Trail Creek
Forest Management Project
Environmental Assessment

DOI-BLM-OR-M050-2013-0004-EA

BLM

Butte Falls Resource Area

February 2014

Medford District Vision

Working together to sustain and enhance resilient landscapes and quality of life in southwest Oregon.

Medford District Mission

We are dedicated to professional management of the public lands by sustaining a wide variety of uses to serve the American people, now and in the future. We do this with a land ethic of balanced resource management in an environmentally, socially, and economically sound manner.

We are engaged, knowledgeable, informed, supported, and contributing toward solutions to current and future challenges.

We contribute to and manage toward resilient landscapes and habitats.

We effectively contribute to our communities through a diverse and flexible portfolio of goods, services, and opportunities.

BLM/OR/WA/PL-14/010+1792

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Medford District Office
3040 Biddle Road
Medford, Oregon 97504
email address: BLM_OR_MD_Mail@blm.gov

FEB 03 2014

IN REPLY REFER TO:

1792 (ORM050)

Dear Interested Party:

The Butte Falls Resource Area of the Medford District, Bureau of Land Management (BLM) is in the final stages of the Trail Creek Forest Management Project Environmental Assessment (EA) (DOI-BLM-OR-M050-2013-0004-EA). This letter is to inform you the EA will be available for your review on the Medford District website [http://www.blm.gov/or/districts/medford/plans/index.php] on February 3, 2014. If the online version does not meet your needs, you may telephone Jean Williams at (541) 618-2385 or e-mail BLM_OR_MD_Mail@blm.gov (be sure to include "Attention: Jean Williams") to request a CD or paper copy. You may also visit the Medford District Office, 3040 Biddle Road, Medford, Oregon for a CD or paper copy.

The proposed project involves the following activities **on BLM-administered lands** located in the Trail Creek 5th Field Watershed:

- Forest Management
    1. Timber harvest on 1,019 acres
    2. Small diameter thinning on 185 acres
    3. Precommercial thinning on 263 acres
    4. Riparian thinning on 63 acres
- Road Work
    1. Renovate 80 miles of road
    2. Decommission 10.3 miles of road
    3. Construct and decommission 0.6 mile of temporary routes
    4. Reconstruct and decommission 0.5 mile of temporary routes
    5. Close (gate or barricade) 1.4 miles of road
- Treatment of Forest Management Activity Fuels
    1. Lop and Scatter
    2. Hand pile and hand pile burn
    3. Biomass removal
- Restoration of 14 water sources
- Reduction of hazardous fuels on 2,638 acres
- Cutting of public roadside firewood along 12 miles of road
- Restoration and trail closure on 5.8 miles of unauthorized off-highway vehicle trails
- Restoration of 282 acres of meadows.
- Riparian Restoration and Stream Habitat Enhancement
- Reclamation of Romine Creek Quarry

The 30-day comment period for this EA will begin when the legal notice is published in the *Medford Mail Tribune* newspaper on February 2, 2014. Any comments you may have regarding this project must be received by March 4, 2014 to be considered in final decisions for this proposal. Please send comments to Jean Williams, Butte Falls Resource Area Planning and Environmental Coordinator, Medford District BLM, 3040 Biddle Road, Medford, Oregon 97504, or e-mail your comments to BLM_OR_MD_Mail@blm.gov ("Attention: Jean Williams"). Questions on the proposed project should be directed to Jean Williams at (541) 618-2385.

Remember, all comments will be made available for public review. If you would like your name, street address or both withheld from public review, or from disclosure under the Freedom of Information Act, please state this clearly at the beginning of your written comment. We will honor your request to the extent allowed by law. All comments received from organizations or officials of organizations, businesses, or government agencies will be made available for public inspection in their entirety.

Thank you for your continued interest in the Trail Creek Forest Management Project. I look forward to hearing from you.

Sincerely,

Jon K. Raby
Field Manager
Butte Falls Resource Area

Acronyms

ACS	aquatic conservation strategy
ARPA	Archaeological Resource Protection Act
BDT	bone dry ton
BLM	Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CHU	critical habitat unit
COR	contracting officer representative
CWA	Clean Water Act
DBH	diameter at base height
DEQ	Department of Environmental Quality
EA	environmental assessment
EIS	environmental impact statement
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FG	fragile slope gradient
FLPMA	Federal Land Policy and Management Act
FOI	forest operations inventory
FP	fragile mass movement potential
FR	Federal Register
GFMA	general forest management area
GIS	geographic information system
ID	interdisciplinary
IVMP	interagency vegetation mapping project
KLE	Klamath East
MBF	thousand board feet
MMBF	million board feet
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRF	nesting, roosting, and foraging
O&C	Oregon and California
PCGP	Pacific Connector Gas Pipeline
PM2.5	particulate matter up to 2.5 micrometers
PM10	particulate matter up to 10 micrometers
PRMP	proposed resource management plan
RA	recovery action
RMP	Resource Management Plan
ROD	record of decision
S&M	Survey and Manage
SEIS	supplemental environmental impact statement
TMDL	total maximum daily load
TPCC	timber production capability class

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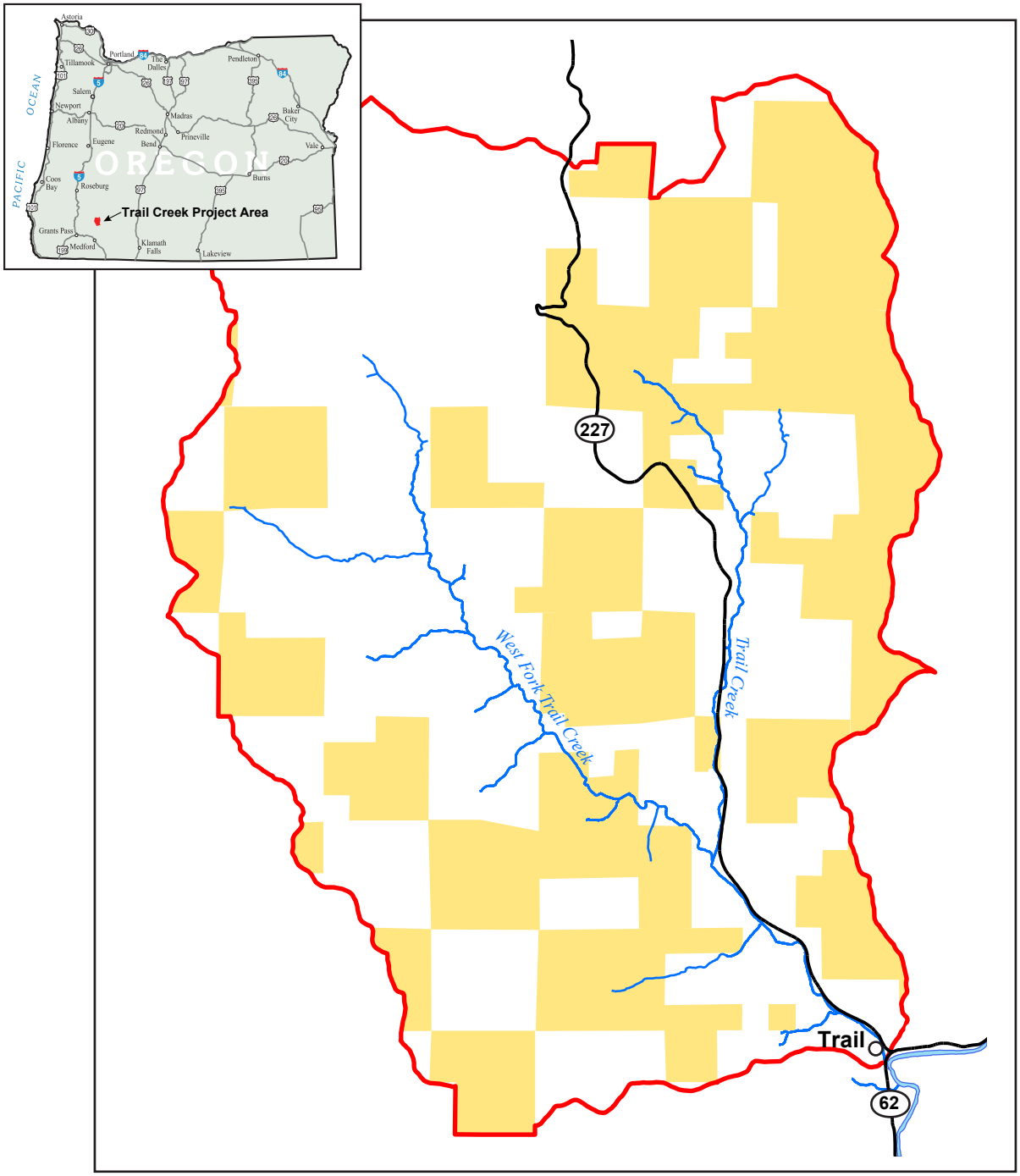


Trail Creek Project Area Boundary

BLM Land

N

0 1 2

miles

Trail Creek Forest Management Environmental Assessment

Butte Falls Resource Area
January 2013

Map 1. Trail Creek Project Area Vicinity Map

1.0 Purpose and Need

This section describes the action proposed by the BLM (Bureau of Land Management), why the BLM is proposing this action, and the location of the proposed action. It also identifies the factors the decision maker will use for choosing the alternative that best meets the purposes of and needs for this project.

The following definitions are for terms used throughout this document:

allowable sale quantity. The gross amount of timber volume, including salvage that may be sold annually from a specified area over a stated period of time in accordance with the approved land use plan.

Authorized Officer. The Federal employee who has the delegated authority to make a specific decision.

coarse woody debris. Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20" in diameter (Bureau of Land Management 1995, 102).

slash. The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging.

snag. Any standing dead, partially dead, or defective (cull) tree at least 10" DBH (diameter at breast height) and at least 6 feet tall (Bureau of Land Management 1995, 114).

1.1 Introduction

The BLM identified the Trail Creek watershed as a high priority watershed on the Medford District where vegetation management actions could be integrated to achieve multiple landscape and resource objectives. The Trail Creek project would apply vegetation management actions to sustain ecosystem health and also provide a reasonable flow of goods, opportunities, and outdoor experiences.

This EA (environmental assessment) documents the environmental analysis the BLM conducted to estimate the potential site-specific effects on the human environment that may result from implementing this project. The EA will provide the BLM's authorized officer (Butte Falls Resource Area Field Manager) with current information to aid in the decision-making process. It will also determine if this project will result in significant impacts not already analyzed in the EIS (environmental impact statement) for the Medford District's RMP (Resource Management Plan) and whether a supplement to that EIS is needed or if a Finding of No Significant Impact is appropriate.

1.1.1 Proposed Action

The BLM's Butte Falls Resource Area proposes forest management actions on approximately 1,530 acres of BLM-managed land. Silviculture prescriptions vary by alternative and may include a combination of commercial thinning, density management, regeneration harvest, restoration thinning, riparian thinning, small diameter thinning, and precommercial thinning. Cut trees would be removed using ground-based, skyline-cable, or helicopter yarding systems. Fuel loads resulting from vegetation management activities would be reduced by lopping and scattering, hand piling and burning, or underburning the activity slash, or removing for use as biomass. Regeneration harvest areas would be replanted. Road projects needed to support the timber harvest activities would include road renovation and temporary route construction or reconstruction.

Other proposed projects include road closure, partial and full road decommissioning, hazardous fuels reduction, water source restoration, off-highway vehicle trail closure and rehabilitation, meadow restoration, stream habitat enhancement and riparian restoration, and quarry reclamation. Opportunities for public roadside firewood collection would also be identified.

1.1.2 Project Area

The Trail Creek Project Area is located in southwest Oregon between Medford and Crater Lake National Park within the Upper Rogue River subbasin. The Project Area lies northwest of the Rogue River and extends upslope to the South Umpqua River Divide to the north. The Project Area comprises the entire Trail Creek watershed and portions of the Elk Creek and Shady Cove/Rogue River fifth field watersheds (Table 1-1). This Trail Creek Project Area consists of 35,646 acres of mixed ownership lands. Of this, 42% (15,015 acres) are managed by the BLM (Figure 1-1).

Table 1-1. Land Ownership in the Trail Creek Project Area by Fifth Field Watershed

Fifth Field Watershed	BLM	USFS	Timber Company	Private	State	Total
Elk Creek (South Umpqua subbasin)	145	0	0	8	0	153
Trail Creek	14,692	4,350	9,892	6,302	79	35,315
Shady Cove/Rogue River	178	0	0	0	0	178
Total Acres	**15,015**	**4,350**	**9,892**	**6,310**	**79**	**35,646**

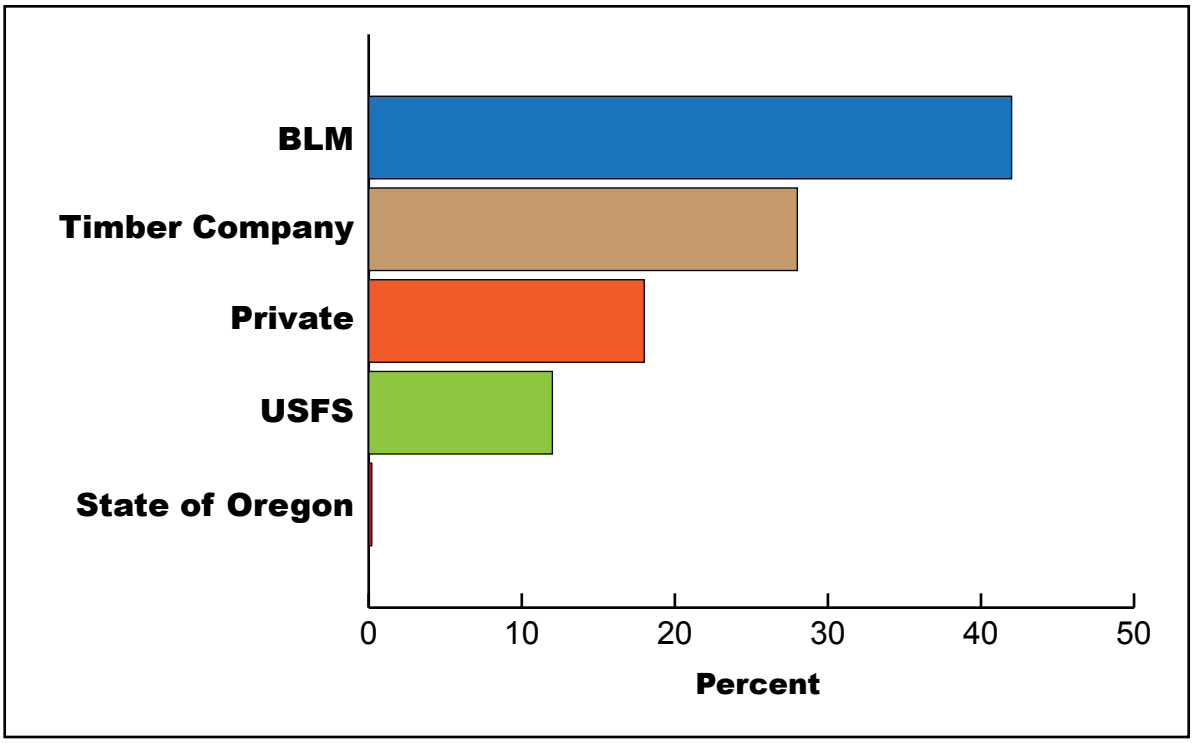


Figure 1-1. Percentage of land ownership in the Trail Creek Project Area.

Proposed projects are located on BLM-administered lands in:

- Township 32 South, Range 1 West, Sections 19, 21, 22, 27–34;
- Township 33 South, Range 1 West, Sections 3, 7, 9, 10, 15, 17–19, 21, 22, 27–34;
- Township 34 South, Range 1 West, Section 5;
- Township 33 South, Range 2 West, Sections 1, 3, 9, 15, 23, 25; and
- Township 34 South, Range 2 West, Section 1; Willamette Meridian; Jackson County, Oregon.

1.2 Purpose

The landscape-scale Trail Creek Project proposes multiple actions that would address problems or opportunities the BLM has identified in the Project Area. Each proposed action has a distinct goal we hope to achieve through project implementation. Additionally, to be given serious consideration as a reasonable alternative, any action alternative must meet the objectives provided in the Medford District ROD/RMP (Record of Decision and Resource Management Plan) for projects to be implemented in the Project Area. Each proposed action demonstrates how the project implements the objectives or management direction found in the ROD/RMP.

1.2.1 Forest Management and Timber Harvest

Design and implement commercial timber sales on matrix lands in the Trail Creek fifth field watershed.

The timber harvested from this project would produce revenue for the Federal government and could contribute up to 7.7 MMBF (million board feet) of timber toward the Medford District's annual allowable sale quantity for fiscal years 2014–2016. The ROD/RMP (p. 81) directs the BLM to design and implement forest management activities to produce a sustained yield of products to support local and regional economic activity.

Timber on matrix lands in the Project Area allocated to the northern GFMA (general forest management area) exceeds the minimum stand age of 100 years set by the ROD/RMP (p. 189). Timber on matrix lands allocated to southern GFMA exceeds the minimum harvest age of 120 years set by the ROD/RMP (p. 194). Under the ROD/RMP, stands that meet the minimum age requirements could be regeneration harvested.

Reduce tree densities in stands less than 100 years old that have a more simplified stand structure with limited layers present in order to control stocking levels and to redistribute the growth potential to fewer, but larger, trees.

Commercial thinning is programmed in the ROD/RMP on matrix lands for the stands less than 100 years old that have reached a combination of stem diameter and surplus volume to allow an economical entry. Commercial thinning would be designed to assure high levels of volume productivity (Bureau of Land Management 1995, p.185).

Maintain or enhance forest health, stand structure, and function in stands identified as northern spotted owl habitat.

The ROD/RMP (p. 189) allows density management to occur in stands to retain patches of denser habitat where desired to meet criteria for wildlife habitat.

Reduce tree densities in stands less than 150 years old on matrix lands to increase landscape resiliency to environmental disturbances.

Forest stands with densities that exceed historic conditions and natural carrying capacities would be harvested using restoration and small diameter thinning techniques. Restoration and small diameter thinning would be implemented to reduce tree mortality and restore stand vigor, resiliency, and stability (Bureau of Land Management 1995, p. 186).

Maintain stands less than 80 years old on developmental paths to achieve desired stand characteristics in the future.

Precommercial thinning would reduce hardwoods and brush that increase competition for needed resources such as nutrients, moisture, or light, and reduce the growth and development of desired species. Treatments would shift stand species composition and structure to desired conditions. RMP direction (p. 62) is to

design and implement silvicultural treatments in stands that are in a condition that prevents management objectives from being achieved. Treatments are intended to restore the ability of stands to respond to other management and to reduce the risk of mortality from insects, disease, and wildfire.

Improve individual tree and stand health, reduce risk for catastrophic wildfires, and restore ecosystem functions in riparian reserves.

Riparian thinning would reduce stand density in overstocked stands, accelerate the growth of the remaining trees, and maintain and restore species and structural diversity. ROD/RMP direction (p. 195) is to use riparian thinning to reduce stocking levels, to reestablish and manage stands, to establish and manage desired nonconifer vegetation, and to acquire desired vegetation characteristics needed to attain objectives of the Aquatic Conservation Strategy.

Aid in reforestation of the areas proposed for regeneration harvest.

A combination of existing regeneration, natural seeding, and tree planting would be used, when applicable, to meet regeneration targets and time frames for the stands. ROD/RMP (p. 72-73) direction is to apply silviculture systems that are planned to produce over time forests that have a desired species composition, structural characteristics, and distribution of seral or age classes.

1.2.2 Road Work

Reduce the potential for sediment production on up to 80 miles of roads that would be used to haul harvested timber.

Before timber is hauled, the timber sale purchaser would implement measures to minimize possible sediment production and sediment delivery to streams from timber hauling. ROD/RMP direction (p. 163) is to restore or improve roads to a desired standard in a manner that minimizes sediment production and water quality degradation.

Decrease the possibility of sediment entering streams by closing or decommissioning up to 1.4 miles of roads surplus to BLM needs at this time.

The 1995 ROD/RMP (p. 28) recommends "closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects to Aquatic Conservation Strategy and riparian reserve objectives and considering short-term and long-term transportation needs."

Provide temporary vehicular access to proposed harvest units on BLM-administered lands in the Project Area that are not accessible by existing roads by constructing up to 0.6 mile and reconstructing up to 0.8 mile of temporary routes.

The ROD/RMP (p. 28 and 157) directs roads to be located to minimize soil erosion, water quality degradation, and disturbance to riparian vegetation by minimizing road locations in riparian reserves and locating roads on stable positions, such as ridges.

1.2.3 Fuels Treatment associated with Timber Harvest

Reduce the potential risk of wildfire that may result from the fuels (e.g., limbs, branches, twigs) produced during harvest activities.

Forest management activities produce fuels that could remain a fire hazard for 10 to 20 years, if left untreated, until natural decomposition occurs. ROD/RMP direction (p. 91) is to reduce activity-based fuel hazards.

1.2.4 Hazardous Fuels Reduction

Reduce the threat of large-scale wildfires on up to 2,638 acres BLM lands and the potential for adverse effects on federally managed resources and private property adjacent to Federal lands in the wildland-urban interface.

The ROD/RMP direction (p. 91) is to reduce both natural and activity-based fuel hazards through methods such as prescribed burning, mechanical or manual manipulation of forest vegetation and debris, removal of forest vegetation and debris, and combinations of these methods. The RMP (p. 89) also directs the BLM to reduce natural fuel hazards on BLM-administered lands in rural interface areas.

1.2.5 Public Roadside Firewood Cutting

Provide opportunities for public collection of firewood for personal use.

This project would provide the public with roadside firewood cutting along about 12 miles of road. The area was chosen for the wood quality, species, ease of cutting, carrying distances, and hauling distances. ROD/RMP direction (p. 75) is to manage for the production and sale of special forest products when demand is present and where actions taken are consistent with primary objectives for the land use allocation.

1.2.6 Water Source Restoration

Improve 14 water sources in the Trail Creek watershed to make them available for wildfire suppression and for use by wildlife.

Water sources at 14 sites are in poor to fair condition and are not currently usable by firefighting equipment. ROD/RMP direction (p. 90) is to locate and manage water drafting sites to minimize adverse effects on riparian habitat and water quality and to supply water for various resource programs while protecting water quality and riparian vegetation (ibid., p. 165).

1.2.7 Off-highway Vehicle Trail Closure and Restoration

Reduce the adverse impacts created by unauthorized off-highway vehicle use by closing and restoring up to 5.8 miles of trails.

This project would decrease the destructive unauthorized off-highway vehicle use in the watershed. Various levels of decommissioning would be used on designated trails and roads in the Project Area. ROD/RMP direction (p. 42) is to manage off-highway vehicle use to protect natural resources.

1.2.8 Meadow Restoration

Restore 282 acres of upland meadows where tree and brush species are encroaching.

Meadow restoration would cut, burn, or both small conifers and areas of older or decadent brush in an effort to rejuvenate brush species that would benefit wildlife as browse and remove encroaching vegetation. ROD/RMP direction (p. 49) is to use management practices, including fire, to obtain desired vegetation conditions in special habitats such as meadows.

1.2.9 Stream Habitat and Riparian Restoration

Restore watershed processes along a section of West Fork Trail Creek by placing wood and rock structures in the stream, removing user-built roads, removing deteriorated fencing and installing new fencing, planting cleared forest land with tree seedlings, and replacing an undersized culvert.

Watershed restoration is one of the key components of the Aquatic Conservation Strategy and is an integral part of program to aid recovery of fish habitat, riparian habitat, and water quality. ROD/RMP direction (p. 23) is to restore watershed processes, recover degraded habitat by removing and upgrading roads, restore large conifers in riparian reserves, and restore stream habitat complexity.

1.2.10 Quarry Reclamation

Reduce erosion and minimize sediment production from the Romine Creek Quarry.

The Romine Creek Quarry is located within a riparian reserve and is no longer being used to produce rock. Reclaiming the quarry would address drainage problems and allow vegetation to grow within this riparian reserve. The ROD/RMP objective (p. 165) for rock quarry reclamation is to minimize sediment production from quarries susceptible to erosion due to steep side slopes, lack of vegetation, or their proximity to water courses.

1.3 Need

The Trail Creek ID Team identified multiple opportunities or underlying problems (the "needs") in the Project Area that have resulted in the list of proposed projects. The needs for the proposed actions are presented below.

BLM employees, through data analysis and field examinations, identified overstocked stands in the Project Area that need immediate forest management because the stands contain more trees than the sites have water, nutrients, and growing space to sustain. Overstocked stands have a greater potential for severe stand-replacing wildfires. Older forest stands in the area have declining growth rates or are deteriorating due to insects, disease, or other factors. Declining growth rates have resulted in reduced volume yield from these matrix lands. The proposed forest management activities are needed in the Project Area to reduce the number of trees and reverse these trends to produce sustainable and resilient stands that contribute to future forest production and other RMP objectives.

Local economies and governments depend on the contributions the BLM lands make to employment and income. In stands identified for harvest, the BLM needs to design economically viable timber sales that contribute to local, regional, and national economies.

The Northern Spotted Owl Recovery Plan recommends maintaining and restoring "older and more structurally complex multi-layered conifer forests on Federal and non-Federal lands across [the northern spotted owl's] range . . . while allowing for other threats, such as fire and insects, to be addressed by restoration management actions" (U.S. Fish and Wildlife Service 2011, III-67). The BLM needs to retain sufficient nesting, roosting, and foraging habitat within the provincial core use area and provincial home range (1.2-mile and 1.3-mile radius) of known northern spotted owl sites to support breeding, feeding, and sheltering.

The BLM needs to conserve the older, high quality, and occupied forest habitat as necessary to meet the northern spotted owl recovery goals. Science-based, active vegetation management is needed to restore forest health, especially in drier forests in the eastern and southern portions of the owl's range. Landscape-level planning and vegetation management that allow historical ecological processes, such as characteristic fire regimes and natural forest succession, needs to occur on these landscapes throughout the range of the owl.

Overstocked stands in selected riparian reserves are at risk for catastrophic wildfires that could increase impacts, such as sedimentation, to aquatic systems and delay achieving desired outcomes, such as increased large woody debris and large trees to provide shade and habitat, in riparian reserves. There is a need for

reducing stocking levels in riparian stands identified as having high stand relative densities that has caused reduced growth rates in individual trees from competition for available resources including water, light, and nutrients (Figure 1-2).

Figure 1-2. Stand proposed for riparian thinning.

The use of existing haul roads, temporary routes, and skid trails associated with forest management activities may provide sources for sediment in streams (Bureau of Land Management 1994, 4-19 and 4-20). Before roads are used for hauling timber, they need to be renovated to reduce the probability of sediment entering streams from these roads. Roads no longer needed for access by the BLM or adjacent landowners need to be closed or decommissioned.

Proposed timber harvest units that are currently inaccessible by vehicle need temporary vehicular access to those units during harvest activities. These temporary routes must meet the road standards set forth in BLM 9100 series manuals, the Medford District ROD/RMP, and the BMPs (best management practices) contained in the ROD/RMP.

Forest management activities result in a temporary increase in wildfire risk through the production of flammable debris such as limbs, branches, and twigs. The BLM needs to address this increased fire risk by reducing activity-generated fuel hazards.

Water sources constructed primarily for fire suppression use also provide a supply of drinking water and habitat for wildlife. Existing water sources are overgrown or no longer hold water. These water sources require maintenance to restore them to a functional condition that provides adequate access for firefighting equipment.

Fire cycles that shape the landscape have been disrupted by fire suppression and fire exclusion. Stands in the watershed have increased hazardous fuel loads caused by reduced fire frequency. An increase in ladder fuels within the stands could give wildfires a greater chance of climbing into the canopy resulting in a stand-replacing disturbance. Hazardous fuels treatments, especially within the wildland-urban interface, are needed to create more fire-resilient stands in the Trail Creek Watershed.

The Trail Creek Watershed Analysis (p. 4-26) recommends implementing stream restoration projects where one or more improvable habitat component (e.g., temperature, large woody debris, or substrate) is currently

limiting aquatic habitat quality. The BLM identified a reach of West Fork Trail Creek that needs a road decommissioned within a riparian reserve; large wood and rock structure placement; culvert replacement; fence removal, replacement, and installation; and riparian vegetation planted (Figure 1-3). These projects are needed to improve stream shade and reduce stream temperature, reduce sedimentation, and improve stream structure.

Off-highway vehicle use in the Trail Creek watershed has created unauthorized trails that are causing adverse impacts to natural resources. Impacts include degraded water quality, damaged soil structure and productivity, and the spread of noxious weeds. The BLM needs to close the unauthorized off-highway vehicle trails and restore them to a more hydrologically stable condition. Upland meadows are gradually shrinking due to the encroachment of brush and conifers resulting from fire exclusion and the periodic burning of the meadows that once occurred. These meadows need fire or other disturbance agents introduced in order to promote the meadow vegetation normally found there.

