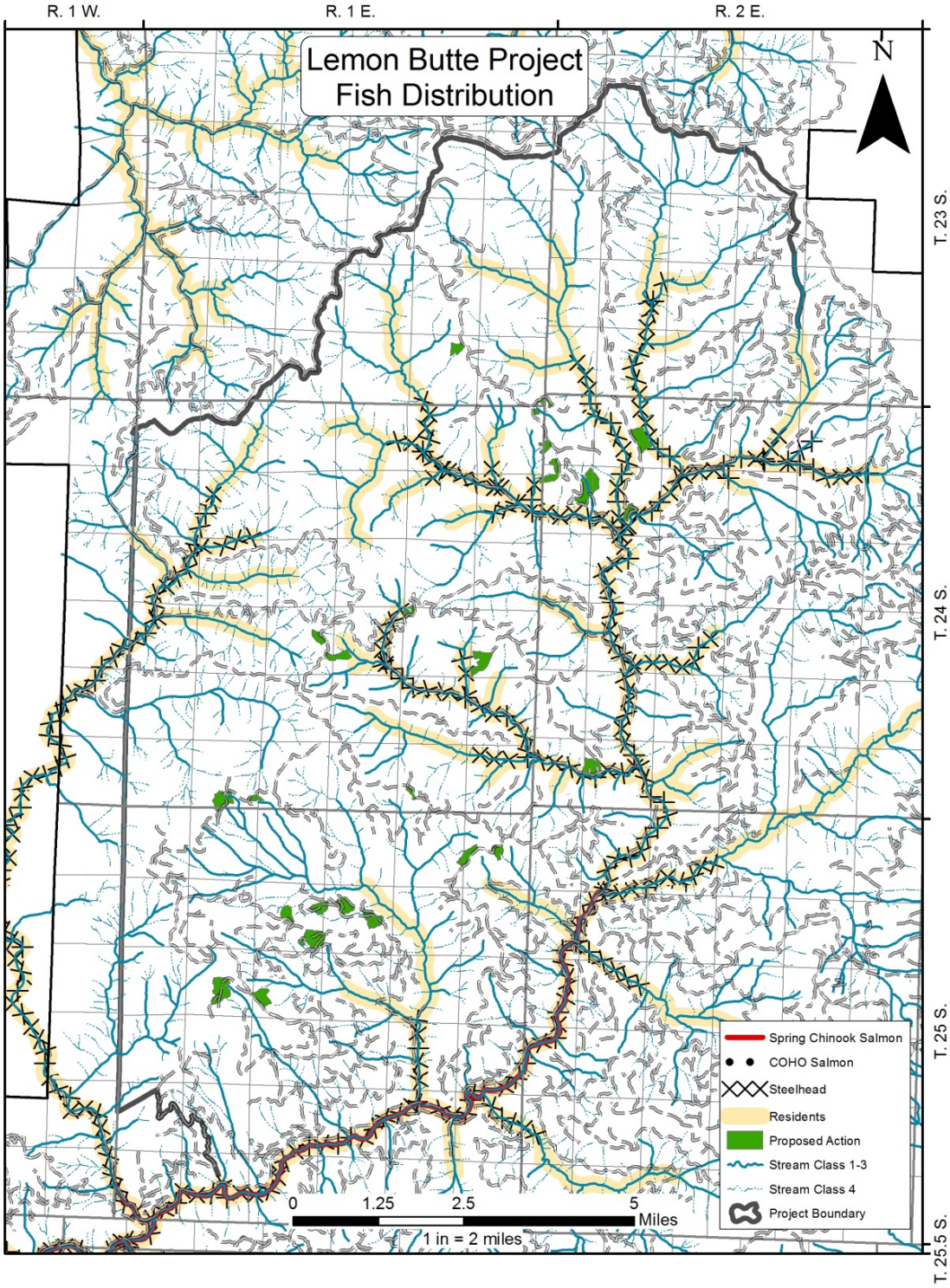


Figure 22. Lemon Butte Project Fish Distribution

Direct and Indirect Effects

Harvest and Haul

Log harvest and haul activities for the Proposed Action, Alternative 2, are described in Chapter 2 of this Environmental Assessment. Harvest and Haul activities as described in Alternative 2 would not authorize any activities that would modify in-stream habitat or otherwise directly affect fish, sensitive aquatic invertebrates, or their habitat; thus, there are no measurable direct effects associated with this project element. This conclusion is based on the following rationale: no-harvest buffers would be placed on all stream channels (measured from the edge of the stream channels), thereby eliminating any direct logging effects to fish and sensitive aquatic invertebrates.

Indirect effects associated with harvest activity having the potential to impact the aquatic environment include stream sedimentation, stream temperature, and large wood recruitment.

There are a limited number of acres of Riparian Reserve proposed for vegetation management under Alternative 2 (Table 27). All riparian harvest would occur on the outside edge of the riparian areas with all streams being protected by no cut buffers. Large wood recruitment and stream temperatures would be protected from measurable negative impacts through project design criteria that include no cut stream buffers. Intermittent stream channels would be protected through maintaining 25 foot minimum buffers while non-fish bearing perennial streams would be protected with 85 foot riparian buffers. Fish bearing streams would be protected with a minimum 180 foot buffer. These no cut buffers would act as living filters to capture any overland sediment transport that may come from harvest units. Stream temperatures would be maintained by not allowing harvest from within the primary shade zone on perennial stream channels. Intermittent channels do not typically contribute to elevated stream temperatures.

There is expected to be some site specific reduction of future large woody material recruitment to some stream channels within harvest units. This would be of limited magnitude and scale. There would be minimum no cut buffers of 25 feet on intermittent channels, 85 feet on perennial non-fish bearing channels, and 180 feet on fish bearing channels. The typical tree height of trees to be harvested is approximately 70 to 90 feet and under 20 inches DBH. The greatest impact is expected to occur on intermittent stream channels where a combined 166 acres of riparian harvest would occur. Table 27 depicts the number of acres proposed for harvest adjacent to the different stream channels. This project would not remove any existing channel wood. There are no expected adverse impacts to large wood densities in any fish bearing or perennial stream.

Table 27. Riparian Harvest by Alternative

Alternative	Acres Riparian in Planning Area	Acres of Proposed Riparian Harvest by Stream Class				Percent of Riparian Proposed for Harvest
		Anadromous fish bearing Class 1	Perennial fish bearing Class 2	Perennial non-fish bearing Class 3	Intermittent Class 4	
Alternative 1	~17,100	0	0	0	0	0
Alternative 2	~17,100	0	13	5	20	~0.002%

Log haul from project area units would occur during the normal operating season, described as June 1 to October 31 as well as a wet season haul period of use. Wet season log haul may occur

on approximately 3.6 miles of FSR 3828, 10.6 miles on FSR 3815, 0.9 mile on FSR 3811, 0.8 miles on FSR 3821, and 6.9 miles on FSR 3806. These are maintenance level 2 gravel roads. Units included for wet season haul activities include skyline units 3, 4, 6, 7, 50, 69, 11, 24, 26, and 39. The wet season haul route would cross one fish bearing perennial stream, two non-fish bearing perennial streams and eight identified intermittent stream channels. All of these channels would likely be flowing water during wet season haul. All of these road systems are largely ridgetop roads that quickly climb out of the Steamboat Creek valley bottom and generally do not parallel stream channels. Because these roads climb quickly out of the valley bottom on a ridge lines, most of the stream crossings are near the headwater areas of the streams. Only one of the streams in the planned wet season haul area is fish bearing. The remainder of the identified wet season haul route is on the paved portion of FSR 3800.

Road maintenance prior to log haul would improve road drainage and assure stream extensions due to ditch lines are minimized by cleaning culverts and adding cross drains where necessary. In addition, blading, spot rocking, and reshaping roads, where necessary, would decrease water channeling and ponding on the road surface. Identified / required pre haul maintenance on identified wet season haul routes would be completed prior to October 31 of the year haul is expected to occur. If identified maintenance is not completed by October 31, no wet season haul would be allowed until the following operating season.

Haul during suitable dry conditions has little potential to create or deliver road-derived sediment to live stream channels. A portion of the paved haul route parallels OC Coho salmon designated critical habitat as well as OC steelhead trout and OC Chinook habitat. There are three stream crossings (concrete bridges) on the haul route that cross anadromous streams and approximately 6.5 miles of gravel roadway that parallel anadromous streams along the haul route.

Wet season haul has a greater potential to increase sediment delivery to area waterways than haul during the normal operating season. Roads can become saturated and log haul traffic can cause fines to move up through the road bed to the surface of the road where they can be easily transported to waterways. Effects of road generated sediment and its delivery are expected to be negligible due to the specified wet season haul route, road maintenance and improvements that would occur prior to haul, BMPs that would be in place, and the monitoring of road conditions during wet season haul to assure that resource damage is not occurring. Logging activities including log haul can be suspended at any time of year when precipitation events are imminent or excessive road deformity would occur during haul due to road moisture conditions. Log haul would be suspended if road surface run off carrying sediment is observed flowing in roadside ditches. All Umpqua Forest Road Rules would be enforced.

As part of the maintenance plan, dust abatement may occur on the graveled haul routes. Magnesium chloride or water would be applied for dust abatement. In the event magnesium chloride is used, application rates would conform to industry standards of up to 19 tons per mile. Application would be required to maintain a one foot buffer along each road edge and no application within 50 feet of any stream crossing. Based upon these application rates and buffers, the application of magnesium chloride as dust abatement is not expected to have a measurable adverse impact on water quality or aquatic species in or downstream of the planning area.

No direct effects from timber harvest are expected to occur for any listed sensitive fish or sensitive aquatic invertebrate species. Maintaining a no-harvest buffer along all streams and retaining much of the treated stands would adequately protect future large wood recruitment, filter and disperse overland flow before it reaches the streams, and protect stream shade-providing vegetation that in turn helps to maintain healthy stream temperatures. There is a low to moderate

potential for increased sediment transport to area streams along the wet season haul route. The magnitude of the effect of increased sediment is expected to be low due to pre-haul road maintenance, BMP's, and sale administration that would be in place during haul activities.

Fuels

Alternative 2 proposes under burning in units 31, 54, and 69 totaling 37.9 acres. There are no perennial streams in the under burn units. There are less than 0.2 combined miles of intermittent stream channel in these three units. Ignition would not occur within the no cut buffers. Fire associated with the under burning operations would be allowed to naturally creep into riparian areas. Fuel moisture would be monitored prior to burning to allow for activity generated fuels to consume while minimizing damage to untreated areas. Riparian buffers are expected to remain largely intact and maintain their ability to filter fire generated sediments. This, along with the no-harvest stream buffers and hand and grapple piling BMPs, would minimize the potential for any meaningful direct effects to aquatic habitat.

Activity fuels treatment in harvest units would occur across approximately 310 acres and would be treated by grapple piling in ground-based yarding system units. Skyline systems would yard trees with tops attached and fuels would be treated at the landing or by hand piling and burning and under burning. The no-harvest buffers are expected to be sufficient to prevent any meaningful amount of sediment from disturbed ground from reaching stream channels. Burning of slash piles would be limited to the interior of the units, and at landings with low erosion potential based upon topography and a deep surrounding forest duff layer to support localized infiltration of precipitation. There would be no hand piles or grapple piles within the no-harvest buffers. Sediment resulting from slash burning and under burning is expected to filter into the forest floor or be captured in the no harvest buffers before reaching stream channels.

Road Maintenance and Temporary Roads

Alternative 2 proposes approximately up to 91 miles of road maintenance. This would include brushing, ditch line and culvert cleaning, road surface blading and shaping, and adding crushed rock where needed. Up to 25 ditch relief culverts would be replaced or installed to facilitate road network drainage. These culverts are typically associated with the road ditch line and not connected to stream channels. Project design features and Best Management Practices would be implemented during road maintenance activities (See Chapter 2). Any closed system roads opened for the project would be closed after use. Any instream work associated with road improvements such as culvert replacements would occur during low flow conditions.

Proposed road improvements would reduce road-derived sediment generated during increased road use over the life of the project. Road-derived sediment would be directed onto the forest floor through cross drains where it would be filtered before reaching stream channels. There would be about 0.5 miles of new temporary spur road constructed and 2.75 miles of existing temporary spur road reconstruction under Alternative 2. The temporary nature of these road placements, minimizing the footprint of new temporary road construction, no-harvest riparian buffer application, and the removed proximity to fish bearing streams would be sufficient to prevent adverse amounts of sediment delivery from temporary road construction or use from being delivered to downstream occupied fish habitat. All temporary roads would be decommissioned and obliterated after use. All pre-haul road work, all temporary road reconstruction/construction, temporary road closures, and temporary road obliteration would occur prior to October 31 of any given year during the life of the timber sale. Any closed system roads opened for the project would be closed after use.

Culvert upgrades to facilitate log haul would require in-channel work. All reconstruction sites are located on non-fish bearing stream channels and would include 15 culvert replacements on non-fish bearing streams. These replacements would help restore aquatic connectivity and reduce the probability of road failures and debris torrents. Instream work would occur during low summer flow conditions, July 1 to October 31st. Due to timing of construction, project design features and BMPs, the reconstruction is expected to transport a negligible amount of sediment to downstream aquatic habitats. Any increase of sediment to the system would be short lived, localized, and would likely be undetectable against background levels in occupied downstream habitat. Due to the proximity of downstream Coho habitat in relation to the proposed action any project derived sediment is not expected to be measurable in Coho critical habitat. Coho critical habitat is approximately 7 miles downstream of the nearest Lemon Butte thinning unit.

This project would likely generate negligible amounts of fine sediment from road activities that would enter stream channels at stream crossings. The impacts are expected to be inconsequential to salmonid habitat. This is due to the focused and limited wet season haul as indicated above; sediment input would be minimized through project design features and BMPs (e.g. turbidity reduction measures and suspension of haul operations if suspended sediment is flowing off of the road).

Road maintenance activities would minimize disturbance to grasses and forbs that are growing in the ditch line that act as sediment traps. Where haul routes parallel stream channels, a sufficient filter strip between the ditch and the stream exists to slow and capture any sediment laden runoff in the event of a rain storm during haul. During wet season haul, erosion control materials would be used to filter sediment moving off of the haul roads. These filters would be maintained as needed to remove trapped sediment. Removed sediment would be disposed of in areas not connected to stream channels. The contract administrator also has the authority to suspend operations if weather conditions arise that could cause a transport of sediment from the road surface to the stream.

Considering the information above regarding vegetated ditch lines, the presence of an adequate filter strip between the road and the stream, adherence to established BMP's, PDC, and instream work timelines, road improvements prior to haul, and the use of erosion control, the likelihood and potential quantity of material reaching the stream is discountable and inconsequential.

Connected Actions

Connected actions analyzed as part of the Lemon Butte Vegetation Management project include;

- Under planting in and around gaps.
- Sub-soiling and seeding – landings, temp roads, skid trails.
- Invasive weed control.
- Snag/down wood creation.
- Instream restoration.

Of the Connected Actions, only sub-soiling and instream restoration activities have the potential to affect the aquatic environment in a meaningful way.

Sub-soiling is not expected to have a measurable impact at the watershed scale but is likely to have an incremental positive impact at the site scale because the project would use existing unrestored foot prints of past logging activities to facilitate this project. These reused features

would then be sub-soiled and hydrologically restored reducing the overall compaction of the stand acreage. Erosion and sediment movement off these sites is not expected to migrate into area waterways. This is due to increased water infiltration into the soil lower the potential for surface runoff, and adjacent vegetated buffers where any sediment that does escape can be trapped and the relatively flat terrain that landings, temporary roads, and skid trails are located on is typically not conducive to sediment migration.

Instream restoration activities can have a more profound and long lasting effect on the aquatic environment. Areas identified for aquatic restoration are currently those areas largely devoid of complex instream habitats that attract aquatic biota. The extent of restoration activities would include the placement of large wood, the placement of large boulder complexes, and tree lining activities in Steamboat Creek within the project area boundary (
Figure 2). Implementation of instream restoration would be limited to within one potential tree height of the stream banks. Methods of placement may include the use of helicopters and ground based equipment. Ground based equipment would be predominantly restricted to existing road prisms using cables to place the instream habitat structures.

A stream reach of approximately 5 miles in length has been identified for instream restoration activities. Activities associated with instream restoration could occur up to 100 feet from the stream channel limited to within one tree height of the stream channel. This translates into approximately 60 acres of riparian landscape were treatments may occur. Individual restoration sites within the 60 acres would typically occupy up to 0.1 acre per site. In the 5 mile reach up to 50 sites may be selected resulting in approximately 5 acres were actual activities may occur. All instream restoration activities would consult with and follow all resource area and instream work period restrictions and guidelines prior to implementation in order to avoid potential adverse effects to those resources.

The result of instream restoration is expected to be a net gain of quality aquatic and riparian habitats in the restoration reaches. As described earlier in this document much of the main-stem of Steamboat can be characterized as depauperate of complex aquatic habitats and largely dominated by bedrock streambed features. By adding habitat complexity through instream restoration we expect to increase spawning gravel availability and retention, provide for high water refuge and hiding cover for juvenile fish, increase prey base availability, and increase the potential for high stream flows to access historic floodplains previously cutoff by channel down cutting and scouring.

Oregon Coast Coho habitat is approximately 12 miles downstream of the proposed instream restoration reaches. Due to the proximity of the instream restoration to the downstream Coho habitat only slight beneficial effects are expected to occur in the downstream Coho habitat.

Aquatic Conservation Strategy (ACS) - Fisheries

No meaningful or measurable negative impacts to habitat elements or the associated beneficial uses of water are expected from any of the proposed activities as described in Alternative 2, including those actions proposed to take place within the Riparian Reserve land use allocations. Both Alternatives were designed to accomplish broad landscape objectives that are designed to restore diversity and variability within previously managed stands, and to contribute to restoring the watershed over the long term.

Alternative 2 is designed to promote the attainment of the ACS, whereas Alternative 1 would not proactively implement this Strategy. See the Hydrology Report for a detailed assessment of these Alternatives relating to the ACS.

Cumulative Effects

The action Alternative does not have the potential to result in any meaningful cumulative effects to water quality, stream flows, or the sediment regime that would affect any TES fish or aquatic invertebrates. This is simply due to the lack of any substantial risk of direct or indirect effects associated with this project. The Action Alternative would have no meaningful or measurable elements (either adverse or beneficial) that would incrementally add to any other past, present, or reasonably foreseeable actions in the affected 5th, 6th, or 7th field watersheds.

Instream restoration is expected to provide for some beneficial effects to affected 5th, 6th, and 7th field watersheds within the project area boundary. Past instream restoration activities within the Steamboat basin have provided for an improvement in aquatic habitat conditions. The Instream Restoration Connected Action as part of this project continues to improve the overall quality of the Basin's aquatic habitat.

Regulatory Framework

Land and Resource Management Plan / Endangered Species Act

The 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) and its amendments to date, including the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (NWFP), have been incorporated into this analysis. This analysis also incorporated guidance elements from the Endangered Species Act as they relate to listed Oregon Coast Coho salmon.

I have determined that the project analysis for the fisheries resource in and downstream of the project area complies with the Land and Resource Management Plan, Endangered Species Act, Essential Fish Habitat, and Aquatic Conservation Strategy.

Fisheries Determination of Effects

Essential Fish Habitat – No Adverse Effect

As discussed above and throughout the Lemon Butte Project Environmental Assessment aquatic section, it is unlikely that downstream effects would occur that would adversely affect any Essential Fish Habitat as defined under the Magnuson-Steven Fishery Conservation and Management Act (MSA) for salmon commercial fisheries.