Use of firewood by the public as a primary or supplemental source of household heat is prominent in homes within the Medford District. Historically, logging debris provided a major source of firewood for the public. With the reduction in timber harvest and the greater use of the logging debris that served as firewood material (e.g., chips, biomass, commercial firewood), there is a need for areas that can supply the public with firewood cutting opportunities.

Romine Creek Quarry has been depleted of rock and cannot be expanded further due to a nearby stream and lack of large amounts of quality rock. The quarry needs to be reclaimed to reduce erosion and the amount of sediment entering the stream.

1.4 Issues

1.4.1 Scoping

The BLM outreach for this project began February 1, 2013 when the BLM mailed postcards to 246 individuals, businesses, organizations, other government agencies, and tribes. The postcard was used to ascertain interest in the project and establish a list for future project mailings. As a result, the BLM mailed or emailed a scoping notice to 48 interested parties on March 29, 2013. The purpose of the scoping notice was to solicit public participation in the development of this project. The letter requested comments, issues, or concerns regarding this project that might help in its development. The BLM received a total of five scoping comment letters in return. Comment letters were from Jackson County Commissioners, American Forest Resource Council, Klamath-Siskiyou Wildlands Center, and two individuals.

1.4.2 Issues Considered in Detail

Issues provide a basis for comparing the environmental effects of the alternatives and aid in the decision making process. Issues are a point of disagreement, debate, or dispute with a proposed action based on some anticipated effect. Many issues may be identified during scoping but only some are analyzed in the EA. To warrant detailed analysis an issue must be within the scope of analysis; not already decided by law, regulation, or previous decision; and open to scientific analysis, rather than conjecture.

The following issues were based on input from the public and the Trail Creek Project's ID (Interdisciplinary) Team plus information contained in the ROD/RMP and Trail Creek Watershed Analysis.

ISSUE: Forest Condition

How can BLM promote the growth and vigor of overstocked forest stands and reduce potential fire hazards in the Project Area?

Forest stands in the Project Area are overstocked with more trees than the sites moisture, nutrients, and growing space can support. The supply of essential site resources has decreased while the demand has increased. With current stand densities, tree growth and vigor decline, increasing the probability of tree mortality from fire, insects, and disease.

ISSUE: Fragile Soil

Can the BLM implement ground-disturbing activities in the Trail Creek watershed on suitable commercial forestland considered fragile for mass movement while minimizing impacts to those fragile soils?

The Project Area contains areas where the soil is prone to mass movement such as deep-seated slumps and shallow-rapid mass wasting. Where soil-disturbing projects are proposed on these fragile soils, the BLM must design projects that would not contribute to slope instability.

ISSUE: Sediment from Roads

Can BLM reduce or eliminate road-related sources of sediment in the Project Area?

Unsurfaced and infrequently maintained roads and roads with ditch lines that connect directly to streams may contribute to increased sediment reaching streams in localized areas. Unsurfaced or natural surface roads may be more likely to contribute sediment to streams at stream crossings.

ISSUE: Northern Spotted Owl Habitat

Can the BLM implement forest management projects on matrix lands in northern spotted owl habitat without harm to an individual owl?

Forest stands on matrix lands in the Project Area contain northern spotted owl habitat (nesting, roosting, foraging, or dispersal). To treat these stands, the BLM must design management actions that would maintain or improve northern spotted owl habitat in order to prevent harm to known northern spotted owls.

ISSUE: Economics

How can the BLM provide an economical timber sale while maintaining healthy, diverse, and productive ecosystems?

Many factors influence the cost of removing timber from Federal lands: harvest prescription, yarding system, volume, road needs, activity slash treatment, hauling distances, and seasonal operating restrictions. The BLM must carefully balance these economic factors with the ecosystem needs to design an economically viable timber sale.

1.4.3 Issues Considered but Not Analyzed in Detail

A number of issues were raised during scoping that will not be analyzed in detail. These issues may be outside the scope of the project, project design features or best management practices may eliminate possible effects, or no species habitat is present in the Project Area. Appendix A provides a list of these issues raised during scoping that are not analyzed or considered further in this EA and includes our rationale for not analyzing them.

1.5 Decision Factors

In choosing the alternative that best meets the purpose and need, the BLM will consider the extent to which each alternative would

- reduce competition-related mortality and wildfire risk, and increase tree vigor and growth;
- provide for the establishment and growth of conifer species while retaining structural and habitat components, such as large trees, snags, and coarse woody debris;
- promote the development of healthy, late-successional characteristics;
- reduce erosion and subsequent sedimentation from roads;
- preserve slope stability on soils considered fragile for mass movement;
- reduce the short- and long-term costs of managing the lands in the Project Area;
- maintain or improve existing highly suitable northern spotted owl habitat within the provincial radius (1.3 miles) of known active northern spotted owl sites and all or substantially all of the older and more structurally complex, multilayered conifer forests; and
- maintain or improve the older, high quality, and occupied forest habitat as necessary to meet the northern spotted owl recovery goals.

1.6 Legal Requirements

This proposed forest management project is in conformance with the objectives, land use allocations, and management direction in the 1995 ROD/RMP and any plan amendments in effect at the time this document is published.

The project also conforms to the following:

- Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan)
- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001 Survey and Manage).

The Trail Creek Forest Management Project EA is a site-specific analysis that supplements the broader analyses found in the PRMP/FEIS (Medford District Proposed Resource Management Plan/Final Environmental Impact Statement). The PRMP/FEIS includes the analysis from the Northwest Forest Plan FSEIS (Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl).

The BLM developed this project to be consistent with laws, regulations, and policies including, but not limited to, the following: Oregon and California Railroad and Coos Bay Wagon Road Grant Land Act (O&C Act), Federal Land Policy and Management Act (FLPMA), Endangered Species Act (ESA), National Environmental Policy Act (NEPA), Archaeological Resources Protection Act (ARPA), Clean Air Act (CAA), and Clean Water Act (CWA).

1.7 Decisions to be Made

The following decisions will be made through this analysis:

- To determine if an SEIS (Supplemental Environmental Impact Statement) should be prepared based on whether the proposed action would result in significant impacts to the human environment not already analyzed in the EIS prepared for the Medford District ROD/RMP and its amendments. If there are any such additional impacts that are significant, we will determine whether the project proposals could be modified to mitigate the impacts so an SEIS would not be necessary. If we determine there is no need to prepare an SEIS, we will document this determination in a Finding of No Significant Impacts.
- To determine at what level, where, and how to harvest trees on BLM-administered lands allocated to the programmed timber harvest base within the Project Area.
- To implement or not implement proposed restoration projects on BLM-administered lands within the Project Area and, if so, which projects, at what level, and where.

2.0 Proposed Projects and Alternatives

Chapter 2 provides a description of the proposed projects and the alternative ways for meeting the purposes and needs of the proposed projects. Project design features that serve as the basis for resource protection during project implementation are included.

2.1 Introduction

The ID Team developed three alternative ways for meeting the purposes of the Trail Creek Project. These alternatives vary in response to the issues identified in Chapter 1. In addition, we have included a No Action Alternative (Alternative 1) to provide a baseline for comparison. The alternatives explore a range of options for forest management in the Project Area.

2.2 Proposed Projects

2.2.1 Forest Management

2.2.1.1 Timber Harvest

See Appendix C, Silviculture Prescriptions, for more description of proposed timber harvest.

Regeneration harvest

Three types of regeneration harvest are proposed in stands with declining growth rates or experiencing deterioration from high stand density levels, insects, disease, or other factors: northern GFMA, southern GFMA, and shelterwood retention (Figure 2-1). The minimum number of retained trees varies from 6 to 25 green conifer trees per acre greater than 20" DBH (diameter at breast height), depending on the silviculture method (Table 2-1). The retained trees would be the largest, full-crowned healthy trees. Hardwoods greater than 16" DBH would be retained. Shelterwood retention stands may be harvested again in 15 to 30 years to remove overstory trees in excess of 6 to 8 trees per acre.

Density management

High-density stands would be thinned from below (smallest trees are removed and largest trees are retained) to remove the suppressed component of the stand, reduce stand density, and improve stand and individual

Table 2-1. Proposed Regeneration Harvest Methods

Northern GFMA	6 to 8	10 to 15%
Southern GFMA	16 to 25	25 to 40%
Shelterwood Retention	12 to 25	20 to 40%

Figure 2-1. Stand harvested under a southern GFMA prescription in 2005.

tree health. Density would be reduced to an average relative density of 25 to 45%. Healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar would be favored for retention over white fir. Ponderosa and sugar pines greater than 20" DBH would be reserved. Density management would maintain a minimum 40% canopy cover in northern spotted owl dispersal habitat and a minimum 60% canopy cover in northern spotted owl nesting, roosting, and foraging habitat.

Commercial thinning

High-density stands would be thinned to accelerate the growth of the remaining trees. Density would be reduced to an average relative density of 25 to 35%. Healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar would be favored for retention over white fir. Large (greater than 20" DBH), healthy ponderosa pine and sugar pine would be favored over Douglas-fir. Two to four of the largest hardwoods (12" DBH or more) would be retained. Commercial thinning would retain a minimum canopy cover of 40%.

Restoration thinning

Stand densities would be reduced to increase landscape resiliency to environmental disturbances such as fire, insects, disease, and climate change. Thinning would create structural diversity by leaving small unthinned patches and creating small openings. Existing stand diversity would contribute to these unthinned patches and small openings. The unthinned patches and openings would range from approximately 0.1 to 0.25 acre in size with an irregular shape. They would occur in spatially random locations in the stand. Healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar would be favored for retention over white fir. Trees 150 years or older would be prioritized for retention. The largest hardwoods (greater than 12" DBH)

with full vigorous crowns would be retained to provide species diversity and canopy layers, and release naturally drought-tolerant species. Restoration thinning would maintain a minimum 40% canopy cover in northern spotted owl dispersal habitat and a minimum 60% canopy cover in northern spotted owl nesting, roosting, and foraging habitat.

Small diameter thinning

High stand densities in younger ponderosa pine and mixed conifer stands would be reduced to increase species diversity and stand vigor, reduce mortality of desired stand components, and reduce susceptibility to insect and disease attack and spread. Off-site ponderosa pine would be targeted for removal in ponderosa pine plantations. Hardwoods greater than 12" DBH and trees greater than 24" DBH would be retained. The stand density of conifers 8" or more DBH in mixed conifer stands would be reduced to a relative density of 35%. Stand structural diversity would be increased by leaving unthinned patches and small openings that range from approximately 0.1 to 0.25 acre. Existing stand diversity would contribute to these unthinned patches and small openings.

Riparian reserves in the pine plantations and mixed conifer stands would be partially thinned using the same treatment as the adjacent upland areas. A no-treatment area would be maintained within 35 feet each side of intermittent, non-fish-bearing streams and 60 feet each side of perennial, fish-bearing streams. No thinning would occur within this area (Figure 2-2).Along with the no-treatment buffers, special yarding areas would be designated within 100 feet both sides of the stream channel. On slopes 20% or less, one skid trail parallel to the stream channel could be used within the 100-foot special yarding area but could not enter the no-treatment buffer. On slopes greater than 20%, equipment would not be allowed inside the special yarding area and thinned trees would be bull-lined from outside the special yarding area. In the remaining portion of the riparian reserve, existing and designated skid trails would be used.

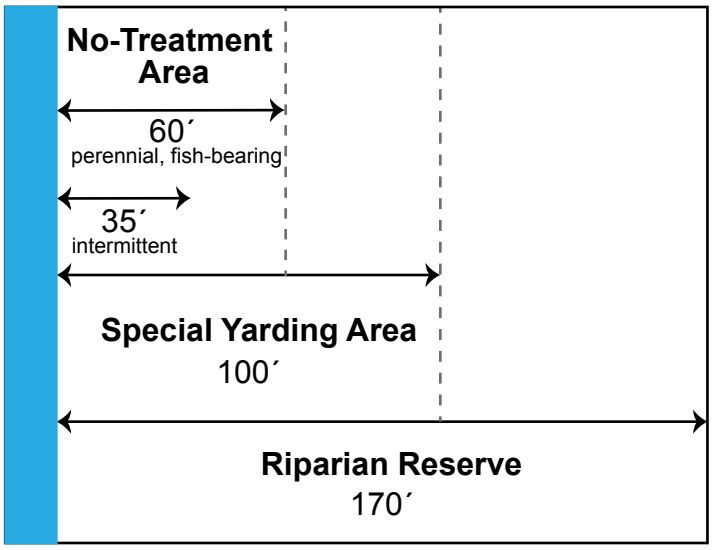


Figure 2-2. Treatment guidelines for small diameter thinning within riparian reserves.

Precommercial thinning

Precommercial thinning would cut competing conifers less than 8″ DBH and hardwoods less than 12″ DBH in dense stands where competition for resources would reduce the growth and development of desired species.

Dominant conifers are preferred for retention; species preference depends on site conditions.

Generally, drier sites would retain more ponderosa pine and incense cedar, and moister sites would retain more Douglas-fir, sugar pine, and true fir. Conifer spacing would range from 16 feet (170 trees per acre) to 20 feet (109 trees per acre) or could be treated on a variable spacing that would range from 12 feet (303 trees per acre) to 16 feet (170 trees per acre) within a treatment unit, depending on size of conifers to be retained. In variable spacing, generally conifers less than 7 feet in height would be retained at the higher densities, depending on stand condition and management objectives. Hardwoods could be cut and spaced between 30 and 40 feet depending on their densities and management objectives; they may be retained in some precommercial thinning areas.

Riparian thinning

Overstocked, even-aged, second growth riparian stands would be thinned to enhance and accelerate the production of healthy trees in the riparian area. Trees would be thinned from below to remove the suppressed component of the stand, followed by thinning the main canopy to reduce density and to remove trees infected by disease or insects or otherwise declining (based on crown ratio and form). Stand density would be reduced to 50% or more in northern spotted owl dispersal habitat and 60% or more in northern spotted owl nesting, roosting, and foraging habitat. Healthy Douglas-fir, incense cedar, ponderosa pine, and sugar pine would be left.

The outer 110 feet of riparian reserves located adjacent to proposed upland thinning units would be thinned. Equipment would not enter the 170-foot riparian reserves (unless on existing roads) but trees could be yarded through the outermost 110 feet. No vegetation would be cut within the no-treatment buffer (Figure 2-3).

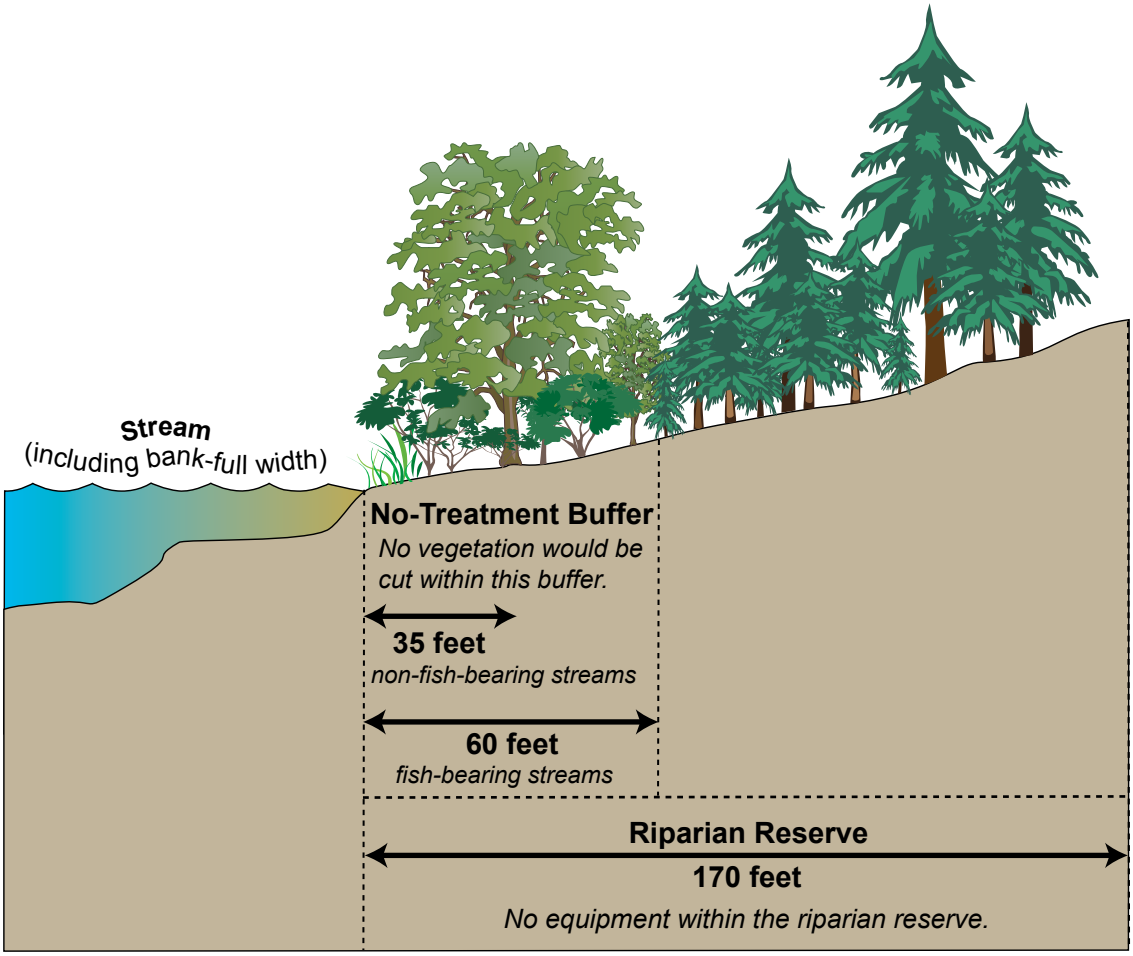


Figure 2-3. Riparian Reserve width and no-treatment buffer.

2.2.1.2 Timber Yarding

Ground-based yarding

In ground-based yarding, a machine travels to the logs and pulls them to the landing. The machines used for skidding are diverse and can have wheels or tracks. Trees and logs are removed from the woods using rubber-tired skidders, tracked skidders, or forwarders. The skidders yard the trees to the landing by lifting the front end of the logs off the ground. Skidders travel on skid trails that are designated and approved by the BLM.

A feller-buncher fells and bunches trees mechanically. The typical feller-buncher is track mounted. Some must move from tree-to-tree for felling, while others use a boom to fell multiple trees from a single position. The feller-buncher bundles trees for a skidder to pick up and move to a landing.

A forwarder is a rubber-tired machine that typically works with a harvester. Harvesters move through the stand felling, delimbing, bucking, and bunching trees selected for harvest. Forwarders travel into the stands on the slash created by the harvester. They load the logs piled by the harvester and carry them to the road where they are off-loaded. The logs carried by a forwarder do not touch the ground during travel.

Ground-based yarding is generally limited to slopes of 35% or less. After harvest is complete, skid trails and landings not needed for future management would be ripped, seeded, and mulched.

Skyline-cable yarding

Skyline-cable yarding uses steel cables to pull logs to the landing. A stationary machine, or yarder, would be located on the road and would pull logs up to the landing with one end of the log suspended. Skyline-cable yarding is typically used where the ground is too steep for ground-based yarding.

Helicopter yarding

Helicopter yarding can be used on nearly any terrain and is not dependent on road location or harvest treatment. Helicopters use a tag line (cable), generally 150 feet or greater, to lift the logs above the standing timber and fly them to a landing.

Predesignated skid trails

Skid trail routes would be specifically selected by the BLM to facilitate yarding operations. The skid trail can be an existing skid trail or newly located and is intended to be used by the yarding operator.

2.2.1.3 Reforestation

Regeneration harvest units would be replanted after harvest with 300 to 500 trees per acre in the following mix of native conifers: 70% Douglas-fir, 20% sugar or ponderosa pine, and 10% incense cedar. In stands with root rot, no ponderosa pine would be planted; a mix of Douglas-fir, sugar pine, and incense cedar would be planted. In regeneration harvest stands adjacent to stands with Douglas-fir mistletoe, no Douglas-fir would be planted within 50 feet of the perimeter of the infected stand.

Target stands would have 280 well-spaced trees per acre. At 1, 3, and 5 years, the BLM would conduct surveys to determine seedling survival, stocking levels, and maintenance needs (e.g., tubing, mulching, shading, scalping). Replanting would occur if needed to meet the target number of trees per acre. If necessary, competing vegetation would be removed for a 3-foot radius around planted seedlings.

2.2.2 Fuels Treatment Associated with Forest Management

Preliminary fuels treatments were recommended for post forest management acres by alternative. The BLM would conduct a fuels assessment within each unit following harvest activity. This assessment would determine the fuel hazard and fire risk based on surface fuel loading, aspect, slope, access, and location of each unit. Fuels treatments could include lop and scatter, hand pile and burn, and biomass removal. Most fuels treatments would begin within 90 days after completion of harvest activities.

2.2.2.1 Lop and Scatter

When the slash (live and dead material 9" or less) remaining in the units after harvest is less than 11 tons per acre, all stems and branches would be cut from the tree trunk and scattered. Trunks 7" in diameter and less would be cut to 3-foot lengths and left on the ground. The depth of the slash would not exceed 18".

2.2.2.2 Hand Piling and Pile Burning

When the slash remaining in the units after harvest is greater than 11 tons per acre, the material between 1 and 7" in diameter and longer than 2 feet would be piled by hand. The piles would be a minimum of 4 feet high and 6 feet in diameter. Piles would be burned in the fall, winter, or spring.

2.2.2.3 Underburning and Broadcast Burning

Underburning would remove at least 60% of slash less than 3" in diameter and a lesser amount of larger fuel size classes in timbered stands. Underburning would be implemented in the spring or fall. Broadcast burning would be used in grasslands and brushlands without a timbered overstory. Broadcast burning is a useful tool for meadow restoration and would be completed in the spring or fall.

2.2.2.4 Biomass Removal

Whole trees or tree tops would be yarded to log landings, the tree tops and limbs would be removed and piled at the landings, and the resulting piles of slash would be hauled away from the landings. Whole tree yarding and tree top yarding would not be required but are options for treating slash.

2.2.3 Road Work

2.2.3.1 Road Renovation

Before roads are used for forest management activities, they would be surfaced or spot rocked; ditches would be cleaned where needed; catch basins would be cleaned or enlarged; brush growing near culvert inlets or outlets would be removed; culvert inlets and outlets would be cleaned; and brush, limbs, and trees would be removed along roadways to improve sight distance and allow for proper road maintenance (Figure 2-4).

Figure 2-4. Road proposed for renovation.

Road surfacing is placing rock the full width and desired length of the road. Surfacing is done by

grading and reshaping the road subgrade, then hauling, placing, and compacting the new surfacing material on the prepared subgrade.

Spot rocking is placing rock on the road in areas as needed to help control erosion and maintain the road surface. This restores the road surface and road condition making it suitable for driving and hauling. Crushed aggregate material would be placed on sections of inadequately surfaced roads that would be used for hauling timber.

2.2.3.2 Road Closure and Full and Partial Decommissioning

Roads that are surplus to BLM's needs at this time and may be needed for future access would be closed to prevent vehicular access. Road closure would be accomplished using methods such as gates, guard rails, or earth or log barricades. The roads behind the closure would be left in a maintenance-free condition.

Road decommissioning would occur where roads are not needed at this time but may be used in the future. Partial decommissioning would water bar roads, remove culverts (armored if necessary), seed with native grasses, mulch with weed-free mulch, and plant to reestablish vegetation. Full decommissioning would include ripping, water barring, removing culverts (armoring if necessary), seeding with native grasses, mulching with weed-free mulch, and planting to reestablish vegetation. In addition, any cross-drain culverts, road fills in stream channels, and potentially unstable fill areas would be removed to restore the natural hydrologic flow.

Decommissioned roads would be closed with a device similar to an earthen barrier or equivalent and would not be maintained in the future. Roads would be closed to vehicles on a long-term basis, but may be used again in the future.

2.2.3.3 Temporary Routes

Temporary routes would allow operators temporary access to harvest units. Temporary routes would be located on stable areas such as ridges. After harvest is complete, routes would be ripped, water barred, seeded with native grass, mulched, and blocked.

Temporary route construction would occur where no previous routes exist. An access route would be constructed to minimum standards. Construction would include clearing, grubbing, removing, and disposing of vegetation and debris from within established clearing limits. Work also includes the construction of a minimum-width subgrade by excavating, leveling, grading, and outsloping.

Temporary route reconstruction would use previously decommissioned roads. The blocked road is not part of the designated transportation network system. The route was blocked and closed to all forms of motorized vehicles. It has a defined prism and receives no periodic maintenance. Routes would be made suitable for hauling timber by removing encroaching vegetation, repairing narrowed sections, and blading the route surface.

2.2.4 Hazardous Fuels Reduction

In areas where ladder fuels could be precommercially thinned, conifers and hardwoods more than 1 foot tall and less than 8" DBH would be cut to a 25-foot by 25-foot spacing or less. Shrub species more than 1 foot tall and less than 12" in diameter (at 1 foot above ground level) would be cut to 45-foot by 45-foot spacing or less. Conifers 6 to 14" DBH would be pruned up to 10 feet above ground level. Slash material 1 to 8" in diameter and more than 2 feet long would be hand piled and burned. Shrub species more than 1-foot tall

and less than 12"in diameter would be burned. Slash and slash piles would be burned between October and May (Figure 2-5).

Figure 2-5. Area proposed for hazardous fuels reduction.

2.2.5 Public Roadside Firewood Cutting

The BLM would make firewood cutting available to the public along 12 miles of road. Dead and down hardwoods or conifers less than 16" diameter would be made available for public firewood collection if snag and down wood requirements are met for the land allocation in which the project is located. Dead standing hardwoods and conifers less than 12" DBH could also be available. Collection by hand within 100 feet of designated roads would be permitted.

2.2.6 Water Source Restoration

Restoration activities would occur on 14 existing water sources to allow use by fire engines and water tenders during fire suppression and by wildlife for drinking water, habitat, and foraging opportunities (Figure 2-6). Restoration activities would include clearing brush and trees; removing accumulated sediment from developed spring sites; installing, repairing, or replacing spring boxes and culverts; repairing or replacing pipelines; installing, repairing, or replacing devices such as bentonite or pond liners that impede water seepage; installing safety devices such as fences and exit ramps; and completing minor road work such as grading and adding rock.

Figure 2-6. Overgrown water source.

2.2.7 Off-highway Vehicle Trail Closure and Restoration

Trails created by unauthorized off-highway vehicle use would be closed by placing boulders, logs, and earthen barricades at strategic points to prevent off-highway vehicles from using existing and creating new unauthorized trails. Trails would be restored with various levels of ripping, pulling ruts back, pulling slash and other material onto trails, seeding, planting, and mulching. This work would be completed in the dry season to minimize erosion and subsequent sedimentation.

2.2.8 Meadow Restoration

Identified upland meadow and brushland vegetation areas would be restored using manual and prescribed fire techniques. Areas of older or decadent brush would be targeted for burning. In some cases, brush pockets and small conifers (<7" DBH) would be cut with a chainsaw and "cured" before burning. In other areas, the brush may be burned without the manual cutting as a pretreatment. Prescribed fire would likely be implemented in the fall and winter. Cut and cured brush pockets would be available for burning only in the spring during green up.

2.2.9 Stream Habitat Enhancement and Riparian Restoration

The following actions are proposed at a location on West Fork Trail Creek in T33S, R1W, section 19 (Figure 2-7):

- Place 10 wood structures and up to 10 rock structures in strategic locations in West Fork Trail Creek to improve fish habitat and aggrade the stream where bedrock is present. Wood structures would consist of three to four pieces of 40- to 50-foot lengths of pine or fir keyed into standing trees in the riparian to resist downstream migration. A key piece approximately 20" or more in diameter would be placed on top of smaller pieces 10 to 18" in diameter. Structures would be placed in an upward "V" angle to focus flow toward the middle of the channel to prevent scouring and widening along the banks. Key logs would be obtained from snags and near-road hazard trees in the Trail Creek Watershed that would be fallen and cut to size for this project. Smaller logs would be taken from overstock within 170 feet of the stream. Rock structures would be placed at upstream angles of approximately 30 degrees to focus scour toward the opposite stream bank. These rock structures would dissipate energy where the existing channel flow is too high to allow aggradation. Rock for this project would be purchased or removed from active BLM quarries.
- Remove 0.5 mile of unimproved, natural surface, user-built roads in riparian areas. Roads would be decompacted with wing-tooth rippers to a depth of 18" and blocked with ditch and berm structures to prevent reentry.
- Remove 0.14 mile of deteriorated fencing and construct 0.1 mile of new fencing to prevent vehicles from entering into an open meadow along West Fork Trail Creek. A gate would be installed in the new fence for power line access.
- Plant 3.5 acres between West Fork Trail Creek Road and West Fork Trail Creek to accelerate regrowth of long-term wood sources. Seedlings would be planted using hand tools.
- Replace an undersized culvert that has a blow-out below the road. The culvert is located on an intermittent stream on West Fork Trail Creek.
- Plant native grass seed and apply weed-free straw mulch to areas of ground disturbance resulting from project implementation.

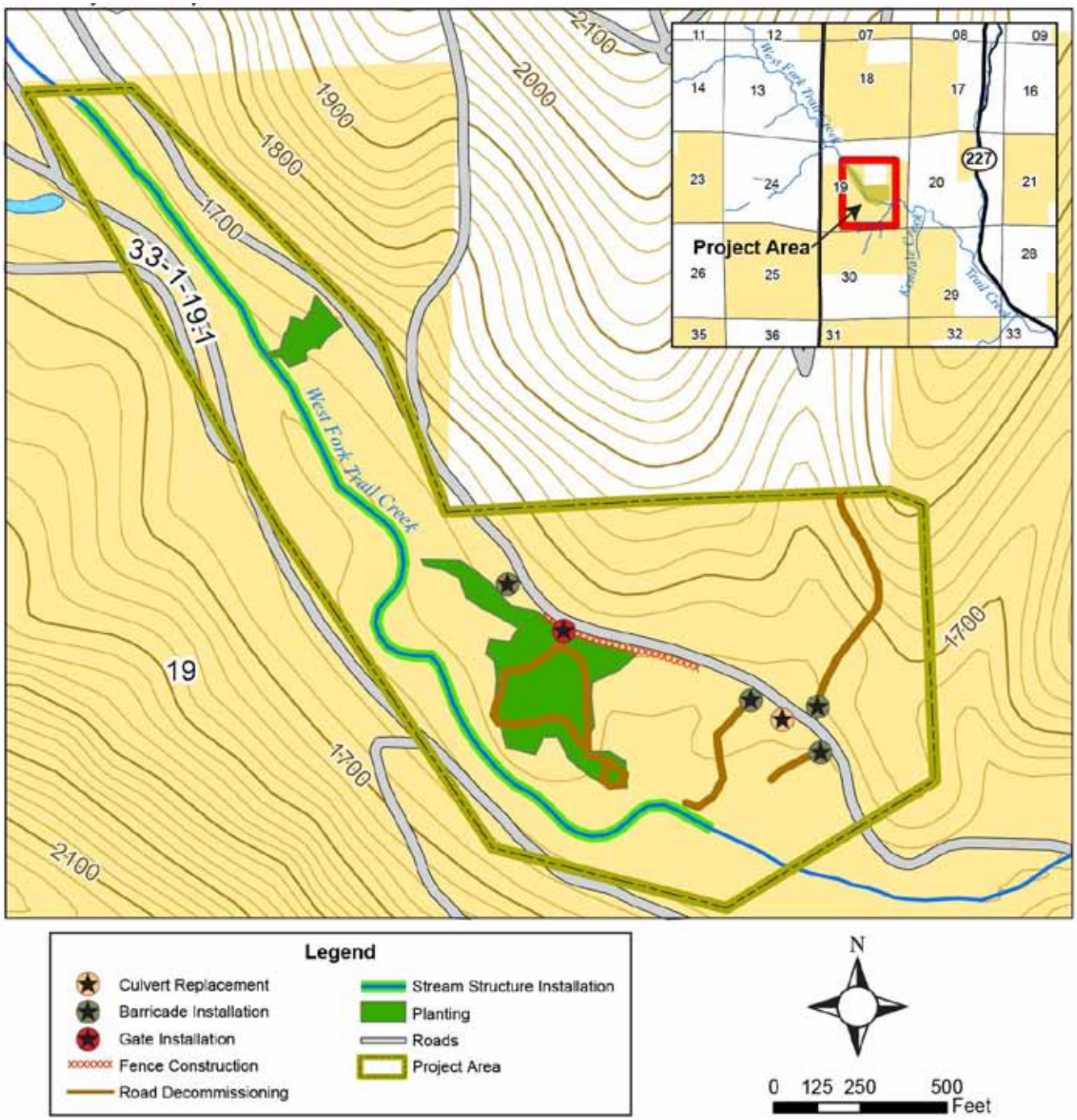


Figure 2-7. Proposed stream habitat enhancement and riparian restoration project in T33S, R1W, section 19.

2.2.10 Quarry Reclamation

The Romine Creek Quarry in T33S, R3W, section 23 would be ripped, recontoured, planted, seeded, and mulched. The rock remaining in the depleted quarry would be stockpiled, used for road work, or used as part of the reclamation process.

To improve the drainage at the quarry, a berm at the bottom of quarry would be trenched and an armored channel would be created through the trench. A 36-inch culvert would be installed on BLM road 33S-3W-23.4 where the new channel would meet the road. The roadside ditch would be armored and an armored water-dip would be created on the 23.4 road above the quarry entrance to reduce ditch line runoff into the

new culvert. All disturbed areas would be seeded with native grass seed and mulched with weed free straw.

A blocked culvert on an old road above the quarry would be removed and a headcut area would be armored. The road would be reblocked and disturbed areas would be seeded with native grass seed and mulched with weed-free straw. Other potential projects include planting conifers or hardwoods, removing blackberries along the channel, and replanting the channel with native shrubs (Figure 2-8).

Figure 2-8. Romine Creek quarry.

2.3 Alternatives

2.3.1 Alternative 1 (No Action Alternative)

The No Action Alternative describes a baseline against which the effects of the action alternatives can be compared. This alternative describes the existing condition and the continuing trends in the Project Area. Under the No Action Alternative, the proposed forest management and restoration activities would not be implemented at this time and current management could continue. Future activities in this area could be proposed and analyzed in subsequent NEPA documentation.

2.3.2 Proposed Actions Common to All Action Alternatives (Table 2-3 and Map 2)

The following proposed actions are the same in all action alternatives (Alternatives 2, 3, and 4):

- 185 acres of small diameter thinning using ground-based yarding
- 263 acres of precommercial thinning
- 63 acres of riparian thinning
- 2,638 acres of hazardous fuel reduction
- 12 miles (272 acres) of public roadside firewood cutting
- 14 sites for water source restoration
- 5.8 miles of unauthorized off-highway vehicle trails closure and restoration
- 282 acres of meadow restoration
- Stream habitat enhancement and riparian restoration projects
- Romine Creek Quarry reclamation

No timber harvest would occur in northern spotted owl nest patches or RA (Recovery Action) 32 habitat.

The BLM Fire Management Specialist would conduct a fuels assessment within each harvest unit following harvest activity. This assessment would determine the fuel hazard and fire risk based on surface fuel loading, aspect, slope, access, and location of each unit. Fuels treatments could include lop and scatter, hand or

excavator pile and burn, and biomass removal. Most fuels treatments would begin within 90 days after harvest activities are completed.

2.3.3 Alternative 2 (Table 2-3 and Map 3)

Alternative 2 is designed to implement the management direction from the 1995 ROD/RMP. The ROD/RMP prescribed forest management activities would be applied to matrix units outside known active northern spotted owl sites. Management actions would not occur within northern spotted owl RA32 habitat or 70-acre nest patches.

2.3.3.1 Forest Management

In Alternative 2, the following forest management activities are proposed on 1,019 acres of matrix land:

- 75 acres of regeneration harvest (32 acres northern GFMA, 19 acres southern GFMA, and 24 acres shelterwood retention);
- 814 acres of density management (leaving a minimum 40 or 60% canopy cover); and
- 130 acres commercial thinning.

Trees would be removed using the following yarding systems:

- 559 acres of ground-based yarding
- 257 acres of skyline-cable yarding
- 266 acres of helicopter yarding

The BLM would identify 1.4 miles of predesignated skid trails. Skid trails and landings in regeneration harvest units would be ripped, seeded, and mulched after harvest. Regeneration harvest units would be replanted with a mix of native conifers.

2.3.3.2 Road Projects

In Alternative 2, the following road work is proposed:

- 80 miles of road renovation
- 1.4 miles of road closure
- 10.3 miles of partial and full road decommissioning
- 0.6 mile of temporary route construction
- 0.5 mile of temporary route reconstruction

No permanent roads would be constructed and temporary routes would be decommissioned after use.

2.3.4 Alternative 3 (Table 2-3 and Map 4)

Alternative 3 emphasizes restoration thinning as derived from *Restoration of Federal Forests in the Pacific Northwest: Strategies and Management Implications* (Johnson and Franklin 2009).

2.3.4.1 Forest Management

In Alternative 3, the following forest management activities are proposed on 1,019 acres of matrix lands:

- 1,019 acres of restoration thinning (658 acres leaving a minimum 40% canopy cover and 361 acres leaving a minimum 60% canopy cover)

Trees would be removed using the following yarding systems:

- 559 acres of ground-based yarding
- 257 acres of skyline-cable yarding
- 266 acres of helicopter yarding

The BLM would identify 1.4 miles of predesignated skid trails.

2.3.4.2 Road Projects

In Alternative 3, the following road work is proposed:

- 80 miles of road renovation
- 1.4 miles of road closure
- 10.3 miles of partial and full road decommissioning
- 0.6 mile of temporary route construction
- 0.5 mile of temporary route reconstruction

No permanent roads would be constructed and temporary routes would be decommissioned after use.

2.3.5 Alternative 4 (Table 2-3 and Map 5)

Alternative 4 also emphasizes restoration thinning; however, no new temporary routes would be constructed to access thinning units.

2.3.5.1 Forest Management

In Alternative 4, the following forest management activities are proposed on 1,019 acres of matrix lands:

- 1,019 acres of restoration thinning (658 acres leaving a minimum 40% canopy cover and 361 acres leaving a minimum 60% canopy cover)

Trees would be removed using the following yarding systems:

- 519 acres of ground-based yarding
- 241 acres of skyline-cable yarding
- 322 acres of helicopter yarding

The BLM would identify 1.4 miles of predesignated skid trails.

2.3.5.2 Road Projects

In Alternative 4, the following road work is proposed:

- 80 miles of road renovation
- 1.4 miles of road closure

- 10.3 miles of partial and full road decommissioning
- 0.2 mile of temporary route reconstruction

No permanent roads or temporary routes would be constructed and temporary routes that are reconstructed would be decommissioned after use.

2.4 Project Design Features

The following project design features are included in the design of the projects. These project design features are a compilation of resource protection measures identified by the Interdisciplinary Team and Best Management Practices identified in the 1995 Medford District ROD/RMP and the updated Best Management Practices that were incorporated into the Medford District RMP in 2011.

Project design features serve as a basis for resource protection during project implementation. They will be considered in the analysis of the impacts of the projects in Chapter 3.

2.4.1 Common to All Projects

- Protect raptor species, if any are located. Apply the appropriate buffers and seasonal restrictions based on species, proposed treatment, site-specific environmental conditions, and protection recommendations.
- Store all hazardous materials and petroleum products in durable containers placed outside of riparian reserves. Locate so an accidental spill will be contained and will not drain into the stream system.
- Cultural sites located within the Area of Potential Effect will be buffered. Buffers will be designed by archeologists or cultural resource specialists and will be established sufficient to protect the features of the site from adverse impacts of proposed management activities. No treatments will occur within this buffer. No fire line construction, prescribed burning, hand piling, or pile burning will occur within the flagged boundaries of the recorded cultural resources. Timber that is to be removed next to a buffer will be directionally felled away from buffers for one site-potential tree length (170 feet).
- During project implementation, if the contractor encounters or becomes aware of any objects or sites of cultural value on Federal lands, such as historical or prehistorical ruins, graves, grave markers, fossils, or artifacts, the contractor shall immediately suspend all operations in the vicinity of the cultural value and notify the BLM Contracting Officer Representative so the site can be evaluated by a BLM archaeologist.
- Protect known Special Status and Survey and Manage wildlife, vascular plant, lichen, bryophyte, and fungi sites with no-treatment buffers. No-treatment buffers will be determined based on species, proposed treatment, site-specific environmental conditions, and available management recommendations (Special Status Species Conservation Assessments and Survey and Manage Management Recommendations).
- When a project requires the application of native seed mix or weed-free straw and mulch, ensure straw and mulch are free of weed reproductive plant parts, per 63 FR 124:51102. The native seed mix and straw shall be provided by the purchaser from an approved commercial source, or may be provided by the BLM if the purchaser is unable to locate and buy the certified seed and straw. Seed must be from native plant species approved by the BLM. The purchaser shall reimburse the government for the cost of seed and straw if provided by the government.

- Wash equipment (including the undercarriages) that will be traveling off system roads prior to entry onto BLM-administered lands.
- Prepare a spill plan. If a spill does occur, waste diesel, oil, hydraulic fluid, and other hazardous materials will be removed from the site and disposed of at an approved location in accordance with Federal regulations.
- Refuel and maintain equipment at least 175 feet from streams, ponds, or other wet areas. Equipment will not be stored in a stream channel overnight. Hydraulic fluid and fuel lines will be in proper working condition in order to minimize leakage into streams.
- In harvest units within the Berry Creek lands with wilderness characteristics:
  - Rip, seed, mulch, and block landings and temporary routes in tractor-yarded units in the same season after use.
  - Access helicopter units and fuels treatment units by foot only, unless other means of access is approved by the Authorized Officer.
  - Place woody debris or other appropriate barriers (e.g., rocks, logs, and slash) on the first 100 feet of vehicle access routes leading into fuels treatment units upon completion.
  - Feather and scallop unit edges and use natural vegetation breaks to reduce straight line effects along property lines and unit boundaries.

2.4.2 Timber Harvest and Small Diameter Thinning

2.4.2.1 Common to Timber Harvest and Small Diameter Thinning

- Maintain existing snags except those that need to be felled for safety reasons. Snags felled for safety reasons will be left on site.
- Maintain existing large coarse woody debris in the stands.
- Restrict harvest activities within 300 feet of meadows.
- Construct new landings outside of riparian reserves and 100-acre northern spotted owl activity centers.
- Limit landings to 0.5 acre or less for tractor or skyline-cable yarding and 1 acre for helicopter yarding.
- Locate temporary routes and landings on stable locations such as ridge tops, natural benches, and flatter transitional slopes near ridges and valley bottoms, and use existing jeep road and skid trail footprints, where possible.
- Minimize temporary route and landing construction on steep slopes, slide areas, and high landslide hazard locations.
- Limit landing and temporary route construction and reconstruction to the dry season (generally May 15 to October 15). Landing or temporary route construction will be located outside of riparian reserves and away from unstable soil conditions and headwalls.
- Rip all temporary routes and associated landings (new construction or reconstruction) to a depth of 18" or bedrock (whichever is shallower), apply native grass seed and weed-free mulch, water bar, and block upon completion of use. If hauling is not completed in the same year the route is constructed, the route will be storm proofed and blocked by October 15 or when soil moisture exceeds 25%.

- Use existing skid trails to the extent possible. Where new skid trails are necessary, limit the extent to minimize the impact.
- Limit the width of skyline-cable corridors to be as narrow as operationally feasible; do not exceed a 12-foot width.
- Restrict tractor yarding and soil ripping operations from October 15 to May 15, or when soil moisture exceeds 25%.
- Allow ground-based equipment operations when snow depth is at least 18".
- Require mechanized felling equipment to have an arm capable of reaching at least 20 feet.
- In order to restrict the amount of compacted soil to less than 12% in a timber harvest unit,
    - Allow mechanized equipment capable of creating and walking on slash (such as a cut-to-length system) to work off designated skid trails for one or two passes on at least 8" of slash and under dry soil conditions (less than 25% soil moisture content).
    - Equipment must be 8 psi or less.
    - Limit skid trails to a minimum of 50-foot spacing off designated skid trails. All other use of ground-based equipment will be restricted to designated skid trails.
- Allow mechanized equipment (feller-buncher systems) to work off designated skid trails during the dry season (soil moisture content less than 25%) for 1 or 2 passes only (one round-trip). These 1 to 2 pass trails must be spaced a minimum of 50 feet apart off of designated skid trails. Equipment must be 8 psi or less. All other use of ground-based equipment will be restricted to designated skid trails.
- Place woody debris or other appropriate barriers (e.g., rocks, logs, and slash) on the first 100 feet of skid trails leading off system roads in all ground-based yarding units upon completion of yarding to block and discourage unauthorized vehicle use.
- Restrict timber hauling and landing operations on native surface or rocked roads whenever soil moisture conditions or rain events could result in road damage or the transport of sediment to nearby stream channels, generally October 15 to May 15. If the Authorized Officer determines that hauling would not result in road damage or the transport of sediment to nearby stream channels based on soil moisture conditions or rain events, the Contracting Officer may approve a conditional waiver for hauling. If soil moisture conditions or rain events are anticipated to cause unacceptable impacts to roads or stream water quality, as determined by the Authorized Officer, the waiver will be revoked.
- Conduct a post-activity fuels assessment on areas proposed for treatment. Modifications or additional treatment recommendations will be based on the fuels assessment and the amount of slash created during harvest activities. Treatments including, but not limited to, hand or excavator piling, slash pile burning, and biomass removal may be needed to further reduce the fuels hazard to an appropriate level within all units.
- Restrict yarding through interior reserves (skips) where feasible; however, no yarding is allowed through buffered plant and wildlife sites. If an existing skid trail is within the skip, it may be used if it is determined it will not cause damage to the resources in the skip.
- Locate skid trails to minimize disturbance to coarse woody debris. Where skid trails encounter large coarse woody debris, a section will be bucked out for equipment access. The remainder will be left in place and not disturbed.

- Restrict tractor and mechanical operations to slopes generally less than 35%. In areas where it is necessary to exceed these gradients to access adjacent tractor area, use ridge tops where possible.
- Use erosion control techniques on landings and skid and forwarder trails to minimize sediment movement off-site (e.g., water bar, apply native grass seed and weed-free mulch, scatter chipped material, or scatter limbs and other fine material).
- Do not allow ground-based equipment on unstable areas within units.
- Seasonally restrict harvest activities from November 15 to April 1 in the Big Game Winter Range and Elk Management Area in Township 34 South, Range 2 West, section 1.
- Seasonally restrict harvest activities and helicopter operation from March 1 to September 30 within 0.25 mile of known northern spotted owl sites (1 mile for blasting). The seasonal restriction will be waived if nonnesting is determined. If new northern spotted owls are discovered in harvest units following the sale date, activities will be halted until mitigation options are determined.
- Seasonally restrict harvest activities from March 1 to July 15 within 0.25 mile of known golden eagle sites. The seasonal restriction will be waived if nonnesting is determined. If new golden eagles are discovered in harvest units following the sale date, activities will be halted until mitigation options are determined.
- Seasonally restrict harvest activities from January 1 to July 15 within 0.25 mile of known peregrine falcon sites (within 0.5 mile for helicopter operations and blasting). The seasonal restriction will be waived if nonnesting is determined. If new peregrines are discovered following the sale date, activities will be halted until mitigation options are determined.
- Seasonally restrict harvest activities from March 1 to August 30 within 0.25 mile of known goshawk sites (0.5 mile for helicopter operations and blasting). The seasonal restriction will be waived if nonnesting is determined. If new goshawks are discovered in harvest units following the sale date, activities will be halted until mitigation options are determined.

2.4.2.2 Timber Harvest

- Designate skid trails at an average 150-foot spacing. In order to minimize ground disturbance, use existing trails and avoid creating new skid trails where feasible.
- Rip skid trails in tractor-yarded regeneration harvest units and apply native seed and weed-free mulch.
- Apply native seed and certified weed-free straw mulch to the top 20 feet of the skyline-cable yarding corridor where yarding logs to the road results in extended soil exposure.

2.4.2.3 Small Diameter Thinning

- Designate skid trails prior to falling timber at an average spacing of 100 feet. Use existing skid trails in harvest units, where feasible.

2.4.2.4 Precommercial thinning

- Do not treat vegetation within 60 feet of fish-bearing, perennial streams and within 35 feet of non-fish-bearing, intermittent streams.
- Do not cut madrone, black oak, and white oak over 6" DBH and preserve riparian hardwoods such as Oregon ash, big leaf maple, and red alder within riparian reserves.

- Remove activity slash from all drivable road surfaces, drainage ditches, fill slopes, and cut banks. Lop and scatter the slash.
- Seasonally restrict activities from March 1 through June 30 within 195 feet of northern spotted owl nest sites. This may be extended to September 30 if nesting activity is occurring. Seasonal restriction may be waived if nonnesting is determined.
- Operate vehicles on existing roads. Restrict road use on unsurfaced roads to the dry season (typically May1 to October 31), unless the road is sufficiently dry to protect the road and resource values.

2.4.3 Riparian Thinning

- Seasonally restrict harvest activities and helicopter operation from March 1 to September 30 within 0.25 mile of known northern spotted owl sites. The seasonal restriction will be waived if nonnesting is determined. If new northern spotted owls are discovered in harvest units following the sale date, activities will be halted until mitigation options are determined.
- Do not cut vegetation within the primary shade zone (Table 2-2) of fish-bearing and perennial streams, springs, seeps, ponds and wetlands with a minimum of 60 feet from the ordinary high water line (no-treatment area), unless necessary to accommodate skyline-cable yarding operations.

Table 2-2. Primary Shade Zone Minimum Width (feet)

Tree Height	Adjacent Hill Slope		
	<30%	30 to 60%	>60%
<20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60
>100 to 140 feet	70	75	85

- Do not cut vegetation within 35 feet of non-fish-bearing, intermittent streams, unless necessary to accommodate skyline-cable yarding operations.
- Maintain a maximum clearing width of 12 feet for skyline-cable corridors across no-treatment areas. Space corridors a minimum of 150 feet apart. Require full suspension for any logs yarded through the no-treatment areas.
- Retain a minimum of 50% (60% in northern spotted owl nesting, roosting, and foraging habitat) overstory canopy cover outside the no-treatment area.
- Do not remove riparian hardwood species such as willow, ash, yew, maple, and California black oak.
- For small diameter thinning within riparian reserves, no vegetation will be cut and no equipment will enter the no-treatment buffer (60 feet for perennial and fish-bearing streams and 35 feet for intermittent streams). Ground-based equipment will be allowed to access the area outside of the no-treatment buffer and within 100 feet of streams, but will be restricted to slopes 20% or less and generally limited to one skid trail parallel to the stream. These trails may be ripped if remaining vegetation would not be affected. No equipment is allowed within 100 feet of the stream on slopes greater than 20%, although, trees may be bull-lined to outside of the 100 feet.
- Do not remove trees greater than 20" DBH. If operationally necessary to fell trees of this size, fell toward the stream and leave on the ground.
- Directionally fell trees away from the no-treatment area.

- When operationally feasible, yard all units in such a way that the coarse woody material remaining after logging will be maintained at or greater than current levels in order to protect the soil surface.
- Wherever trees are cut to be removed, directionally fell trees away from dry draws and irrigation ditches. Fell trees toward skid trails. Protect irrigation ditches in the project area from damage and keep free of activity slash.
- Operate ground-based equipment during the dry season, generally May 15 through October 15, or on approval by the Authorized Officer or contracting officer's representative (COR). Variations in these dates will depend on review of weather and soil moisture conditions by the project soil scientist or hydrologist.
- Shut down all harvest and yarding operations if there is potential for sediment movement to waterways due to weather or soil moisture conditions.
- Do not pile activity slash within the no-treatment area. Stack slash piles more than 60 feet from fish-bearing, perennial streams and more than 35 feet from non-fish-bearing, intermittent streams. Piles will not be placed in channel bottoms.
- Prohibit the use of foam agents within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing, intermittent streams during prescribed burning and mop-up activities.
- Apply native seed and weed-free straw mulch to skid trails after harvest is complete.

2.4.4 Road and Quarry Projects

- Seasonally restrict blasting activities from March 1 to September 30 within 1 mile of known northern spotted owl sites.
- Seasonally restrict heavy equipment and chainsaw operations from March 1 to June 30 within 195 feet of known northern spotted owl sites. The seasonal restriction will be waived if nonnesting is determined.
- Complete culvert removal and placement and road construction, improvement, renovation, closure, and decommissioning work during the dry season, generally May 15 to October 15, or when soil moisture is less than 25%.
- Block or barricade identified roads after use and before the beginning of the rainy season (generally by October 15).
- Water bar decommissioned roads on each side of stream crossings in order to adequately filter road surface runoff and minimize sediment transport to streams.
- Install sediment barriers (e.g., hay bales, silt fence, settling ponds) on natural-surface and rocked haul routes and related ditch lines that could deliver sediment into Southern Oregon/Northern California Coho critical habitat to prevent sediment from reaching these streams.
- Install cross drains or armored water dips on haul routes within 0.25 mile of Coho critical habitat to disconnect roadside ditches from streams.
- Avoid blading and vegetation removal unless necessary to remove drainage impediments when maintaining inboard ditches. Control sediment by spreading straw in ditch lines, where ditch line blading is required within 100 feet of streams. Avoid blading ditch lines within 200 feet of stream crossings in Coho critical habitat.

- Apply mulch (weed-free straw or native materials) to areas of ground disturbance due to road maintenance, renovation, or decommissioning within 200 feet of any stream. Maintain a minimum of 80% ground cover following such activities. Where the potential for surface erosion is high, consider seeding with native grass seed.
- Where possible, use rolling grades and outsloping on road grades less than 8% to reduce concentration of flows and minimize accumulation of water from road drainage.
- Apply water or approved road surface stabilizers/dust control additives to reduce surfacing material loss and buildup of fine sediment that can enter into waterways. Prevent entry of road surface stabilizers/dust control additives into waterways during application. Restrict the application of dust-abatement materials, such as lignin, Mag-Chloride, or approved petroleum-based dust abatement products, during or just before wet weather, and at stream crossings or other locations that could result in direct delivery to a water body (typically not within 25 feet of a water body or stream channel).
- Rip roads identified for decommissioning to a depth of 18" using a subsoiler or winged-toothed ripper, apply native grass seed and weed-free mulch, and block with rocks and forest debris.
- Apply native seed and weed-free mulch to fill slopes and disturbed areas of roads to be partially and fully decommissioned. Seeding and mulching will occur in the same operational season that construction activities occur.
- Apply native seed and weed-free mulch to soils that are disturbed or exposed during stream culvert removal, replacement, and installation in the same operational season the work is completed.
- Place waste stockpile and borrow sites resulting from road construction or reconstruction in a location where sediment-laden runoff can be confined, at least one site-potential tree height from streams and on stable slopes.
- When removing culverts, pull slopes back to the natural slope, or at least 1:1, to minimize sloughing and erosion, and to minimize the potential for the stream to undercut streambanks during periods of high streamflows. Apply weed-free mulch and native plant seed on all sideslopes of the stream where the culvert was removed in the same season the culvert was removed.
- Dewater streams during culvert placement and replacement to maintain optimum bedding material moisture content and to minimize the movement of sediment downstream.
- Remove all possible excess sediment from stream channels during culvert removal, replacement, and installation in the same operational season the work is completed.
- Use approved riprap, aggregate, and borrow material for road construction, renovation, and surfacing. BLM material sources will be surveyed before use and will be free of noxious weeds. If noxious weeds are found, they will be treated prior to material extraction and use.
- Restrict quarry development and rock crushing operations whenever soil moisture conditions or rainstorms could cause the transport of sediment resulting from quarry operations to nearby stream channels (generally October 15 to May 15).
- If explosives are necessary in quarry development, require a detailed blasting plan to minimize the amount of rock material outside the designated quarry perimeter.
- Construct silt fences or other preventative structures (diversion ditches, settling ponds) as needed to prevent the potential for runoff from quarry operations into nearby stream channels.