ESA Listed/FS Sensitive Fish and Aquatic Invertebrate Species

Oregon Coast Coho Salmon: *No Effect (NE).*

Green Sturgeon: *No Effect (NE).*

Pacific Smelt: *No Effect (NE)*

Oregon Coast Steelhead, Pacific Coast Chum Salmon, Western Ridged Mussel, Rotund Lanx and Umpqua Chub*: No Impact (NI).*

Table 28. Determination of Effects to Threatened and Sensitive Aquatic Species

Species	Alts. 1 and 2
OC Coho salmon (Threatened) and designated Coho critical habitat	NE
Green Sturgeon (Threatened)	NE
Eulachon (Threatened)	NE
Oregon Coast steelhead (sensitive)	NI
Umpqua Oregon chub (sensitive)	NI
Pacific Coast chum salmon (sensitive)	NI
Rotund Lanx	NI
Western Ridged Mussel	NI

Erosion and Sedimentation

Erosion and sedimentation are geomorphic processes that shape the physical appearance of the landscape and strongly influence aquatic ecosystems. The range of natural variability for sediment delivery to streams and wetlands within the planning area is considered to be very large because erosion processes are influenced by infrequent natural disturbance events such as floods and wildfire. Sedimentation rates to streams are typically inconsequential on a year to year basis but can spike several orders of magnitude during large storm events. Land management and road uses have the potential to accelerate erosion rates and the volume of sediment entering streams and wetlands.

Within the planning area sediment enters the aquatic environment through mass wasting, surface erosion and fluvial erosion.

Surface erosion occurs when mineral soil is exposed to the erosive forces of water, wind and gravity. This occurs in forest environments when the protective surface layer of duff and other materials such as wood and rock is removed or displaced and exposes mineral soil to erosive forces. Activities such as yarding trees across the ground during harvest, burning activity-created fuels, road building, reconstruction, or decommissioning, and timber haul on existing dirt or gravel roads, can all result in erosion and sedimentation of the aquatic environment.

Management Direction

The most relevant standard and guidelines from the Umpqua Land Resource Management Plan (LRMP) related to soil productivity (USDA, Umpqua NF, 1990) include:

Soil standard and guidelines #2 and #3 (LRMP IV-69) requires a minimum amount of effective ground cover in order to meet acceptable levels of surface soil loss resulting from gravity, water, or wind action and to maintain soil productivity. Acceptable levels of ground cover must exist within the first year following the end of a ground disturbing activity. The action alternatives would maintain 85% effective ground cover in riparian reserves, along drainage ways, in areas mapped as conditionally unsuitable, and on steep slopes greater than 65%. In all other disturbance areas a minimum of 65% effective ground cover would be maintained. This

minimum effective ground cover requirement is included as a project design feature for the action alternatives as listed in Chapter Two. If adequate ground cover is not present such options as wood chips, wood straw certified weed free mulch, or hydro-mulch would be applied as needed.

Soil standard and guideline #11 (LRMP IV-71) requires monitoring during and immediately following the implementation of ground-disturbing activities (i.e. mechanized harvest and yarding, prescribed burning) to determine if soil management objectives were met.

Soil standard and guideline #13 (LRMP pp. IV-71) requires all areas of soil disturbance to have erosion control measures (effective ground cover and erosion control structures) in place by the beginning of the rainy season. During the rainy season (November 1 - April 30), no more than ½ acre of exposed soil, including landings, skid trails, and temporary roads would exist at any time without erosion control that is effective in preventing sediment movement.

Soils standard and guideline #16 ((LRMP IV-72) requires the identification of erosion control in existing developed areas where pre-existing surface erosion is on-going.

Agriculture and forestry on federal lands. Agriculture and forestry activities conducted on federal land must meet the requirements of this division and are subject to the department's jurisdiction. Pursuant to Memoranda of Agreement with the USDA Forest Service water quality standards are expected to be met through the development and implementation of water quality restoration plans, best management practices, and aquatic conservation strategies. Where the department designates a federal agency as a designated management agency, implementation of these plans, practices, and strategies is deemed compliance with this division (Oregon DEQ. Water Pollution Div. 41, Water quality standards: Beneficial uses policies, and criteria for Oregon.)

Existing and Desired Conditions

Units located on steeper terrain were originally clearcut using a highlead logging system where entire log lengths were dragged either down or uphill without any part of the log suspended off the ground. Highlead logging was used up until the mid-1970s. The system lacked a tall tower and typically lacked the ability to suspend any portion of the log off the ground. It has been replaced by skyline logging which typically gets one end of the log off the ground. Highlead yarding often displaced large amounts of soil that ended up at the bottom of slopes and in streams, along with large amounts of large woody debris. Most of the old surface erosion from the historic highlead logging has subsided with the recovery of ground cover and stream flow, thus restoring site productivity.

Existing roads are another source of surface erosion that leads to sedimentation of streams. Road inventories in the planning area revealed an overall low level of road prism erosion. When erosion is occurring it is mostly due to a lack of adequate aggregate or irregular road maintenance.

Regular road maintenance is critical to keeping the levels of road-related surface erosion in check. However, road maintenance has declined sharply in the last two decades because fewer timber sales have occurred to help accomplish road maintenance, appropriated funds to do road maintenance have also declined, and severe cuts in Forest roads maintenance personnel prevents all but minimum response maintenance to roads. In the past fifteen years maintenance has been primarily limited to main use roads.

The desired condition is to reduce total compaction (legacy plus predicted) to no more than 20% of an area (LRMP S&G 1, pp. IV68), and to reduce long-term chronic surface erosion associated

with system roads, legacy skid trails and abandoned roads, and future wildfires in keeping with ACS objective #5, which calls for the restoration of sediment regimes.

Concern was expressed that there is not enough flexibility in the use of ground based equipment and the season of operation to allow for removal of forest products in an economical fashion. Project Design Features and Best Management Practices were developed for the project, based upon site specific conditions in order to follow the Umpqua NF LRMP Standards & Guidelines for soil productivity (Ref. Chapter 2 BMPs). Further, the full normal operating season (June 1 to Oct. 31) would be utilized as long as conditions are suitable and ground disturbance does not exceed 20% of the harvest area with cumulative (past and present) skid trails, landings, temporary roads, and haul routes (S&G 1 LRMP IV:67-68). The combined total amount (including legacy disturbances) of unacceptable soil condition (detrimental compaction, displacement, puddling, of severely burned) within an activity area (cutting unit, range allotment, site preparation area, etc.) should not exceed 20 percent. All roads, landings, and soil disturbances, unless rehabilitated towards more natural conditions, are considered to be detrimental condition and are included as part of this 20 percent. With the following exceptions, ground based logging shall not occur outside the Normal Operating Season.

Approximately 23 miles of road would be considered for commercial winter haul includes FS-3806, FS-3815 & FS-3811, FS-3821, and Monte Rico Ridge (FS-3828) Roads. Only those roads preapproved by Engineering for wet weather haul or that have been brought up to Forest Service standards for wet weather haul during the normal operating season would be considered suitable for wet weather haul outside the Normal Operating Season. Roads approved for wet weather haul, but later found to require more than 75 cubic yards per mile of spot rocking in order to prevent “road distress” would no longer be considered suitable for wet weather haul until reconstructed during the “normal operating season”.

Direct Effects

Direct effects are defined as the potential for surface erosion to occur, deliver sediment to streams, and the short-term effects of what may occur within the planning area streams as an immediate result of the proposed road work, timber haul, logging and treatment of activity fuels with fire. Best Management Practices (BMPs) are developed at the National, State, Forest, and Project levels and prescribed (Chapter 2) with the intent of reducing the potential for surface erosion to occur and provide contingencies for preventing unacceptable sediment delivery to streams, when erosion does occur. State and Federal soil and water quality standards provide the measures by which to predict and measure the potential for unacceptable effects to aquatic resources.

Under the worst conditions, the best BMPs can be inadequate to prevent erosion and off-site sediment movement. Therefore, implementing BMPs does not in itself guarantee compliance with State and Federal water quality standards and the implied effects of not meeting these standards. Additional ‘Adaptive Management’ strategies for monitoring erosion sources, sediment movement, and delivery points, and adapting practices that effectively address the conditions and prevent unacceptable sediment delivery, exceed acceptable measures water quality standards, and directly affect aquatic resources. The concept of ‘Adaptive Management’ relies heavily on the Purchaser’s ability and willingness to recognize and adjust to conditions as they change, often beyond minimum contract and BMP requirements.

Roads are a source of surface erosion leading to sedimentation of streams. When compared to log haul induced sediment, sediment from other processes upon the road surface is considered

insignificant after considering the assumptions for road conditions (USDA Forest Service 1985). Reid's (1984) findings in the Clearwater Basin, Washington, found that for gravel surfaced roads, heavy log truck traffic of 16 trucks a day produced 130 times more sediment than roads without truck traffic and 1,000 times more than abandoned roads. If these kinds of values apply to roads on the Umpqua's aggregated surfaced roads, sediment yield from aggregate surfaces other than resulting from haul traffic would be very small in comparison (USDA Forest Service 1985). Grading and graveling dirt roads in the action alternatives would help to decrease erosion by more effectively dispersing surface water before it becomes concentrated as runoff over road surfaces. The potential benefit from increased road maintenance in the project planning area would reduce the potential for sediment delivery over the next five to ten years from roads after the sale has closed and traffic is reduced. In addition, season of haul, and adherence to the Umpqua Road Rules (2015 draft) would help to reduce the potential for damage to road subgrade as a result of log haul.

Public scoping comments have requested the ability to harvest and haul outside the normal operating season (November 1 through May 31). During typical years this would be the period surface soils become saturated, groundwater recharge has taken place, and surface water runoff with the potential for sediment delivery is most likely to occur. It is also the period when subgrade failure from log haul is most likely to occur. However, dry periods can provide opportunities for non-ground based yarding and log haul to be conducted without adverse risks provided Purchasers are adaptive in responding to changing conditions with minimal Forest Service oversight. In order to respond both the identified need for a longer operating season and the increased risk for resource damage the action alternative makes skyline harvested units along the FS-3806, FS-3815 & FS-3811, FS-3821, and Monte Rico Ridge (FS-3828) Roads available for operations outside of the normal operating season. Yarding and haul would be limited to the immediate road listed. No ground based harvest nor use of temporary roads would be considered during this period of operation.

Erosion and sedimentation from temporary roads are expected to be low and would not be expected to be measurable. The project design features of subsoiling would have the direct effect of increasing soil infiltration to decrease the potential for surface water runoff and restarting the process of restoring site productivity (Ref. Best Management Practices, Project Design Features and Soil Productivity).

Alternative 1 would not result in surface erosion above background levels in the unmanaged sites. However, this alternative would not implement road maintenance or upgrade culverts. In addition. The indirect effect of reduced road maintenance under Alternative 1 could potentially result increased delivery of road sediment.

The harvest, yarding, harvest-fuels prescriptions, and broadcast burn prescription in Cedar Creek proposed for Lemon Butte are low impact and would not be expected to result in adverse sediment delivery to streams. Alternatives 2 would also meet or exceed Forest Standards and Guidelines minimums for effective ground cover (standard and guidelines #2 and #3 (LRMP IV-69).

Indirect Effects

Indirect effects are defined as the effects of delivery of sediment from surface erosion to streams within the planning area that can continue to contribute large spikes of fine sediment for several years or longer. Indirect effects are also defined as effects that could occur downstream in

Steamboat Creek if a substantial storm event should occur immediately following the proposed ground disturbances.

The amount of predicted surface erosion associated with the action alternatives is not expected to exceed the capacity of the local streams to properly store, route, and transport their burden of sediment. Based on sediment analysis of similar past and current practices and turbidity monitoring records between 1982 to the present within a local watershed similar to Steamboat Creek, any spikes of sediment into the system would be expected to recover within one to two years (USDA Forest Service 2006).

Without the restoration projects that include road decommissioning, road inactivation and culverts upgrades, the no action alternative has the potential to increase surface erosion. However, long-term indirect effects are not expected to be measurable.

Cumulative Effects

Under Alternatives 2, sediment delivery from harvest, yarding, and fuel prescriptions would only be expected to increase slightly. Such increases would be short-term during the initial 1 to 2 years following disturbance but would be expected to decrease as ground cover and vegetation comes in to cover bare soil. Under these alternatives project road maintenance would be expected to improve dispersal of surface water runoff and therefore reduce the carrying capacity of runoff to carry sediment to streams when compared with no action. However, increased road use and truck haul during the period of haul would result in a short-term sediment spike from road surface erosion over background levels by as much as 130 times (USDA Forest Service 1985). The majority of the sediment delivery from “in season” haul would have the highest potential for delivery during the first few storms once road surfaces and hill slopes are saturated, between November and December. Seasonal restrictions, project road maintenance, proactively implementing erosion control measures, with active implementation and effectiveness monitoring (refer to Best Management Practices and 2015 draft Forest Road Rules) would help to keep this expected increase in sediment delivery from haul roads to a minimum over a minimal period of time. The action alternative would have the potential for a short-term spike of several weeks for haul roads used in the dry season to several months for roads used for winter haul, and a slight increase in hill slope erosion during the first winter following harvest or fuel treatments.

When considering past, present, and reasonably foreseeable future activities within Steamboat and North Umpqua watersheds the effects of any potential spike in sediment from this project would be seasonal, and short-term, spread out over the implementation period of this project. Therefore, it is reasonable to assume that no adverse direct, indirect, or cumulative effects from sediment delivery would occur to water quality or fisheries as a result of implementing actions as proposed under the action alternative, and given the limited potential for indirect effects and the lack of action, no cumulative effects would occur under Alternative 1.

Mass Wasting and Problem Soils

Mass wasting is the dominant mechanism of sediment production within temperate rain forests of the Pacific Northwest (Naimen, et al. 1990), which includes Lemon Butte particularly in the steep faceted mountain portion of the planning area The potential mass wasting processes within the planning area include rapid-shallow landslides such as debris avalanches and in-channel debris flows, and slow-moving deeper-seated forms of mass-movement that include rotational slumps, earthflows, and soil creep. Topography has a strong influence on the form of a landslide.

Regulatory Framework

LRMP soil standard and guideline 5 (IV-68). Prepare a risk and hazard analysis when the potential exists for triggering slope mass-movements as a result of proposed land management activities (USDA-FS Umpqua N.F., 1990).

LRMP S&G 10 pp. IV-71. The project analysis will address how the proposed activities plan to meet soil standards and guidelines. Project design features (or alternatives) will be developed and evaluated when detrimental soil conditions are expected as a result of the proposed action (USDA-FS Umpqua N.F., 1990).

FEIS Appendix B8 – B12. During project surveys District Resource Specialists with the assistance of the Forest's soil scientist delineate and inventory those lands meeting the Forest's criteria for unsuited forest lands classified as 'Unsuited-Nonmanageable' and 'Unsuited-poor regeneration capabilities'. (USDA-FS, Umpqua N.F., 1990) and NFMA (1976).

FEIS Appendix D-27 section 6(a-g). Objectives for harvest of forest lands classified 'Unsuited-Non-manageable' and 'Unsuited-poor regeneration capabilities'. (USDA-FS, Umpqua N.F., 1990).

NWFP RF-2e. For each existing or planned road, meet Aquatic Conservation Strategy (ACS) objectives by minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow (USDA/USDI, 1994).

NWFP RF-3a. Meet ACS objectives by reconstructing roads and associated drainage features that pose a substantial risk (USDA/USDI, 1994).

NWFP RF-4, Existing stream crossings determined to pose a substantial risk to riparian conditions would be improved to accommodate at least a 100-year flood. Crossings would be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure (USDA/USDI, 1994).

Existing and Desired Conditions

Slope and soil stability was field verified for the Lemon Butte units (Table 29). A total of 24 acres were delineated as potentially prone to landslide, slope failure, or active earthflow and removed from the proposed harvest. This field review has resulted in modifications to unit 54 within the proposed action Unit 54 has small hydric soil habitats that require protection from ground based disturbances. Units 6, 14, 23, 38, 54, and 68 all have areas of droughty skeletal soils considered 'Unsuited – poor regeneration capabilities' under the National Forest Management Act of 1976 (NFMA). Soils within this classification, under five contiguous acres would are considered to be manageable (FEIS Appendix D-27 section 6.f.). Prescriptions under the Lemon Butte proposal would harvest within the larger areas to enhancing wildlife openings (FEIS Appendix D-27 section 6.c., Wildlife Prescriptions C5-1, LRMP IV-200).

Table 29. Soil Concerns from field reviews

Inventoried PROBLEM SOILS	Planning Area acres	Unit acres
Active Earthflow	1	
		1
Conditionally Unsuitable	15	
Verified Unstable Slopes	773	
Unit 54		5
Droughty Skeletal Soils	11,012	
Units 6,14,23,,54,		55
Wetland Soils		
Units 14,54		0.5

Stream crossings represent potentially critical sites for mass wasting when culverts are undersized to pass large flows or become plugged by some combination of sediment and wood debris. Under these circumstances, water can divert down the road where it might exit the road in a steep area causing a rapid-shallow landslide. Improperly functioning (plugged) cross drains or an insufficient number of cross drains are a chief cause of road fill failures (USDA Forest Service, 1999). When road fills become saturated and fail, rapid-shallow landslides can occur. Roads that cross active earthflows often become buckled and slumped. Road grading, reconstruction, and maintenance would improve drainage on all roads that were identified in the Lemon Butte Roads Analysis.

The desired condition is improved road drainage and stream crossings with less risk of mass wasting triggered by roads, and is intended to meet ACS objectives through improved road drainage and stream crossings that in turn results in less risk of mass wasting, and is in keeping with ACS objective #5 of restoring the sediment regime. Roads that are not maintained develop ruts and carry runoff for several hundred feet down the road surface to where it is finally dumped as concentrated runoff onto fill slopes. Maintaining a well graded road bed is critical for dispersing runoff before it can concentrate and cause erosion with leads to road damage and slope failures.

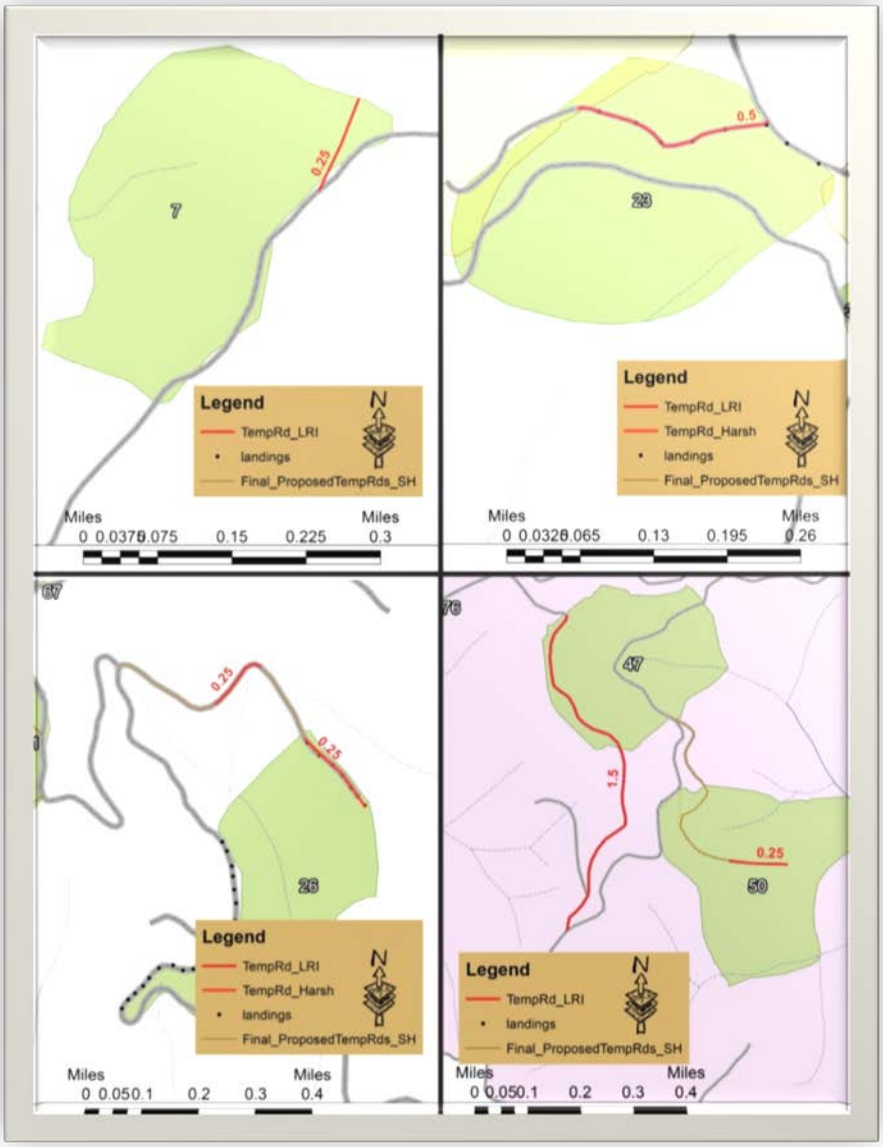


Figure 23. Temporary Roads with section of soils that would be difficult to reestablish vegetation.