- Plant native grass seed, native vegetation, or both within the same operating season to stabilize exposed soil in overburden areas from quarry operations.
- After Romine Quarry reclamation, revegetate with native species, apply mulch, and provide adequate drainage to minimize erosion (Bureau of Land Management 1995, 165)

2.4.5 Fuels Treatments Associated with Timber Harvest and Small Diameter Thinning

- Seasonally restrict site preparation with chain saws from March 1 to June 30 within 195 feet of known active northern spotted owl nests. The seasonal restriction will be waived if nonnesting is determined.
- Seasonally restrict prescribed burning from March 1 to July 15 within 0.25 mile of known active northern spotted owl nests. The seasonal restriction will be waived if nonnesting is determined.
- Conduct a post-activity fuels assessment on all areas proposed for timber harvest and small diameter thinning. Modifications or additional treatment recommendations will be based on the fuels assessment and the amount of slash created during harvest and small diameter thinning project activities. Treatments including, but not limited to, hand or excavator piling, slash pile burning, and biomass removal may be needed to further reduce the fuels hazard to an appropriate level within all units.
- To reduce the amount of surface fuel loadings and emissions from prescribed burning, remove slash from the site, when feasible, by using whole tree yarding, chipping limb slash in the harvest unit, or a combination of both methods. Where whole tree harvesting is used, landing slash will be chipped, burned, or moved off site.
- Stack slash piles more than 60 feet from fish-bearing, perennial streams and more than 35 feet from non-fish-bearing, intermittent streams. Piles will not be placed in channel bottoms.
- Do not hand or excavator pile slash or burn slash piles within the channel bottom of intermittent streams, or within the bottom of dry draws.
- In small diameter thinning units: Do not treat vegetation within 60 feet of fish-bearing, perennial streams and within 35 feet of non-fish-bearing, intermittent streams.
- In timber harvest units: Do not treat vegetation within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing, intermittent streams.
- Prohibit the use of foam agents within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing, intermittent streams during prescribed burning and mop-up activities.
- Provide an approved prescribed fire plan prior to ignition of all prescribed burn units in compliance with the Interagency Prescribed Fire Planning and Implementation Procedures Guide (PMS 484). The prescribed burn plan would contain measurable objectives, a predetermined prescription, and an escape fire plan to be implemented in the event of an escape.
- To prevent fire escapes and to minimize damage to residual vegetation/trees, schedule burning to occur when weather and fuel conditions allow for lower fire intensities (typically late fall through spring).
- Conduct prescribed burning in compliance with Oregon Department of Forestry's Smoke Management Plan. Smoke emission control could also include conducting mop-up as soon as possible after ignition is complete, covering hand piles to permit burning during the rainy season,

and burning lighter fuels with lower fuel moistures to facilitate rapid and complete combustion, while burning larger fuels with higher moisture levels to minimize consumption.

- Disperse slash piles across the treatment areas. Burn piles when soil and duff moisture content is high.
- Do not conduct fuels treatment activities such as hand piling and burning within "skips." Skips are designated areas within a stand that are not to be treated, manipulated, or managed at this time.

2.4.6 Hazardous Fuels Reduction

- Seasonally restrict hazardous fuels reduction activities from November 15 to April 1 in the Big Game Winter Range and Elk Management Area in Township 34 South, Range 2 West, section 1.
- Conduct prescribed burns under moderated weather conditions when soil moisture is elevated in order to reduce surface fuel loading in the 0- to 3-inch diameter size class by 60 to 80%. Whenever possible, burning will be planned during conditions that would allow heavier fuels to remain on-site and to not fully consume.
- Develop an approved prescribed fire plan for all prescribed burn units prior to ignition and in compliance with the Interagency Prescribed Fire Planning and Implementation Procedures Guide (PMS484). The prescribed burn plan will contain measurable objectives, a predetermined prescription, and contingency plan to be implemented in the event of an escaped burn.
- Monitor burning conditions closely to prevent fire escape and to minimize damage to residual trees and vegetation.
- Conduct broadcast burning only when soil moisture is sufficient (generally greater than 35%) to prevent consumption of the duff layer. Duff consumption in a burn unit should not exceed 2 to 10% for low to moderate burns (Bureau of Land Management 1995, 169).
- Construct fire lines by hand.
- Construct water bars on fire lines according to District spacing guidelines (Bureau of Land Management 1995, 167).
- Rehabilitate fire lines and water bars constructed for this project that intersect existing roads or trails to the extent that unauthorized off-highway vehicle use is discouraged. This could include dragging cut vegetation over the lines, seeding, or mulching to hide the fire lines at points where they intersect roads or existing trails.
- Do not pile slash (or burn slash piles) in the channel bottom of short-duration intermittent streams, or within the draw bottom of dry draws.
- Disperse piles across treatment areas. Whenever possible, pile burning will be planned and scheduled when surrounding vegetation and organic material moisture content is enough to maintain an unburned ring of woody material on the ground surrounding the burn pile. This helps to prevent exposed soils from moving beyond the burn pile site.
- Close all natural surface roads opened during fuel hazard reduction prior to the wet season, generally October 15 to May 15.
- Prohibit the use of foam agents within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing streams during prescribed burning and mop-up activities.

- Ignite prescribed burns outside riparian buffers.
- Allow low intensity prescribed burns to back into riparian reserves
- Limit fire line construction inside riparian reserves. Where fire lines are constructed in riparian reserves, construct by hand and place slash or other native mulch materials on fire lines to provide 80% effective ground cover.
- Water bar and rehabilitate fire lines adjacent to or within riparian reserves after completion of prescribed burns.
- Do not treat vegetation or burn piles within 60 feet of fish-bearing or perennial streams, springs, seeps, wetlands, and ponds and within 35 feet of long-duration, intermittent streams.
- Maintain a minimum 50% canopy cover within riparian reserves post-treatment.
- Exclude fuels treatments from inner gorge slopes 35% or greater along all streams.
- In pine series forests, hand pile and burn thinning slash outside the drip lines of individual pine trees.
- Perform prescribed burns when moisture conditions are high enough and prescription windows are at a level so that no more than 50% of the mound depth/duff layer around pine trees is consumed during burning.
- Ensure no more than 25% of the pine tree live crown is scorched for trees 8" DBH and larger.
- Implement prescribed burning when soil and duff moisture and weather conditions allow for low intensity burning in order to minimize tree stress and adverse effects on tree roots and foliage.
- Do not operate chainsaws within 195 feet of any northern spotted owl nest site or activity center of known pairs and resident single between March 1 and June 30 (or until two weeks after the fledgling period) unless protocol surveys have determined owls are not occupying the activity center, are not nesting, or have failed in their nesting attempt.
- Restrict burning from March 1 to July 15 within 0.25 mile of northern spotted owl nests.
- Retain existing snags unless they need to be felled for worker safety.
- Leave approximately 10% of each unit untreated. This would include untreated riparian buffers and special status plant and wildlife buffers.
- Leave 2 to 4 piles per acre unburned to provide wildlife habitat.
- Buffer special status wildlife species sites according to the management recommendations for that species in effect at the time of treatment. Buffer size and strategy would depend on site-specific conditions, proposed treatments, and species involved. Fuels treatment could take place within those buffers if the species or specific habitat characteristics would not be adversely impacted.
- Buffer special status plant sites according to the management recommendations for that species in effect at the time of treatment. Buffer sizes would be determined based on species, proposed treatments, and site-specific environmental conditions.
- Understory burning may occur through some vascular plant sites during plant dormancy, with approval from the BLM botanist.
- Operate motorized vehicles and equipment on existing roads and trails.
- Apply seed from native plant species on burn pile scars and broadcast burn areas in units containing

noxious weed populations.

- Implement prescribed burns in accordance with the Oregon Smoke Management Plan to reduce emissions and avoid smoke intrusions into designated areas.
- Complete fire mop-up as soon as practical to reduce potential level of smoke emissions.
- Cover hand piles to permit burning during the rainy season and to ensure lower fuel moisture to facilitate quick and complete combustion while reducing smoke emissions. If covers would not be removed prior to burning, only polyethylene sheeting no more than 100 square feet in size and no more than 4 mils thick [Oregon Administrative Rule 629-048-0210(4)] may be used.
- Burn during the rainy season when there is a stronger possibility of atmospheric mixing to allow for better smoke dispersion. All burning would be completed after proper clearances have been provided by the Oregon Department of Forestry.

2.4.7 Public Roadside Firewood Cutting

- Seasonally restrict chainsaw and heavy equipment use from March 1 through June 30 within 195 feet of known northern spotted owl or raptor nests. This may be extended up to September 30 if nesting activity is occurring at that time. Seasonal restriction will be waived if nonnesting is determined.
- Do not operate motorized vehicles off the road surface.
- Clear roads surfaces, ditches, and catch basins of debris from wood cutting.
- Lop and scatter slash.
- Harvest firewood by hand (includes winching/lining) within 100 feet of designated roads.
- Do not cut standing trees (hardwood or conifers) greater than 12".
- Do not cut dead and down trees (hardwoods or conifers) greater than 16".
- Do not cut trees within a minimum of 60 feet from the ordinary high water line of springs, seeps, ponds, wetlands, and fish-bearing and perennial streams.
- Do not cut trees within a minimum of 35 feet from the ordinary high water line of intermittent streams.

2.4.8 Water Source Restoration

- Seasonally restrict chainsaw and heavy equipment use from March 1 through June 30 within 195 feet of known northern spotted owl or raptor nests. This may be extended up to September 30 if nesting activity is occurring at that time. Seasonal restriction will be waived if nonnesting is determined.
- Lop and scatter, hand pile, chip, or remove from the site slash resulting from brushing and clearing activities in order to prevent creating a fire hazard.
- Dispose of end-haul material in stable sites outside of floodplains, as identified by the BLM Authorized Officer. Apply erosion control measures at disposal sites to minimize sediment delivery to water bodies.
- Meet Medford District ROD/RMP and Oregon Department of Fish and Wildlife standards for replacement culvert design and installation.

- Minimize disturbance to existing riparian vegetation in order to maintain slope stability and shade. Limit vegetation clearing to the vehicular access point.
- Use sediment-control measures such as straw bales, filter cloth, or sediment fences.
- Limit instream work to the period from June 15 to September 15.
- Maximize maintenance activities during late summer and early fall to best avoid wet conditions.
- Temporarily suspend work if monitoring indicates rain storms have saturated soils to the extent there is potential for causing excessive stream sedimentation.
- Apply native plant seed and weed-free mulch as soon as possible after excavation or ripping to reduce erosion.
- Install, operate, and maintain fish screens on water withdrawal equipment in accordance with NOAA (National Oceanic and Atmospheric Administration) Fisheries.

2.4.9 Off-highway Vehicle Trail Closure and Rehabilitation

- Restrict trail decommissioning work from October 15 to May 15, or when soil moisture exceeds 25%.
- Water bar trails based on gradient and erosion class guidelines in the ROD/RMP (167).
- Apply native seed and certified weed-free mulch to all decommissioned trails and areas that are disturbed during project implementation.
- While in riparian areas, carefully plan access needs for individual work sites to minimize exposing bare soil, compacting soil, and damaging tree roots. Use existing trails when possible.
- Inspect all mechanized equipment daily to help ensure toxic materials such as fuel and hydraulic fluid do not enter the stream.
- Do not rip areas within 10 feet of a stream channel.
- Spread debris such as logs and boulders on rehabilitated off-highway vehicle trails to discourage use.
- Install “Road Closed to Off-highway Vehicle Use” signs.

2.4.10 Meadow Restoration

- Seasonally restrict heavy equipment and chainsaw operations from March 1 to June 30 within 195 feet of known northern spotted owl sites. The seasonal restriction will be waived if nonnesting is determined.
- Restrict burning from March 1 to July 15 within 0.25 mile of northern spotted owl nests.
- Use broadcast burning or hand cutting and piling to remove encroaching conifers and shrubs.
- Use broadcast burning to reduce native or nonnative grass thatch build-up.
- Pretreat noxious weeds or other nonnative species, conduct post-burning monitoring, and re-treat as needed.
- Seed or plant appropriate, site-specific native plants after broadcast burning to restore native plant composition.
- Retain down wood, snags, and other unique legacy features.
- Rehabilitate tire tracks or roads by ripping or blading, and seeding with native species

- Leave 25% of shrub patches untreated for bird and small mammal cover.
- Seed burn pile scars with native grass or forb seed.
- Seed meadows containing nonnative grass species with native grass seed after broadcast burning.

2.4.11 Stream Habitat Enhancement and Riparian Restoration

- Apply native grass and weed-free straw mulch to area of ground disturbance caused by project implementation.
- Wash equipment (including the undercarriage) that will travel off system roads prior to entry onto BLM-administered lands.
- Conduct instream work, between the high water lines of the creek, during the instream work period, July 1 to September 15. If instream work needs to occur beyond September 15, obtain a variance from Oregon Department of Fish and Wildlife.
- Restrict ground disturbance from road decommissioning and decompacting activities from October 15 to May 15, or when soil moisture exceeds 25%.
- Do not begin project work until July 1 if nesting raptor sites are identified in the project area.
- Do not rip roads within the drip line of residual conifer trees.
- Use existing skids and roads, if possible, to place log and rock structures in the stream; otherwise, place logs with a yarder using a cable line.
- Acquire rock for structures from weed-free quarries/sources.

Table 2-3. Comparison of Projects Proposed in Alternatives 2-4

Proposed Project	Alternative 2	Alternative 3	Alternative 4
Forest Management (acres)			
NGFMA Regeneration	32	0	0
SGFMA Regeneration	19	0	0
Shelterwood Retention	24	0	0
Density Management—40% Canopy	512	0	0
Density Management—60% Canopy	302	0	0
Commercial Thinning	130	0	0
Restoration Thinning—40% Canopy	0	658	658
Restoration Thinning—60% Canopy	0	361	361
Small Diameter Thinning	185	185	185
Precommercial Thinning	263	263	263
Riparian Thinning	63	63	63
Total Forest Management	**1,530**	**1, 530**	**1, 530**
Yarding Systems (acres)			
Ground-based	741	741	702
Skyline-cable	259	259	243
Helicopter	267	267	322
Total Yarding Systems	**1,267**	**1,267**	**1,267**
Predesignated Skid Trails (miles)	1.4	1.4	1.4

Table 2-3. Comparison of Projects Proposed in Alternatives 2-4

Proposed Project	Alternative 2	Alternative 3	Alternative 4
Roads (miles)			
Renovation	80.0	80.0	80.0
Closure	1.4	1.4	1.4
Partial Decommissioning	6.0	6.0	6.0
Full Decommissioning	4.3	4.3	4.3
Temporary Route Construction	0.6	0.6	0
Temporary Route Reconstruction	0.8	0.8	0.2
Other Proposed Projects			
Reforestation (acres)	75	0	0
Hazardous Fuel Reduction	2,638 acres		
Public Roadside Firewood Cutting	12 miles (272 acres)		
Water Source Restoration	14 sites		
Off-highway Vehicle Trail Closure and Restoration	5.8 miles		
Meadow Restoration	282 acres		
Stream Habitat Enhancement and Riparian Restoration	• 10 wood and 10 rock stream structures • 0.5 mile of road removal • 0.14 mile of fence removal • 0.1 mile of fence construction • 3.5 acres of tree planting • 1 culvert replaced		
Quarry Reclamation	Romine Creek Quarry		

3.0 Affected Environment/ Environmental Consequences

This section provides the environmental analyses of the biological, physical, social, and economic elements relative to the issues that were identified for the Trail Creek project. This section is organized around the issues identified for detailed analysis where the analysis of the issue will help the decision maker make a reasoned choice between alternatives. For each issue, the setting (Affected Environment) is presented, followed by the effects analysis (Environmental Consequences).

The affected environment describes the existing conditions and trends for the issue-related elements that may be affected by implementing the Trail Creek project. It provides the baseline for measuring the potential effects of implementing an action. The environmental consequence of implementing an action predicts the degree to which the elements relative to the issues would be affected by the action. The effects may be beneficial or detrimental; short term or long term; and direct, indirect, or cumulative.

3.1 Introduction

3.1.1 Physical Setting

The Trail Creek Project Area includes the public lands and resources administered by the Butte Falls Resource Area of the Medford District BLM. It contains a total of 35,646 acres with 15,015 acres administered by the BLM.

The Project Area is located primarily in the Trail Creek fifth field watershed within the larger Upper Rogue River fourth field subbasin. Trail Creek flows south and east from the divide with the South Umpqua River to the confluence with the Rogue River. Paved State Highway 227 (Tiller-Trail Highway) travels north and south through the Project Area and generally parallels Trail Creek. The topography of the Trail Creek watershed is mainly hill slopes with slopes between 5 and 75%. Slopes are gentle to moderate in the southern part of the watershed and steeper at the higher elevations in the northern part of the watershed.

The Trail Creek watershed is within the Western Cascade and Oregon Klamath Mountains physiographic provinces. The area has wet, mild winters and hot, dry summers. The average high temperatures are 46°F in the winter and 89°F in the summer. The average frost-free period is 100 to 160 days. Average annual precipitation ranges from about 34" near the mouth of Trail Creek to about 52" near the South Umpqua River divide. Elevation ranges from a low of 1,436 feet to a high of 4,698 feet.

The Trail Creek Project Area contains the unincorporated community of Trail, Oregon. Trail is located at the southwest tip of the Project Area near Trail Creek's confluence with the Rogue River and the intersection of State Highway 227 and State Highway 62.

3.1.2 Land-Use Allocations and Additional Considerations

The BLM designed this project to conform to the Medford District 1995 ROD/ RMP and the management direction and objectives for the land use allocations found in the Project Area.

3.1.2.1 Matrix

The 1995 ROD/RMP objectives for matrix lands are to "produce a sustainable supply of timber and other forest commodities to provide jobs and contribute to community stability; provide connectivity (along with other allocations such as riparian reserves) between late-successional reserves; provide habitat for a variety of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees; and provide early successional habitat" (Bureau of Land Management 1995, 39). The Northwest Forest Plan (C-39) described matrix lands as those areas where most scheduled timber harvest would occur. Matrix lands are divided into northern and southern GFMA and Connectivity/Diversity Blocks.

Connectivity/Diversity Blocks are spaced throughout the northern GFMA matrix land use allocation. Each block is to be maintained in at least 25 to 30% late-successional forest condition. Riparian reserves and other allocations with late-successional forest count toward this percentage. The Project Area contains two 640-acre Connectivity/Diversity Blocks: T32S, R1W, section 31 and T33S, R2W, section 3.

3.1.2.2 Riparian Reserves

Riparian reserves are "areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis" (Forest Service and Bureau of Land Management 1994b, 7). Riparian reserves are managed to

provide benefits to riparian-associated species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal for many terrestrial animals and plants, and provide habitat connectivity within the watershed. Riparian reserve widths are set during watershed analysis and the boundaries may vary based on site-specific elements and characteristics including the size of a site-potential tree. The riparian reserve width is 170 feet for the Trail Creek watershed.

3.1.2.3 100-acre Northern Spotted Owl Activity Centers

Known northern spotted owl activity centers are one of the five components of the Northwest Forest Plan's late-successional reserve system. Known spotted owl activity centers are defined as "one hundred acres of the best northern spotted owl habitat as close as possible to a nest site or owl activity center for all known (as of January 1, 1994) northern spotted owl activity centers" (Bureau of Land Management 1995, 32). There are 14 known northern spotted owl activity centers in the Project Area (11 on BLM and 3 on Forest Service).

3.1.2.4 Big Game Winter Range and Elk Management Area

A portion of the Trail Creek project lies within the Big Game Winter Range and Elk Management Area—Unit 5 in T34S, R2W, section 1. These areas are managed as winter range for deer and elk, with an emphasis on providing thermal cover and minimizing disturbances, and enhancing elk habitat consistent with the objectives of other allocations (Bureau of Land Management 1995, 48).

3.1.2.5 Visual Resource Management (VRM) Class III and IV

The Project Area contains BLM lands classified in the 1995 ROD/RMP as VRM Class III and IV. VRM Class III lands include "land allocated to meet rural interface area (RIA) objectives . . ." or "the southern general forest management area (GFMA) as inventoried" (Bureau of Land Management 1995, 70). VRM Class IV lands may also include southern GFMA as well as northern GFMA.

3.1.2.6 Lands with Wilderness Characteristics

The Project Area contains lands that have been inventoried and determined by the BLM to contain wilderness characteristics, as defined in section 2(c) of the Wilderness Act. Wilderness characteristic attributes include the area's size, its apparent naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. The BLM's inventory found 6,254 acres with all of these wilderness characteristics in the Berry Creek unit (OR 11-9). The Project Area contains 1,322 acres of the Berry Creek unit in T33S, R1W, sections 10, 15, 21, 27, 28, 32, and 34.

3.1.3 Project Area Background

3.1.3.1 Brief History of the Project Area

The history of the Trail Creek watershed provides the foundation for understanding the conditions that exist in the Project Area today. Natural processes and human activities influence and shape the vegetation and landscape found within the watershed. They may cause slow and subtle changes only visible through the passage of time, or sudden, devastating changes that occur in an instant.

Natural forces such as wildfires, floods, and windstorms have altered vegetation and stream conditions. Wildfires and windstorms influence vegetation patterns, stand ages, and species composition. Floods cause streams to change channels, wash away soils and streamside vegetation, deposit gravels and sediments, and form pools.

Studies indicate that settlement by Native Americans in the Trail Creek watershed began 5,000 years ago and intensified 2,000 years ago. The watershed has one of the lowest passes between the Rogue and Umpqua basins and may have been used as a corridor for movement between the basins. Native Americans relied on elk, deer, fish, and forest-derived products such as berries, roots, and nuts for sustenance. Native Americans used fire as a tool to trap and expose game, clear obstructions, and manage vegetation. The resulting landscapes of the watershed were dependent on ongoing fire management prior to European settlements. Native Americans were largely removed from the area by warfare, disease, and forced relocations during the mid-19th century.

Fur trappers were the first Europeans to arrive in the Rogue Valley in the early 1800s. Streams in the Trail Creek watershed may have had beaver-influenced morphological features prior to this period. In the mid-1850s, gold mining brought settlers to the area around Trail Creek; although, there were no mines in the watershed itself. The mines likely contributed to development of roads in the area. Between the 1850s and early 1900s, most of the watershed was used for timber harvest. The land was homesteaded for agriculture; some was turned around and sold to timber companies. When timber prices decreased in the 1920s, more of the watershed became used for agriculture. Sheep and cattle grazing on the Forest Service lands in the watershed became fairly prevalent from 1910 into the early 1930s.

By the mid-1940s, much of the mature timber on timber company lands had been harvested and the demand for timber from Federal lands increased. In addition, the high demand for lumber during World War II also served to increase timber harvest on Federal lands. Roads were built or extended to provide access to timber stands, improve fire protection capabilities, and provide access for recreation and administration.

Passage of the O&C Act in 1937 provided direction for Federal lands managed by the BLM in this area. The O&C Act was intended to contribute to the local economy by providing for Federal timberlands to be managed for permanent timber production on a sustained-yield basis. One of the purposes of the O&C Act was to increase timber harvest on these lands to their timber-producing capacity. Timber harvest revenues were to provide a consistent level of income to the counties that contain O&C lands.

Past Actions in the Project Area

Land ownership patterns, past timber harvest, wildfires, and fire exclusion have helped to create the existing conditions in the Trail Creek Project Area. Fire exclusion and timber harvest methods have contributed to the current high density and multiple-layered stand conditions in many of the proposed harvest units. Past harvest methods also influenced the locations and conditions of the roads within this watershed. These past practices have contributed to the affected environments described in detail later in this section.

The landscape pattern in the Trail Creek Project Area is largely determined by the checkerboard ownership. Blocks of BLM-administered lands intermingle with privately owned lands. Field observation and review of aerial photographs indicates most timber company lands within the watershed have been harvested. The majority of merchantable overstory trees were removed, leaving a younger stand of Douglas-fir with lesser amounts of ponderosa pine, incense cedar, and scattered hardwoods. Most of these harvested acres have been planted and are now plantations of ponderosa pine or Douglas-fir of varied sizes and ages.

"The nonfederal forests within the range of the northern spotted owl are predominantly forests that have grown back since harvest and are generally even-aged stands. They are typically managed as commercial forests. . . . harvest generally occurs in a stand's fifth or sixth decade" (Forest Service and Bureau of Land Management 1994a, p. 3&4-6). The Northwest Forest Plan states "these forests generally are now in early and mid-successional stages, with many at or approaching ages and sizes that will predictably result in harvest."

Over the past 60 years, timber harvest has occurred on about 72% of the BLM forested land within the Project Area; harvest practices ranged from mortality salvage and selective cutting of individual trees, to clearcutting and regeneration harvest (Figure 3-1).

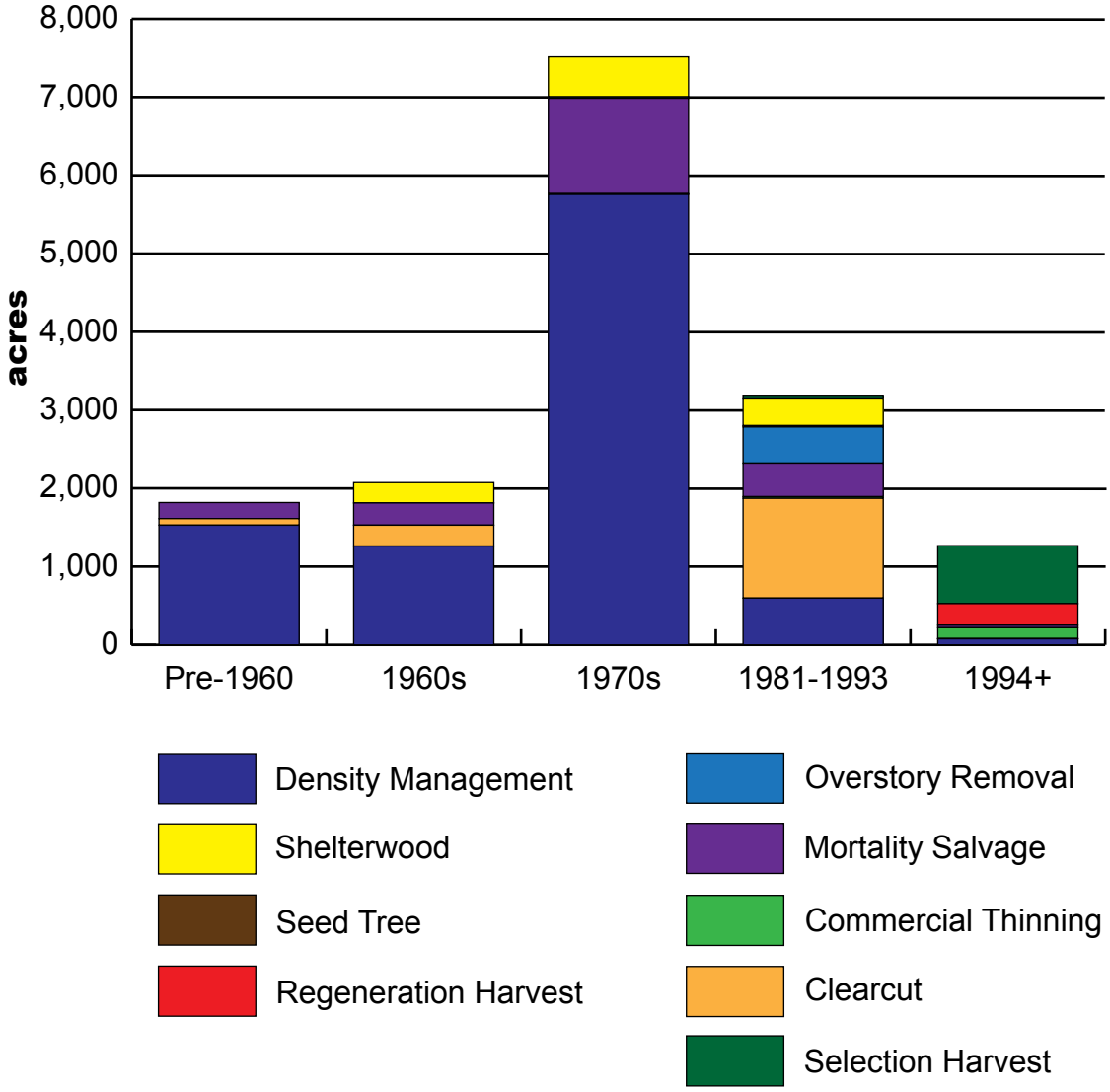


Figure 3-1. Past timber harvest in the Trail Creek Project Area.

The Record of Decision for the Northwest Forest Plan was signed in April 1994. The Medford District ROD/RMP, completed in June 1995, incorporated the standards and guidelines of Northwest Forest Plan. Under the ROD/RMP and Northwest Forest Plan, direction for timber management includes regeneration harvest, commercial thinning, density management, and selection harvest. Since implementation of the 1995 ROD/RMP, timber harvest in the Trail Creek fifth field watershed has included 1,267 acres of harvest: 276 acres of regeneration harvest, 140 acres of commercial thinning, 78 acres of selection harvest, 32 acres of mortality salvage, 740 acres of density management, and 1 acre of clearcut. These harvest activities occurred on matrix lands and implemented riparian reserve buffers, green tree retention (larger remnant trees) in regeneration harvest units, and coarse woody debris retention, as directed by the ROD/RMP.

In 2013, 25 acres in the Trail Creek Project Area were harvested as part of the Skeleton Mountain Timber Sale. Those acres, located in T33S, R2W, section 9, were a part of the larger Evans Creek Forest Management

Project. The harvest prescription was dry forest management leaving a minimum of 40 or 60% canopy cover and using skyline-cable and tractor yarding.