Direct and Indirect Effects

Direct effects would occur as an immediate result of the proposed road work; such work can result in immediate changes to slope stability due to changes in water routing. Indirect effects are

defined as those that occur over a longer time period as a result of longer-term changes to slope stability caused by chronic road problems, thinning, and potential future fires.

The action alternatives are not be expected to result in any adverse short-term direct effects or longer-term indirect effects to the aquatic environment as a result of mass wasting. Unstable soils were removed from the timber harvest base and “no treatment” was prescribed to these areas. This has diminished the risk of activating new mass movements in debris flow terrain. Alternatives 2 would not expected to trigger any new mass movement within units or in downslope locations.

Alternatives 2 would upgrade culverts at 15-priority undersized or deteriorating stream crossings; replace 25 older ditch-reliefs (Table 30). This along with the proposed road surface and drainage maintenance on up to 91 miles of road would result in beneficial effects to the aquatic environment. Such modifications to the existing road network would decrease the risk of mass wasting and would meet the desired condition of less road-related mass wasting. The duration of these culvert replacements are expected to extend road culvert life another 15 to 20 or more years assuming some level of road maintenance would occur.

Table 30. System road improvements proposed for Lemon Butte planning area.

SYSTEM ROAD IMPROVEMENTS	Alternative 1	Alternative 2
Ditch relief culvert replacement	0	25
Replacement of undersized or deteriorating stream culverts	0	15
Road surface & drainage maintenance (miles)	0	91 miles

Alternative 1 would not result in any beneficial effects of reducing the existing mass wasting potential of high priority stream crossings. Not taking action would likely maintain a risk of stream crossing failure at 15 undersized or deteriorated culverts and drainage failures along with putting off road surface and drainage maintenance of up to 91 miles of road.

Cumulative Effects

Since there are no adverse direct or indirect effects of increased mass wasting under the action alternatives, there would be no chance of these alternatives resulting in any adverse cumulative effects to the aquatic environment.

Chemical Contamination

The action alternatives presents some risk of water contamination due to the use of fuel products and dust abatement chemicals that have the potential to enter streams if spilled or misapplied. Dust abatement would be accomplished through the application of magnesium chloride to the gravel haul roads. Excessive rates of application could potentially increase either the surface runoff or the migration of the material through the soil to stream channels. The primary risk of water contamination would occur with a spill near a waterway.

Magnesium chloride is highly soluble and moves through the soil with water. The movement is largely dependent on the rate of application, the frequency and intensity of rainfall, the drainage characteristics of the area of application and the chemical and physical nature of the soil. During periods of long duration or high intensity rainfall, in areas of high surface runoff, or in areas of high soil permeability, magnesium can move considerable distances either as surface runoff or as

soil leachate (materials dissolved in water that is within the soil). Surface runoff typically drains into streams, lakes, or ponds whereas leachates feed ground water.

Under these conditions it is the constituent ions of magnesium and chloride (Mg2+, and Cl-) that migrate through the environment. Magnesium ions are readily held by soil particles while chlorides tend to remain in solution and potentially infiltrate ground water or runoff into surface waters. Magnesium is a very common element in soil and water because it readily bonds with soil particles, however they typically do not migrate far from their point of application, which is the case of dust abatement chemical application (USDA, 1997). Because chlorides do not bond well with soil particles and tend to migrate, their effects are more widespread. Although chloride is present in all natural waters it usually occurs in concentrations of less than 50 ppm (parts per million). Trout begin to suffer serious effects from chlorides when concentrations reach 400 ppm. Concentrations in excess of 10,000 ppm place all fresh water biota in immediate jeopardy of mortality. At typical application rates, measurable increases in background concentrations would not be expected to occur (USDA, 1999).

Direct Effects

Alternative 1 would have no direct effects relative to chemical contamination because no chemicals would be applied as a result of this alternative.

Under Alternative 2, a dust abatement spill or petroleum spill could potentially result in direct effects to aquatic resources and the beneficial uses of water. Dust abatement would be applied to gravel haul roads as needed, up to 30 miles total over the lifetime of the project. The risk of water contamination due to the application of dust abatement is minimized under the action alternatives by several mitigation measures that would be required under the timber sale contract. Dust abatement with chemical compounds under all action alternatives include maintaining an average 25 foot no treatment buffer at perennial stream crossings and maintaining a 1-foot no treatment area adjacent to the outside edge of the ditch line. Moreover, the application of dust abatement materials would normally occur only once per year in a window of time when no rain is forecast for at least three days. The buffering of applications away from perennial stream crossings has been found to effectively mitigate pollution of adjacent waters (USDA 1999). The rate of application of dust abatement compounds in the planning area would be “typical” and therefore is not expected to contribute to adverse riparian or aquatic effects.

Magnesium chloride is typically used on a limited basis and at low application rates, as compared to study areas where the most noticeable effects have been seen. Based on the literature review and typical application rates for dust abatement purposes that would be used in the Lemon Butte planning area, effects from these compounds to plants and animals in the riparian and aquatic environments would be negligible under the action alternative.

Timber sale purchasers would be required to have spill prevention and recovery equipment on site, they would be required to develop spill prevention plans if substantial amounts of fuel or other pollutants are stored in sale areas, and traffic control measures would be required in the timber sale contract. All of these requirements associated with the action alternative, detailed in Chapter 2 and in the Best Management Practices Checklist (Project Record), function to diminish the chances that potential direct effects to aquatic resources and the beneficial uses of water from project-related pollutants would actually occur. Thus, risk of chemical contamination is considered to be low for all action alternatives.

Indirect Effects

Alternative 1 would not utilize chemical compounds and would result in no risk of indirect effects to downstream beneficial uses due to water contamination.

Alternative 2 would present more risk of indirect effects to downstream beneficial uses because of the amount of potentially polluting products transported to the project area. The likelihood of an accidental spill is believed to be low under all alternatives; therefore no mitigation measures would be applied to the transport of potential pollutants outside the timber sale areas.

Cumulative Effects

Most past and on-going land management operations throughout the Umpqua River basin such as silvicultural activities, timber sales, and all forms of road work use a variety of potentially polluting products (such as dust abatement, petroleum, concrete, adhesives, cleansers, herbicides, etc) that pose a risk of entering waterways if spilled or mishandled. The level of timber harvest and associated road work on Federal land has diminished over the last two decades relative to the previous three decades. Therefore, the level of additive effects that can contaminate water from such actions has also diminished.

Potential contamination of waters within the river basin associated with private industrial forestry operations, intensive agricultural operations (using pesticides, fertilizers, other petroleum products, and herbicides), and city and town development and use by people (sewage, plus all the above mentioned potential pollutants and others not mentioned) has not diminished. Water contaminations from these sources can be expected to increase as demand for food and natural resources increases with the human populations. Therefore, the lower areas of the Umpqua River basin are where the cumulative effects of all the additive forms and sources of water contamination would be most likely realized.

The chances of any of the action alternatives resulting in any cumulative effects to water contamination hinges on whether a substantial spill of petroleum or dust abatement products occurs. Should a spill occur and clean-up measures fail, a cumulative effect could be realized. This is particularly true the further downstream an accidental spill occurs.

None of the Lemon Butte alternatives are expected to appreciably affect water quality over the long-term (decades, or longer), and none are expected to contribute to chemical contamination or have a measurable effect on the nutrient regime unless an accidental spill were to occur. The chances of such a spill are offset as much as possible by a series of Best Management Practices required in the timber sale contract of the action alternatives.

Any impacts to water quality associated with contamination of water due to timber sale operations would be short-term and likely localized. As such, the broad-scale goals of the ACS would not be impacted.

Social Environment

Economics

The economic analysis focuses on the direct, indirect, and induced costs and benefits of the alternatives and the connected actions described in Chapter 2. Net present value and benefit/cost ratio are the primary criteria used to compare the direct effects of the alternatives to the Federal

Government, termed economic efficiency analysis. Impacts to the general economy of the analysis area are modeled using Apheleia, a Public Land Economic Analysis Front End Tool version 02.06.2015. Apheleia uses new Timber Mill Survey Data from 2014 imported from IMPLAN output data. IMPLAN is a modeling program developed by the Forest Service, but now managed privately (IMPLAN 2009). Assumptions regarding the economic analysis are footnoted where appropriate.

Most timber sales from the North Umpqua Ranger District are purchased and operated by individuals and companies based in Douglas County, Oregon. Merchantable sawtimber is also generally marketed to and processed by facilities in Douglas County, Oregon; therefore, the economic effects of the alternatives are assessed at the scale of Douglas County. Total softwood mill capacity in Douglas County is estimated at 700 MMBF using processing capacity figures for 2008, given sufficient supply and firm product market demand (Ragon, Robert. 2011. Pers. Comm). Douglas County log processing data through 2011 that shows the average annual production since 1997 has been 445 MMBF in Douglas Co. (Ragon, Robert. 2011. Pers. Comm). Therefore, 445 MMBF is be used to estimate the contribution of each alternative towards meeting demand. Final demand is assumed to be wood products ready for shipment at the mill yards.

Regulatory Framework

Forest Service project analysis and design is guided by law, policy, and direction. The following economic section is guided by several direction documents. Overall direction begins with the Office of Management and Budget (OMB) Circular No.A-94 Revised (Oct. 1992). This “Circular provides general guidance for conducting benefit-cost and cost-effectiveness analyses. It also provides specific guidance on the discount rates to be used in evaluating Federal programs whose benefits and costs are distributed over time” (OMB, 1992). Further Forest Service direction in the form of Forest Service Handbooks and Forest plans provide more specific instruction.

Forest Service Handbook (FSH) 2409.18 Ch. 30 provides direction on how to integrate financial and economic analysis into NEPA and project planning. It requires that a financial analysis of each timber sale alternative is completed during project analysis and design. It provides additional analytical methods that can be completed as needed based on the complexity of the project. Such methods include economic efficiency, socio-economic impacts, trade-offs, and sensitivity analyses. This section includes an economic efficiency analysis, which incorporates the financial analysis, as well as an economic impacts analysis. This analysis is consistent with FSH direction and extends beyond what is required in order to provide additional economic information commonly requested by the public.

Forest Service Handbook (FSH) 1909.17 is the economic and social analysis handbook. Ch. 10 provides detailed instructions on evaluating economic efficiency. An economic efficiency analysis measures the benefit/cost ratio and economic net present value (NPV). Benefit/Cost ratio can be used to determine the most economically efficient alternative while NPV will compare all monetarily-value cost and benefits. This was completed in accordance with handbook direction.

The Umpqua N.F. Land and Resource Management Plan (LRMP) Resource Management Standard and Guide 8 (pg. IV-45) requires that an economics analysis should be prepared on all timber sales offering over 1.0 MMBF. This analysis is consistent with the Forest Plan.

Douglas County Economic Situation

Total employment in each county is difficult to quantify exactly, as the State of Oregon Employment Department, Census Bureau, and IMPLAN/Apheleia use different criteria to

measure employment. The State of Oregon Employment Department has the most current information.

The 2008-2009 recession impacted the timber industry in the region especially hard. Unemployment in Douglas County rose from 8.3% in January of 2008 to its highest point in May, 2009 at 16.5%. Current unemployment (October 2015, not seasonally adjusted) stands at 7.2% in Douglas County (State of Oregon, 2015).

According to the State of Oregon as shown in Table 31, Douglas County lost 2,086 forestry, logging and wood products manufacturing jobs from a recent high in June, 2005 to the low in December, 2010. Since then, 577 jobs have been added back as log and lumber markets have improved (State of Oregon, 2015).

Table 31. County Employment (not seasonally-adjusted)

County	Sector	Highest Point 2005	Lowest Point 2010	June 2015
Douglas	Forestry & Logging	1,073	705	950
Douglas	Wood Products Manufacturing	4,396	2,678	3,010
Total		5,469	3,383	3,960

In 2014, the logging, forestry and wood products manufacturing sectors provided about 14% of Douglas County's non-governmental employment (State of Oregon, 2015).The average annual wage paid in the Douglas County area in 2014 was $35,280, compared to the forestry, logging, and wood products manufacturing average wage of $44,490 based on the State of Oregon Employment Department data. The forest products industry continues to be a key part of the Douglas County economy.

Economic Efficiency Analysis

The direct economic effects of the alternatives are displayed in Table 32. The standard criterion for deciding whether a government program can be justified on economic principles is net present value (NPV) – the discounted[16] monetized [17]value of expected net benefits (OMB A-94).

Forest Service planning costs are not included in the economic efficiency analysis since they are considered sunk (OMB A-94). It is estimated that this project has cost about $300,000 to plan over the past two fiscal years. Alternative 1 is considered below-cost since there would be no return to the U.S. Treasury with expenditures for planning. Based on the expected return to the Federal government plus the value of restoration activities potentially funded by stumpage[18] shown in Table 32, Alternative 2 would be above-cost, including all Forest Service planning, sale preparation, and administration costs.

[16] Discounting is the process of calculating the present value of a future amount of money. 4% is the standard discount rate for long-term projects (OMB A-94).
[17] Lit. "to give the character of money to." A cost or benefit is monetized when it is expressed in terms of money.
[18] Stumpage is the value of the timber "on the stump." It is the timber sale contract minimum value and is determined by subtracting logging, road work, and slash disposal costs from the delivered log price. Timber sale purchasers may bid more in a competitive auction. The actual monetary return to the U.S. Treasury is determined by subtracting all post sale costs from the stumpage.

Alternative 2 has harvest and other activities that would occur over a multiple year time span. For example it is expected that the timber volume would be sold in multiple sales and harvest would occur over a 2-5 year period, while reforestation and snag creation wouldn't occur until after year 5 (or when logging is completed). The economic analysis that was conducted is a multi-year analysis. Future values are discounted at 4% to the present year to put everything on the same basis to better account for the multi-year nature of the project.

The Lemon Butte Project includes several restoration activities which are considered to provide ecosystem services. Due to the difficulty to quantify these ecosystem services it was not included in the economic analysis. This project is above-cost therefore any monetary analysis of the ecosystem services benefits would result in an additional benefit. The qualitative benefits of the restoration activities are described their associated resource areas in Chapter 3.

The Economic Efficiency Analysis below analyzes alternative 2 three different ways. The first column analyzes alternative 2 without winter haul to better inform the decision maker. Alternative 2 as proposed includes 2,464 MBF of winter haul, analyzed in the second column. The third column represents a sensitivity analysis based on volume. FSVeg predicts that the Lemon Butte Units average 18.6 MBF/acre. Based on three previous sales in the vicinity (Rowboat T.S., Bloody T.S., and Jack T.S.) we expect that the volume per acre would be lower than predicted. The Rowboat, Bloody, and Jack Timber Sales averaged 12 MBF/ac, 16 MBF/ac, and 11 MBF/ac respectively. I applied the average volume per acre from those sales into my sensitivity analysis. This resulted in a total sale volume of 7,839 MBF and 1,721 MBF available for winter haul which was used in the third column.

Table 32. Economic Efficiency Analysis

	Alternative 2- No Winter Haul	Alternative 2 With Winter Haul	Volume Sensitivity Analysis
Timber Volume (MBF)[19]	11,220	11,220	7,839
Acres by Harvest Method			
Skyline	418	418	418
Ground-based	185	185	185
Helicopter	0	0	0
Total Acres	603	603	603
Volume (MBF)/Acre	18.6	18.6	13
Total Present Value Benefits			
Gross Benefits	$4,996,646	$5,041,310	$3,522,168
Value/MBF[20]	$445	$449	$449
Value/Acre	$8,286	$8,360	$5,841
Total Present Value Costs			

[19] MBF is thousand board feet. The Forest Service estimates MBF using east-side Scribner rules, therefore the volume as shown, is higher than if west-side, long log Scribner rules would be applied.
18 Note "With Winter Haul" does not include Ground-Based logging for winter haul. This is just the amount of volume of Ground-Based in this alternative.

[20] West side delivered log prices derived from ODF log price surveys have been adjusted to reflect equivalent east side values due to the differences in scaling rules.

	Alternative 2- No Winter Haul	Alternative 2 With Winter Haul	Volume Sensitivity Analysis
FS Prep & Admin	$447,519	$447,519	$320,457
Logging	$2,857,705	$2,857,705	$2,078,597
Slash Disposal	$311,597	$311,597	$311,597
Road Work (Reconstruction & Maintenance)	$659,902	$672,615	$544,318
Reforestation	$2,762	$2,762	$2,762
Restoration Activities potentially funded by stumpage	$42,180	$42,180	$42,180
Restoration Activities not funded from stumpage- *Instream Restoration and Non-Commercial Thin Unit*	*$149,971*	*$149,971*	*$149,971*
Total Cost	$4,471,638	$4,484,351	$3,449,883
Cost/MBF	$398	$400	$400
Cost/Acre	$7,416	$7,437	$5,721
Net Present Value	$525,007	$556,959	$72,284
Stumpage (2015 dollars)	$1,283,172	$1,319,113	$630,992
Predicted Stumpage Price/MBF	$114.36	$117.57	$80.49
Potential Return to the Treasury[21]	$1,041,754	$1,077,695	$389,575
B/C Ratio[22]	1.12	1.12	1.02

The economic efficiency analysis displayed in Table 32 uses average delivered[23] log prices in the Douglas County market from the most recent four calendar quarters, adjusted for short log volume. An additional adjustment was made for potential hauling of some of the volume in the winter months, when log prices are typically higher. Over the last 10 years, Douglas-fir average log prices have been 4.07% higher in the 1st quarter than in the 3rd quarter (summer season) according to the ODF data. Skyline logging below about 3,000 in elevation can reasonably be operated during the average winter conditions in this area.

Log prices fluctuate due to a variety of market forces, many of which are external to Western Oregon. Typically, log prices are higher in the winter months and lower in the summer/fall, reflecting the availability of logging due to weather. The recent recession and slowdown in nation-wide housing caused the local log market to fall drastically from 2006 to 2009. Figure 24 displays a composite Douglas-fir log price average ($/mbf) for the Douglas County market since 1990 using Oregon Department of Forestry log price information (ODF, 2015). This data is not adjusted for inflation and is equated to west side long log Scribner scaling rules.

Log prices hit historic lows during the 1st quarter of 2009 and have since risen to near or above "average" levels. The outlook for continued recovery is tenuous, but indications are for housing to continue to improve, providing a more stable log market. In the short-term, log prices could fluctuate based on import/export pressure, natural disasters, or general economic trends. If log prices decline, less money would be available for post-sale restoration activities, and the value of

[21] This is calculated to at least cover the requirement for 25% Payments to Counties and 10% Road & Trail Fund.
[22] B/C Ratio is the benefit/cost ratio, another standard criterion for economic efficiency. It is the product of the present value of benefits divided by the present value of costs.
[23] Delivered log price is the amount paid per MBF at the mill location.

the timber could reach a point where an individual sale may not be marketable. It would be speculative to predict the local markets at the time of sale offer or operation.

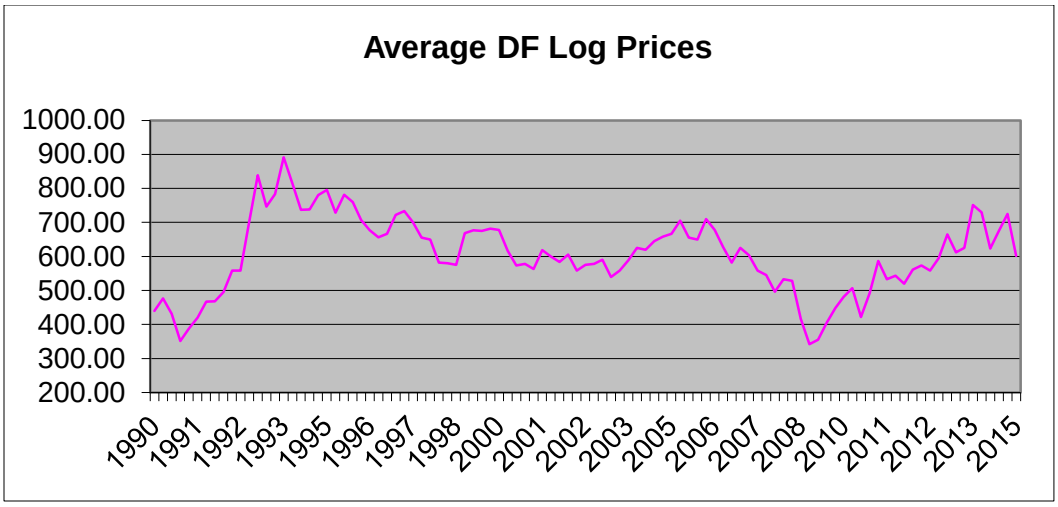


Figure 24. Average Composite Douglas-fir Log Price, Douglas County Market Area.

At current log prices and logging costs, this alternative would likely result in a positive timber sale contract, indicating the sale(s) would receive bids in a competitive market. The action alternative would be marketed as one or more individual timber sales. These sales would be offered in a public auction to achieve the highest return possible[24]. The estimated stumpage price for alternative 2 as proposed is $117.57 per MBF. The sensitivity analysis based on the lower volume still predicts a positive timber sale contract, but with an estimated stumpage price of $80.49 per MBF. It appears there would be sufficient stumpage funds in either scenario to pay for restoration activities identified in chapter 2. $149,971 of restoration work not funded by stumpage has also been identified. Specifically these activities include the instream restoration work and the non-commercial thin unit. The District expects 75% of the funding needed for these projects to come from grants or cost-share programs, while the remainder would be funded by the forest. Alternative 2, as proposed, is predicted to provide $362,756 return to treasury in 25% fund payments.

Economic Impact Analysis

The economic impact analysis using Apheleia considers changes in employment and income due to changes in the economic activity of the county from the project. An individual timber sale may not substantially change the overall economic activity of the county, since the amount of timber volume represents a small percentage of the total demand. Since 2005, Umpqua National Forest timber volume has been offered at a somewhat consistent level, at about 40 MMBF per year. Timber sales from the National Forest are viewed as raw material available for the local industry, allowing production and support for jobs in the local economy to be sustained. Local National Forest timber would offset logs imported to the area, potentially reducing overall costs and increasing production.

[24] Individual timber sales would be appraised and offered at fair market value, or the minimum to cover reforestation costs and a $0.50/ccf return to the Treasury, whichever is higher. The minimum advertised rate for Douglas-fir is $6.00 per MBF.

Table 33 displays the results of the economic impact analysis by alternative. In general, the sale of timber from the National Forest would result in sustained or increased employment in the logging and wood products manufacturing sectors, in the forestry services (slash treatment, planting, etc.) and indirect and induced employment in many other sectors. Payments in lieu of taxes due to Douglas County from timber receipts are not included in these figures, as they are accounted for in the return to the Federal Treasury shown in Table 32. Table 32 does not include impacts to the local economies from Federal salaries paid to produce and administer the timber sales, or taxes paid to state and local governments as a result of harvesting timber.

Other direct, indirect, and induced benefits are derived from road reconstruction and other restoration activities that may be funded by revenue from the timber sales or other funding sources. These work activities are treated as costs in the benefit/cost analysis since they reduce the revenue to the Federal Treasury, but they have economic benefits to the local community since most are contracted services. These benefits are included in the economic impact analysis and in the numbers reported in Table 33.

The numbers in Table 33 are not intended to be absolute. The analysis should be used to compare the relative differences among alternatives. The percentage of value assigned to sawlog and veneer production is 95% and 5%, respectively, based on the estimated average diameter of harvested trees and the milling capacity in the analysis area.

Table 33. Economic Impact Analysis

Impact	Alt 2
	Value
Change in Total Industrial Output	$63,659,000
Change in Employment*	179
Change in Labor Income	$8,669,000
Contribution to Douglas County Annual Production	11.2 MMBF (2.5%)

* Number of jobs based on average annual.

Direct and Indirect Effects

Alternative 1 is not shown in Table 33 since by definition it would not change the conditions or level of economic activity in the analysis area. This alternative may, however, contribute to a decline in the local timber industry, since it would keep federal timber from the market, at least in the short-term. Other sources of logs would be used to meet the needs in local mills, or total production would decline. No attempt was made to quantify the impacts, as it is beyond the scope of this analysis to speculate on the reasonably foreseeable timber supply changes in the local area.

Alternative 2 would have a beneficial direct effect to the local economy, as it is likely the timber sales would sell and the restoration activities would be accomplished. As shown in Table 33, Alternative2 is projected to add approximately 180 jobs to the economy. Of the total jobs contributed, 51% are direct jobs in the forestry, restoration, logging and milling sectors, and 49% are indirect and induced jobs in many sectors of the local economy. The direct jobs contribute 60% of the increased labor income, indicating these are higher wage jobs. These higher wage jobs contribute to a higher standard of living within Douglas County. The increased jobs are expected

to add approximately nine million dollars in labor income. The ripple effect through the economy is expected to result in a large increase in industrial output.

Cumulative Effects

As stated at the start of the economics section most timber sales and associated activities from the North Umpqua Ranger District are purchased and performed by individuals and companies based in Douglas County, Oregon. Therefore, the cumulative economic effects of the alternatives is assessed at the scale of Douglas County.

Under alternative one none of the proposed actions would occur and ongoing activities would continue, resulting in no change in the level of economic activity in the analysis area. Therefore, the project would have no cumulative effect on the jobs or wood products sector in Douglas County.

Alternative two would have timber harvest and associated work as well as restoration activities occurring each year for the next two to ten years. During this time frame many other restoration projects and federal, state and private timber sales will also be operating in Douglas County. The Umpqua Forest as a whole normally contributes approximately 40 MMBF annually, which equates to less than 10% of Douglas County's annual production of 445MMBF. The Lemon Butte project is expected to contribute 2.7% towards the County's annual production. When combined with other ongoing and reasonably foreseeable timber sales in the County, Lemon Butte would contribute to meeting Douglas County's average annual production and therefore contribute to a beneficial cumulative effect of sustaining the wood products industry in Douglas County.

Road Building and Access

Regulatory Framework

Land and Resource Management Plan

The Umpqua National Forest Land and Resource Management Plan (LRMP) provides standards and guidelines.

- Road density should be the most economical system necessary to meet land management objectives. Evaluation of road development alternatives for planned uses would consider safety, costs of transportation, and the effects upon lands and resources.
- Assure short-term (temporary) roads are closed within one year of when the timber purchaser has completed contractual requirements for the portion of the timber sale served by the road. Re-establish vegetation cover to put land back into production within ten years of contract, lease, or permit termination on roads not remaining a permanent part of the Forest transportation system.
- Roads closed for one of the above reasons may be closed either seasonally or year-around. Seasonal closures are preferred over year-around closures wherever feasible, consistent with Forest Plan prescriptions, and where the objectives of the closure can be met.
- Forest development roads (system roads) would generally be open to use by vehicles licensed for highway travel, except when closed for one of the following reasons:
    - ✓ The mode of access causes unacceptable damage to, or negates adequate protection and management of, Forest resources.

- ✓ Safety hazards to the road user exist.
- ✓ Prescriptions in the Forest Plan recommend closures in elk winter range.
- ✓ To provide security to contractors/cooperators, special use permittees, private land owners, and Forest Service administrative facilities.
- ✓ Road maintenance costs to keep a road open are high compared to existing or expected use of the road.

Existing Condition

The Lemon Butte planning area includes 288.79 miles of roads, which equates to a density of 2.85 miles per square mile of land. The Lemon Butte transportation system would use approximately 91 miles of these roads. Regular maintenance, as well as upgrading and reconstruction of high-use segments, would be the primary focus of management in the future.

The transportation system provides access for commercial users, including forest product harvesters. Most roads were built to facilitate timber harvest, mining activity and access to private land holdings. Recreation use focuses on providing access to hiking trails, hunting, fishing, and driving for pleasure, with the majority of the use taking place in the summer and early fall.

Background and History

Road construction in the watershed generally developed to provide access for timber sales but occurred mainly from 1950 to 1980. Road construction standards have changed through time reflecting not only transportation needs, but environmental concerns as well. Most of the roads in the watersheds were built in the 1950's through the 1980's and were generally designed geometrically relatively straight alignments and grades which required large cuts and fills and, in many cases, substantial impact on the land. Design standards changed in the late 1970's to allow non-geometric design, which resulted in roads that follow the contours more closely. These roads generally have smaller cuts and fills, more curves, steeper grades, narrower clearing, and less overall impact to the land and resources.

Transportation System Characteristics

The following tables describe the road system in the planning area along with roads that would be needed for log haul in terms of road maintenance levels and surface types. Road maintenance levels 3 through 5 are maintained for public passenger car travel. Maintenance level 2 roads are maintained for high-clearance vehicles and maintenance level 1 roads are closed to public travel.

Table 34. Road Maintenance Levels

Maintenance Level	Forest Service (mi)	% of Total
5	0.00	0
4	17.11	19
3	0.00	0
2	72.59	80
1	1.22	1
Total	90.92	100

Table 35. Surface Types

Surface Type	Forest Service (mi)	% of Total

Asphalt Pavement	16.71	18
Aggregate	69.93	77
Native	4.28	5
Total	90.92	100

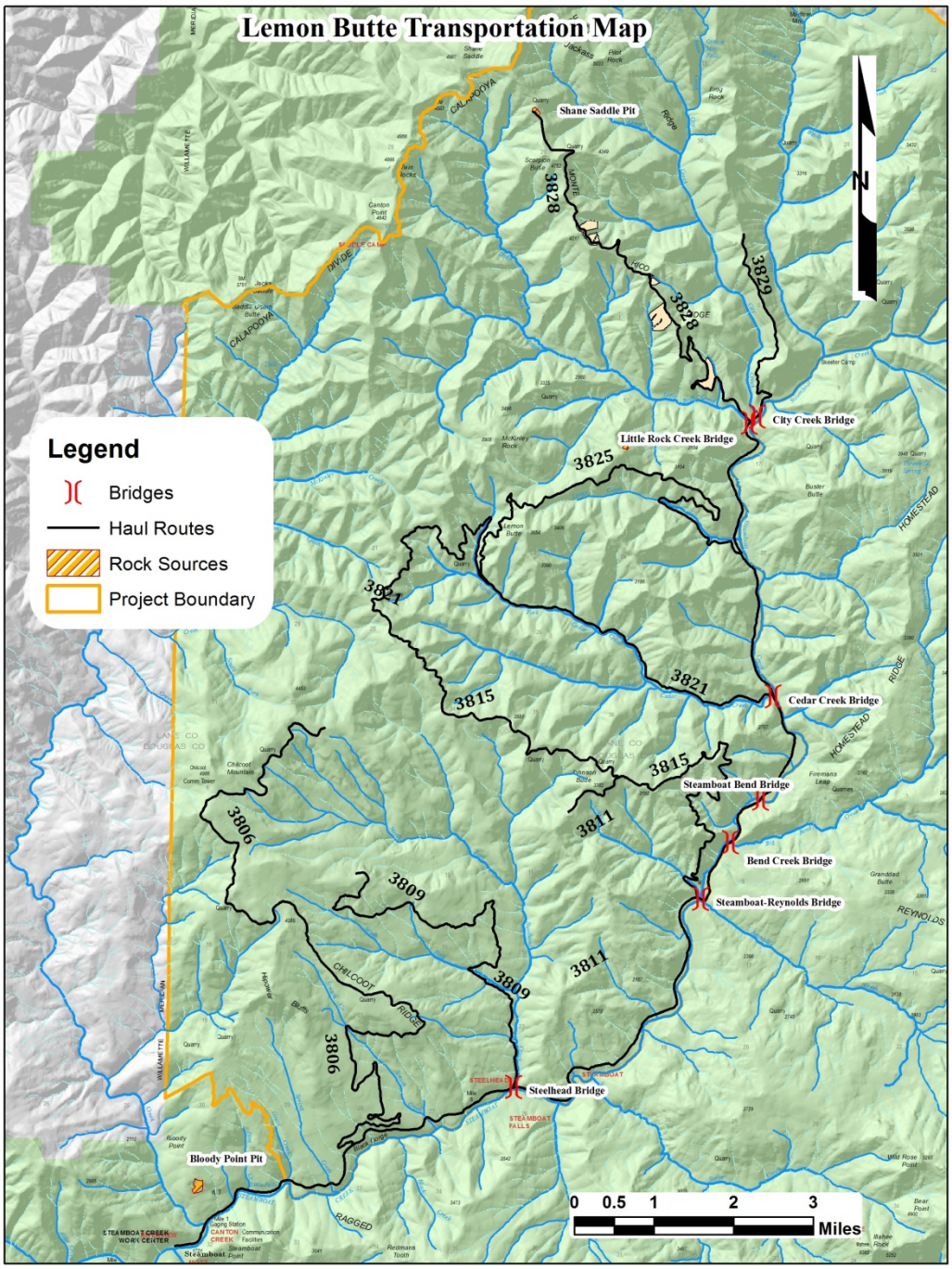


Figure 25. Transportation Map

Road Maintenance

Prior to 1990, road maintenance in the planning area was accomplished using several sources of funds and people. Timber sale purchasers performed most of the maintenance on level 1, 2 and 3 roads, along with contributing funds towards maintaining the paved and high use roads. The

Forest Service funded a road maintenance crew through appropriations and collections to perform the maintenance on multiple use roads.

When timber harvest declined in the 1990's, purchaser road maintenance and contributed funds also declined sharply. At the same time, appropriated road maintenance funds declined, forcing shrinkage of the district road crew size and capability. Currently, the District shares the road crew with the forest and they alternate their work between the districts on the forest. Annual road maintenance is limited primarily to level 3, 4, and 5 roads, which are part of the primary road system identified in the Forests Access and Travel Management Plan.

Road – Stream Interactions

There are several stream crossings in the planning area due to the high density of streams and roads. The following table describes the road-stream intersections in terms of numbers of crossings by stream class.

Table 36. Road-Stream Intersections

Stream Class	Crossings
I	9 (7 Bridges)
II	4
III	25
IV	100

Watershed Analysis and Roads Analysis Recommendations

The Lower Steamboat Watershed Analysis (USDA 2007) and the Upper Steamboat Creek Watershed Analysis (USDA 1997) made several recommendations in order to improve the current condition. The watershed has two roads analyses (RAs), one for Upper Steamboat completed with the WA in 1997 and one for Lower Steamboat completed in 2000. Both are in keeping with direction to accomplish roads analysis that weighs the various costs of road-associated effects to ecosystem values and benefits of access. The majority of Forest Service roads were planned and developed in conjunction with timbers sales.

Direct and Indirect Effects

The environmental effects of roads are disclosed in numerous places in Chapter 3 including the sections on Forest Wildlife, Botany, Aquatics, and Mass Wasting. This section displays the overall effects of the alternatives in terms of miles of roads, access and economics. The scale used in this analysis for direct/indirect effects is the planning area. Table 37 provides a summary of road activities by alternative.

Table 37. Summary of Road Activities Associated with Each Alternative

Alt	Total road miles	New temporary road construction/ obliteration (miles)	Existing temporary road use/ obliteration (miles)	New temporary road construction on previously decommissioned road	Roads maintained by purchaser (miles)
1	90.92	0	0	0	0
2	90.92	0.50	1.50	1.25	73.81

Temporary Roads

Alternative 1 - Under Alternative 1 no new temporary roads would be constructed and no road reconstruction, inactivation or decommissioning would occur.

Alternatives 2 - No new system roads are proposed for construction. As displayed in Table 37, Alternative 2 would build 0.50 miles of new temporary road, re-use 1.50 miles of existing temporary road, and 1.25 miles of new temporary road would be constructed on the existing footprint of previously decommissioned roads. These temporary roads are the only proposed road construction for the action alternative and would subsequently be obliterated after logging is complete. Temporary road obliteration involves subsoiling, as appropriate, and pulling displaced soil and duff back over the road surface. The previously decommissioned roads proposed for use include 3806-495, 3821-060, and 3828-148.

The decision to decommission road 3806-495 was from the Hipower Roads Restoration Project Environmental Assessment in July of 1997 to reduce the potential for mass wasting and debris flows, restore hydrologic function, and to reduce miles of road as directed by the standards and guidelines, and the ACS objectives for key watersheds in the Record of Decision (1994). Decommissioning would range from simply restoring water routing and eliminating slope stability hazards to full fill removals. Decommissioning activities would include a combination of oversteepened road fill and landing pullback, culvert removal, stream channel restoration, roadbed ripping, hillslope recontouring, erosion control, and possibly revegetation of disturbed sites, eliminating the need for continued maintenance. The EA identified that there were second growth stands accessed by these roads that could be commercially harvested by helicopter logging within 20 years following the decision. This passively decommissioned road has not been properly obliterated/subsoiled. The road has been closed with an entrance barrier at the entrance. Beyond the entrance barrier, the road has an aggreagate surfacing and minimal vegetative regrowth. The road bed exceeds the 12’ minimum width needed for use. The road has had culverts removed and replaced with approximately ten waterbars and has visible drainage problems. In some areas water can be seen running down the road with sediment deposition. Previous decommissioning efforts cost approximately $2,500 to $3,000.

The decision to decommission road 3821-060 was from the Canton Creek Road Decommissioning Project Environmental Assessment in June of 1997, In response to direction in the Standards and Guidelines of the Northwest Forest Plan to restore aquatic conditions, a watershed improvement needs inventory was conducted. The inventory assessed actions needed to improve water quality, aquatic habitat, and hydrologic function within portions of the road system in Upper Canton Creek, a key watershed. Several roads of short length which currently have very steep and unstable fills, are prone to road failures, and restrict normal hydrologic functioning. In addition to these findings, Umpqua cutthroat trout, an endangered species, inhabit the reaches of stream which could be impacted by mass wasting and debris flows from these roads. The potential adverse impacts create a need for decommissioning these roads. This decommissioned road has not been properly obliterated/subsoiled. The road has been closed with an entrance barrier at the entrance. Beyond the entrance barrier, the road has native surfacing and is heavily revegetated with conifer and hardwood saplings. The road bed exceeds the 12’ minimum width needed for use. The road has had culverts removed and replaced with approximately ten waterbars. Previous decommissioning efforts cost approximately $5,000 to $5,500.

The decision to decommission road 3828-148 was from the Little Rock Creek-Related Restoration Environmental Assessment in September of 1998. The watershed restoration proposal

is an outgrowth of recommendations made in the Upper Steamboat Watershed Analysis (WA). The WA described a need to control and prevent road related impacts to the riparian and aquatic resources within the Little Rock Creek subbasin of the Upper Steamboat watershed. The Watershed Analysis was carried out in 1996-97 in accordance with the Aquatic Conservation Strategy of the Northwest Forest Plan. Steamboat Creek is a Tier 1 key watershed identified as such in the Northwest Forest Plan because of its direct contribution to anadromous salmonid conservation (ROD B-19). Watershed restoration is an integral part of the Aquatic Conservation Strategy, and key watersheds have the highest priority for restoration. The Upper Steamboat Creek Watershed Analysis ranked roads by their impact on each category: Wildlife, Aquatic, and Human Use. Segments ranked with a high aquatic impact rating and a moderate or low human use, or segments with moderate aquatic impact ratings and low human use ratings were assigned to the decommissioning category. The Little Rock Creek-Related Restoration identified that there was potential for commercial thinning projected to occur in 25 years when the trees would be large enough to feasibly harvested. In the cost: benefit analysis of the EA says that another important assumption built into this analysis would be the temporary rebuilding of decommissioned roads to gain access. The assumption was made that these roads would then, once again, be decommissioned immediately following the thinning. This decommissioned road has not been properly obliterated/subsoiled and has a native surfacing. The road bed is stocked with very dense young conifers, primarily Douglas-fir, with the largest being approximately 14 inches at stump height. This road only has one waterbar in place and no culverts. The road currently has fill slope sluffing downhill in several places. Previous decommissioning efforts cost approximately $1,000 to $2,000.