Since 2003, the BLM has completed the following aquatic restoration projects in the Project Area:

- Replaced 1 culvert
- Added 5 large woody debris jams and 3 boulder sites to streams for fish habitat improvement
- Installed 0.5 mile of boulder weirs
- Closed 1.4 miles of road
- Decommissioned 12 miles of road
- Stabilized 0.5 acre of upland

The BLM manages 2 grazing allotments within the Trail Creek watershed: Clear Creek and Sugarloaf (only the Sugarloaf allotment is active). The allotments are located in the northeast corner of the watershed and encompass a total of 2,287 acres, or 6.5% of the watershed. The allotments are within the Upper Trail Creek and Wall Creek seventh field drainages. Both allotments extend into the Elk Creek fifth field watershed. The Clear Creek allotment is authorized to use 45 animal unit months. An animal unit month is the amount of forage required by one cow with calf for one month. The grazing period runs from mid-May through the end of October, although the allotment is not currently grazed. The Sugarloaf allotment is authorized to use 15 animal unit months. The grazing period is from mid-April through the end of June.

Wildland fires in the Project Area predominately occur from mid-July through mid-October due to low relative humidity, low precipitation, and high ambient temperatures. Fire history analysis shows a total of 114 wildland fires occurred throughout the Project Area from 1960 to 2011 and burned 466 acres. Of the 114 wildland fires, 33% of the fires occurred on Federal lands and 67% occurred on private lands. Approximately 99% of all past wildland fires in the Project Area were suppressed at less than 10 acres.

On BLM-administered lands, 56% of the wildland fires were human-caused and generally started along roads or in abandoned campsites, while 44% were started by lightning, usually in higher elevations and along ridgelines. On private lands, nearly 78% of the wildland fires were human-caused and mainly resulted from debris burning. Most of the fires on private land occurred in the wildland urban interface or more populated areas.

3.1.3.2 Future Actions in the Project Area

Pacific Connector Gas Pipeline

The PCGP (Pacific Connector Gas Pipeline) Project is a proposed 232-mile interstate natural gas transmission line designed to transport natural gas from its connection with transmission lines in Malin, Oregon to the terminal in Coos Bay, Oregon for export to foreign markets. The proposed pipeline right-of-way crosses through 10.6 miles of the Trail Creek Project Area with 4 miles on BLM lands. The proposed pipeline travels through the following sections: T32S, R2W, sections 22, 26, 27, 35, and 36; T33S, R2W, section 1; T33S, R1W, sections 7, 18, 20, 29, 32, and 33; and T34S, R1W, sections 2, 3, and 4.

The PCGP proposal includes clearing a 95-foot-wide temporary right-of-way along the length of the pipeline. Clearing a 95-foot wide corridor would require 122 acres of public and private land base (46 acres of BLM) within the Project Area, wherein a 36-inch steel pipeline would be installed below ground. Of the initial 95-foot clearing, 50 feet (25 feet both sides of the centerline) would be granted in a permanent right-

of-way. Within the 50-foot right-of-way, vegetation within a 30-foot (15 feet both side of the centerline) corridor would be maintained at heights no greater than 6 feet tall. The remaining 65 feet of the cleared 95-foot temporary right-of-way would be replanted or left to revegetate naturally and would not be maintained.

The PCGP proposal also includes temporary or permanent use of both existing and newly constructed roads. Within the Trail Creek Project Area, two permanent access roads, totaling 330 feet, would be constructed. One road (130 feet) would be on Forest Service land and the other road (200 feet) would be on private land. No new temporary or permanent roads are proposed on BLM lands.

The FERC (Federal Energy Regulatory Commission) is the lead Federal agency for the preparation of the PCGP project EIS. Various other agencies, including the BLM, are cooperating agencies for the development of the Project EIS. A cooperating agency has jurisdiction by law or special expertise with respect to environmental impacts involved with the proposal, and is involved in the NEPA analysis, including the development of mitigating measures. The FERC and the cooperating agencies each have their own actions related to the review and approval of the PCGP.

An FEIS was prepared and completed in 2009 for the PCGP project; however, the FERC withdrew the associated certificate when the PCGP project was modified to change the direction the liquefied natural gas would travel through the pipeline. This, coupled with vacating the 2008 Western Oregon Planning Revision in 2012, foreseeable amendments to Forest Service and BLM Land Use Plans, and reinstatement of Survey and Manage policies in 2011, will result in both the reissue of a certificate and the completion of a new PCGP project EIS. Because the plan has not been finalized and additional NEPA analysis is required, the eventual effects of the project are largely unknown at this time, as is the anticipated mitigation plan that will result from the aforementioned changes in policy and regulations. Therefore, it would be speculative to attempt to anticipate the potential cumulative effects of the Trail Creek Forest Management Project when combined with the effects of the PCGP project at this time. The cumulative effects of the Trail Creek Forest Management Project will be addressed in the forthcoming PCGP project EIS.

3.2 Forest Condition

ISSUE: *Can the BLM promote the growth and vigor of overstocked forest stands and reduce potential fire hazards in the Project Area?*

This section analyzes the potential impacts of the proposed projects on the forest condition issue. The following definitions are for terms used in this section:

crown ratio. The proportion of total tree length supporting live foliage.

ORGANON. An individual tree growth model that projects stand development for several species mixes, stand structures, and management activities.

plant series. A major stratification of habitat named after the dominant plant species in the final stage of ecological succession.

relative density. A measure of crowding in a stand of trees. It compares the number of trees present to the number of trees the site has resources (water, nutrients, and sunlight) to support.

3.2.1 Methodology

The forest condition for the Trail Creek Project Area was compiled from a variety of sources:

- The Medford District Proposed Resource Management Plan/Environmental Impact Statement

(PRMP/EIS, 1994) provided general vegetation information for planning analysis.

- The Trail Creek Watershed Analysis (1999) provided baseline information specific to forest vegetation and the impacts of managing forest stands.
- Geographic information system (GIS) data described the kind, amount, and distribution of forest vegetation on BLM-administered lands across the watershed in which the projects are located.
- Field visits (stand exams) from 2012–2013 within the Trail Creek fifth field watershed provided stand-specific data related to tree density, structure, composition, and general stand health.

3.2.2 Assumptions

- Timber management activities will occur on BLM-administered lands allocated to planned, sustainable harvest. The type, quantity, and impacts of timber management activities were analyzed in the Medford PRMP/EIS for both the short- (10 years) and long-term (decades).
- Northern Spotted Owl Recovery Plans will influence stand treatment using owl analysis circles in conjunction with owl habitat types as directed by management.
- Stands designated as RA32 by the project wildlife biologist will not be considered for forest management activities.
- Most private forestlands will be intensively managed with final harvest on commercial economic rotations averaging 60 years (Bureau of Land Management 1994, 4-5).
- Impacts to forest vegetation by predicted regional climate change is uncertain. The regional climate has become warmer and wetter with reduced snowpack and continued change is likely (Bureau of Land Management 2008b).

3.2.3 Affected Environment

3.2.3.1 Introduction

See Appendices B and C for additional information on site and stand conditions in the Trail Creek Project Area.

Three types of forest stands are proposed for treatment in the Project Area:

1. Ponderosa pine plantations established in the 1960s and Douglas-fir plantations established in the early 1980s. The ponderosa pine stands contain even-aged ponderosa pine with an average dominant tree diameter of 11". Varying amounts of natural regeneration of Douglas-fir, white fir, and incense cedar are present in the understory. Douglas-fir plantations are composed of even-aged Douglas-fir with an average diameter of 7"; no natural regeneration is present in the understory.
2. Residual young, mixed-conifer stands harvested in the early 1960s. At the time of harvest, nearly all merchantable trees were removed leaving individual and small pockets of trees less than 8" in diameter. Following the harvest, some stands were interplanted. Currently, the stands are a mosaic of species, diameters, and density levels.
3. Mixed-conifer, closed-canopy stands of Douglas-fir, white fir, incense cedar, sugar pine, and ponderosa pine ranging from 50 to 350 years old. Stand structure varies from single layered even-aged to multi-layered uneven-aged.

Within these forest stands, conifer growth and timber yield is determined by environmental factors and tree age. Environmental factors that affect tree growth and yield are high growing-season temperatures, moisture

and nutrient availability, vegetative competition, soil type, frequent frosts, insects (beetles), and disease (mistletoe and root rot). Conifer growth rates vary with tree age; young trees grow rapidly, but as they age, the rate of growth slows (Figure 3-2). For most sites in southwest Oregon, 100 years (culmination of mean annual increment) is the age at which the average yearly growth in volume of a forest stand has peaked (Bureau of Land Management 1995, 103).

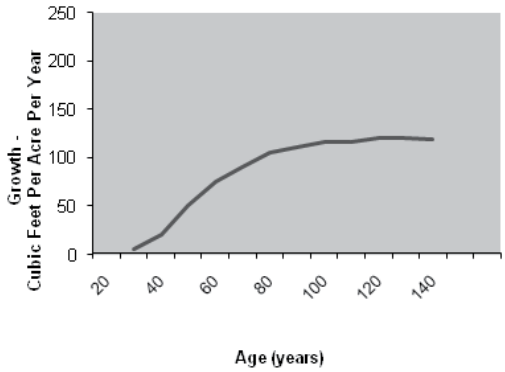


Figure 3-2. Conifer growth rates.

Elevation, slope, aspect, precipitation, soil type, and periodic disturbance events (fire, insects, and disease) are the primary environmental factors that determine the presence, abundance, and structural characteristics of forest plant communities. Within the Project Area, the plant communities have been altered by previous management activities, large wildfires, and fire containment strategies that have permitted the development and growth of dense forest stands. These factors have changed the size, diversity, and arrangement of forest vegetation and have created a mosaic of stands of varying densities and developmental stages across the landscape. High growing-season temperature and high evaporative demands affect the establishment, growth, and productivity of forests within the Project Area. The forest plant communities are at the warm/dry end of the environmental gradient, with moisture limitations late in the growing season limiting biomass production.

3.2.3.2 Plant Series

The Douglas-fir and white fir plant series are the most common forest plant classifications in the Project Area (Atzet, et al. 1996). Plant series follow an elevation gradient from lowest to highest with the Douglas-fir series occupying the lowest elevation lands in the watershed and the white fir series occupying the highest. The Douglas-fir series generally occurs in the southern two-thirds of the Trail Creek watershed and the white fir series is present in the northern one-third of the watershed.

In the Douglas-fir series, ponderosa pine, sugar pine, and incense-cedar make up a small percentage of the overstory tree canopy, with Douglas-fir the dominant overstory as well as understory tree species. Madrone and black oak are the main hardwood species. Shrub species found in varying amounts are oceanspray, hazel, deerbrush ceanothus, Oregon grape, poison oak, and vine maple.

The white fir series is characterized by Douglas-fir as the dominant overstory tree with white fir and lesser amounts of ponderosa pine, sugar pine, incense cedar, and hemlock (higher and wetter areas) present. Hardwood species include madrone and chinquapin. Shrub species found in varying amounts are dwarf Oregon grape, pinemat manzanita, salal, baldhip rose, and snowberry.

3.2.3.3 Stand Density, Tree Vigor, and Growth

Forest stands with relative densities above 60% have reduced tree vigor; higher mortality of suppressed trees; and higher susceptibility to insects, disease, and severe fire behavior (Perry 1994) (Hann and Wang 1990) (Curtis 1982). These conditions reduce stand resiliency and resistance to environmental stresses.

Forest stands proposed for treatment have high relative densities (average 85%), decreased stand resiliency, and are susceptible to environmental disturbances. Direct competition among individual trees for limited site resources (nutrients, water, and sunlight) is likely to increase mortality rates. Growth and vigor of healthy trees within these stands is likely to decline. With the loss of the natural thinning effects of wildfire, overstocked, stagnant forest stands have developed. The supply of essential site resources has decreased

while the demand has increased. The quantity of on-site nutrients in forests varies from stand to stand and is influenced by site quality and the amount, type, and size of vegetation present. The current amount of vegetation defines the existing levels of nutrients and is considered the baseline amount that would be affected by management actions.

Overstocked stands have more trees than the site has moisture, nutrients, and growing space to sustain (Figure 3-3). Without adequate resources, tree growth and vigor declines, increasing the probability of tree mortality from insects or disease. Overstocked forest stands and increased fuel accumulations create conditions that increase the potential for stand-replacement wildfires. In the event of wildfires, forest stands with a canopy cover of 70% or greater have an increased fire spread rate, a higher probability of crown fires, and fires that are more difficult to control. The existing forest canopy cover in the stands proposed for treatment is 83 to 100%. Tree species diversity is affected by high stand densities. Competition for limited site resources (nutrients, water, and sunlight) between dense understories and large overstory ponderosa and sugar pines has increased. This competition has affected pine species by reducing tree vigor, increasing tree susceptibility to bark beetle attack, and increasing pine mortality rates throughout the Trail Creek fifth field watershed.

Figure 3-3. Overstocked stand in the Trail Creek Project Area.

The crown ratio of the trees is used to indicate tree vigor. The crown is the upper part of the tree with live branches and foliage. Live foliage produces food for the tree. The bigger the crown, the better the tree's growth will be. The tree's rate of growth slows when the crown ratio is less than 35%.

3.2.4 Environmental Consequences

3.2.4.1 Effects of Alternative 1 (No Action) on Forest Condition

Direct and Indirect Effects

Under Alternative 1, no forest management activities would take place. No regeneration harvest would occur in stands 100 years or older on matrix lands in which the point of optimum net wood production has been reached. Conifer growth and timber yield would not be maximized on these sites. Forest stands that have reached the culmination of mean annual increment would remain and would not meet the sustained yield objectives of the RMP/ROD.

Forest stand densities would remain high (currently 85% average relative density) and would continue to increase. Intense competition for limited site resources would result in a decline in tree vigor and limited conifer growth potential. Minimum growth per tree would occur with the maximum volume growth per acre offset by mortality (Ernst and Knapp 1985). Growth rates would remain stagnant or decline with tree mortality expected to increase. In stands with a relative density greater than 60%, the annual tree mortality rate is about double (Hann and Wang 1990) compared to forest stands with relative densities less than 60%. In the absence of disturbance events, such as wildfire or timber harvest, the number of trees per acre would remain at levels above the carrying capacity of the site (Oliver, Ferrell and Tappeiner 1996).

Cumulative Effects

Past Actions

The BLM has harvested timber on 1,267 acres within the Trail Creek fifth field watershed since the completion of the PRMP/EIS in 1994. This represents 3.6% of all land and 8.6% of BLM land in the Trail Creek watershed. Density reduction treatments (e.g., commercial thinning, density management, and individual tree selection) occurred on 76% (958 acres) of the treatment acres, regeneration harvest on 22% (276 acres), mortality salvage on 2% (32 acres), and clearcut on less than 1% (1 acre). Density management has redistributed growth from many small trees to fewer large healthy trees. The remaining trees have adequate site resources to maintain good growth rates with tree vigor at levels necessary to minimize mortality due to competition, insects, or disease. Regeneration harvest has replaced stands that have passed the point of optimum wood production with young, fast-growing conifer stands that maximize the volume growth capability of the site.

On BLM-administered lands, the greatest impact to on-site nutrients has occurred in forest stands that had regeneration harvests. The removal of the majority of the trees followed by slash burning reduced the amount of on-site nutrients. Lower intensity silviculture treatments that reduced density (e.g., commercial thinning, density management, restoration thinning, riparian thinning, small diameter thinning, and scattered mortality salvage) removed less vegetation and subsequently had a lower impact to on-site nutrients. Lower intensity treatments retain stand densities and structural characteristics (live trees, snags, ground level vegetation, and coarse woody debris). The partial loss of nutrients from the stand is not expected to affect long-term site productivity.

Since the implementation of the Northwest Forest Plan in 1994, very little harvest has occurred on Forest Service lands within the Trail Creek watershed. Harvest consisted of 5 acres of salvage harvest and 125 acres of precommercial thinning.

On private timber company lands within the Trail Creek watershed, harvest activities have ranged from partial harvests to clearcuts. Most of the 9,892 acres of timber company lands have been logged over the past 60 years. Within these stands, management objectives are designed to maximize volume growth per acre. Generally, these lands are managed using even-aged silviculture systems that remove the majority of the trees on short rotations (<60 years). It is expected that a loss of on-site nutrients would occur and could affect long-term site productivity.

Of the 6,310 acres of privately owned lands within the Trail Creek watershed, varying levels of harvest have occurred over the past 60 to 80 years. Conifer growth and timber yield rates for these lands are unknown.

Fire exclusion since the early 1900s has contributed to development of high stand densities; forest stands have become overstocked with shrubs and smaller trees. As a result, tree growth and volume yield has declined within stands that have relative densities greater than 60%. Forest stands with relative densities above 60% have lower tree growth rates; higher mortality of suppressed trees; and a higher susceptibility to insects, disease, and more severe fire behavior (Perry 1994) (Hann and Wang 1990) (Curtis 1982).

Present Actions

In the Trail Creek watershed, no Forest Service or BLM lands are currently being harvested. On private timber company lands, some logging is occurring at this time, although the amount and duration of logging activity is unknown. On lands owned by private individuals, the amount of logging is unknown, but harvest is generally limited to small areas and individual trees are used for lumber or firewood.

Future Actions

No commercial timber sales or stewardship projects outside of this analysis are currently proposed by the BLM within the Trail Creek watershed within the 5-year planning cycle. Within the Project Area, noncommercial treatments such as protection, maintenance, fuel hazard reduction, precommercial thinning, and release may occur. These treatments would enhance seedling survival, reduce vegetative competition, and allow for increased conifer growth.

Currently, there are no planned timber sales within the 5-year planning cycle on Forest Service lands within the Project Area.

On timber company lands, harvest plans are unknown. However, in stands with an average diameter of 8" and greater at breast height, we can reasonably expect commercial logging within the next 5 to 10 years. Timber companies would likely use silviculture methods (e.g., clearcutting and overstory removal) that create early seral stands. Post-harvest activities such as conifer planting, applying herbicides to control brush and hardwoods, and precommercial thinning would be scheduled to ensure the survival, establishment, and maximum growth per acre of conifers. In stands less than 8" DBH, little commercial logging is expected in the next 15 to 20 years. Within such stands, brush and hardwood control and precommercial thinning are the two primary management activities most likely to occur, both of which would reduce stand densities and increase conifer growth and timber yield.

On privately owned lands, limited harvest activities are expected. Occasional logging of large individual trees would occur and would most likely be limited to small areas. Impacts to conifer growth are unknown.

3.2.4.2 Effects of Alternative 2 on Forest Condition

The primary objective of Alternative 2 is to apply silviculture treatments that benefit stand health while maintaining owl habitat within the home range of the northern spotted owl. Within the northern spotted owl home range (1.2 miles in Cascades West Province and 1.3 miles in Klamath Mountains Province), spotted owl habitat currently defined as structurally complex; dispersal; or nesting, roosting, and foraging would not be altered to the extent that the current habitat designation would be downgraded. Outside of the home range, this alternative would implement Medford District RMP management direction for matrix land.

Direct and Indirect Effects

Regeneration harvest (northern GFMA, southern GFMA, and shelterwood retention), commercial thinning, density management, riparian thinning, and small diameter thinning are proposed on 1,267 acres (Table 3-1).

Table 3-1. Silviculture Treatments Proposed in Alternative 2

Silviculture Prescription	Acres
NGFMA Regeneration	32
Shelterwood Retention	24
SGFMA Regeneration	19
Commercial Thinning	130
Density Management—40% canopy cover	512
Density Management—60% canopy cover	302
Riparian Thinning	63
Small Diameter Thinning	185
Total	1,267

Regeneration harvest would convert 75 acres of slow-growing stands into fast-growing early seral stands. Conifer growth and timber yield would be maximized and would meet the short- and long-term timber objectives for Matrix lands analyzed in the PRMP/EIS. Stands proposed for regeneration harvest are above the age of culmination of mean annual increment and have passed the point of optimum wood production. To maximize the volume growth capability of the site, slow-growing trees would be harvested and young, fast-growing conifers would be established. Canopy cover would be reduced to 10 to 40%, depending on the level of green tree retention (Table 3-2).

Table 3-2. Green Tree Retention Levels for Regeneration Harvest

Regeneration Harvest Type	Green Trees Per Acre Retained (greater than 20″ DBH)	Residual Canopy cover (%)
Northern GFMA	6 to 8	10 to 15
Shelterwood	12 to 25	20 to 40
Southern GFMA	16 to 25	25 to 40

Stands identified for regeneration harvest would not remove all trees of marketable size, but would retain variable levels of healthy, large, full-crowned green trees greater than 20" DBH. Existing snags and down wood would be retained. Additional healthy or cull green trees greater than 20" DBH would be reserved if needed to meet the required 1 to 2 wildlife snags per acre or to meet coarse woody debris requirements. The retained green trees and snags would reflect the species mix of the original stand. Two to four of the largest hardwoods per acre would be retained for stand diversity. Buffers for special status species found within the stands would provide additional structural diversity. Retained overstory trees and down logs would provide for structural and biological legacies (Franklin 1992) (Hunter 1995) (Hansen, et al. 1991). These structural components are necessary to maintain ecosystem processes throughout the management cycle (Bureau of Land Management 1995, 188).

Following regeneration harvest, logging slash would be treated to minimize wildfire risk, conifer trees would be planted, and associated silviculture treatments would be applied to ensure seedling survival and establishment. The growth and vigor of planted trees would be maximized due to low vegetative competition and the retention of trees with crown ratios greater than 35%. Trees with crown ratios of 35% or greater have sufficient leaf area for photosynthesis in order to maintain individual tree health and survivability.

Commercial thinning, density management, riparian thinning, and small diameter thinning would occur on a total of 1,192 acres. Stands identified for commercial thinning, density management, riparian thinning, and small diameter thinning would have the smaller, less vigorous trees harvested. These silviculture treatments would reduce the number of trees per acre toward levels the site has water and nutrients to sustain. Depending on the average diameter of the remaining trees, 40 to 100 trees per acre greater than 8" in diameter would remain with relative density below 60%. Stands with larger diameter trees would have fewer trees per acre left; stands with smaller diameter leave trees would have more trees per acre remaining.

Riparian thinning would target stands generally 100 years old and less that have little or no structural complexity (second growth, even-aged type stands). Stand densities would be reduced to less than 60% relative density by removing smaller diameter trees and leaving a minimum canopy cover of 50% in northern spotted owl dispersal habitat and a minimum canopy cover of 60% in roosting and foraging habitat. By reducing tree density to below 60% relative density, the annual mortality rate would decline by about 50%. An increase in tree growth would occur once the root systems of the residual trees expand (approximately 5 to 10 years) and are able to use moisture, nutrients, and additional growing space. Tree crowns would increase in size and photosynthetic area, with stand crown closure increasing approximately 10% every 5

years (based on ORGANON growth and yield projections) until 100% canopy cover is reached (Hann 2003). These silviculture treatments would generally result in stands with fewer but larger trees and trees with increased growth rates.

In addition to the post-harvest treatment of logging slash, hazardous fuels reduction and precommercial thinning is proposed on lands outside of the proposed timber sale units. Hazardous fuels reduction on 2,638 acres and precommercial thinning on 263 acres would cut shrubs and small trees less than 8" in diameter. The slash created from these activities would likely be hand piled and burned. Stand canopy cover would be reduced from 100% to 70–90%. The reduction of shrubs and small tree densities would provide additional site resources (moisture and nutrients) for the growth of residual trees.

Additionally, about 20% (465 acres) of the proposed hazardous fuels reduction acres would be underburned within 5 to 10 years following hand pile burning. Depending on the intensity of the fire, underburning may either have a positive or negative effect on conifer growth and yield. The positive effects include the reduction of competing understory vegetation, release of nutrients into the soil for tree growth, reduction of fire hazard, and retention of sufficient duff material to maintain the nutrients necessary to sustain long-term forest productivity. If the burn is too hot, the litter and duff layer may be lost with a subsequent loss of nitrogen and a reduction in long-term soil productivity and tree growth. A hot burn outside of the prescription may result in the mortality of reserve trees and growth loss to the remaining trees due to needle scorch and needle mortality. Excessive mortality of reserve trees would reduce the number of trees per acre to below optimum stocking levels and result in the loss of the growth and yield potential of a fully stocked stand.

Approximately 0.5 mile of temporary route construction would remove all vegetation within the route prism on about 1 acre of forested land. Following harvest activities, temporary roads would have the road bed tilled, seeded, and mulched. Removing the compacted surface would restore site productivity and provide suitable growing conditions for vegetation.

Cumulative Effects

See section 3.2.4.1, Effects of Alternative 1 (No-Action) on Forest Condition, Cumulative Effects.

Optimum net wood production has been reached in northern and southern GFMA forest stands. Proposed regeneration harvest in Alternative 2 would reduce structural components, lower biological diversity, and increase habitat fragmentation on 75 acres, or less than 1% of the Trail Creek watershed.

On 725 acres of matrix lands where silviculture prescriptions such as density management and commercial thinning would occur in place of regeneration harvest, those prescriptions would not place forest stands on the desired developmental trajectories, speed the development of desired habitat components, or enhance timber yield. Density management and commercial thinning would not convert these slow-growing stands into fast-growing, early seral stands. In the absence of regeneration harvests these stands would continue to grow at rates less than full site potential. Density management and commercial thinning would retain late-successional stand densities and characteristics (live trees, snags, ground level vegetation, and coarse woody debris).

This alternative would treat 405 acres (14%) of the BLM matrix lands estimated as needing commercial thinning or density management within the Trail Creek fifth field watershed. Stands needing commercial thinning or density management are generally 50 to 100 years old in northern GFMA forest stands and 50 to 120 years old in southern GFMA forest stands. Stand densities on BLM lands would be reduced and tree growth and vigor would be maximized by reducing the competition for limited site resources. An increase

in usable timber yield would occur by concentrating and increasing growth rates in fewer trees, resulting in larger and more valuable logs. Trees that would otherwise die prior to the final regeneration harvest would also be harvested.

Young or early seral stage stands, or mature stands with high density understories on matrix and TPCC withdrawn lands generally between 30 to 120 years old would have understory reduction treatment. This alternative proposes 2,638 acres of hazardous fuels reduction and 263 acres of precommercial thinning. These density reduction treatments would reduce competition-related mortality, increase tree vigor and growth, and maintain preferred species. The trend of forest conditions in the treated stands would improve and approach the range of natural variation associated with the plant series, leading to more complex stand structures. With an increase in tree vigor, the treated stands would be less susceptible to insects and disease. This treatment combined with past and future density reduction treatments in the watershed would improve stand and landscape resistance and resiliency to environmental disturbances.

On timber company lands, harvesting would continue and older stands would be converted to early seral stands, with conifers planted to maximize growth and timber yield. Most private forestlands would be managed with final harvest on commercial economic rotations averaging 60 years (Bureau of Land Management 1994, 4-5).

3.2.4.3 Effects of Alternatives 3 and 4 on Forest Condition

Alternatives 3 and 4 would increase landscape resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change) by reducing stand densities, retaining old trees, favoring drought-tolerant species, and increasing structural complexity while maintaining or enhancing northern spotted owl habitat within their designated home ranges. Owl habitat that is currently defined as structurally complex; dispersal; or nesting, roosting, and foraging would not be altered to the extent that the current habitat designation is downgraded within designated active home ranges of northern spotted owls. No regeneration harvest is proposed.

Direct and Indirect Effects

Restoration thinning, riparian thinning, and small diameter thinning are proposed on 1,267 acres (Table 3-3).

Table 3-3. Silviculture Treatments Proposed in Alternatives 3 and 4

Silviculture Treatment	Acres
Restoration Thinning—40% Canopy Cover	658
Restoration Thinning—60% Canopy Cover	361
Riparian Thinning	63
Small Diameter Thinning	185
Total	1,267

Restoration thinning would reduce stand density, strive to retain older trees (>150 years), favor drought-tolerant species, provide structural complexity (unthinned patches and small openings), increase average stand diameter, and maintain at least 40% canopy cover. These characteristics would increase stand resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change) by removing smaller trees and vegetation that compete for limited site resources and provide surface and ladder fuels that increase fire intensity. On the 75 acres proposed for regeneration harvest in Alterative 2, restoration thinning would be a silviculturally more appropriate treatment because these stands are dominated by

smaller diameter trees less than 20" DBH. These smaller trees are suppressed, while the dominant and codominant trees are generally healthy.

Riparian thinning would target stands generally 100 years old and less that have little or no structural complexity (second growth, even-aged type stands). Thinning would reduce the number of trees per acre toward levels the site has water and nutrients to sustain. Approximately 80 to 100 trees per acre greater than 8" in diameter would remain with a relative density below 60%. With a reduction of tree density to below 60% relative density, the annual mortality rate would be expected to decline by about 50%. An increase in tree growth would occur once the root systems of the residual trees expand (approximately 5 to 10 years) and are able to use moisture, nutrients, and additional growing space.