Road Reconstruction

Alternative 1 – Alternative 1 provides for no road maintenance or reconstruction.

Alternatives 2 – The reconstruction identified in Chapter Two addresses the specific recommendations of the Watershed Analysis and Roads Analyses. Road reconstruction is generally intended to fix specific drainage concerns, perform deferred maintenance items, and bring the road surface to the design standard so it can facilitate timber haul. Alternatives 2 includes placement of surface rock and reconditioning and reshaping road surfaces, installing drivable cross ditches and abandoning sections of ditchline in areas due to cut slope stability issues, replacement of approximately 25 ditch relief culverts and 15 stream crossing culverts, and bridge maintenance. Placement of surface rock, combined with reconditioning and reshaping of road surfacing, would help minimize stream sediment delivery, improve road drainage, and help facilitate log haul. The 3829 has been identified as having cut slope stability issues which has caused ditches to plug and drainages to be ineffective. Ditch flow is blocked and traveling down the road surfaces causing loss of surface rock and draining in undesired locations. Abandoning these sections of ditchline and installing drivable cross ditches would minimize the flow along road surfaces and focus the flow to desired drainage locations. Replacement of the 18 stream culverts would help to either eliminate the potential for stream diversion or to accommodate 100-year flood flows. Replacement of approximately 25 rusted ditch relief culverts would help to continue to accommodate flood flows, lessen the risk of erosion and provide for safe road use. The Cedar Creek Bridge (FSR 38 MP 12.78) was identified as needing repairs to the concrete beams during a routine bridge inspection. Approximately 40 percent of the planned volume is accessed and scheduled to haul across the Cedar Creek Bridge.

Road Maintenance

Alternative 1 - Alternative 1 provides for no purchaser maintenance and allows existing road related drainage problems to continue. Road maintenance would continue to be limited primarily to level 3, 4, and 5 roads and level 2 and 1 roads would receive minimal to low maintenance. A lack of regular road maintenance increases the probability of culverts plugging, ditch overflows, and other maintenance related problems that could result in fill failures. The next scheduled maintenance would be on a "when needed" basis due to budget constraints where only obvious problems are repaired. Repairs are usually implemented after failure and/or erosion occur and the impact to the aquatic habitat has already happened.

Alternatives 2 - Alternative 2 would provide maintenance and improve the road conditions in the planning area. Improved road maintenance results in higher degrees of user comfort and safety. In addition, well-maintained roads reduce the risk of road failures and the resulting ecological and economic effects.

Road maintenance is important for user comfort and safety, and for the protection of resources and the road facility. The Umpqua Forest-level Roads Analysis (USDA 2003b) describes the current situation of declining budgets for road maintenance, the reduction in timber sale-related maintenance and the amount of maintenance that needs to be done on the Forest. Maintenance that would be performed by timber purchasers could provide a substantial portion of the total needs for several years.

Under the action alternatives, the reconstruction and maintenance work would be implemented in order to meet the Standards and Guidelines of the Northwest Forest Plan which are designed to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (ROD C 32-33), while providing for safe, cost-effective timber haul.

Wet Season Log Haul

Wet season log haul may occur on approximately 3.6 miles of road 3828, Monte Rico Road. This is a maintenance level 2 single lane aggregate surfaced road. Units included for wet season haul activities include skyline units 11, 24, 26, and 39 see Figure 26. This wet season haul route would cross one non-fish bearing perennial streams and three intermittent stream channels. All of these channels would likely be flowing water during wet season haul. Road 3828 is largely a ridgetop road that quickly climbs out of the Steamboat Creek valley bottom and generally does not parallel stream channels. Because this road climbs quickly out of the valley bottom on a ridge line most of the stream crossings are near the headwater areas of the streams. In order to have the haul route able to support wet weather haul, it is recommended that the road surface be graded, reprocessed, and compacted. Additionally, a 2% to 4% crown needs to be established on the road surface and ditches needs to be cleared of material that has settled in them.

Wet season log haul may occur on approximately 6.9 miles of road 3806, Chilcoot Road. This is a maintenance level 2 single lane aggregate surfaced road. Units included for wet season haul activities include skyline units 3 and 4, see Figure 26. This wet season haul route would cross two non-fish bearing perennial streams and seven intermittent stream channels. All of these channels would likely be flowing water during wet season haul. In addition to the overhaul of the drainage structures, in order to have the haul route able to support wet weather haul, the road surface should be graded, reprocessed, and compacted. Additionally, a 2% to 4% crown needs to be established on the road surface and ditches needs to be cleared of material that has settled in them. Approximately 100 cubic yards of 1.5” minus crushed aggregate is recommended to be added as spot rock during Specified Work. The aggregate shall be placed in areas that the

engineering staff expects to see excess wear. Additionally, another 50 cubic yards of 1.5” minus crushed aggregate should be placed as maintenance rock in order for the Purchaser to be reactive to problems that may arise during winter haul.

Wet season log haul may occur on approximately 0.9 miles of road 3811, Johnson Ridge Road. This is a maintenance level 2 single lane aggregate surfaced road. Units included for wet season haul activities include skyline units 6 and 7, see Figure 26. This wet season haul route would cross no non-fish bearing perennial streams and no intermittent stream channels. In order to have the haul route able to support wet weather haul, it is recommended that the road surface be graded, reprocessed, and compacted. Additionally, a 2% to 4% crown needs to be established on the road surface and ditches needs to be cleared of material that has settled in them. It is recommended that approximately 30 cubic yards of 1.5” minus crushed aggregate should be placed as maintenance rock in order for the Purchaser to be reactive to problems that may arise during winter haul. The maintenance rock shall be placed regardless of need. Since road 3811 is tributary to road 3815, wet weather haul would be dependent on design features on road 3815, for wet-weather haul, up to the junction with road 3811 to be performed.

Wet season log haul may occur on approximately 10.6 miles of road 3815, Johnson Creek Road. This is a maintenance level 2 single lane aggregate surfaced road. Units included for wet season haul activities include skyline units 6, 7, and 69, see Figure 23. This wet season haul route would cross one fish bearing perennial stream, no non-fish bearing perennial streams and six intermittent stream channels. All of these channels would likely be flowing water during wet season haul. In order to have the haul route able to support wet weather haul, it is recommended that the road surface be graded, reprocessed, and compacted. Additionally, a 2% to 4% crown needs to be established on the road surface and ditches needs to be cleared of material that has settled in them. It is recommended that approximately 60 cubic yards of 1.5” minus crushed aggregate should be placed as spot rock during Specified Work. The aggregate shall be placed in areas that the engineering staff expects to see excess wear.

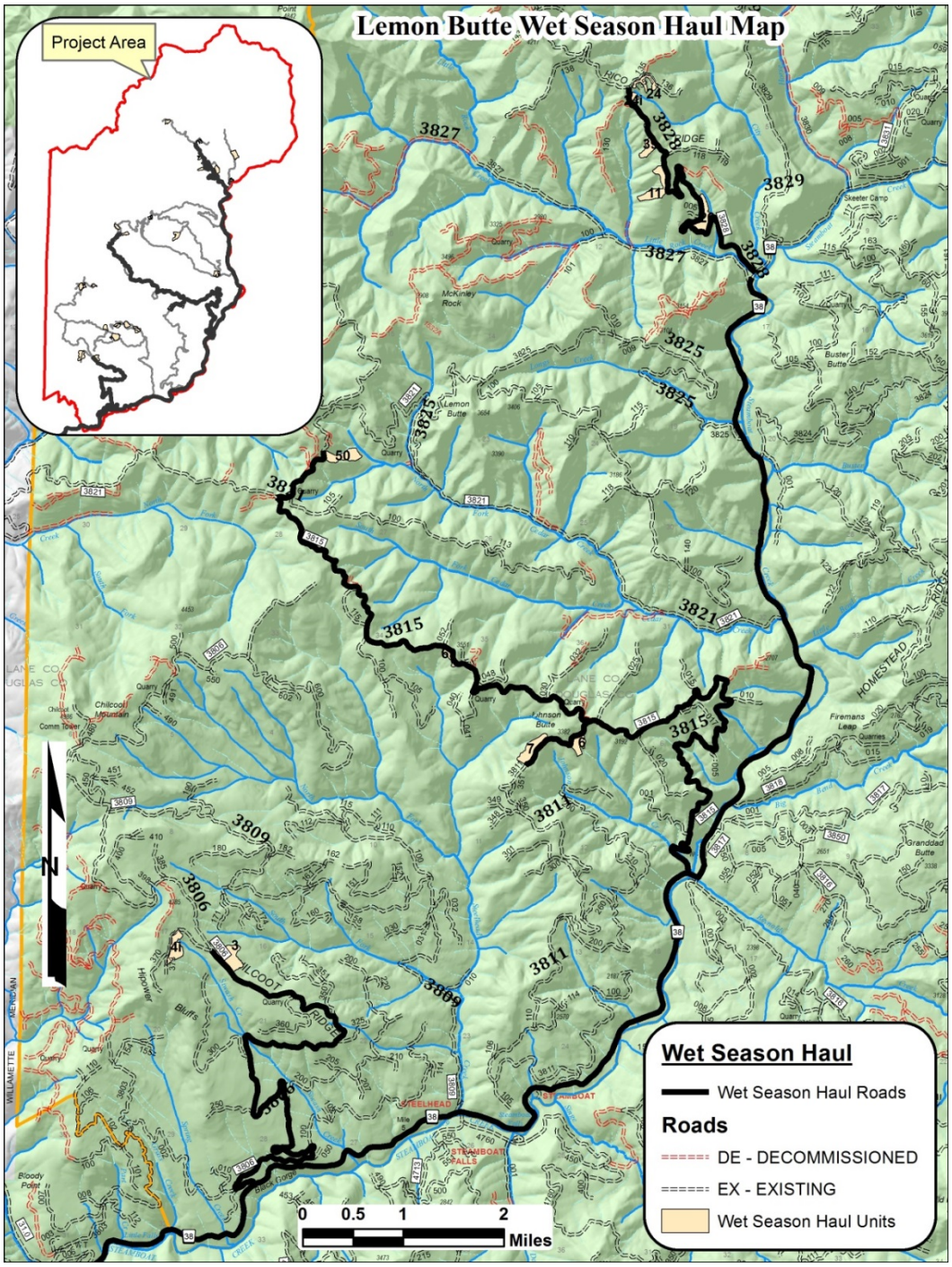
Wet season log haul may occur on approximately 0.8 miles of road 3821, Cedar Creek Road. This is a maintenance level 2 single lane aggregate surfaced road. Units included for wet season haul activities include skyline unit 50, see Figure 23. Tresource conhis wet season haul route would haul to road 3815 and would cross no fish bearing perennial stream, no non-fish bearing perennial streams and no intermittent stream channels. In order to have the haul route able to support wet weather haul, it is recommended that the road surface be graded, reprocessed, and compacted. Additionally, a 2% to 4% crown needs to be established on the road surface and ditches needs to be cleared of material that has settled in them.

The remainder of the identified wet season haul route is on approximately 16.8 miles of the paved portion of road 38, Steamboat Road. This is a maintenance level 4, double lane, asphalt surfaced road.

Road reconstruction and maintenance work must be completed prior to October 31 of the year haul is expected to occur. During wet season haul erosion control would be used to filter sediment moving off of the haul roads. These filters would be maintained as needed to remove trapped sediment. Removed sediment would be disposed of in areas not connected to stream channels. If identified maintenance is not completed by October 31 no wet season haul would be allowed until the following operating season. Logging activities including log haul can be suspended at any time of year when precipitation events are imminent or excessive road deformity would occur during haul due to road moisture conditions. Log haul would be suspended if road surface run off

carrying sediment is observed flowing in roadside ditches. All Umpqua Forest Road Rules would be enforced.

Figure 26. Wet Season Approved Units and Roads



Bridges

Over load permits would be required when hauling over weight loads across the bridges located on road 38, Steamboat Road. These bridges are located at milepost 5.60 Steelhead Bridge, 10.00 Steamboat-Reynolds Bridge, 10.90 Bend Creek Bridge, 11.90 Steamboat Bend Bridge, 13.10 Cedar Creek Bridge, 17.10 Little Rock Creek Bridge, and 17.40 City Creek Bridge. Specific requirement for the above bridges can be obtained from the Umpqua National Forest Bridge Engineer.

Rock Sources

The Bloody Point rock pit on road 3803-003 and Shane Saddle rock pit on road 3828, just south of the Calapooya Divide and the border between Cottage Grove and North Umpqua ranger districts, would be used as the rock sources for the road work.

Summary

Under Alternative 1 the 1.5 miles of compacted temporary roads would continue to exist within the planning area. No new temporary roads would be constructed and no road reconstruction, inactivation or decommissioning would occur. In addition, no purchaser road maintenance would occur.

Under Alternative 2 the new (0.50 miles) and existing (1.50 miles) temporary roads and new temporary road constructed on previously decommissioned roads (1.25 miles) would be obliterated (3.25 miles total); approximately 45 miles of road reconstruction and approximately 91 miles of maintenance would occur. The reconstruction and maintenance work would provide for safe and economical timber haul, as well as improved drainage capacity and reduced risk of failure. All maintenance level 1 roads used would have the appropriate closures as directed by Travel Management Plan, Subpart B (USDA, 2015).

Cumulative Effects

The Lemon Butte Planning Area is the scale at which cumulative effects are analyzed for roads. Several roads have received some level of road maintenance or reconstruction work in the past 10 years. This work includes road brushing, culvert cleanout, road grading, spot rocking, resurfacing with crushed rock, culvert upgrades and asphalt patching. All of the roads listed above would receive periodic road maintenance into the foreseeable future as well. All past, present and planned road improvement projects did not or would not have adverse effects to access, condition, or economics of the transportation system within the planning area. Therefore, no cumulative adverse effects would occur as a result of this project. All road maintenance and improvement work incorporates specifications that meet applicable Standards and Guidelines and Best Management Practices (see Appendix A).

Heritage Resources

The affected environment for heritage resources falls within the areas of proposed activities with the potential to affect those resources (timber harvest, fuels treatment activities, road construction, reconstruction, and decommissioning; subsoiling, landing construction, etc).

Regulatory Framework

Forest Plan goals and objectives and Cultural Resource (Heritage) Standards and Guidelines are listed in Chapter IV, pages 28-30 of the Umpqua National Forest LRMP. All applicable Standards and Guidelines have been met through the inventory and evaluation of the significant historic

properties as required under the National Historic Preservation Act (NHPA) of 1966, as amended. All significant aspects of potentially eligible sites shall be protected through mitigation measures.

A heritage resource inventory was conducted as part of the compliance process of section 106 of the NHPA. The Lemon Butte Planning Area project reconnaissance report was completed and submitted to the State Historic Preservation Office (SHPO) and Tribal Preservation Office (THPO) as required. The Lemon Butte Planning Area project cultural resources inventory and monitoring meets the criteria for Case-by-Case Review required by the Programmatic Agreement among the United States Department of Agriculture Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer Regarding Cultural Resources Management in the State of Oregon (PA).

The potential exists for unidentified heritage resources in the Lemon Butte Planning Area project implementation areas, and that those identified are larger than currently known. This is especially true in areas that were over grown by vegetation, and/or covered by dense down woody materials. Mitigation measures described in Chapter 2 would protect undiscovered heritage resources, lowering the potential for effects to these resources. Overall, proposed project activities have met the criteria of historic properties avoided for known heritage resources. Standard contract provisions would provide for protection of heritage resources discovered during project implementation.

The Umpqua National Forest sent a cover letter with the quarterly copies of the Schedule of Proposed Action (SOPA) to each of the Tribes. Each quarter, the cover letter highlights new projects and projects that may be of interest to the Tribes; the Lemon Butte Planning Area Project was identified as a new project when the project was first initiated. The Confederated Tribes of the Grand Ronde, Confederated Tribes of the Siletz, and the Cow Creek Band of Umpqua Tribe of Indians were contacted in this manner. Other contacts in the form of phone calls, letters, and opportunities to participate in public tours and public meetings, and meetings at Tribal offices were also utilized to interact with the Tribes.

Direct, Indirect, and Cumulative Effects

Under the treaties with the Tribes, no trust resources or reserved treaty rights are given for the lands managed by the Umpqua National Forest. Therefore, no effects to trust resources or reserved treaty rights would occur with any of the alternatives.

Based on the results of the heritage surveys, review and mitigation of known resources, mitigation of undiscovered sites, and consultation with tribes, there would be no direct, indirect, or cumulative effects on the known heritage resources as the result of implementing any of the proposed Lemon Butte Planning Area Project alternatives. Mitigation measures have been established which will protect historic properties' significance for eligibility to the National Register of Historic Places affected by the project. The no action alternative would have no direct or cumulative effect on any heritage resources. Indirectly, a wildfire and associated suppression activities may have the potential to burn or damage existing heritage resources, especially if the fire was of high intensity under Alternative 1.

National Historic Preservation Act

Cultural resources were identified in or near project activity areas. Implementation of mitigation measures on the attachment would ensure that there is no potential to adversely affect these sites. Therefore, the Forest Specialist has determined that there are historic properties, but the undertaking would have no adverse effect on them as defined by 36 CFR 800.16(i). The Lemon

Butte Project Area project meets the criteria for Historic Properties Avoided under Stipulation III (B)2. As proposed, the undertaking would have no effect on cultural resources. The State Historic Preservation Office (SHPO) issued concurrence on May 26, 2015.

Recreation

Relevant Standards and Guidelines

All Recreation Standards and Guidelines would be met with this project. No Recreation Standards and Guidelines apply based on the proposed action.

Specifically, standards and guidelines for developed recreation do not apply due to the low level of development for affected areas. For dispersed roaded and unroaded recreation, none of the activities fall within Roaded Dispersed Recreation Sites and Special Features (List IV-4), Special Interest Areas (List IV-5), Unroaded Recreation Management Areas (URMA- MA1) or the Oregon Cascades Recreation Area (OCRA). Similarly, no sensitive trails would be affected. Recreation Standards and Guidelines are listed on pages IV-11 to IV-18 of the LRMP.

Existing Condition

Recreation development in this portion of the North Umpqua Ranger District is low and limited to dispersed camping. Recreation activities in this area are also fairly low, but do include hunting, climbing, hiking and camping. Trails and associated trailheads within the planning area boundary include: Long Ridge Trail (#1532A) and Canton Creek Trail (#1537). The trailhead for Long Ridge Trail (#1532A) is approximately 320 feet from the edge of unit 46, however the unit would not be visible either from the trailhead or the trail. There are no units near Canton Creek Trail (#1537) or associated trailheads.

Direct and Indirect Effects

Alternative 1

There would be no direct or indirect effects under Alternative 1 (no action) as no actions would occur that would impact recreationists or recreational opportunities.

Alternative 2

Dispersed Sites

While unlikely due to the low number of dispersed sites in the area, some dispersed sites may experience some short and possibly long term effects. Landings or pull offs traditionally used as dispersed camping sites may be temporarily closed to allow for operations in the area, while other dispersed campsites may be within the harvest areas. The effects on such sites would vary depending on prescription used, but generally the area would be left more open. Indirect effects include activity sounds and log traffic Monday through Friday.

Trails

Effects to trails under Alternative 2 would be limited to indirect effects to trail Long Ridge Trail (#1532A) and possibly Canton Creek Trail (#1537). Indirect effects include sounds that may travel during logging operations, such as chainsaws, whistles, etc, along with increased traffic along rd 3821. Short-term air quality impacts (visibility) during fuel treatment operations may affect both Long Ridge Trail (#1532A) and Canton Creek Trail (#1537).