In addition to the post-harvest treatment of logging slash, hazardous fuels reduction and precommercial thinning is proposed on lands outside of the proposed timber sale units. Hazardous fuels reduction on 2,638 acres and precommercial thinning on 263 acres would cut shrubs and small trees less than 8" in diameter. The slash created from these activities would likely be hand piled and burned. Stand canopy cover would be reduced from near 100% to 70–90%. The reduction of shrubs and small tree densities would provide additional site resources (moisture and nutrients) for the growth of residual trees.

Additionally, about 20% (465 acres) of the treated hazardous fuels reduction acres would be underburned within 5 to 10 years following hand pile burning. Depending on the intensity of the fire, underburning may either have a positive or negative effect on conifer growth and yield. Underburning would reduce competing understory vegetation, release nutrients into the soil for tree growth, reduce fire hazard, and retain sufficient duff material to maintain the nutrients necessary to sustain long-term forest productivity. If the burn is too hot, the litter and duff layer may be lost with a subsequent loss of nitrogen and a reduction in long-term soil productivity and tree growth. A hot burn outside of the prescription may result in the mortality of reserve trees and growth loss to the remaining trees due to needle scorch and needle mortality. Excessive mortality of reserve trees would reduce the number of trees per acre to below optimum stocking levels and result in the loss of the growth and yield potential of a fully stocked stand.

Approximately 0.5 mile of temporary route construction proposed in Alternative 3 would remove all vegetation within the route on about 1 acre of forested land. Following harvest activities, temporary routes would be tilled, seeded, and mulched. Removing the compacted surface would restore site productivity and provide suitable growing conditions for conifer regeneration. No temporary route construction is proposed in Alternative 4 so there would not be a reduction in forested land due to route construction.

Cumulative Effects

See section 3.2.5.1, Effects of Alternative 1 (No-Action) on Forest Condition, Cumulative Effects.

Restoration thinning in Alternatives 3 and 4 would occur on 799 acres (17%) of the 4,700 acres if northern and southern GFMA stands within the Trail Creek fifth field watershed where optimum net wood production has been reached. Restoration thinning would not convert these slow-growing stands into fast-growing early seral stands. Conifer growth and timber yield would not be maximized and would not meet the timber objectives in the PRMP/EIS. Restoration thinning retains late-successional stand densities and characteristics (live trees, snags, ground level vegetation and coarse woody debris).

In northern and southern GFMA stands, stand densities on BLM lands would be reduced. Tree growth and vigor would be maximized by reducing the competition for limited site resources. An increase in usable timber yield would occur by concentrating and increasing growth rates in fewer trees, resulting in larger

and more valuable logs. Trees that would otherwise die prior to the final regeneration harvest would also be harvested. This alternative would treat 405 acres (14%) of the BLM matrix land between 50 to 100 years old (northern GFMA stands) and 50 to120 years old (southern GFMA stands) estimated as needing density reduction within the Trail Creek fifth field watershed.

Early seral stage or mature stands generally between 30 to 120 years old with high density understories would receive hazardous fuels reduction on 2,638 acres and precommercial thinning on 263 acres of matrix and withdrawn lands. These density reduction treatments would reduce competition-related mortality, increase tree vigor and growth, and maintain preferred species. The trend of forest conditions in the treated stands would improve and approach the range of natural variation associated with the plant series, leading to more complex stand structures. With an increase in tree vigor, the treated stands would be less susceptible to insects and disease. This treatment combined with past and future density reduction treatments in the watershed would improve stand and landscape resistance and resiliency to environmental disturbances.

On private forest lands, harvesting would continue and older stands would be converted to early seral stands, with conifers planted to maximize growth and timber yield. Most private forestlands would be intensively managed with final harvest on commercial economic rotations averaging 60 years (Bureau of Land Management 1994, 4-5).

3.3 Fragile Soils (Unstable Areas)

ISSUE: *Can the BLM implement ground-disturbing activities in the Trail Creek watershed on suitable commercial forestland considered fragile for mass movement while minimizing impacts to those fragile soils?*

agglomerate. Rock composed of volcanic fragments of various sizes and degrees of angularity.

argillic horizon. A mineral soil horizon characterized by the accumulation of illuvial (material moved from one soil horizon and deposited in another) phyllosilicate (sheets of silicate minerals) clays.

colluvium. Rock and soil that accumulates at the foot of a slope from gravitational forces.

decommissioning. Ripping the compacted soil of roads and landings to a depth of 18″ with a winged-tooth ripper, excavating and removing culverts if needed, water barring, seeding with native grasses, mulching with native straw, and blocking with a barricade.

fragile soils. Areas where the timber growing potential is easily reduced due to inherent soil properties and landform characteristics.

> **Fragile Slope Gradient (FG):** Steep to extremely steep slopes that have a high potential for debris-type landslides. Gradients commonly range from 60 to 100% plus. Classifications are based on geology, geomorphology, physiographic position, climate (especially precipitation), soil types, and other factors.
>
> **Fragile Slope Gradient—Nonsuitable (FGNW):** Sites where unacceptable soil and organic matter losses could occur from surface erosion or mass soil movements as a result of forest management activities. These losses cannot be mitigated even using best management practices.
>
> **Fragile Mass Movement Potential (FP):** Sites with deep seated, slump or earthflow types of mass movements with undulating topography and slope gradients generally less than 60%.
>
> Operational Guide for FP sites with soils derived from soft volcanic bedrock (tuffs and breccias) with claypan subsoils: (1) Avoid mechanical piling and scarification and (2) Road locations should seek areas of high stability. Avoid side casting material in slide prone areas.

Fragile Mass Movement Potential—Suitable (FPR): These sites may contain soil tension cracks, sag ponds, or both. On sites where conifers exist, some trees are curved at the butt or along the stem. Because of the slow rate of movement, forest management is feasible.

Fragile Mass Movement Potential—Nonsuitable (FPNW): These sites have active deep-seated slump-earthflow types of mass movements. They include areas where soils have been removed and are presently nonproducing, or where the rate of movement has resulted in jackstrawed trees. Because of the rapid rate of movement, forest management is not feasible on these sites.

regolith. Unconsolidated residual or transported material that overlies solid rock.

residuum. Material resulting from the disintegration, decomposition, and weathering of bedrock in place.

temporary route. Short-term overland roads, primitive roads, or trails authorized or acquired for the development, construction, or staging of a project or event that has a finite lifespan. Temporary routes are not intended to be part of the permanent or designated transportation network system and must be reclaimed when their intended purpose has been fulfilled (Instruction Memorandum No. 2007-176).

3.3.1 Methodology

- The soil analysis area is the Trail Creek Project Area (35,700 acres). The Project Area is within the Trail Creek fifth field watershed with small portions just outside of the Trail Creek watershed in the Elk Creek watershed (South Umpqua subbasin) and Shady Cove-Rogue River watershed.
- The BLM soil scientist conducted field reconnaissance of the Trail Creek Project Area in order to assess the current condition of the soils and possible issues.
- GIS was used to calculate the watershed area, road density, and other land area measurements.
- The Soil Survey of Jackson County, Oregon (National Resource Conservation Service 1993) was used for information about specific soils in the Project Area.
- The Trail Creek Watershed Analysis (1999) was used for more detailed soil information within the Project Area.
- All proposed temporary route construction was field reviewed by the BLM soil scientist and layout forester with input from the hydrologist, engineering technician, and fish biologist. Route design and location were reviewed to ensure compliance with 1995 Medford District ROD/RMP objectives and recommendations (Bureau of Land Management 1995, 157-165). Routes that could not be constructed without meeting the objectives were dropped from the project or were redesigned to meet the objectives.
- All proposed tractor yarding units were field reviewed by the layout foresters or soil scientist to ensure slope stability.

3.3.2 Assumptions

- Timber harvest activities (e.g., road construction and timber harvest) will occur on private timber company lands within the next 5 years with the majority of the harvest using tractor or skyline-cable yarding.
- Short term is less than 5 years and long term is greater than 5 years.

3.3.3 Affected Environment

The watershed is located in the Western Cascades Province (eastern portion of Project Area) and Klamath Mountains Province (western portion of the watershed). The Western Cascade Province is an irregular boundary between the landforms on the western flank of the Cascade Mountains and the younger volcanic landforms of the High Cascades. The High Cascades trend in a north-to-south direction; the older Western Cascades follow the same trend.

The western flank of the Cascades is made up of lava and pyroclastic rock. During the Miocene, the rock was uplifted, folded, faulted, affected by intruding shallow stocks, and then deeply eroded. The rock dips to the east until it is overlain by more recent flows from shield volcanos of Pliocene to recent age. Rock strata typically include beds of volcanic ash (tuff), large flows of andesite lava, and layers of andesitic breccia and agglomerate.

The soils that formed in the Western Cascade province were directly influenced by the weatherability of the parent material. The strata of hard andesite and basalt include soft breccia and tuffaceous rock. Soils formed from hard andesite and basalt, such as McMullin soils, are shallow and medium textured. Other soils in this province not only formed in material weathered from hard bedrock but also are influenced by soft, easily weathered tuff and breccia. As a result, they are fine textured and have an argillic horizon.

In some areas, the concave slopes (with concentration of water in tuffs and breccias) are the result of gravitational mass movement in the regolith. This is generally where there is a dense claypan that is very slowly permeable. Bybee and Medco soils are examples.

The oldest of the volcanic strata is in the foothills on the westernmost side of the province. There are few soils that have these characteristics in the Project Area. These soils are layers of alluvial volcanic material and nonmarine sandstone. Carney soil is an example.

The younger strata within the Western Cascade province are along the boundary of the High Cascade province. The soils in this area are well developed. Some of this area is characterized by low relief. The bedrock is hard. A soil series with these characteristics in the Project Area is the Farva series. The Farva series is moderately deep and formed on convex slopes on hills and ridges.

The Klamath Mountains province contains complex areas characterized by steep, rugged terrain. The mountains were formed from uplifted metamorphic rock with intrusions of ultramafic (peridotite and serpentinite) and granite rock. The erodibility of the residuum combined with the forces of stream flow has created a steep topography. The high dissection of the topography leads to stream channels that are typically narrow with high gradients (10-60%). Erosion is most active in areas with steep slopes, concave topography, and shallow soils (National Resource Conservation Service 1993, 427-431).

3.3.3.1 Soils Series

The dominant soils series identified in the project units are Bybee, Farva, Freezener, Geppert, Goolaway McMullin, Medco, Medford, Rock Outcrop, Shippa, Straight, Tatouche, and Terrabella (Table 3-4 and Figure 3-4). There may be minor amounts of other soil series included within the proposed units.

Table 3-4. Soil Series and Characteristics Within Proposed Harvest Units and on Adjacent BLM Land

Map Unit #	Soil Series Name	Depth (inches)	Soil Texture	Soil Sensitivity Category
19, 20	Bybee[1]	60+	Loam, clay loam, clay	3
56–58	Farva[1]	20–40	Very cobbly loam, cobbly loam	2
62–64, 66, 67	Freezener[1]	60+	Gravelly loam, clay loam, clay	2
66–70	Geppert[1]	20–40	Very cobbly clay loam, extremely cobbly clay loam	2
72	Goolaway	20–40	Silt loam	1 and 2 (based on slope)
111, 113, 116, 117, 125	McMullin[1, 2]	<20	Gravelly loam, gravelly clay loam	1
111, 114–119, 126	McNull[1, 2]	20–40	Loam, clay loam, cobbly clay	2
112, 118, 119, 121–126	Medco[1, 2]	20–40	Cobbly clay loam, clay	3
128	Medford	60+	Silty clay loam, silty clay, clay loam	3
113	Rock outcrop[1]			
184, 185	Shippa[1]	12–20	Extremely gravelly loam, extremely cobbly loam	2
182, 184, 185	Straight[1]	20–40	Extremely gravelly loam, very gravelly loam, very cobbly clay loam	2
190, 191, 19, 20	Tatouche	60+	Gravelly loam, gravelly clay loam, clay	2
192	Terrabella	60+	Clay loam, clay	2

[1] Soils in which slumps or unstable slopes were found in the Project Area.

[2] All or portions of these soil series are mapped as Fragile for Mass Movement Potential (Pyroclastics)

Soil Sensitivity Categories:

1= (highly sensitive): burn only in spring-like conditions when soil and duff are moist. Maximize retention of duff layer. Assure retention of minimum levels of coarse woody debris and recruitment of snags as specified in the Standards and Guidelines.

2= (moderately sensitive): burn only in spring-like conditions when soil and duff are moist. Maximize retention of duff layer. Assure retention of minimum levels of coarse woody debris and recruitment of snags as specified in the Standards and Guidelines. Write fire prescriptions that reduce disturbance and duration and achieve low fire intensity.

3= (least sensitive): burn to avoid high intensity (severe) burns to protect a large percentage of the nutrient capital. Maximize retention of duff layer. Assure retention of minimum levels of coarse woody debris and recruitment of snags as specified in the Standards and Guidelines (USDI 1995, p. 168).

3.3.3.2 Fragile Soils

The Trail Creek Project Area contains soils classified as fragile for slope gradient (FG) and fragile for mass movement potential (FP). Most of the Project Area consists of slope less than 40%; however, there are some areas of steep slopes greater than 70%. Approximately 657 acres in the watershed are considered nonsuitable due to slope gradient and would not be considered for forest management activities. Since no projects are proposed on FG soils, they will not be discussed further.

There are 119 acres FP soils classified as nonsuitable in the watershed; however, no timber harvest or small diameter thinning activities would occur in these areas. The FP soils classified as suitable are proposed for forest management activities that require additional restrictions in project design. These are the focus of the Fragile Soil issue and the conditions of these areas were assessed.

Generalized Soil Map Units in the Trail Creek Project Area

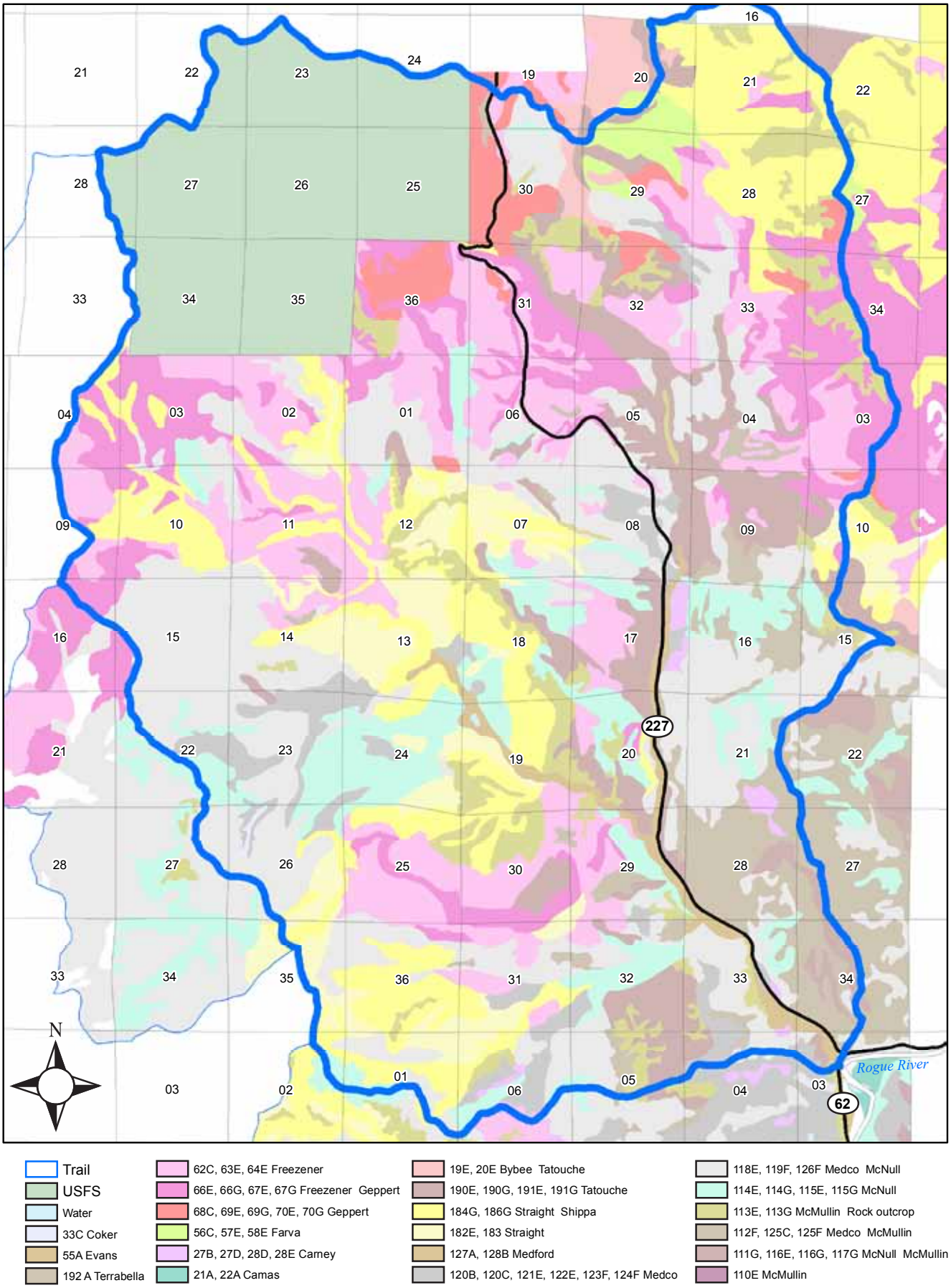


Figure 3-4. Generalized soil map units in the Trail Creek Project Area.

The Trail Creek Watershed Analysis distinguished two different kinds of mass movement: deep-seated slumps and shallow-rapid mass wasting. Deep-seated slumps and earthflows are common within the Trail Creek watershed and are associated with the clay-rich soil formed from volcaniclastic parent materials that underlie the entire watershed (Figure 3-5). Ancient slumps/earthflows occupy major areas of the moderate and low gradient slopes of the watershed, particularly in areas of weaker formations (flow Breccias and Ash Tuffs). Shallow-rapid mass wasting (debris avalanches and debris flows) are much more sensitive to forest management activities and can have substantial effects on stream systems. However, relatively few debris avalanches were observed within the watershed, and no debris flows were observed to have occurred within the watershed's stream channels (Bureau of Land Management 1999, 1-5).

Figure 3-5. Toe of slump in T32S, R1W, section 33.

The project soil scientist mapped unstable areas in the Project Area (Figure 3-6). Included in this map is the inventory of unstable areas identified in the Trail Creek Watershed Analysis and landslides described above (refer to Figure 3-2 in the Trail Creek Watershed Analysis for the different kinds of landslides). Other slumps or unstable areas were found during field work for this project and are included in this map. Past inventoried unstable areas were also included.

Roads have the potential to affect slope stability. The Trail Creek Watershed Analysis (p. 3-13) observed, "roads located in old earthflow toes, headwall source areas, and concave areas where water is concentrated contributed to several slump/earthflow (small, sporadic deep-seated) reactivation failures. . . ." In these circumstances, reading the hill slope is an important tool in finding the proper location of a road.

"Roads are the predominant cause of increased rates of mass wasting associated with forest management, with acceleration factors due to roads commonly found to be in the range of 10 to 100 times greater for roads than for harvesting (Swanston and Swanson 1976). Road fill failures, including fill failures associated with culvert blockages and diversions, are the predominant form of road-associated mass wasting in the Trail Creek Watershed" (Bureau of Land Management 1999, 3-11).

Unstable Slopes in the Trail Creek Project Area

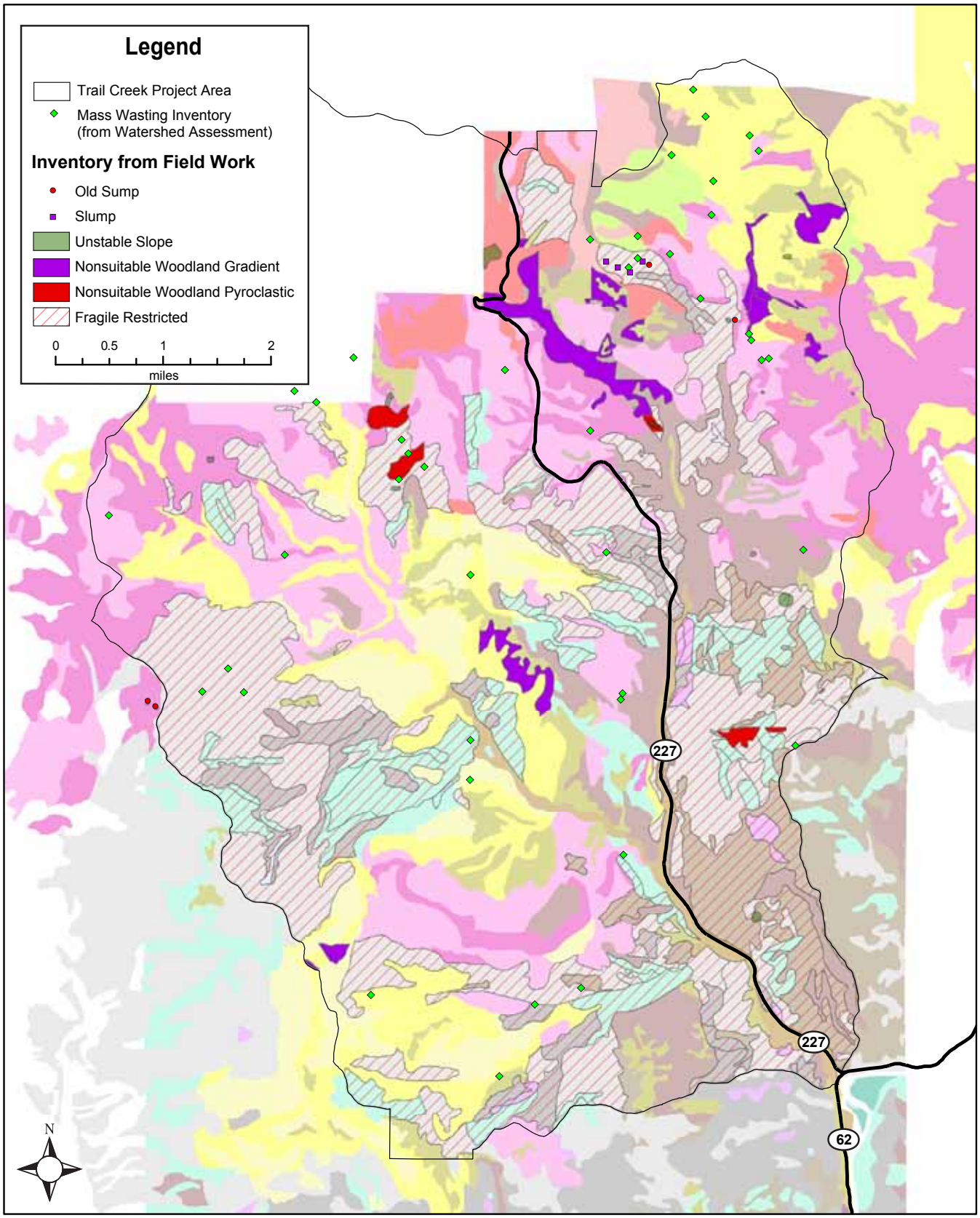


Figure 3-6. Unstable areas in the Trail Creek Project Area.

3.3.4 Environmental Consequences

3.3.4.1 Effects of Alternative 1 (No Action) on Fragile Soils

Direct and Indirect Effects

In Alternative 1, the No Action Alternative, projects proposed in the Trail Creek project would not occur. Effects related to the existing condition would continue. The existing condition may be described by analyzing past events or actions. Past events or actions are manifested in current conditions.

In the No Action Alternative, deep-seated slumps may still occur and the active ones would still be active. No road treatment would occur so roads identified as having resource damage would continue to have issues.

Cumulative Effects

Timber harvest has occurred in the last 15 years. None of the past harvested units would be harvested in this project. Field review of some of the past harvest units indicated no slope destabilization from harvest activities.

3.3.4.2 Effects on Fragile Soils Common to All Action Alternatives

Direct and Indirect Effects

The following projects are the same in each action alternative: small diameter thinning; precommercial thinning; road renovation, closure, and decommissioning; temporary route reconstruction; off-highway vehicle trail decommissioning; firewood cutting; water source restoration; meadow restoration; stream habitat enhancement and riparian restoration; and quarry reclamation.

Small Diameter Thinning

Small diameter thinning is proposed on 185 acres using ground-based yarding. No temporary routes would be constructed. Approximately 109 acres of the proposed 185 acres are on fragile (FP) soils. The project's soil scientist conducted a field review of these areas for slope stability. These areas have been used in the past and do not show signs of unstable slopes.

A route proposed for temporary reconstruction is located on fragile (FP) soils; however, it is located on an existing footprint on a gentle gradient hill slope. Temporary route reconstruction would occur in locations where a road footprint still exists but may be grown over or blocked. Temporary routes would be decommissioned after use. There would be a short-term effect from reopening the road by soil displacement and further compaction. This location was already compacted and the displacement would not have an effect on slope stability in the surrounding fragile (FP) soils.

Precommercial Thinning

Precommercial thinning on fragile (FP) soils would have no effect to slope stability because no mechanized ground equipment would be used.

Road Renovation, Closure, and Decommissioning; Temporary Route Reconstruction; and Off-highway Vehicle Trail Closure and Restoration

An interdisciplinary team reviewed all the roads in the Project Area to determine possible road-related concerns. The review allowed the BLM to develop road projects that would address those concerns.

Road renovation would occur on 80 miles of road and 1.4 miles of road would be closed to vehicular use using barricades or gates. Proposed partial (6.0 miles) and full (4.3 miles) road decommissioning are the same in all action alternatives.

Road renovation would disturb soil in the local area in the short term but would not result in mass movement in fragile soils.

Partial road decommissioning on 6 miles of road would be similar to full road decommissioning except the road bed would not be ripped. Partial road decommissioning on fragile (FP) soils would improve the drainage by pulling the culverts, which could have a positive impact on slope stability.

Full road decommissioning on 4.3 miles of road would decompact soil and allow rain to infiltrate into the soil at a higher rate. The soil is not expected to return to the undisturbed state but the soil would function the same as or close to an undisturbed soil. Further discussion and information of decommissioned and blocked roads are included in Appendix D, Soil.

Of the 4.3 miles of road proposed for full decommissioning, 0.4 mile is located within fragile soils. It is located in portions of BLM roads 33-1-28.0 and 33-1-31.1. The portions of these roads where fragile soils exist are not expected to become unstable from road decommissioning. The improved drainage of the roads is expected to have a positive impact on slope stability.

In the Project Area, 16.8 miles of off-highway vehicle trails are located on both private and public lands. Some begin outside the Project Area and connect to trails within the Project Area. Approximately 5.8 miles of off-highway vehicle trails are proposed to be blocked or reblocked to prevent further vehicle use in those areas. Currently, there are ruts and gullies on the surface of the soils in the trails. In T32S, R1W, section 29, the barricade would be improved and the portion of the trail just off the road would be rehabilitated. The trail beyond that would not be decommissioned. Approximately 1.0 mile of blocked roads in T33S, R1W, sections 25, 29, 31, and 32 that connect off-highway vehicle trails would be reblocked and decommissioned. By reestablishing barricades, the damage to the blocked road surface would decrease. The portion of road through T33S, R1W, section 30 (0.2 mile) on private land would not be decommissioned by the BLM. Decommissioning these trails would improve the drainage and improve slope stability. There may be a short-term increase in soil displacement from decommissioning activities. However, after the first few seasons, the soil surface would stabilize.

Fuels Treatment associated with Forest Management Activities and Hazardous Fuels Reduction

The slash produced during forest management activities and hazardous fuels reduction would be lopped and scattered, hand piled and burned, or removed for biomass use. Lopping and scattering, hand piling and burning, or removing the slash for biomass use is not expected to have an impact on fragile (FP) soils.

Public Roadside Firewood Collection

No effect to fragile (FP) soils is expected to occur from this project because mechanized vehicles would be restricted from traveling off the road.

Water Source Restoration

These water sources already exist and restoration would not change the hill slope. Restoring the water sources may help stabilize hill slopes by ensuring the sources are functioning properly. It is not expected this project would result in slope instability on fragile soils.

Meadow Restoration

Meadow restoration project is not expected to have an effect on fragile (FP) soils because none of the meadows are located in FP soils.

Stream Habitat and Riparian Restoration

The northern planting area in this project is in fragile (FP) soils. Soil stability in this area is not expected to be impacted from this project.