Recreationalists

Overall, the primary effects to recreationists and recreational opportunities (such as driving for pleasure and hunting) in the planning area under alternative 2 would include short-term noise disturbance during logging operations; short-term traffic congestion during yarding and logging operations; possible short-term access limitations (temporary road closures) during logging and yarding to protect the safety of forest visitors; and short-term air quality impacts (visibility) during fuel treatment operations.

In general, all effects to recreationists would be limited in extent and duration, however activities may recur over more than one season.

Connected Actions

None of the connected actions would have any lasting effects on the recreation resources. Short term impacts include equipment blocking or taking up space on roads, fire or forestry personnel moving or driving throughout the forest, increases in traffic from crew movement during thinning operations. All of these impacts would be short term and are not expected to have a major effect on recreation in the area.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area.

There would be no cumulative effects under Alternative 1 (no action) as no actions would occur that would impact recreationists or recreational opportunities.

For Alternative 2, ongoing and reasonably foreseeable future actions that may contribute to the cumulative effects analysis for Lemon Butte T.S. EA include the fuel treatments and the Ragged Ridge Prescribed burning. Project activities for this project may occur on a yearly recurring basis during spring and/or fall until projected number of acres is achieved. These projects may overlap with direct and indirect cumulative impacts on recreation users during spring and fall. Direct effects on recreationalists (specifically hunters) would include limited access to the areas being treated to protect the safety of the forest visitors. Indirect effects include short term air quality impacts (visibility). Because of the short duration, the effects on recreation are considered minimal when considering the cumulative effects of past, ongoing and foreseeable future actions within the Lemon Butte Planning Area.

Visuals

Relevant Standards and Guidelines

The Umpqua LRMP applies the Visual Management System (Agriculture Handbook Number 462) as a minimum standard that project proposals should achieve when implemented. The Visual Management System sets forth the criteria to determine Visual Quality Objectives (VQO) based on the distance zone, variety class and sensitivity level of the area. VQOs include Preservation, Retention, Partial Retention, Modification and Maximum Modification. While visual resources can also be described by the USDA's National Forest Scenery Management System (SMS) (Agriculture Handbook Number 701), the Umpqua National Forest LRMP has not been amended to officially adopt this system. However, SMS terms are described in parenthesis where applicable.

In addition, the Umpqua LRMP has specific Visual Standards and Guidelines that are associated with sensitivity level 1 or 2 routes, water bodies and use areas. None of the specific Visual Standards and Guidelines would be affected with this project. All general Visual Standards and Guidelines pertaining to Visual Quality Objectives and associated restrictions would be met or exceeded with this project. Visual Standards and Guidelines are listed on pages IV-19 to IV-26 of the LRMP.

Existing Condition

For the Lemon Butte Planning Area, VQOs include partial retention (moderate scenic integrity), modification (low scenic integrity) and maximum modification (very low scenic integrity). In the areas where the VQO is partial retention, management activities are to remain visually subordinate to the characteristic landscape. In areas with a VQO of modification, management activities may visually dominate the landscape; however, roads and visible remnants from logging such as slash and stumps, etc. should remain visually subordinate to the landscape. The maximum modification VQO allows management activities of vegetative and landform alterations to dominate the landscape.

The majority of the planning area is in modification or maximum modification with a corridor of partial retention along a portion of RD 38. The south portion of unit 14 and a section of the eastern portion of unit 26 are within Partial Retention, while the rest of the units fall either within modification or maximum modification.

No visually sensitive areas listed in the LRMP would be affected by proposed activities.

Direct and Indirect Effects

Alternative 1

Alternative 1 (no action) would have no direct or indirect effects to the visual quality of the area because no ground disturbing activities would occur.

Alternative 2

The prescription under alternative 2 would meet the requirements for partial retention as it would leave sufficient trees to minimize the visual impact on the landscape, thus naturally borrowing the line, color, and texture from the existing landscape. Partial retention has a suggested gap creation of 0.5 to 1.5 acres in size, while the prescription has 0.5 to 1.0 acre gap creation. As such, the prescription for alternative 2 would meet a higher VQO for units in modification and maximum modification and would meet the VQO for units in Partial Retention.

Typical direct effects to visual resources would be short term and include sight of equipment, landings, wood piles and associated timber harvest activities. The area would be considered to be recognizable as managed for approximately 60 years, by which point regeneration would hide most traces of harvest activities. Units under alternative 2, however, already fall within areas harvested within the last 60 years.

Fuel treatments do have the potential to directly and indirectly impact visuals, especially if the burn were to run ‘hot’ and consume more slash or trees than planned. However, the effects from the slash burns would fade after a few years as vegetation grows and the burned area no longer becomes visible.

There are no known adverse indirect effects. LRMP standards and guidelines and VQOs would be met or exceeded.

None of the connected actions would have any lasting effects on the visual resources. Short term impacts include equipment visible in and along roads, small piles visible along roads, charred vegetation visible after burning, and other minor changes to the visible environment; these are all considered normal forest activities that a visitor would reasonably expect to see in a National Forest.

Cumulative Effects

Alternative 1 (no action) would not have cumulative effects to the visual quality of the area because it does not alter the landscape. Alternative 2 would have short term and minimal direct effects, given the prescription calls for thinning stands and prescribed burning within units that have been harvested within the last 60 years. LRMP standards and guidelines and VQOs would be met or exceeded. When considering past projects, present activities, and foreseeable future activities, no cumulative effects are anticipated to occur with these alternatives

Under both alternatives, there would be no significant effects to any Wild and Scenic Rivers. While the Umpqua Wild and Scenic River Corridor is within the planning area, none of the activities are planned within the corridor.

Potential Wilderness Evaluation

Relevant Standards and Guidelines

The potential wilderness area analysis for the Lemon Butte Timber Sale project is based on and is consistent with the criteria found in Forest Service Handbook (FSH) 1909.12, sec. 71.

Per Forest Service Handbook 1909.12, sec 71.11(9), any managed stand which have substantially recognizable stumps, skid trails, or evident management do not qualify for potential wilderness areas.

- Areas managed within the last 60 years are considered to retain features that are evident of management, and would not qualify for potential wilderness areas.

Existing Condition

Due to the nature of this project, all units for the Lemon Butte Timber Sale are within areas that have been managed within the last 60 years. There are no units planned within any unmanaged or potential wilderness area. Identification of these areas is project specific and situational. This does not constitute as an official inventory. Official inventories of potential wilderness areas are completed during forest planning.

Direct and Indirect Effects

Alternative 1

There would be no direct or indirect effects under Alternative 1 (no action) as no actions would occur that would impact any undeveloped or potential wilderness areas.

Alternative 2

There would be no direct or indirect effects under Alternative 2 as no actions would occur that would impact any undeveloped or potential wilderness areas because all units are limited to areas managed within the last 60 years. No undeveloped areas would be removed from the available pool for potential wilderness. Units managed under alternative 2 would reset to 60 years before they are considered unmanaged.

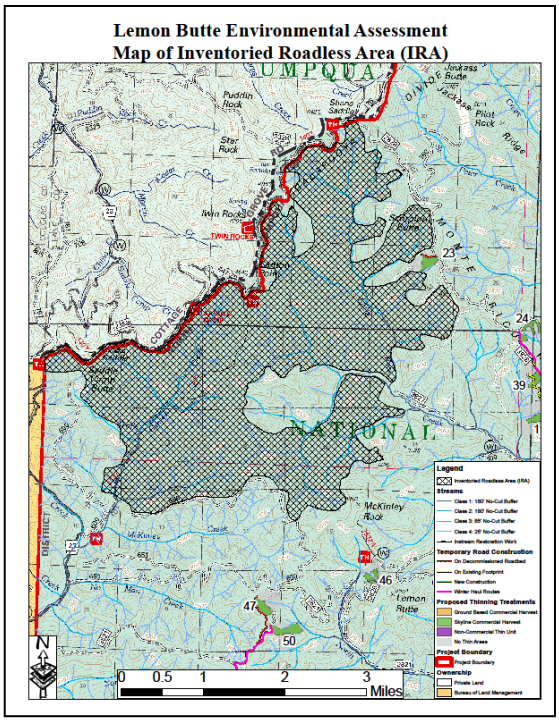
Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area.

Alternative 1 (no Action) would not have cumulative effects to potential wilderness areas. Similarly, alternative 2 would not have cumulative effects because the units are limited to areas that have been managed within the last 60 years. As such, no areas have been removed from the pool for potential wilderness areas. Managed stands would reset to 60 years before they are considered unmanaged.

Under all alternatives, there would be no significant effects to any Wilderness because no project activities would occur within or adjacent to a wilderness area.

Inventoried Roadless Areas (IRA)



Existing Condition

While the Canton Creek IRA is within the Lemon Butte planning area, no units are planned within any IRA. Unit 23 is the closest and only unit proximal to the IRA. Unit 23 is within areas that have been managed in the last 60 years.

Direct and Indirect Effects

Alternative 1

There would be no direct or indirect effects under Alternative 1 (no action) as no actions would occur that would impact any IRA.

Alternative 2

There would be no direct or indirect effects under Alternative 2 as no actions would occur that would impact the Canton Creek IRA or any other IRA.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area.

Under both Alternatives 1 and 2, there would be no contribution to IRA cumulative effects because none of the units are within an existing IRA.

Under all alternatives, there would be no significant effects to any IRA because no project activities would occur within any IRA.

Prime Farmlands, Rangelands, Forestlands, and Parklands

No prime farmlands, rangelands, forestlands or parklands exist within the area; therefore; no direct, indirect or cumulative effects would occur.

Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs Federal agencies to address environmental justice by identifying and disclosing the effects of the proposed activities on minority and low-income populations. The effects of the alternatives on the economic conditions of the State and county are disclosed in the Economics section of this chapter.

According to 2013 statistical data for Douglas County, about 11% of the population is made up of minorities. Unemployment and poverty in the county is higher than the State average. The project occurs well away from any large population center that would be directly affected by the project. Several small communities are located along the haul routes, some of which may see an increase in business during logging operations and an increase in traffic. The ongoing and reasonably foreseeable activities may also contribute to log truck traffic; overall, this increase in traffic may be measurable, but would not be comparable to the logging that occurred in the area in the late 1980s. No other adverse direct, indirect, or cumulative effects to these communities are expected to occur.

Areas that would be treated by the project may have some recreational value, as described in the recreation section. Where there is dispersed recreation, the effects to those recreating in the area would be greatest. Minority groups or low-income groups that use these areas may be impacted during logging operations by the increase in log truck traffic. These groups may choose to recreate elsewhere. Adverse impacts to these groups would end when logging and other connected actions are completed. Overall, none of the action alternatives imposes any other additional hardships on minority or low-income communities; therefore, there would be no direct, indirect, or cumulative effects to environmental justice with any action alternative. Alternatives would have no direct, indirect, or cumulative effects to any low-income or minority populations that utilize the area for recreation.

Consumers, Civil Rights, Minority Groups, and Women

Contracting procedures would ensure that projects made available to contractors through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups. Because of this consideration, there would be no direct, indirect, or cumulative effects to consumers, civil rights, or minority groups with implementation of any of the alternatives. (Executive Order 12898)

Conflicts with Plans, Policies, or Other Jurisdictions

Implementation of any of the alternatives would not conflict with the plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act, Endangered Species Act, and the National Historic Preservation Act. Effects to air quality and compliance with the Clean Air Act are described in this chapter. (40 CFR 1502.16(c))

Potential or Unusual Expenditures of Energy

Alternative 2 would require expenditures of fuel for workers to access the Lemon Butte Project for use of power equipment and to utilize the logging systems. Alternative 1 would require no expenditure of fuel. No other direct, indirect, or cumulative effects are expected to occur with any of the action alternatives. (40 CFR 1502.16(e))

Chapter 4

Public Involvement

Public involvement for the Lemon Butte Project began with the publishing of the May 2014 Schedule of Proposed Actions (SOPA). A scoping notice describing a draft proposed action was sent to approximately 80 members of the public on August 19, 2014, which initiated the scoping period. The scoping letter also included an open invitation to attend a public field trip to the project area on September 12, 2014. Eleven members of the public attended the field trip.

The Lemon Butte interdisciplinary team received eight letters from the public; seven letters were supportive with suggestions and one letter was against. The Confederated Tribes of Grand Ronde Indians, the Confederated Tribes of Siletz Indians, and the Cow Creek Band of Umpqua Indians' tribal governments were sent a letter describing the project and solicited comments, however no comments were received.

The scoping letter also included treating a 6,058 acre natural stand prescribed fire area in the proposed action. The prescribed fire area has been removed from this EA and is discussed as an alternative eliminated below. A letter was sent to the scoping mailing list describing this change on May 20, 2015.

On November 9, 2015 another update letter was sent to inform the public that the commercial thin portion of the proposed action from 1,046 to 603 acres. After additional field review it became clear that some areas within the initially proposed units already met density prescription objectives. Additionally, some of these areas already have small openings with species and structural diversity considered characteristic under a natural disturbance regime. The Deciding Official determined that silviculture treatments in these areas would be unwarranted

The Lemon Butte administrative record contains a detailed scoping summary that describes Forest Service outreach efforts, the scoping comments received for the project, and how the Forest Service addressed scoping comments in the Lemon Butte EA.

Agency and other Government Consultation

The regulatory agency charged with overseeing the Endangered Species Act (ESA), the U.S. Fish and Wildlife Service (USFWS), was consulted and communicated with as appropriate during the planning process. A Biological Assessment was submitted to the USFWS and a letter of concurrence is expected in summer 2016. Tribal consultation also occurred, as discussed in the previous paragraph. The Lemon Butte Planning Area project reconnaissance report has been completed and submitted to the State Historic Preservation Office (SHPO) and Tribal Preservation Office (THPO) as required.

Interdisciplinary Team

The following people are members of the Interdisciplinary Team (IDT) that participated in the preparation or review of all or part of this environmental assessment:

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Errin Trujillo	Wildlife Biologist
Ron McMullin	Fisheries Biologist
Mark Sommer	Hydrologist
Bryan Benz	Botanist
Monica Ramirez	Fire/Fuels Specialist
Steve Hanussak	Engineering Technician
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Miguel Amat y Leon	Recreation Specialist
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Lori Miller	Logging Systems

In addition, the following people assisted in developing the proposal or in the editing and review of this document:

Mike Gebben	Geographic Information Systems Specialist
Tiffany Young	Forest Wildlife Biologist
Jane Beaulieu	Forest Environmental Coordinator

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Appendix A

Best Management Practices, Project Design Features, and Mitigation Measures

The following measures address the laws, regulations and policies that relate to reducing potential environmental effects. These requirements apply to the action alternative. Project Design Features are defined as actions that:

- avoid the impact all together (such as avoiding harvest on unstable land);
- minimize effects by limiting the degree or magnitude of the action;
- rectify the impact via rehabilitation or restoration activities;
- reduce the impact over time through recurring operations such as road maintenance.

Best Management Practices (BMPs) protect the beneficial uses of water and address water quality objectives as required by the Federal Clean Water Act (USC 2002) and the 1990 Forest LRMP. The BMPs are listed by codes used in the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA, FS-990a, 2012) which is available here: http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

As a summary, "the Forest Service National BMP Program is the agency's nonpoint pollution source pollution control for achieving and documenting water resource protection" (USDA, FS-990a, 2012). The "Implementation and monitoring of these Best Management Practices is the fundamental basis of the Forest Service water quality program to protect, restore, or mitigate water quality impacts from activities on NFS lands" (USDA, FS-990a, 2012). Each BMP category lists an associated Forest Service Manual, Forest Service Handbook, and/or timber sale contract reference to find more information. Each BMP also lists the associated objective and practices. In this document you will find the local, site specific, practices initiated by the interdisciplinary team while the National Core BMPs are hereby included/ incorporated by reference.

Project Design Features

Cultural Mitigations

- In the event that an unknown historic or prehistoric site is discovered in the course of the project, the activity will be stopped and the appropriate measures will be taken to stop any adverse effects to the site resulting from the activity (BT6.24). Any adverse effects, should they occur, shall be mitigated.
- Heritage resources were identified during project inventory. Following Stipulation IIIB.2(C) of the PA the Forest Archaeologist has determined the following protection measures for a determination of *Historic Properties Avoided* as described in the PA under Standard Case-by-Case Review. The protection measures outlined in the memo from the Forest Archaeologist regarding this undertaking will be implemented.

- Heritage clearance for this project is based on an impact area survey. Connected and/or similar actions, activities outside of units, or activities with unknown locations or unspecified scope of work may require additional monitoring or separate clearance.
- Site monitoring will be conducted in order to evaluate the effectiveness of mitigation measures and the need for additional preventative measures.

Fire Mitigations

- Burn plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire.
- As needed, fire lines would require water bars at slopes greater than 30%. Fire line water bars would deflect surface run-off from the trail down slope onto stable material such as rock surface cover. Fire lines would be constructed in units designated for underburning. Sale area map will show fireline location(s).
- Burning would be conducted to meet air quality standards as outlined by Oregon DEQ, and air quality monitoring would be conducted in conjunction with the DEQ.
- Maximum depth of slash on temporary roads and landings is 12 inches.
- Grapple piles would be constructed to the following specifications: All slash from 1 inch in diameter up to 6 inches in diameter and exceeding 3 feet in length shall be piled. Piles would be constructed compactly with minimal soil in the piles and covered to shed water so they remain dry for burning during the fall or winter; height would be at least 6 feet and no greater than 12 feet; width would be at least 6 feet and no greater than 10 feet. Piles would be evenly spaced between trees and snags left after harvest. Piles would be placed on temporary roads or designated equipment trails when possible. Piles would be placed at least 50 feet away from live streams.
- Machine piles at landings will be built by grapple or shovel to keep dirt and rock debris out. No cat piling or pushing of piles.
- Where the volume of landing and roadside slash exceeds the ability to create piles and meet pile size and location specifications above, slash would be returned to temporary roads and designated forwarding corridors for piling or dispersal after subsoiling, if needed.

Wildlife Mitigations

- To protect nesting spotted owls, for proposed and connected actions that create above-ambient noise levels within 60 meters of known spotted owl nesting sites or un-surveyed suitable habitat (i.e. road maintenance, chainsaw use, heavy equipment use, or haul). When possible, do not schedule these activities to occur between March 1 and July 15.
    - These seasonal restrictions apply to units: 3,6,7,11,14,19,21,23,24,26,31,46,48,50,54,60,61
- Unit 48- To reduce impacts to Spotted owls during nesting season, road construction for the temporary road will follow seasonal restrictions (March 1st-July 15th). In addition to this, any trees over 20”DBH that need to be felled during construction will be dropped into the adjacent stand, to the east of the road.
- Timber harvest operations and post-sale fuels treatments will be managed to help achieve snag availability objectives
    - Standing green trees in any gap are available for snag creation techniques

- Gaps will be available for supplemental planting of coniferous tree, broad-leaf tree, forbs, and shrubs to increase species diversity
- Where seeding occurs for erosion control or noxious weed control, desired forage species may be included
- Retain existing large down wood (>6 inch diameter) and snags (>9 inch dbh) to the extent practical and safe. Where feasible, avoid mechanical impacts and movement of large down wood and leave felled snags on site. Care will be taken when yarding to attempt to avoid loss of bark on downed wood. If possible, directionally fall and yard trees away from large downed wood.
- If feasible, in skyline units, retain all trees used as anchors in the skyline operation as long as they do not pose a hazard.
- OSHA requires that hazardous trees/snags be felled to protect workers on the ground during forest operations. Snags that must be felled for safety reasons should be retained to help attain down wood requirements.
- When felling hazard trees retain as high of a stump as is operationally safe to do so.
- All trees damaged during harvest operation, such as intermediate support trees or corridor damage trees, would be retained to mitigate the decreased rate of snag recruitment caused by thinning and harvest activities.
- Leave all guyline tail-hold trees outside of unit boundaries.
- Anchor Tree Selection: Cable logging systems may use healthy green trees to anchor rigging (tailholds) and yarders (guyline trees). Anchor tree removal will not occur in any habitat type. The smallest possible anchor trees will be selected in all instances, trees with suitable spotted owl nest structures will be avoided when possible, and anchor trees will be left standing when feasible. These measures will help to reduce impacts to spotted owl habitat features. Anchor Tree felling of occupied nest trees will be strongly avoided where- and whenever possible (due to lack of current surveys throughout the planning areas, the Forest cannot be absolutely certain no occupied nest trees will be felled). The following features will minimize the likelihood of felling occupied nest trees: when large guyline trees are necessary, trees closer to the road will be selected in lieu of trees farther into the adjacent stand; trees with characteristics suitable for spotted owl nesting will be avoided wherever possible; use of guyline trees necessitating felling of large snags in the adjacent stands will be avoided wherever possible; use of guyline trees close enough to possible nest trees that felling them will disrupt the current micro-climatic conditions associated with said possible nest trees will be avoided wherever possible. Guyline trees felled for safety reasons will be left on site when felled outside of units after the cessation of logging operations. All anchor trees outside of unit boundaries are to be retained as either live trees or snags if they have been topped.

Underburning Activity Fuels

- To the extent practical, conduct as much of the noise-generating work, such as chainsaw use, outside of the critical spotted owl nesting season (March 1 to July 15) as possible.
- To the extent practical, conduct as much of the noise-generating work outside of the peregrine falcon nesting season (January 15 to July 31) as possible.
- To the extent practical and safe, maintain existing down wood and standing snags.

Fisheries Management (Instream Habitat Restoration)

- Instream restoration activities shall occur between July 01 and September 15 of any implementation year unless otherwise agreed upon.
- All restoration sites will be reviewed by Forest Service Botany, Wildlife, Heritage, and Aquatic resource personnel prior to implementation.
- All instream restoration implementation will follow criteria outlined in the Aquatic Restoration Biological Opinion. (USFWS, 01EOFW00-2013-9664, and NMFS, NWP-2013-9664)

Vegetation Management

- Rx Reforestation activities will occur in the gaps in all thinning units as well as within the heavy thinning portions of each thinning unit. Planting of reforestation seedlings will include a mix of three species (SP, IC, WRC) and at variable densities to replicate natural stocking patterns. Seedlings will not be uniformly spaced.
- Rx Big game repellant will be applied to planted seedlings at the time of spring planting for animal damage protection.
- Rx Bare root stock will be inoculated with mycorrhizal fungi spores mixed with water and a material, such as Terrasorb, immediately before outplanting.
- Rx Seedling handling will meet Region 6 standards.
- Rx Minor conifer species will be preferred for retention in harvested areas, as feasible. Generally, these include non-Douglas-fir species, such as ponderosa pine, sugar pine, and western hemlock.

Botanical Management

- In units containing dry unique habitats, units 7, 11, 14, and 50, harvest activities will not occur within these habitats and trees will be directionally felled away from the edges. (Umpqua N.F.LRMP, Programmatic Forest Plan Amendment for Unique and Mosaic Habitats, Jan. 2015).
- Treatment of weeds would be based on the Forest Integrated Weed Management Decision Notice and Finding of No Significant Impact signed in June 2003. The Forest Service will flag noxious weed sites to be avoided in the higher priority sites, prior to work commencing. Infested sites to be avoided will be marked with florescent orange flagging and labeled “NOXIOUS WEEDS” with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated “A” noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the Forest Service.
- Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands (Prevention Standard 2—Regional Invasive Plants FEIS and B/BT6.35).
- A District or Forest weed specialist will inspect active gravel, fill, sand stockpiles, quarry sites and borrow material for invasive plants before use and transport. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (including material from commercial sites) (Prevention Standard 7 - Regional Invasive Plants FEIS).

- Treat or require treatment of infested sources before any use of pit material (Prevention Standard 7 - Regional Invasive Plants FEIS). Starting with the highest slopes that have invasive vegetation growing in previously disturbed areas scrape off the top several inches of soil and rock to remove all of the seed bank. Stockpile this material in a location at the quarry where it would not be disturbed, i.e. no machinery should drive over the pile. This contaminated material would be monitored and covered as necessary to ensure it does not become a future source of weeds at the quarry.
- All personnel, contractors, etc. working on the project will be made aware of the high priority "A" weeds (specifically Scotch broom) that could be found during activities; any high priority noxious weeds found should be reported to the Forest Service.
- Use signs such as "logging use only" to discourage public access to active road construction sites by establishing road closures. Allowing only vehicles involved with the construction on the site will help limit introduction of noxious weed seed.
- After harvest, treat remaining or new infestations of noxious weeds for up to three years following sale closure.
- Wherever possible, use native re-vegetation techniques to reestablish native plants on sites where weeds are removed as well as in areas where exposed mineral soil provides optimal conditions for weeds to colonize. Native plant materials are the first choice in re-vegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species); 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants; 3) if native plant materials are not available; or 4) in permanently altered plant communities.
- Under no circumstances will non-native invasive plant species be used for re-vegetation (Prevention Standard 13 - Regional Invasive Plants FEIS).
- Maintain desirable roadside native vegetation. If desirable vegetation is removed to bare mineral soil during blading or other ground disturbing activities, that area must be re-vegetated.
- Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists; incorporate invasive plant prevention practices as appropriate (Prevention Standard 8 - Regional Invasive Plants FEIS). Weed areas of concern will be marked with orange flagging and labeled "NOXIOUS WEEDS" with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated "A" noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the COR/FSR. Whenever possible, roadside brushing will be accomplished prior to seed setting of noxious weed species (approximately late June) in noxious weed flagged areas. The intent of this is to stop and/or prevent noxious weed spread and establishment.
- If needed, use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch are not available then it must be certified, all states, noxious weed-free (Prevention Standard 3 - Regional Invasive Plants FEIS). Note: because of the aquatic nature of rice, the harvested straw is already considered weed-seed free. The District or Forest weed specialist may approve the use of rice straw for some applications.

Best Management Practices (BMPs)

General Planning Activities

Plan-1. Forest and Grassland Planning

Manual or Handbook Reference

- Forest Service Manual (FSM) 1900, FSM 1920, Forest Service Handbook (FSH) 1909.12, and FSM 2511

Objective

- Use the land management planning and decision making processes to incorporate direction for water quality management consistent with laws, regulation, and policy into land management plans.

Site Specific BMPS

- No site specific additions

Plan-2. Project Planning and Analysis

Manual or Handbook Reference

- Forest Service Manual (FSM) 1950, Forest Service Handbook (FSH) 1909.15, and FSM 2524.

Objective

- Use the project planning, environmental analysis, and decision making processes to incorporate water quality management BMPs into project design and implementation.

Site Specific BMPS

- No site specific additions

Plan-3. Aquatic Management Zone Planning

Manual or Handbook Reference

- Forest Service Manual (FSM) 2526

Objective

- Use the land management planning and decision making processes to incorporate direction for water quality management consistent with laws, regulation, and policy into land management plans.

Site Specific BMPS

- No site specific additions

Aquatic Ecosystems Management Activities

AqEco-2. Operations in Aquatic Ecosystems

Manual or Handbook Reference

- None Known

Objective

- Avoid, minimize, or mitigate adverse impacts to water quality when working in aquatic ecosystems.

Site Specific BMPS

- Protect all no-harvest stream and wetland buffers with directional felling (C/CT6.41#), and waive debris cleanout of streams (B/BT6.5).
- Trees that are in no-harvest buffers and are damaged during timber harvest or road activities will be left on site.

- Restrict ground-based equipment entry to beyond 50 feet of streams and wet areas, or outside the no-harvest buffer, whichever is greater.
- The following are the recommended minimum no-harvest buffer widths to ensure protection of unmapped streams and wet areas identified during project implementation. The district hydrologist or fish biologist will be consulted to assign appropriate or to modify stream buffers. Buffers must assure compliance with ACS and the NWFP Temperature TMDL Implementation Strategy by providing the following minimum buffer widths:
    - fish bearing perennial streams: 180 foot buffers
    - non-fish bearing perennial streams: 85 foot buffers or the slope break, whichever is greater
    - intermittent streams without erosion concerns: 25 foot buffers or the slope break, whichever is greater
    - wet unique habitats greater than 1 acre: 150 foot buffers.

AqEco-3. Ponds and Wetlands

Manual or Handbook Reference

- None Known

Objective

- Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

Site Specific BMPS

- Wetlands should be protected from ground disturbance or substantial microclimate change by applying no-harvest buffers for commercial operations. No logging corridors, roads or landings would be put in no-cut buffers.

Chemical Use Management Activities

Chem-6. Chemical Application Monitoring and Evaluation

Manual or Handbook Reference

- Forest Service Manual (FSM) 2150.1; Forest Service Handbook (FSH) 2109.14, chapter 50.

Objective

- Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected nontarget effects.
- Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other nontarget resources or areas by chemicals.

Site Specific BMPS

- Monitor the application of dust abatement chemicals.
- Perennial stream crossings will be buffered by 50 feet on each side of the stream based on the center of stream channel and one foot from the edge of the road. The streams will be GPSed by engineering during road design and include in the Sale Area Map. All stream crossings requiring dust abatement buffers will have the buffers flagged for identification prior to dust abatement application.
- Application of dust abatement will occur between July 1 and September 30. Dust abatement will not be applied when raining and will only be applied if there is a 3-day forecast of clear weather.

Road Management Activities

Road-1. Travel Management Planning and Analysis

Manual or Handbook Reference

- Forest Service Manual (FSM) 7710; Forest Service Handbook (FSH) 7709.55; and FSH 7709.59, Chapter 10.

Objective

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

Site Specific BMPS

- No site specific additions

Road-2. Road Location and Design

Manual or Handbook Reference

- Forest Service Manual (FSM) 7720 and Forest Service Handbook (FSH) 7709.56.

Objective

- Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Site Specific BMPS

- No site specific additions

Road-3. Road Construction and Reconstruction

Manual or Handbook Reference

- Forest Service Manual (FSM) 7720; Forest Service Handbook (FSH) 7709.56; and FSH 7709.57.

Objective

- Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.

Site Specific BMPS

- During construction and reconstruction activities, unsuitable or excess excavated soil material shall be placed in Forest Service approved waste sites. Spread and shape material to drain. Finish slopes on waste no steeper than 1V:1.5H. Furnish and spread straw/hay or wood chips uniformly on finished slopes. Straw must be certified noxious weed free.
- Relief culvert locations will be located, flagged, and approved by the Forest Service before installation to ensure that water is routed only onto stable soil/vegetation.

Road-4. Road Operations and Maintenance

Manual or Handbook Reference

- Forest Service Manual (FSM) 7732; Forest Service Handbook (FSH) 7709.59, Chapter 60.

Objective

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

Site Specific BMPS

- Erosion control measures (e.g. silt fences, weed-free straw/straw bales, etc.) will be placed and maintained at sites that have potential for off-site sediment movement or to deliver sediment to the stream network during the wet season haul on or immediately preceding expected seasonal periods of precipitation or runoff. If off-site sediment movement is noted, additional erosion control measures will be placed and maintained.
- Road construction or reconstruction operations (including culvert replacements) will occur during the normal operating season.
- Avoid blading ditches that are vegetated, functioning, and effectively draining. Remove vegetation from swales, ditches, shoulders, and cut and fill slopes only when it impedes adequate drainage, vehicle passage, or obstructs necessary sight distance to avoid or minimize unnecessary or excessive vegetation disturbance.
- Implement suitable erosion control measures during drainage maintenance and reconstruction and immediately preceding mechanical vegetation treatments.
- Applied erosion control measures associated with road work will be inspected for functionality and maintained during operations as determined by the Sale Administer and Engineering Representative.
- Aggregate will be placed on access roads into water sources to reduce sedimentation to streams, as needed.
- Haul on native surfaced roads should not occur during the wet weather or outside of the normal operating season. Surface rock placement less than 75 cubic yards per mile may be done outside the normal operating season as weather and road conditions permit, but no surface rock can be added outside the normal operating season to extend the season of haul on native surface roads.
- Spot rocking of less than 75 cubic yards per mile of aggregate may be required for road maintenance with an approved gradation at locations designated by the Forest Service. Roads requiring more than 75 cubic yards of aggregate for more than a mile would fall under road reconstruction (USFS-R6 Road Maintenance Handbook 7709.59 Chapter 60) requiring work to be completed within the normal operating season. Only those roads that have been brought up to Forest Service standards during the normal operating season and placed on the project's transportation map during NEPA would be considered suitable for winter haul. Roads approved for winter haul, but later found to require more than 75 cubic yards per mile of spot rocking in order to prevent "road distress" would no longer be considered suitable until reconstructed during the "normal operating season".
- All exposed soils will have required erosion control treatments completed the same year they are constructed before October 31, even if they are not completed to final acceptance specifications. If the same area requires further disturbance to complete the road construction, it will be treated for erosion control as needed to insure surface soil protection and the potential for off-site movement of sediment.
- Construction activities that may expose new soil (including clearing, grubbing, excavating, and fill placement) will be limited to the normal operating season (June 1 to October 31). However, construction activities will be suspended anytime during wet weather to prevent the potential for off-site movement of sediment. Construction sites will be treated for erosion control as needed to ensure surface soil protection sufficient to prevent off-site movement of sediment.

- Water bars sufficient to disperse surface water runoff before it becomes concentrated flow in a 50-year storm event shall be designated by the Forest Service and implemented before October 31.Waterbars shall be of sufficient depth to capture water flowing though the road aggregate as well as to prevent future traffic on all Maintenance Level 1 system roads. Waterbars shall include the entire road width including drainage ditches and have outlets that are clear of debris.
- No dust abatement chemicals will be applied within one foot of the outside edge of road ditch lines, see Chemical Use Management section above for more information.
- Work consisting of cleaning bridge decks and curbs, and cutting vegetation growth will be done in accordance with Forest Service Specification (T-833F – Bridge Maintenance Specification).
- Rock quarry benches, access roads and work areas should be sloped to drain and disperse surface water without ponding. Runoff should not flow directly into streams.
- Road use shall conform with the Umpqua National Forest's road rules ("Commercial Road Use Rules And Road Use Permit Requirements", Umpqua National Forest, May 2012)

Road-5. Temporary Roads

Manual or Handbook Reference

- Covered in timber sale contracts. CFR Subsection CT5.12, Section B(T)5.2, Subsection B(T)6.63, and items B(T)6.631, B(T)6.64, B(T)6.65, B(T)6.66, B(T)6.67. The final treatment for temporary roads, after the purchaser's use is completed, is described in contract provision B(B(T))6.62 - Temporary Roads

Objective

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

Site Specific BMPS

This treatment is designed to reduce erosion, preclude further use of the road, and ensure reestablishment of vegetative cover that has been disturbed by the construction of the road, within ten years after the termination of the contract, permit, or lease either through artificial or natural means as required by the National Forest Management Act of 1976 (16 U.S.C. 472a).

- **EXISTING TEMPORARY ROADS** - Existing uninventoried non-system roads that are identified for short-term project use of two years or less shall be classified as "existing temporary". Roads identified as "existing temporary" shall meet the following criteria:
    - Will not be used between October 31 and June 1 unless otherwise agreed upon in writing.
    - Can be obliterated and storm-proofed prior to October 31 within two years or less of their reconstruction.
    - Can be effectively revegetated within 10 years of contract termination (NFMA, 1976)

- **NEW TEMPORARY ROADS** - New road construction over undisturbed native surface identified for short-term project use of two years or less shall be classified as "new temporary". Roads identified as "new temporary" shall meet the following criteria:
    - Constructed between June 1 and October 31.

- Will not be used outside the normal operating season (October 31 through June 1), unless otherwise agreed upon in writing.
- Constructed over gentle to moderate slopes less than 30% and do not require slope cuts greater than 5-feet in height;
- Do not cross a fish bearing stream or wetland habitat;
- Can be effectively obliterated and storm-proofed before October 31 to prevent concentrated surface water runoff and restrict off-site movement of erosion, when carried to a second season;
- Can be effectively revegetated within 10 years of contract termination (NFMA, 1976)
- Conserve topsoil from roadway excavation and embankment foundation areas. Stockpile conserved topsoil in low windrows immediately beyond the rounding limits of cut and embankment slopes or in other approved locations. Separate topsoil from other excavated material. Place conserved topsoil on completed slopes according to Section 624[25].
- Obliteration of temporary roads would require subsoiling using winged shanks designed to lift and fracture the soil between passes to a minimum depth of 20 inches (NOTE: straight shank ripping is not acceptable and in violation of this provision). To further prevent the potential for runoff to be carried down the treated road surface the majority of subsoiling passes shall occurring in a herring bone pattern the road alignment. Side cast fill within 20 feet shall be pulled onto the treated road surface. The treated surface shall be covered with slash as needed to prevent soil erosion. All shall occur within the one operational pass.
- Sensitive soils that cannot be fully stocked after 10 years of contract termination are unsuitable for temporary road consideration without the use of soil amendment composts. These soils include Umpqua SRI[26] Landtypes 1-5, 7, 15, 21, 46, 56, 80-82, 90, 91, 99; soils in cryic temperature regimes; lithic and paralithic soils, skeletal soils, and soils that have a soil suitability code of TRR, TRG, or TRV (USDA-FS, 1976).

    - Examples of soil amendments shown suitable for road restoration in severe soil conditions include the use of Class A biosolids applied at a rate equivalent to 300 lb N/acre (USDA-FS, 2007) both alone or when combined with a carbon source such as woodchips or biochar.

Application Rates for Temporary Turf Establishment[27]

Material	Application Rate pounds/acre
Seed	35
Compost nitrogen	300 to 400
Mulch	1,500 to 2,000

[25] Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects - FP-03 U.S. Customary Units U.S. DEPARTMENT OF TRANSPORTATION Federal Highway Administration.
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[27] *Refer FP-03 U.S. Customary Units U.S. DEPARTMENT OF TRANSPORTATION Federal Highway Administration, subsection 157.11, Table 157-1.*

Road-6. Road Storage and Decommissioning

Manual or Handbook Reference

- Forest Service Manual (FSM) 7734; Forest Service Handbook (FSH) 7709.59, Chapter 60.

Objective

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

Site Specific BMPS

- Under the timber sale contract, native-surfaced system roads will have water bars installed and will be closed with road barriers to prevent damage after commercial use is complete before October 31, unless otherwise agreed upon in writing.
- Water bars sufficient to disperse water shall be designated by the Forest Service to prevent future traffic and disperse subsurface water on all Maintenance Level 1 system roads.
- The timber sale purchasers are required to obliterate temporary spur roads under the timber sale contract. This involves subsoiling the road as appropriate, seeding as needed, and pulling displaced soil and duff back over the road surface. Slash will be pulled over the top of the road to provide additional ground cover and bare soil protection. Obliteration of temporary roads (new or legacy) shall meet specifications of the Forest Service, for depth of treatment and use of effective ground cover on treatment area.
- Prior to October 31st of the first year, all opened temporary roads that are not further needed for project implementation would be obliterated and erosion control measures in place. Erosion control, at a minimum, would include water bars and ground cover at 80% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71).
- Temporary roads still needed to complete project implementation would be winterized with all erosion control measures in place, and barricaded or blocked. Erosion control, at a minimum, would include water bars and ground cover at 25% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71).
- Sensitive soils, including Umpqua SRI Landtypes 1-5, 7, 15, 21, 46, 56, 80-82, 90, 91, 99; soils in cryic temperature regimes; lithic and paralithic soils, skeletal soils, and soils that have a soil suitability code of TRR, TRG, or TRV shall include a prescription for soil amendments (USDA-FS, 1976). Examples of soil amendments shown suitable for road restoration in severe soil conditions include the use of Class A biosolids applied at a rate equivalent to 300 lb N/acre (USDA-FS, 2007) both alone or when combined with a carbon source such as woodchips or biochar.

Road-7. Stream Crossings

Manual or Handbook Reference

- Forest Service Manual (FSM) 7722; Forest Service Handbook (FSH) 7709.56.b.