Quarry Reclamation

The quarry reclamation project is located within fragile (FP) soils. The Project is expected to improve the drainage of the quarry, which would benefit the surrounding soils. The disturbance may affect the soils in the short term but the improvement of drainage is expected to help stabilize the fragile soils in this area in the long term.

Cumulative Effects

The projects combined are on fragile (FP) soils; however, none of the proposed projects alone or cumulatively are expected to result in slope instability.

3.3.4.3 Effects of Alternatives 2, 3, and 4 on Fragile Soils

Direct and Indirect Effects

Alternatives 2, 3, and 4 propose forest management activities; ground-based, skyline-cable, and helicopter yarding; and road projects. Proposed small diameter thinning; precommercial thinning; road renovation, closure, and decommissioning; public roadside firewood cutting; water source restoration; meadow restoration; stream habitat enhancement and riparian restoration; and quarry reclamation projects are the same for all action alternatives. Potential impacts are discussed in section 3.3.4.2 Effects on Fragile Soils Common to All Action Alternatives.

The actions in proposed timber harvest that could negatively affect fragile (FP) soils are (1) yarding systems, (2) harvest unit access, (3) vegetation removal, and (4) slope instability.

There is no difference in the effects to fragile (FP) soils between activities proposed in Alternative 2 and Alternative 3. Ground-based, skyline-cable, and helicopter yarding units, as well as harvest access routes, are the same in both alternatives. The only difference between alternatives is the harvest prescription, which would not affect slope stability in fragile soils because unstable areas would not be harvested.

In Alternative 4, the same number of acres would be harvested but 56 acres of ground-based and skyline-cable yarding would be helicopter yarded; 2.1 acres are on fragile (FP) soils in T32S, R1W, section 19. Changing 40 acres of ground-based yarding to helicopter would have less impact on soils.

Yarding Systems

In Alternatives 2 and 3, timber would be harvested using ground-based (559 acres), skyline-cable (259 acres), and helicopter (267 acres) yarding systems. In Alternative 4, 56 acres of ground-based and skyline-cable yarding would change to helicopter yarding.

Ground-based Yarding: Of the 559 acres of ground-based yarding in Alternatives 2 and 3 (519 acres in Alternative 4), 166 acres (164 acres in Alternative 4) would be located in fragile soils. Recent and active deep-seated slumps would be buffered out to prevent further movement.

Slopes where evidence of past slumping was found may still be stable enough for management actions. The project soil scientist conducted a field review of previously tractor yarded areas located on fragile pyroclastic soil, as well as surrounding soils (see Appendix D, Soils, for a site-specific review of tractor units in fragile [FP] soils). There was no sign of instability on these soils that resulted from past tractor yarding. The skid trails were in place and vegetative indicators of instability, such as jack-strawed or pistol-butted trees, were not present. In most of the unit, the ground was a gentle gradient and not hummocky. As a result, the soils were determined to be stable. Unstable locations in the Project Area were not considered for timber harvest. Therefore, ground-based yarding proposed in Alternatives 2, 3, and 4 would not result in mass movement.

Skyline-cable Yarding: Skyline-cable yarding is proposed on 257 acres in Alternatives 2 and 3 (241 acres in Alternative 4). Skyline-cable yarding would not occur on unstable areas so there would be no effect on fragile soils.

Helicopter Yarding: The effect of helicopter yarding on fragile (FP) soils would be minimal because very little ground disturbance would occur. Changing 16 acres of ground-based yarding (including 2 acres on fragile soil in Alternative 4) to helicopter yarding would be less impacting to soils.

Harvest Unit Access

Predesignated Skid Trails: Timber harvest would use 1.6 miles of predesignated skid trails. The BLM would predesignate locations outside of timber harvest units for use as skid trails during yarding operations. Predesignated skid trails are narrower than temporary routes. Stumps would not be uprooted and the surface would not be scraped off as occurs when opening a temporary route. This means that some of the organic horizon as well as root systems in the trail may remain post-harvest. Since the proposed predesignated skid trails would not be located on fragile (FP) soils, there would be no impact on fragile (FP) soils. Based on the slope and conditions of the soils, slope instability is not expected to occur.

Temporary Route Construction: In Alternatives 2 and 3, proposed construction of 0.5 mile of temporary route would allow temporary access to timber harvest units. Temporary route construction would be the most impactful of the temporary route work. Routes would be designed using proper locations, such as ridge tops, on the landscape. These proposed routes would use existing footprints (in most cases old skid trails) where possible. Not all proposed route construction would follow an existing route; some construction would occur on previously undisturbed soil.

Temporary route construction would include 5 route segments for a total of 0.5 mile; one proposed route in T32S, R1W, section 30 is located in fragile soils (FP) for about 0.13 mile. Due to location on the landscape (gentle shoulder, straight slopes) and no evidence of slope instability (no active slumps or pistol butting), temporary route construction would not impact slope stability. The remaining routes are not located on fragile soils (FP) so there would be no effect on slope stability. Refer to Appendix D, Soil, for site-specific information about the proposed temporary routes.

In Alternative 4, no temporary routes would be constructed. The temporary routes proposed for construction in Alternatives 2 and 3 would be dropped and the timber harvest units changed according to changes in access. No change to the effect on fragile (FP) soils is expected to occur from dropping the temporary routes.

Temporary Route Reconstruction: In Alternatives 2 and 3, 0.8 mile (0.2 mile in Alternative 4) of temporary routes would be reconstructed. These routes are currently on the landscape but are not currently in use. For example, the temporary route may be currently blocked and would require very little preparation, if any, to use for timber hauling. One route is located on fragile soils (FP); however, temporary route reconstruction would not impact slope stability in the fragile soils because the road bed is already in place.

In all action alternatives, temporary routes would be decommissioned after use by ripping, water barring, seeding, mulching, and blocking.

Vegetation Removal

Vegetation removal could have an impact on unstable slopes in fragile (FP) soils. The loss of vegetation has the potential to decrease the amount of evapotranspiration, resulting in more saturated soils. This could lead to possible instability. The amount of vegetation remaining on site would be sufficient to prevent this. More importantly, the areas where soils appear to be unstable enough that removal of trees may cause movement would not be harvested.

Cumulative Effects

The proposed projects have the potential to cumulatively affect unstable soils but it depends on the degree of impact. The number of acres in fragile soils proposed for treatment in the Project Area is not expected to be enough to have a cumulative effect on the fragile (FP) soils with regard to slope stability.

3.4 Sediment from Roads

ISSUE: *Can the BLM reduce road-related sources of sediment in the Project Area?*

This section analyzes the potential impacts of the proposed actions on the sediment from roads issue. The following definitions are for terms used in this section:

ephemeral. Stream that flows only in direct response to precipitation, and whose channel is at all times above the water table.

colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

3.4.1 Methodology

The project hydrologist used the following sources for analysis:

- Field visits to proposed harvest units and associated roads in 2013 to determine current watershed conditions and identify potential issues related to water resources.
- Trail Creek Watershed Analysis (Bureau of Land Management 1999) for general water resources background information for the project area.
- GIS to analyze the existing condition of the Project Area.
- Site visits to identify stream types on BLM-administered lands; aerial photo interpretation, and information on streams on BLM-administered lands were used to estimate stream types on adjacent Forest Service and non-Federal land.
- The analysis area for localized road sediment includes the West Fork Trail Creek, Upper Trail Creek, Lower Trail Creek, Upper Elk Creek (Elk Creek-Umpqua fifth field), and Indian Creek-Rogue River

(Shady Cover-Rogue River fifth field) sixth field watersheds. Cumulative effects for water resources were analyzed at the Trail Creek fifth field watershed scale.

3.4.2 Assumptions

- Short-term effects are 10 years or less; long-term effects last longer than 10 years (Bureau of Land Management 1994, 4-4).
- 60-year harvest rotation for timber company lands (Bureau of Land Management 1994, 4-5).
- Proposed project design features will be properly implemented in order to meet resource objectives.
- Roads listed as "unknown" for surface type in GIS were assumed to be natural surface roads for this analysis.

3.4.3 Affected Environment

The Trail Creek Project Area lies in portions of 3, fifth-field watershed: Trail Creek, Shady Cove-Rogue River, and Upper Elk Creek. The Trail Creek fifth-field watershed is one of 7, fifth-field watersheds within the Upper Rogue fourth field subbasin. The majority of land in the Project Area drains into the Rogue River basin with a small portion draining into the Umpqua basin.

The Project Area is located in 5, sixth field subwatersheds. One subwatershed (Indian Creek-Rogue River) is within the Shady Cove-Rogue River watershed, one subwatershed (Upper Elk Creek) is within the Elk Creek watershed, and 3 subwatersheds (Lower Trail Creek, Upper Trail Creek, and West Fork Trail Creek) are within the Trail Creek watershed (Table 3-5 and Figure 3-7).

Table 3-5. Subwatersheds Containing the Trail Creek Project Area

Subwatershed	Total Acres	Square Miles
Shady Cove-Rogue River watershed/Upper Rogue subbasin/Rogue River basin		
Indian Creek-Rogue River subwatershed	25,217	39.4
Elk Creek watershed/South Umpqua subbasin/Umpqua River basin		
Upper Elk Creek subwatershed	17,571	27.5
Trail Creek watershed/Upper Rogue River subbasin/Rogue River basin		
Lower Trail Creek subwatershed	5,530	8.6
Upper Trail Creek subwatershed	15,484	24.2
West Fork Trail Creek subwatershed	14,301	22.3
Total	78,103	122.0

About 1% (331 acres) of the Trail Creek Project Area is located outside of the Trail Creek fifth field watershed: 153 acres in the 25,217-acre Indian Creek-Rogue River subwatershed and 178 acres in the 17,571-acre Upper Elk Creek subwatershed.

Surface water in the Trail Creek Project Area includes streams, irrigation ditches, springs, wetlands, and reservoirs. Streams in the Project Area are classified as perennial, intermittent with seasonal flow (long-duration intermittent), intermittent with ephemeral flow (short-duration intermittent), and dry draws with ephemeral flow. The Trail Creek Project Area contains 572 miles of stream: 198 miles of short-duration intermittent, 242 miles of long-duration intermittent, and 132 miles of perennial (Table 3-6).

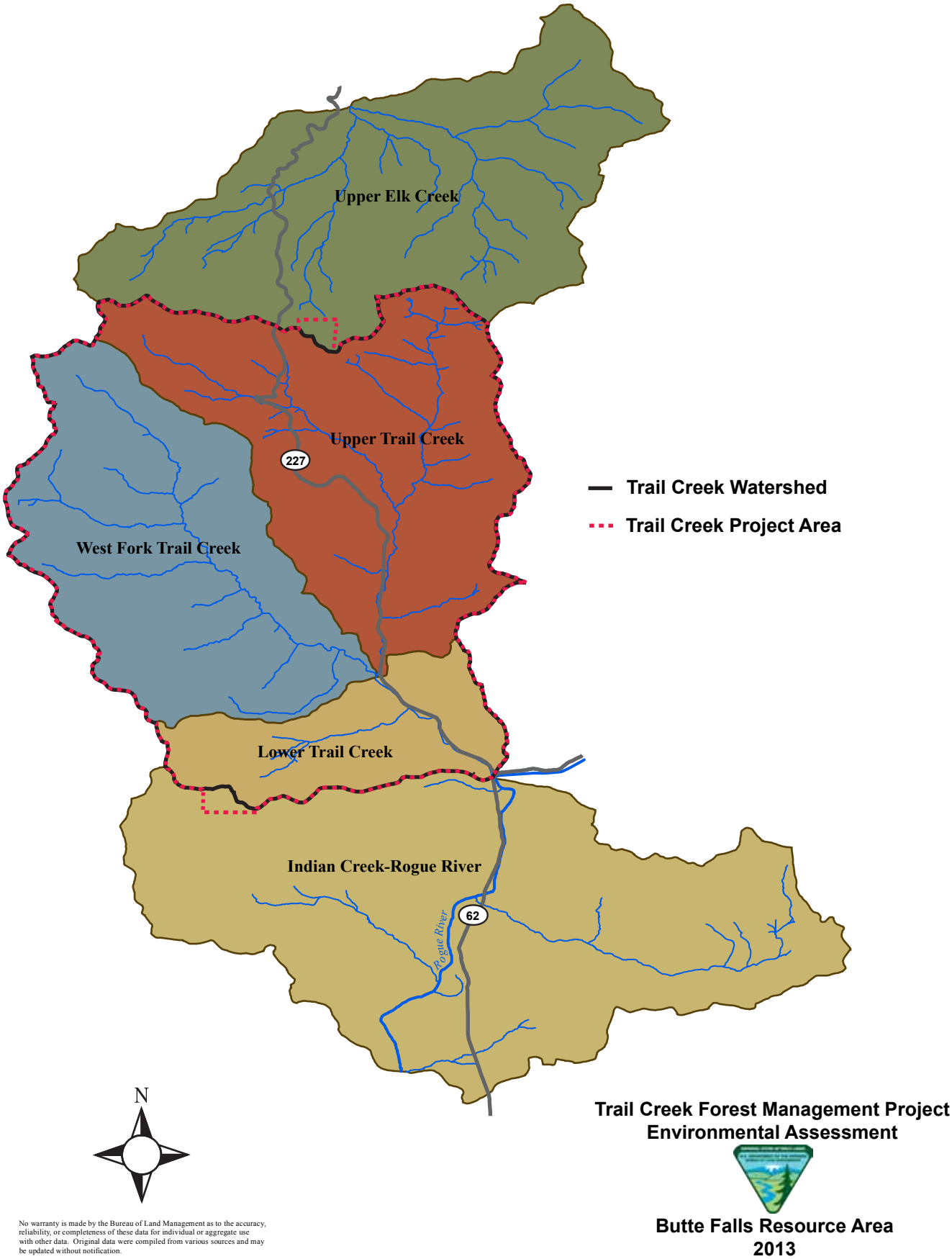


Figure 3-7. Sixth Field Subwatersheds containing the Trail Creek Project Area.

Table 3-6. Stream Miles by Subwatershed, Ownership, and Stream Classification

	Subwatershed					Total
	Indian Creek-Rogue River	Upper Elk Creek	Lower Trail Creek	Upper Trail Creek	West Fork Trail Creek	
Short-Duration Intermittent (miles)						
BLM	42.4	0	4.6	16.6	6.2	**69.8**
Private	52.8	0	12.6	21.5	29.6	**116.5**
State of Oregon	0.1	0	0.3	0	0	**0.4**
Forest Service	0	0	0	4.8	6.4	**11.2**
					Total Short-Duration Intermittent	**197.9**
Long-Duration Intermittent (miles)						
BLM	24.7	1.3	5.9	26.9	16.4	**75.2**
Private	41.1	34.5	9.3	13.0	13.0	**110.9**
State of Oregon	0.7	0	0.3	0	0	**1.0**
Forest Service	0	44.9	0.0	3.7	6.7	**55.3**
					Total Long Duration Intermittent	**242.4**
Perennial (miles)						
BLM	5.2	0	3.6	17.2	7.7	**33.7**
Private	20.0	14.9	4.7	10.1	14.3	**64.0**
State of Oregon	7.0	0	0	0	0	**7.0**
Forest Service	0	22.4	0	3.0	2.2	**27.6**
					Total Perennial	**132.2**
Total Stream Miles by Ownership and Subwatershed						
BLM	72.3	1.3	14.1	60.7	30.3	**178.7**
Private	113.9	49.4	26.6	44.6	56.9	**291.4**
State of Oregon	7.8	0	0.6	0	0	**8.4**
Forest Service	0.0	67.3	0	11.5	15.3	**94.1**
Grand Total	**194.0**	**118.0**	**41.3**	**116.8**	**102.5**	**572.6**

Streams categorized as perennial or intermittent on Federal lands are required to have riparian reserves as defined in the Northwest Forest Plan (Forest Service and Bureau of Land Management 1994b). Dry draws do not meet requirements for streams needing riparian reserves because they lack the combination of a defined channel and annual scour and deposition (Bureau of Land Management 1995). Streams on private forest lands are managed according to the Oregon Forest Practices Act, which classifies and protects streams based on three beneficial use categories—fish use, domestic water use without fish use, and all other streams. About 47% of the stream miles flow through Federal ownership and have riparian reserve buffers of 170 feet in the Trail Creek fifth field watershed. Unstable areas found on pyroclastic soils in the watershed are also identified as riparian reserves and have been excluded from harvest.

The Trail Creek watershed is characterized by rugged topography with irregular ridges and deep narrow valleys. Gentle to moderate slopes predominate in the southern and lower elevations of the watershed, with slope steepness generally increasing with increasing elevation to the north, toward the watershed's margins. The generally moderate to steep terrain with high-gradient streams results in a moderate stream density (Table 3-7). Steep ground, high-energy streams, and high stream density result in more hydrologic connectivity from roads and skid trails to streams than in more gently sloping watersheds with lower stream densities.

Table 3-7. Stream Drainage Density for the Subwatersheds containing the Trail Creek Project Area

Subwatershed	Stream Miles	Square Miles in Watershed	Drainage Density (Miles/Square Mile)
Indian Creek-Rogue River	194.0	39.4	4.9
Upper Elk Creek	118.0	27.5	4.3
Lower Trail Creek	41.3	8.6	4.8
Upper Trail Creek	116.8	24.2	4.8
West Fork Trail Creek	102.5	22.3	4.6
Total	572.6	122.0	4.7

The Oregon Environmental Quality Commission has adopted water quality standards to protect designated beneficial uses. In practice, water quality standards have been set at a level to protect the most sensitive uses. Cold-water aquatic life such as salmon and trout are the most sensitive beneficial uses in the Rogue River and its tributaries (Oregon Department of Environmental Quality 2004). The DEQ (Department of Environmental Quality) is required by the CWA (Clean Water Act) to maintain a list of impaired stream segments that do not meet water quality standards for one or more beneficial uses. This list is called the 303(d) list because of the section of the CWA that makes the requirement. DEQ's 2010 303(d) list is the most recent listing of these streams (Oregon Department of Environmental Quality 2010). The analysis area contains 23.6 miles of streams on the 303(d) list. Streams are listed as impaired for Dissolved Oxygen levels (Appendix E, Water Resources).

Section 303(d) of the Clean Water Act also requires states to develop TMDLs (Total Maximum Daily Loads) for impaired water bodies. A TMDL is a calculation of the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. The Rogue Basin TMDL addresses temperature and bacteria (*E. coli*) impairments for an area that contains the Project Area. The Project Area contains an additional 20 miles of impaired streams that are water quality limited and also have an approved TMDL. The Trail Creek Project Area contains a total of 43.7 miles of streams identified as water quality impaired (Table E-2, Appendix E, Water Resources). No streams in the Project Area were listed as water quality limited for sedimentation. However, DEQ does not currently have a methodology for assessing sedimentation; the agency is in the process of developing such a methodology.

Sediment from Roads

Of all forest management activities, roads typically have the greatest potential to influence aquatic habitat in forested watersheds. Roads have three primary effects on hydrologic processes: (1) they intercept rainfall directly on the road surface and road cutbanks and affect subsurface water moving down the hill slope; (2) they concentrate flow, either on the surface or in an adjacent ditch or channel; and (3) they divert or reroute water from paths it otherwise would take were the road not present (Gucinski, Furniss, et al. 2001).

Impacts include both near-term and ongoing (chronic) impacts. Near-term impacts stem from activities that include new ground disturbance, such as construction or maintenance of road segments. These activities lead to increased potential for erosion and transport of sediment to channels. Sediment contribution to channels stemming from these activities generally diminishes after 1 to 3 years (Luce and Black 2001) (Megahan 1974).

Weathering of road surfaces can lead to chronic sediment and turbidity contributions to aquatic habitats, and maintenance and use of roads (such as for timber hauling) can accelerate rates of erosion, particularly during the wet season (Luce and Black 2001) (Reid and Dunne 1984). Intercepted runoff that becomes

concentrated over erodible road surfaces mobilizes and transports sediment with it. Surfaces armored by pavement do not experience this type of chronic weathering, while rocked roads are more resistant than natural-surface roads. For these reasons, natural-surface (or depleted rocked surface) roads with a high degree of hydrological connectivity are generally more likely than surfaced roads (rocked or paved) to contribute sediment to streams. Around 67.5% (387.5 miles) of BLM roads and BLM-controlled roads in the Project Area are natural surface roads (Table 3-8).

Table 3-8. Road Surface Types for Roads on BLM-Administered Lands and BLM-Controlled Roads on Non-BLM Lands by Subwatershed

Subwatershed	Paved	Gravel	Natural Surface	Total	Percent Natural Surface of Total Road Miles
Indian Creek-Rogue River	15.2	24.0	156.0	195.2	79.9
Upper Elk Creek	5.1	22.0	87.8	114.9	76.4
Lower Trail Creek	0	13.1	27.8	41.0	68.0
Upper Trail Creek	3.5	51.6	57.4	112.5	51.0
West Fork Trail Creek	0	52.1	58.5	110.6	52.9
Total	**23.9**	**162.8**	**387.5**	**574.1**	**67.5**

It is important to note that not all roads or road segments contribute deleterious effects to aquatic habitat. Many variables interact to determine the potential for any given stretch of road to influence aquatic habitat, with the most important being the degree to which the road is hydrologically connected with the aquatic system (Furniss, Flanagan and McFadin 2000) (Jones, et al. 1999) (Macdonald and Coe 2008). Hydrological connectivity is present at any point where roads and streams interface. Midslope and valley bottom roads constructed in areas of high drainage density (which necessitates many crossings) have a high degree of connectivity, while ridge top segments that do not cross channels have no connectivity. Segments with high connectivity have high potential to affect aquatic habitat, while those with no connectivity have no potential.

Road-stream crossings are used as an indication of connectivity between roads and streams. Concentration of runoff by road drainage systems may contribute to more rapid delivery of storm runoff directly to streams, resulting in increased peak flows. Road segments linked to the channel network increase flow routing efficiency and offer a plausible mechanism for peak flow increases (Wemple, Jones and Grant 1996). Drainages with a larger number of road-stream crossings are more likely to experience an increased magnitude and frequency of peak flows and subsequently increase localized stream sedimentation from roads. Subwatersheds containing the Trail Creek Project Area have a relatively moderate density of road-stream crossings (Table 3-9).

Table 3-9. Road-Stream Crossing Density in the Subwatersheds containing the Trail Creek Project Area

Subwatershed	Road-Stream Crossings	Stream Miles	Road-Stream Crossings/Mile
Indian Creek-Rogue River	385	193.8	2.0
Upper Elk Creek	214	117.9	1.8
Lower Trail Creek	73	41.1	1.8
Upper Trail Creek	187	116.6	1.6
West Fork Trail Creek	210	102.4	2.1
Total	**1,069**	**571.9**	**1.9**

Road-stream crossings on natural surface roads have the greatest potential to deliver sediment to streams locally. The Project Area contains 141 natural or rocked road-stream crossings that would be used for timber hauling (Table 3-10). Crossings on paved roads are not considered to be sediment sources and will not be analyzed further.

Table 3-10. Haul Route Stream Crossings by Road Surface and Stream Type in the Trail Creek Project Area

Stream Type	Road Surface	
	Natural	Rocked
Perennial	0	45
Intermittent	1	55
Dry Draw	1	39
Total number of crossings	2	139

Roads that cross dry draws have the potential to route storm flow into the dry draw. Subsurface flow through the colluvium (i.e., loose rock and soil at the base of the slope) can also be intercepted by a road cut or compaction from a road that crosses the bottom of a dry draw, initiating surface flow with scour and deposition in the draw. This has the potential to change the downstream flow characteristics of the draw to a short-duration intermittent stream, affecting the size of downstream peak flows due to the more rapid delivery of storm flow to downstream reaches (water flows much faster through the defined surface channel of a short-duration intermittent stream than it does subsurface through the colluvium of a dry draw).

In addition to channel crossings, the design of the road also plays into the degree of hydrological connectivity. Well-designed roads with a properly functioning drainage system attempt to mimic the local natural drainage pattern by keeping the local downslope movement of water similar to the preroad condition. However, during extreme events (drought or peak flow) any hydrologic differences between the artificial drainage associated with the road system and the natural system become more critical and can cause noticeable effects, such as stream sedimentation, to the local environment.

Roads that are designed to shed intercepted water quickly off their surface and back to the forest floor have connectivity only from the point of the last turn-out device to where the road crosses the stream. Examples of such designs include outsloped road surfaces, rolling dips, and water bars, which are effective and common designs used to reduce connectivity between roads and the aquatic system when constructed and maintained properly (Luce and Black 2001; MacDonald and Coe 2008). Contrast this with an insloped road drained by an inboard ditch with few cross drains; such a road would have a greater portion of its length directly connected to the stream and would have a greater potential to impact aquatic habitat. Connectivity also changes in response to climactic conditions, with the greatest road-stream hydrological connectivity occurring during the wettest period of the year when soil moisture contents are high, ground water tables are elevated, and runoff is more likely (Furniss et al. 2000). For this reason, wet season use of a given road system would have a higher potential to contribute impacts to aquatic habitat than dry season use.

Road density provides a general index of the relative amount of road in the analysis areas. Areas with higher road densities will generally experience more road-related effects such as stream sedimentation; however, many other factors such as design, location, maintenance, use, surface type, gradient, and geology can influence the effect of any particular road. Road density in all subwatersheds is relatively high with Indian Creek-Rogue River having the highest road density at 5 miles per square mile and Upper Elk Creek having the lowest at 4.2 miles per square mile. The average road density for the analysis area is 4.7 miles per square mile (Table 3-11).

Table 3-11. Road Miles, Road Density, and Percent of Roaded Area in the Subwatersheds containing the Trail Creek Project Area

Subwatershed	Road Miles	Subwatershed Area (square miles)	Road Density (miles/ square mile)	Percent of Subwatershed Area in Roads
Indian Creek-Rogue River	195.2	39.4	5.0	1.3
Upper Elk Creek	114.9	27.5	4.2	1.1
Lower Trail Creek	41.0	8.6	4.7	1.2
Upper Trail Creek	112.5	24.2	4.6	1.2
West Fork Trail Creek	110.6	22.3	4.9	1.2
Total	**574.1**	**122.0**	**4.7**	**1.2**

Other potential sediment delivery locations include roads that parallel stream channels closely where road ditches can transport sediment through cross drains. There are approximately 62 miles of natural surface roads within 100 feet of streams throughout the 5, sixth field subwatersheds analyzed in the Trail Creek project. On BLM-administered roads in the Project Area, 6.3 miles of the natural surface roads are within 100 feet of stream channels.

Transportation management objectives were completed for the entire Trail Creek fifth field watershed to determine the long-term objectives for roads within the watershed. Recommendations for the management of each road would be addressed by this project or future projects.

Since 2000, road construction has declined and road decommissioning and upgrading has increased. Implementation of BMPs during road and timber harvest operations has reduced impacts on water quality. A review of forest management impacts on water quality concluded that the use of BMPs in forest operations was generally effective in avoiding significant water quality problems; however, the report noted that proper implementation of BMPs was essential to minimizing nonpoint source pollution (Kattelmann 1996). Water quality on Federal lands is on an upward trend with reductions in sediment input.

3.4.4 Environmental Consequences

The effects described under Alternative 1 reflect current conditions and trends that are shaped by ongoing management, reasonably foreseeable future actions, and events unrelated to the Trail Creek project. Discussion for Alternatives 2, 3, and 4 reflects the direct and indirect impacts of the proposed action. Effects discussion also includes cumulative impacts of those direct and indirect actions when added incrementally to past, present, and reasonably foreseeable actions. Short-term effects are defined as those lasting 10 years or less and long-term effects last more than 10 years (Bureau of Land Management 1994).

3.4.4.1 Effects of Alternative 1 (No Action) on Sediment from Roads

Direct and Indirect Effects

No actions are proposed under Alternative 1. The current conditions in the Project Area are the result of past actions not related to the Trail Creek project. Alternative 1 describes anticipated effects of not implementing the proposed project and continuing with current management.

Under Alternative 1, there would be no change in existing water quality on BLM-administered lands. Surface erosion from roads would continue and the risk of sediment inputs to streams would remain relatively constant. A minimum level of BLM road maintenance would occur to repair drainage failures or

prevent major sediment input. There would be no action to decrease overall road densities or decrease road interactions with streams.

There would be no reduction in total road miles and no improvement to infiltration or reduction in sediment delivery under this alternative. Alternative 1 would not implement any road-related projects and therefore would not reduce localized sediment coming from natural surface roads or from roads that are paralleling streams.

Cumulative Effects

Past actions have resulted in increased fine sediment levels above background level. The main actions resulting in these conditions are timber harvest and road building. Other contributors to these conditions include agriculture and grazing.

Off-highway vehicle use has increased in the past 10 years and also contributes to watershed cumulative effects by increasing erosion and subsequent sedimentation in the Trail Creek fifth field watershed, although the extent of this effect is not known.