Objective

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

Site Specific BMPS

- Road work at perennial streams, to be done under the timber sale contract, will be completed during low flow conditions and during the in water-work period (July1-

September 15) when the potential for off-site movement of construction-related sediment can be minimized. During construction, stream water will be diverted around the work site and back into the channel.

- Stream crossing culvert locations will be located, flagged, and approved by the Forest Service before installation.

Road-8. Snow Removal and Storage

Manual or Handbook Reference

- Forest Service Manual (FSM) 7700-41; Forest Service Handbook (FSH) 7709.59, Chapter 24.11.

Objective

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

Site Specific BMPS

- Snow plowing without a permit is prohibited.

Road-9. Parking and Staging Areas

Manual or Handbook Reference

- Forest Service Manual (FSM) 7700-41; Forest Service Handbook (FSH) 7709.59, Chapter 24.11.

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing and maintaining parking and staging areas.

Site Specific BMPS

- Parking or staging will not occur in areas designated as off limits by the Forest Service on the sale area map.
- From October 31 to June 1 all parking and staging areas shall have sufficient erosion controls in place to restrict the off-site movement of sediment.
- All parking or staging areas where refueling will occur will have spill prevention and recovery equipment on site at all times until all equipment is removed and the site effectively treated to restrict off-site sediment movement.

Road-10. Equipment Refueling and Servicing

Manual or Handbook Reference

- Forest Service Manual (FSM) 2160; Forest Service Handbook (FSH) 7109.19, Chapter 40.

Objective

- Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.

Site Specific BMPS

- Roadwork contractors will have spill prevention and recovery equipment on site during all road construction operations as agreed to by the Forest Service.
- Fuel should not be stored or equipment refueled within 150 feet of any stream channel or surface water feature.

Facilities and Nonrecreation Special Uses Management

Fac-2. Facility Construction and Storm water Control

Manual or Handbook Reference

- Storm water control practices are covered in timber sale contracts.

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling erosion and managing stormwater discharge originating from ground disturbance during construction of developed sites

Site Specific BMPS

- Storm water pollution prevention practices are listed in Veg-2 Erosion Prevention and Control

Wildland Fire Management Activities

Fire-1. Wildland Fire Management Planning

Manual or Handbook Reference

- Forest Service Manual (FSM) 5120; 5150; Forest Service Handbook (FSH) 5109.19 Ch. 50

Objective

- Use the fire management planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during wildland fire management activities.

Site Specific BMPS

- Piles would be placed at least 50 feet away from live streams.
- Woody material within any stream channel will not be cut or removed from the stream channel.
- Air quality would be emphasized during prescribed fire planning. Mitigating measures would be considered including extending the burning season to spread emissions throughout the year. All burning would be planned and conducted to comply with applicable air quality laws and regulations and coordinated with appropriate air quality regulatory agencies.
- Equipment used to machine pile slash would use legacy skid trails, and temporary and permanent roads on slopes less than 30%, as much as possible.
- Burning would be carried out when fuel moistures are sufficient to help retain existing snags and down wood to the extent feasible.
- Maximum depth of activity fuels slash on temporary roads and landings is 12 inches.
- Grapple piles would be constructed to the following specifications:
    - All slash from 1 inch in diameter up to 6 inches in diameter and exceeding 3 feet in length shall be piled.
    - Piles would be constructed compactly with minimal soil in the piles and covered to shed water so they remain dry for burning during the fall or winter; height would be at least 6 feet and no greater than 12 feet; width would be at least 6 feet and no greater than 10 feet.
    - Piles would be evenly spaced between trees and snags left after harvest.
    - Piles would be placed on temporary roads or designated equipment trails when possible.
    - Piles would be placed at least 50 feet away from live streams.

- Hand piles would be constructed to the following specifications:
  - Piles would be composed of needles, limbs, branches, and damaged brush greater than ½ inch in diameter, up to and including 6 inch in diameter and having a minimum length of 3 feet.
  - Piles would be constructed compactly and aligning individual pieces in the same direction, placing heavier slash on top and covered to shed water. Height of pile would be at least 3 feet, width would be at least 3 feet and length would be at least 6 feet.
  - Piles would be placed on temporary roads or designated equipment trails when possible. Roadway piles would be placed on the outside shoulder of road.
  - Piles would be placed at least 50 feet of live streams or 25 feet from subdivision boundary.
- Machine piles at landings will be built by grapple attachment to keep dirt and rock debris out. No cat piling or pushing of piles.
- Where the volume of landing and roadside slash exceeds the ability to create piles and meet pile size and location specifications above, slash would be returned to temporary roads and designated forwarding corridors for piling or dispersal after subsoiling, if needed.

Fire-2. Use of Prescribed Fire

Manual or Handbook Reference

- Forest Service Manual (FSM) 5140

Objective

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

Site Specific BMPS

- Woody material within any stream channel will not be cut or removed from the stream channel.
- Monitor 1,000 hr. fuel moisture to maintain a minimum average of 70% effective ground cover over the burn area with a minimum average of 80% where burns enter into riparian or stability buffers. (LRMP IV-68 S&G 2 & 3).
- Burn plans would include water quality objectives.
- Burn plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire.
- As needed, fire lines would require water bars at slopes greater than 30%. Fire line water bars would deflect surface run-off from the trail down slope onto stable material such as rock surface cover. Fire line construction would generally avoid sensitive areas like unique habitats. Fire lines would be constructed in activity fuels units designated for underburning. Sale area map will show fireline location(s).
- All burning would be conducted to meet air quality standards as outlined by Oregon DEQ, and air quality monitoring would be conducted in conjunction with the DEQ.
- Activity fuels burning would be carried out when fuel moistures are sufficient to help retain existing snags and down wood to the extent feasible.
- Hoses used for drafting water from fishbearing streams must be equipped with a 5/32” mesh screen.
- Pumps should be placed on level ground as far away from the streambanks as possible.
- Place pumps and fuel cans in plastic berms and/or absorbent pads.
- Fire equipment would be refueled at least 150 feet away from wet areas and surfaces.

Minerals Management Activities

Min-5. Mineral Materials Resource Sites

Manual or Handbook Reference

- Forest Service Manual (FSM) 2850.

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and using upland mineral materials resource sites or instream sand and gravel deposits.

Site Specific BMPS

- No specific additions

Mechanical Vegetation Management Activities

Veg-1. Vegetation Management Planning

Manual or Handbook Reference

- Forest Service Manual (FSM) 1921.12

Objective

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

Site Specific BMPS

- The silviculturist will review marking guides with the purchaser prior to marking timber sale units. The silviculturist will monitor marking quality on a sample of each type of prescription, both during and after the unit is completely marked, as funding and staffing allows. If the number of leave trees per acre varies from the target retention by plus or minus 10 percent, remarking or amending the silvicultural prescription will be necessary.
- Limit logging operations during the bark slippage season from April 15 to July 1. Where purchasers can demonstrate adequate mitigation, this limitation can be waived by the Contracting Officer. (C6.32)
- Mortality of merchantable leave trees resulting from activity fuel burning operations should not exceed 5% in pile-and-burn areas and 10% in underburn areas except in areas identified for reforestation (1/2-acre and 1-acre gaps) where the intent is to create snags with prescribed fire.

Veg-2. Erosion Prevention and Control

Manual or Handbook Reference

- Forest Service Manual (FSM) 2409.15; FSH 2509.22 Ch. 10-13.11. Erosion prevention and control measures are covered in timber sale contracts. Refer to C6.3, B6.31, B(T)6.3, B(T)6.6, B(T)6.65, B(T)6.66, B(T)6.3, Table CT5.12#.

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.

Site Specific BMPS

- Maintain 70% or greater effective ground cover for site productivity and erosion control standards and guidelines (LRMP IV-68 S&G 2 & 3)

- Use of all ground based equipment on or off skid trails and temporary roads is prohibited between October 31 and June 1, unless otherwise agreed upon; as well as any time during wet weather conditions.

Contractors are responsible for assessing, monitoring, and suspending or moderating their operations as needed to prevent on-site soil erosion and restrict the off-site movement of sediment. The following is provided as additional general operating guidelines to operators:

- Haul will be evaluated and maybe suspended or modified when rain is expected of more than 1/4 inch in the 24 hour forecast and will be suspended when there is a forecast of more than 1/2 inch in a 24 hour period. Snow melt on the road surface will be handled the same as rain when determining the potential for environmental and/or road damage as defined under the Commercial Road Use Rules and Road Use Permit Requirements.
- Haul will be suspended immediately when road distress occurs (refer to Facility Distress in Road Rules Exhibit A). Maintenance to correct the problem must be performed prior to continuing haul and road conditions must be improved to the point no additional road distress will occur when operations resume.
- Implement suitable erosion control measures during drainage maintenance and reconstruction and immediately preceding mechanical vegetation treatments.
- Applied erosion control measures associated with road work will be inspected for functionality and maintained during operations as determined by the Sale Administer and Engineering Representative.
- Contractors shall maintain and ultimately remove/dispose all temporary sediment control structures (i.e. straw bale structures in ditchlines). Removal will occur at the end of the project and inside of the normal operating season. All captured sediment will be seeded with grass to stabilize or removed then placed and seeded in an approved location in agreement with Sale Administrator. Where approved, sediment controls may be left in place to breakdown over time if doing so will not lead to future drainage issues.
- Contractors shall routinely inspect and maintain erosion and sediment controls as necessary to ensure they are effective functioning. *Refer NBMP fac-2, LMRP IV-71 S&G 11*.
- Contractors who operate outside the normal operating season shall have a minimum of 20 bales of protected dry straw, <u>o</u>r equivalent material, <u>*or*</u> a chipper on the project area and available as needed for erosion control.
- <u>June 1 through October 31</u>
  Observe all practicable precautions for minimizing soil erosion. Equipment will not be operated when ground conditions are such that excessive damage will result. Erosion control work will be kept current immediately preceding expected seasonal periods of precipitation. *Refer B(T)6.6 and C(T)6.6.*
- <u>October 31:</u>
  Road construction work shall be complete. Roads approved for haul outside the normal operating season shall have been brought to prescribed standards and approved by an engineer [incorporate into Use of Roads by Purchaser C5.12]. Forty bales of straw or an on-site chipper shall be staged and available as need for erosion control.
- The Erosion Control Supervisor (ECS) shall submit a Storm Water Pollution Prevention Plan (SWPP) to the Contract Officer 15 days prior to contract approval to operate beyond October 31. Do not begin or continue any ground disturbing work or road haul after October 31 and until the plan has been accepted. Include all data and plan updates pertaining to erosion and sediment control in the SWPPP/plan for the project. *Refer FP-03 U.S. Customary Units Subsection 157.03.*
- Prior to October 31st of the first year, all skid trails and temporary roads that are not further needed for project implementation would be obliterated and erosion control

measures in place. Erosion control, at a minimum, would include water bars and ground cover at 80% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71).

- Skid Trails and temporary roads still needed to complete project implementation would be winterized with all erosion control measures in place, and barricaded or blocked. Erosion control, at a minimum, would include water bars and ground cover at 25% plus coverage at a 2 to 3 inch depth, approximately 1.5 to 2 tons weed free straw of grass, grain, wood straw or woodchips per acre (LRMP S&G 13, pp IV-71).
- All other bare soil (landings, landing access, temporary roads, drainage ditches, and any portion of a roadway affected by project activities) associated with the sale shall be effectively covered (80% plus coverage at 2 to 3-inch depth) with wood straw, certified weed free straw, woodchips (1 to 2 plus inch depth) or slash sufficient to restrict off-site movement of sediment regardless of its potential for delivery to streams. *Refer B(T)6.65.*
- The Purchaser shall accept responsibility for repairing as needed all drainage and erosion control features over the contract area, over the life of the contract. Sediment delivery to a stream *and/or* Road [facility] Damage *(refer to Road Rules Exhibit A*) as a result of purchaser's actions <u>*or*</u> inaction shall be considered a breach of this contract. *Refer B(T)6.6 and C(T)6.6.*
- <u>Any Time of Year</u>
  A Forest Service Contract Officer may order the performance of the work to be stopped, either in whole or in part, for such periods deemed necessary due to the following (*Refer B(T)6.6 and C(T)6.6)*:
  - Weather or soil conditions considered unsuitable for prosecution of the work; or
  - Failure of the Contractor to:
    - Correct conditions unsafe for the workers or the general public;
    - Carry out written orders given by the CO; or
    - Perform any provision of the contract.

Veg-3. Aquatic Management Zones

Manual or Handbook Reference

- Forest Service Manual (FSM) 2526, 2527

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.

Site Specific BMPS

- Refer to AqEco-2

Veg-4. Ground-Based Skidding and Yarding Operations

Manual or Handbook Reference

- Forest Service Handbook (FSH) 2409.15

Objective

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

Site Specific BMPS

- No Yarding Operations outside the normal operating season, unless otherwise agreed upon.
- All skid trail locations would be approved by Forest Service prior to their use. Adequate drainage and water dispersion are critical. Trails located at near right angle to contour

shall not exceed 15% grade, since they are nearly impossible to properly drain. All other skid trails shall not exceed 25% grades other than short pitches to 35% less than 50 feet in length.

- Sub-soil landings that fall outside of the prisms of roads identified on the Forest transportation inventory as permanent, all skid trails and uninventoried non-system roads identified for project use, or roads identified for obliteration, shall be subsoiled and covered.
- Maintain a minimum 50-foot no-equipment operational zone on each side of stream, wetland, dry meadow, and stability buffers. End-lining is permitted to yard logs out of this 50-foot no-equipment operation zone.
- Landings that have been used shall be sloped and ditched to allow water to drain or spread. Refer B(T)6.64, B(T)6.63, B(T)6.6.
- Block skid trails to prevent vehicle use;
- Water barring to an adequate depth and length and spacing to effectively disperse surface water runoff without maintenance. Minimum recommended space would include: 200 feet for grades < 5%, 100 feet for grades 6-15%, 50 feet for grades >15%. Water bars should be skewed 30-45o to the skid trail alignment and excavated at least 20 inches below road grade. Runoff outlets will be constructed to prevent ponding behind water bars. Wherever possible, locate outlets to drain onto vegetated undisturbed soil areas (supplements items B(T)6.64, B(T)6.65, and B(T)6.67);
- Skid Trails still needed for project implementation would be winterized by applying ground cover (straw, slash, wood chips) at a minimum application rate equivalent to a 2-inch application of straw (applied at 2 tons per acre with a minimum 25% effective ground cover).
- All skid trails not further needed for project implementation shall be subsoiled and ground cover applied (straw, slash, wood chips) at a minimum application rate equivalent to a 2-inch application of straw (applied at 2 tons per acre with a minimum 80% effective ground cover).

Veg-5. Cable and Aerial Yarding Operations

Manual or Handbook Reference

- Forest Service Handbook (FSH) 2409.15

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during cable and aerial yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Site Specific BMPS

- Sub-soil landings that fall outside of the prisms of roads identified on the Forest transportation inventory as permanent, all skid trails and uninventoried non-system roads identified for project use, or roads identified for obliteration, shall be subsoiled and covered.
- Landings that have been used shall be sloped and ditched to allow water to drain or spread. Refer B(T)6.64, B(T)6.63, B(T)6.6.
- Allow for artificial Guyline anchors (Deadmen) in unit No.s 22, 24 and 33 if adequate natural anchors (trees and/or stumps) are not available.

Veg-6. Landings

Manual or Handbook Reference

- Forest Service Handbook (FSH) 2409.15

Objective

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

Site Specific BMPS

- No specific additions.

Veg-7. Winter Logging

Manual or Handbook Reference

- Forest Service Handbook (FSH) 2409.15

Objective

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

Site Specific BMPS

- Limit winter logging activities to specified skyline units only.
- Use of temporary roads is prohibited from October 31 through June 1, unless otherwise agreed upon in writing.
- Refer to Supplemental Table and Map CT5.12# –.Use of Roads by Purchaser.
  - The project Engineer will provide a project transportation map during NEPA. Purchaser's use of existing roads identified on Sale Area Map and/or the project's transportation map with winter restrictions is prohibited or subject to restrictive limitations as designated, unless agreed otherwise. Construction of Specified Roads shall be completed, with erosion control in place, no later than October 31.

SUSPENTION OF OPERATIONS and/or HAUL

The Purchaser is responsible for assessing, monitoring, and suspending or moderating operations as needed to prevent the potential for road distress *and/or* environmental damage (*refer to Road Rules and B(T)9.3*). The following is provided as additional general operating guidelines to operators:

- During periods of freezing and thawing, haul maybe suspended in order to prevent damage to forest roads.
- Haul may need to be suspended or modified when rain in excess of ¼ inch is in the 24 hour forecast. Snow melt on the road surface will be handled the same as rain, when determining the potential for environmental and/or road damage as defined under the *Commercial Road Use Rules and Road Use Permit Requirements*.
- Haul shall be suspended before *or* immediately when Road Distress (*refer to Facility Distress, Road Rules Exibit A*) occurs. If maintenance to correct the problem cannot be performed, as when rain or snow is occurring or predicted, use must be reduced or stopped until maintenance can occur *or* signs of distress are no longer present. The Forest Service must agree in writing to a resumption of haul.

Veg-8. Mechanical Site Treatment

Manual or Handbook Reference

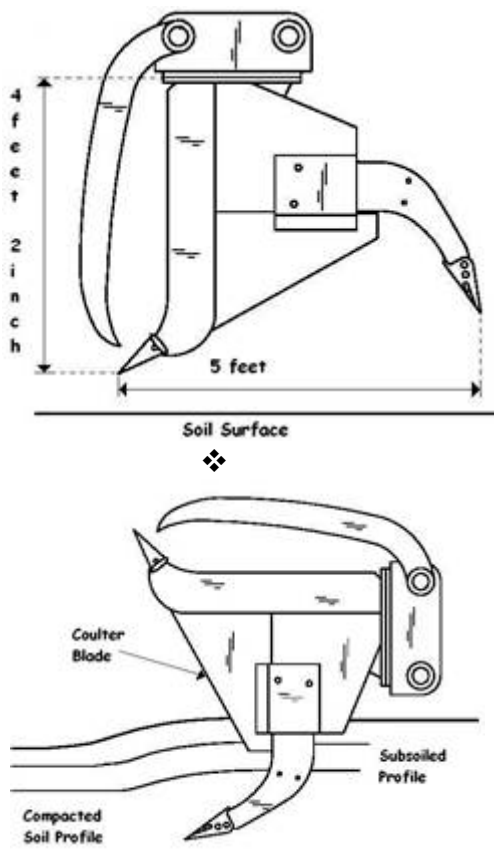
- None Known

Objective

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment

Site Specific BMPS

- Subsoiling operations shall lift and fracture the soil between rips to a minimum depth of 20 inches (as measure after subsoiling). To further prevent the potential for runoff to be carried down the treated road surface the majority of subsoiling rips shall occurring across (i.e. herringbone pattern) the road alignment. Where the soil is too rocky for subsoiling (pulling rock >5 inches in size to the surface). This requirement may be waived by a soil scientist or sale administrator where the ground is less than 20 inches to bedrock or too skeletal (>35% cobbles). A winged ripper shank and excavator are recommended for all subsoiling and covering the surface with slash in a single operational pass.
- Subsoiling operations shall lift and fracture the soil between rips to a minimum depth of 20 inches. To further prevent the potential for runoff to be carried down the treated road surface the majority of subsoiling rips shall occurring across the road alignment. Where the soil is too rocky for subsoiling (pulling rock >5 inches in size to the surface). This requirement may be waived by a soil scientist or sale administrator where the ground is less than 20 inches to bedrock or too skeletal (>35% cobbles).
- A winged ripper shank and excavator are recommended for all subsoiling and covering the surface with slash in a single operational pass. See Figure below.



Drawings show the Subsoiling Grapple Rake in grapple mode (top) and subsoiling mode (bottom). (USDA Forest Service, Technology & Development Program, Multipurpose Subsoiling Excavator Attachments, 2011)