Timber sales completed in the last 10 years on BLM-administered lands in the Trail Creek fifth field watershed include the North and South Trail timber sales. These timber sales implemented riparian reserve buffers and likely did not contribute to increased stream sedimentation. Road renovation and road improvement occurred as part of these projects to reduce the overall amount of sediment coming from roads.

Restoration projects in the Trail Creek fifth field watershed included adding boulders in 2002 and large wood and boulders in 2008 to West Fork Trail Creek. Adding large wood to streams aids in restoring stream complexity in simplified stream channels. The added structure dissipates stream energy, which reduces erosion and promotes deposition of transported sediment.

In 2003, an undersized culvert was replaced with a bottomless arch on an unnamed tributary to West Fork Trail Creek. The replaced culvert was designed to provide fish passage for overwintering coho salmon, increase summer steelhead spawning habitat, and to allow gravels to be transported downstream.

Road work that helps reduce sedimentation has included adding cross drains to improve road drainage by reducing distances between cross drains. Both road closures and road decommissioning have also been completed in the watershed during the last decade. However, some of the closed roads were not effective at limiting off-highway vehicles access and the subsequent erosion and sedimentation to streams.

3.4.4.2 Effects of Alternatives 2, 3, and 4 on Sediment from Roads

Direct and Indirect Effects

Timber Harvest, Small Diameter Thinning, Precommercial Thinning, and Riparian Thinning

Although timber harvest proposals differ by alternative, no hydrologic connectivity would exist between harvest units and stream channels because harvest and yarding operations would not occur within the no-treatment buffers identifies within standard riparian reserves. Fine sediment mobilized from units or skid trails would be filtered by vegetation with the riparian reserves and deposited on the forest floor before reaching streams. Activities related to timber harvest and yarding operations would not be hydrologically connected to the stream network and, therefore, would not contribute sediment to stream channels.

Proposed Road Projects

Timber hauling and road renovation would occur on 80 miles of road: 75 miles are rocked roads and 5 miles are natural surface. The majority of work is proposed in Upper Trail Creek and West Fork Trail Creek subwatersheds. The main line haul routes include the paved road along portions of Trail Creek and West Fork Trail Creek and well-rocked roads located throughout the Project Area.

Most of the road stream crossings identified within the haul route for this project cross intermittent streams. Intermittent channels only flow seasonally and would likely not be flowing when haul is occurring. In the rare circumstances that the road network has dried enough to reinitiate haul and the intermittent channels are still running, there would not be a mechanism for sediment from the road to be transported into the stream channel because the roads would be dry. However, fine sediment generated from haul could be transported off site during high flow events when intermittent channels are flowing.

Sediment inputs to streams may result from haul-related surface erosion. Surface erosion would be minimized because project design features would allow log hauling during dry conditions and would restrict hauling whenever soil moisture conditions or rainstorms could result in the transport of sediment to ditch lines and nearby stream channels. Most of the haul roads are rocked (75 of 80 miles) or paved, rather than native or natural surface. This reduces the probability of road surface erosion and subsequent sedimentation of aquatic habitat, as the hardened surfaces can withstand more wear and tear.

After the dry season, during the fall and winter rains, sediment from the road prism could be transported into the ditch system. However, this would occur at a time when stream levels are elevated and transporting sediment naturally. Under these conditions, the small amount of sediment indirectly contributed from hauling would not be measureable or detectable above background levels. The amount of sediment entering stream channels from timber hauling as part of this project would be greatly reduced because hauling would be seasonally restricted, most haul routes would be located high in the watershed, haul routes cross intermittent channels, and roads are well-maintained (mostly rocked). Any haul dust or sediment from wear and tear on rocked roads would only be moved during intense rain events when it would not be measurable or detectable above background levels.

Approximately 80 miles of road renovation is proposed. Renovation would include blading, brush removal, and improving drainage features on existing roads. Project design features are designed to limit the amount of road work (blading and ditching) that occurs near stream crossings and requires seeding and mulching where these actions are deemed necessary for road stability and drainage improvement. In this case, seeding and mulching would occur within the same season as the road work to stabilize the surfaces. Additionally, roads would be disconnected from the stream network by adding cross drains where necessary.

Road renovation would improve the long-term drainage of the roadway, which would reduce the amount of sediment being produced from these roads. Road renovation (cleaning ditches and culverts) could increase the amount of sediment transported to nearby streams in the short term during implementation. This amount is expected to be small and localized because work would occur during the dry season when sediment transport is low.

Surfacing would occur on 1 mile and spot rocking would occur on 1.9 miles of natural surface roads within 100 feet of streams. Adding rock to natural surface roads within 100 feet of streams would reduce the overall amount of chronic road sediment at these locations.

The majority (77 miles) of proposed road renovation would be located outside of riparian areas; therefore, there is little probability that it would intercept ground water. The roads would be able to intercept precipitation directly, which could potentially become concentrated flow capable of rutting the road surface and transporting eroded material downslope. However, drainage relief would be incorporated into the renovation, which would ensure the road surfaces would shed intercepted water and any mobilized sediment off of their prisms and into downslope vegetation, minimizing the potential for rutting and disruption of natural flow paths. In the long term, cleaning ditch lines and culverts is expected to reduce sediment by reducing the amount of potential erosion.

In all alternatives, 1.4 miles of road would be closed with either a gate or a barricade; 0.2 mile are on natural surface roads within 100 feet of streams. Sediment from these roads would be reduced because the amount of traffic traveling on these roads would be limited, especially during the wet season when most sedimentation occurs. Roads would be closed in the Upper Trail Creek and West Fork Trail Creek subwatersheds.

Partial and full road decommissioning is proposed on 10.3 miles of road. This project would address sediment from natural-surface roads by placing roadbeds in a stable, well-drained, no-maintenance condition that produces little road-related sediment. Of the 10.3 miles proposed to be decommissioned, 6 miles would be partially decommissioned and 4.3 miles would be fully decommissioned. Partial decommissioning would occur on 0.8 mile of natural surface roads within 100 feet of streams. Full decommissioning would occur on 0.6 mile of natural surface roads within 100 feet of streams.

Decommissioning roads near streams would reduce the amount of sediment coming from roads in the long term. Partial decommissioning includes pulling culverts, water barring, seeding, mulching, and blocking the access. Full decommissioning would additionally include ripping the road surface. Ripping the road prism breaks up the existing compacted soil and allows for better water infiltration into the soil, reduces runoff, and improves vegetative recovery. This would reduce the introduction of sediments into nearby streams from these roads. While both methods would reduce the overall amount of sediment coming from roads, fully decommissioned roads would also increase infiltration allowing for quicker and more long-lasting recovery of the site. Where stream crossings and culverts are removed, sediment could enter the stream system at the site. The amount of sediment would be minimized by following the project design features and by working during the instream work period when flows are lowest.

Water Source Restoration

Water source restoration is proposed at 14 sites. Because each site is unique, the amount and type of work needed to restore the water sources to their original design varies. The following PDFs would be implemented:

- Dispose of end-haul material in stable sites outside of floodplains, as identified by the BLM Authorized Officer. Apply erosion control measures at disposal sites to minimize sediment delivery to water bodies.
- Minimize disturbance to existing riparian vegetation in order to maintain slope stability. Limit vegetation clearing to the vehicular access point.
- Use sediment-control measures such as straw bales, filter cloth, or sediment fences.
- Limit instream work to the period from June 15 to September 15.

PDFs would keep the disturbance localized and minimize or eliminate any downstream sedimentation.

Off-highway Vehicle Trail Closure and Restoration

Trail closure and restoration is proposed throughout the Project Area. Most of the proposed segments are located along ridge tops and, as such, are not hydrologically connected to the stream network. Three segments are located within riparian reserves. One segment is located in the riparian reserve of an intermittent tributary to Wall Creek. The second segment is located along the main stem of Trail Creek. The third segment is located in the riparian reserve of a perennial tributary to Chicago Creek. Sediment input to streams during project implementation would be limited by the use of project design features such as restricting work to the dry season, minimizing bare soil exposure, not ripping trails within 10 feet of streams, and seeding and mulching areas disturbed during restoration. Closing and restoring these trails would reduce the amount of sediment currently entering streams.

Temporary Route Construction and Reconstruction

In the Trail Creek Project, 1.1 miles of temporary route construction and reconstruction are proposed in Alternatives 2 and 3 to facilitate access to treatment units. No temporary routes would be constructed in Alternative 4 and 0.5 mile would be reconstructed. These temporary routes are either extensions of existing roads or short spur routes off existing roads; they are located outside riparian reserves. Temporary routes would be constructed on stable locations, used, and decommissioned within the same operating season. Additionally, 1.6 miles of designated skid trails are proposed. These activities would not contribute to increased road density in the Project Area because these routes and skid trails are temporary and the effects would be mitigated by ripping and water barring to minimize the potential for sedimentation. Temporary route construction and reconstruction would occur during the dry season. This is not expected to affect aquatic resources because they would not be connected to the stream network.

Hazardous Fuels Reduction

Hazardous fuels reduction would leave no-treatment riparian buffers, require minimal ground disturbance, and would not treat large trees. All fire lines would be water barred and rehabilitated after ignition operations were completed. Treatments would not lead to increases in sediment inputs to channels because streamside vegetation would remain after treatment to intercept rainfall and filter overland flow.

Public Roadside Firewood Cutting

Project design features would keep vehicles from traveling off road surfaces and require cutters to keep road surfaces, ditches, and catch basin free from debris. This would maintain the function of the road drainage system. The public would not be allowed to cut firewood within 60 feet of fish-bearing and perennial streams, springs, seeps, ponds, and wetlands and 30 feet of intermittent streams so riparian vegetation would remain to intercept rainfall and filter overland flow.

Stream Habitat Enhancement and Riparian Restoration

This project includes placing wood and boulders into West Fork Trail Creek, decommissioning approximately 0.5 mile of user-created roads in riparian areas, replacing an old fence to prevent vehicle access to the decommissioned user-created roads, replacing an undersized culvert, and planting 3.5 acres along West Fork Trail Creek.

Placing wood and boulders into West Fork Trail Creek and planting 3.5 acres with native conifers would not directly affect road-related sediment, but would indirectly improve sediment storage and transport. Sediment storage and, subsequently, aquatic habitat in West Fork Trail Creek would be improved in the stream section where large wood and boulders are added.

Decommissioning the user-created roads, rebuilding the fence, and replacing an undersized culvert all would reduce the amount of sediment coming from local roads entering West Fork Trail Creek. Decommissioning the roads would eliminate the ruts that are currently transporting sediment. Planting the decommissioned user-created roads and riparian area would reduce the amount of sediment transported by providing vegetation to intercept overland flow and filter sediment before it reaches streams. Fencing would reduce sediment by eliminating traffic from the user-created roads. Replacing the undersized culvert with a culvert that would accommodate a 100-year flood would reduce road-related sediment by reducing the amount of erosion occurring around the existing culvert.

Cumulative Effects

See cumulative effects under Effects of Alternative 1 on Sediment from Roads for previous, ongoing, and future projects in the Project Area.

Proposed activities that would be hydrologically connected to the stream network include timber hauling, road renovation, and road decommissioning. Short term (one to five years), small inputs of sediment at stream crossings in the Project Area could result from these actions. Given the dry season haul restriction, inputs would occur only during a precipitation event following a season of hauling and would be spatially spread over many input locations. It is extremely unlikely that sediment input from these activities would be detectable above background levels and would have an effect on aquatic habitat. Sediment increases would be minor and undetectable relative to existing sediment levels and would not contribute measurable or detectable effects above already elevated background levels. Over the long term, road renovation would improve drainage and reduce road-related sediment inputs.

Upland work, including timber harvest and follow-up fuels treatments, would have no effect on fine sediment levels due to the filtering action of riparian reserve buffers, project design features designed to prevent overland sediment movement, and best management practices.

The proposed 10.3 miles of road decommissioning would reduce the total miles of road in the Trail Creek fifth field watershed from 574.1 miles to 563.8 miles. Road density would be reduced from 4.7 to 4.6 miles per square mile. While this amount of road decommissioning does not greatly affect road density or sediment from roads in the fifth field watersheds, the trend on BLM lands is to reduce the amount of roads and related effects while minimizing new construction.

Timber harvest and development on private land is expected to continue existing trends in fine sediment potential currently present in the Project Area. The Trail Creek project would, in the short term, contribute a small amount of sediment to streams within the Project Area, in addition to the amounts contributed annually from all other sources. Direct inputs of fine sediment resulting from timber hauling would not be detectable above background levels.

3.5 Northern Spotted Owl Habitat

ISSUE: *Can the BLM provide silviculture treatments on matrix lands in northern spotted owl habitat without harm to an individual owl?*

This section analyzes the potential impacts from the proposed forest management activities on northern spotted owl habitat. Terms used in this section are defined as follows:

Bureau sensitive species. A special status species category established by the BLM that includes those plant and animal species eligible for status as federally listed, Federal candidate, state listed, or state candidate

(plant) species; or approved for this category by the BLM State Director; or included under agency species conservation policies.

core area. A 0.5-mile radius circle (about 500 acres) from the nest or center of activity that delineates the area most heavily used by spotted owls during the nesting season; it is included within the provincial home range circle. Core areas represent the areas that are defended by territorial owls and generally do not overlap the core areas of other owl pairs.

nest patch. The 300-meter radius (70 acres) around a known or likely northern spotted owl nest site. The nest patch is included in the core and provincial home range circles.

northern spotted owl site. Any location where territorial northern spotted owls are known to be present, were historically present, or may be present in unsurveyed habitat. Owl sites are analyzed at the nest patch, core area, and provincial home range scales. Sites can be identified through surveys where spotted owls were detected (US Fish and Wildlife Service 2010). In cases where survey data are unavailable, spotted owl sites can be identified by (1) conducting surveys, or (2) using a modeling approach that uses habitat and landscape characteristics to identify areas with a high probability of being occupied.

occupied northern spotted owl site. A location with evidence of continued use by northern spotted owls. Evidence includes breeding, repeated location of a pair or single bird during a single season or over several years, presence of young before dispersal, or some other strong indication of continued occupation.

primary constituent elements. Those physical and biological features of a landscape that a species needs to survive and reproduce.

provincial home range. Radius of a circle that represents an approximate home range for a northern spotted owl in a given geographic location or province. It represents the area owls are assumed to use for nesting and foraging in any given year. The Trail Creek project is located in the Western Cascades and Klamath Mountains Provinces. The provincial radius is 1.2 miles (2,895 acres) for the Western Cascades Province and 1.3 miles (3,400 acres) for the Klamath Mountains Province. The provincial home ranges for several pairs of owls may overlap.

treat and maintain. An action or activity occurs within spotted owl dispersal or nesting, roosting, and foraging habitat but will not change the conditions that would classify the stand as dispersal or nesting, roosting, and foraging habitat post-treatment.

3.5.1 Methodology

- The process for conducting biological evaluations and assessments includes a review of existing records, field reconnaissance, field surveys, and analysis of potential impacts. The project wildlife biologist conducted a review of potential wildlife habitat using field assessments, maps, aerial photographs, GIS software, wildlife survey data, and stand exam records for the Project Area.
- The BLM wildlife biologist identified northern spotted owl habitat in the Project Area using IVMP (Interagency Vegetation Mapping Project), TPCC (Timber Production Capability Classification), FOI (Forest Operations Inventory) information, and on-site habitat analysis.
- Northern spotted owl habitat classifications (Table 3-18) were derived using the 1997 IVMP and the BLM's FOI information. IVMP is a joint Forest Service/BLM project that derives a 25-meter pixel-based vegetation map from 1997 satellite imagery. The 1997 IVMP provides a representation of vegetation age classes across all ownerships within the Project Area. The vegetation map has been classified into categories according to the Interagency Vegetation Standards that were adopted by the Interagency Advisory Committee. IVMP data is primarily useful for cumulative effects analysis that

includes public and private lands. The FOI gives a more detailed description of age classes on BLM lands because it is based on field data as well as aerial photo inventories. The combined data allows the vegetation to be grouped into the early, mid-, and late seral age classes for comparison purposes, although these data sources have differing degrees of detail and resolution. The TPCC refers to the suitability of the soil to produce timber.

- In January 2010, the Rogue River-Siskiyou National Forest Supervisor and BLM Medford District Manager approved the use of the RA32 Habitat Evaluation Methodology 1.3. It complies with the RA32 recommendation in the Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina) to maintain all of the older and more structurally complex, multilayered conifer forests. The methodology was used to determine the presence or absence of highly suitable, structurally complex spotted owl habitat in all project units under consideration in this analysis.
- The BLM will conduct strategic surveys for northern spotted owls following the 2011 Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls (2011 NSO Survey Protocol, Revised January 9, 2012).
- Using recommendations from Recovery Action 10 in the Northern Spotted Owl Recovery Plan, known spotted owl sites within the Project Area were identified and considered for habitat retention. Forest treatments within known owl home ranges would generally avoid habitat downgrade or removal.

3.5.2 Assumptions

- Late-successional forest is forested habitat 80 years or older. Late-successional forest generally, but not always, provides suitable habitat for spotted owls. Suitable spotted owl habitat is usually 80 years and older, but it also contains other attributes, such as multiple tree layers, snags, and decaying logs. Spotted owl habitat is specifically rated for its suitability for spotted owls, while late-successional forest not rated as suitable spotted owl habitat may provide habitat for other wildlife species.

3.5.3 Affected Environment

3.5.3.1 Northern Spotted Owl Habitat

The northern spotted owl, listed as threatened under the Endangered Species Act, is associated with the existing habitats found within the Project Area. Northern spotted owls prefer coniferous forest with multiple vertical layers of vegetation; a variety of tree species and age classes; and the presence of large logs and large diameter live and dead trees (snags) for NRF (nesting, roosting, and foraging) habitat. They may also be found in younger stands with multilayered, closed canopies, large diameter trees, and abundance of dead and down woody material. Based on studies of owl habitat selection, including habitat structure and use and prey preference throughout the range of the owl, northern spotted owl habitat consists of four components: nesting, roosting, foraging, and dispersal (Thomas, et al. 1990) (Table 3-12).

Suitable habitat (NRF) in southwest Oregon is typified by mixed-conifer habitats with recurrent fire history, patchy habitat components, and higher incidences of woodrats (US Fish and Wildlife Service 2006, BA-6). A review of current habitat ratings of Federal lands within the Trail Creek fifth field watershed indicates that 33% of Federal lands provide NRF habitat (including 4% RA32 habitat), 5% provide roosting and foraging habitat, and 29% provide dispersal-only habitat (Figure 3-8). Suitable NRF habitat also functions as dispersal habitat.

Table 3-12. Northern Spotted Owl Habitat Types

Habitat Type	Description
Type 1: Suitable Nesting, Roosting, Foraging (NRF)	NRF habitat meets all spotted owl life requirements. These forests have a high canopy cover (greater than 60%), a multilayered structure, and large overstory trees greater than 21" diameter. Deformed, diseased, and broken-top trees, as well as large snags and down logs, are also present.
High-quality habitat (RA32) Subset of Type 1 habitat	Older, multilayered, structurally complex forests characterized as having large trees greater than 17" diameter, high canopy cover (>60%), and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees. RA32 habitat may vary due to climatic gradients across the range.
Type 2: Roosting, Foraging (RF)	Canopy cover greater than 60% and canopy structure generally single-layered. Overstory trees are generally greater than 16" in diameter. Snags and down wood not considered a requirement.
Type 3: Capable	Does not presently meet spotted owl needs but has the potential to grow into habitat Types 1, 2, or 5.
Type 4: Non-habitat	Does not have the potential of developing into late-successional forest or supporting old growth dependent species.
Type 5: Dispersal	This habitat is not suitable for nesting, but provides requirements believed important for spotted owl dispersal. Canopy cover is between 40 and 60%, or overstory tree diameters are generally less than 16". The area has the capability of becoming foraging or nesting habitat. Deformed trees, snags, and down wood are absent or less prevalent than in Type 1 habitat.

Critical Habitat

In December 2012, the US Fish and Wildlife Service released the Revised Critical Habitat for the Northern Spotted Owl. The final rule was published in the Federal Register on December 4, 2012 (77 Federal Register 233:71876-72068). This rule designated northern spotted owl critical habitat on BLM lands. CHU (critical habitat unit) identifies geographic areas that contain features essential for the conservation of the northern

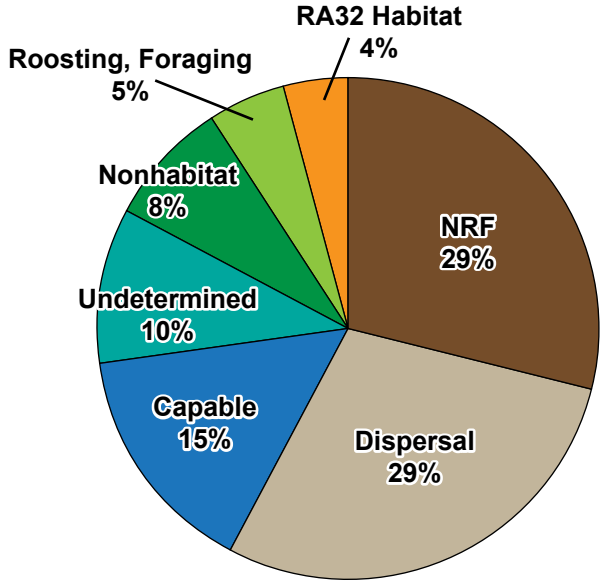


Figure 3-8. Existing northern spotted owl habitat on Federal lands in the Trail Creek fifth field watershed.

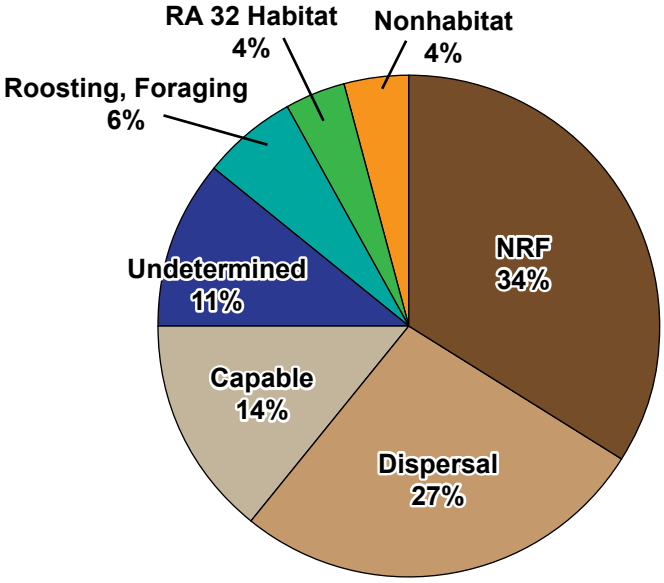


Figure 3-9. Existing northern spotted owl CHU habitat in the Trail Creek fifth field watershed.

spotted owl and may require special management considerations. For the northern spotted owl, these features include particular forest types of sufficient area, quality, and configuration distributed across the species' range to support the needs of territorial owl pairs throughout the year, including habitat for nesting, roosting, foraging, and dispersal. Approximately 40% of the Trail Creek fifth field watershed is in designated critical habitat and 61% of the CHU provides dispersal and nesting, roosting, and foraging habitat (Figure 3-9).

The Trail Creek projects are within CHU 10, subunit KLE (Klamath East)-3. The KLE-3 subunit occurs in Jackson, Josephine, and Douglas Counties, Oregon and comprises Federal lands managed by the Forest Service and BLM under the Northwest Forest Plan (Forest Service and Bureau of Land Management 1994b). Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire, effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for east–west connectivity between subunits and critical habitat units and also for demographic support. This subunit facilitates northern spotted owl movements between the western Cascades and coastal Oregon and the Klamath Mountains.

Northern Spotted Owl Recovery Plan

In July 2011, the US Fish and Wildlife Service released the *Revised Recovery Plan for the Northern Spotted Owl* (Strix occidentalis caurina). The plan recommends retaining all occupied northern spotted owl sites as well as high quality habitat, as identified in RA32. The plan provides guidance to bring about recovery through prescribed management actions and supplies criteria to determine when recovery has been achieved.Approximately 700 acres in the Project Area originally proposed for harvest were identified as highly suitable, structurally complex forest (RA32) and were dropped from consideration at this time. The RA32 stands will contribute to maintaining forest with large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees (Figure 3-10).

Figure 3-10. Example of the 700 acres of RA32 habitat identified and retained in the Project Area. Stand contains large-diameter overstory trees, 3 tree layers, large coarse woody material, and large snags.

The current foundation of the northern spotted owl recovery plan is the 1994 Northwest Forest Plan. Management direction and land allocations in the standards and guidelines of the Northwest Forest Plan are intended to constitute the Forest Service and BLM contributions to the recovery of the northern spotted owl (Forest Service and Bureau of Land Management 1994b, A-2). The Medford ROD/RMP and the Northwest Forest Plan provide a network of late-successional reserves (including 100-acre activity centers), connecting riparian corridors, connectivity/diversity blocks, and 15% of late-successional forests on Federal lands being retained within fifth field watersheds.

Known Northern Spotted Owl Activity Centers

The Northwest Forest Plan designated 100 acres of the best habitat on Federal lands to be retained as close as possible to the northern spotted owl nest site, or activity center, for all sites known as of January 1, 1994.

This was intended to preserve an intensively used portion of the breeding season home range close to a nest site or center of activity (Bureau of Land Management 1995, 32) (Forest Service and Bureau of Land Management 1994b, C-10). These known spotted owl activity centers are managed as late-successional reserves. There are ten, 100-acre activity centers in the Project Area.

Provincial Home Range

The home range is a circular area around a spotted owl center of activity. The size of the home range is based on the geographic province in which it is located. The Trail Creek project is located within two provinces—Cascades West and Klamath Mountains. The provincial home ranges are a 1.2-mile radius from the site center for the Cascades West province and a 1.3-mile radius for the Klamath Mountains province. The removal of suitable habitat to below 40% of the median annual home range area is likely to cause significant impairment of northern spotted owl life history functions (Bart and Forsman 1992) (Bart 1995). Based on these studies, suitable habitat coverage of at least 40% or higher at the home range scale is likely necessary for maintaining spotted owl life history functions. As the amount of suitable habitat in an owl's home range decreases, so does site occupancy, reproduction, and survival.

Proposed projects are located within the provincial home ranges of 17 known spotted owl sites. A known spotted owl site is defined as a location with evidence of historic or current use by spotted owls. Evidence includes breeding, repeated location of a pair or single bird during a single season or over several years, presence of young before dispersal, or some other strong indication of occupation. Five of the known spotted owl sites were discovered after January 1, 1994, and do not have established 100-acre activity centers (Forest Service and Bureau of Land Management 1994b, C-10).

Late-Successional Forest

The ROD/RMP and Northwest Forest Plan require that 15% of all Federal forestlands within fifth field watersheds retain late-successional forest conditions, generally defined as stands 80 years or older. Currently, 60% (8,998 acres) of the 15,069 acres of BLM forested land in the Trail Creek fifth field watershed is in late-successional condition. Late-successional forest conditions allow for spotted owl dispersal, foraging, or nesting opportunities.

Connectivity/Diversity Blocks

Connectivity/Diversity blocks were designated in the 1995 Medford ROD/RMP throughout the northern GFMA matrix land use allocation. These provide habitat connectivity for old growth dependent and associated species within the northern GFMA and between late-successional reserves. Each block is to maintain at least 25 to 30% in late-successional forest. These blocks may be a combination of northern spotted owl nonhabitat and NRF, dispersal, and capable habitat. The Project Area contains two connectivity/diversity blocks: T32S, R1W, section 31 and T33S, R2W, section 3.

3.5.3.2 Northern Spotted Owl Population Trends

Spotted owl productivity varies widely year-to-year, depending on how spring weather conditions affect prey availability (reproduction) (Franklin, et al. 2000, 539). Ongoing demographic monitoring of two study areas located east and northwest of the Project Area indicates the population of spotted owls in southwest Oregon is statistically stable (Forsman, et al. 2011).

3.5.3.3 Barred Owls

Barred owls are thought to compete with spotted owls (Courtney, Blakesley, et al. 2004) (Kelly, Forsman and Anthony 2003) and barred owl distribution has spread in recent decades. Although there is a perceived threat because barred owls use habitats typical of northern spotted owl habitat, there is great uncertainty associated with the actual and potential effects of the barred owl on spotted owls (Courtney, Blakesley, et al. 2004, 7-4). "Thus, while we are convinced that Barred Owls are having a negative impact on Spotted Owls at least in some areas, the extent of this impact and its ultimate outcome is uncertain" (Courtney, Blakesley, et al. 2004, 7-43). The barred owl may be more of a habitat generalist and occupy a wider diversity of habitat types than the spotted owl. The response of northern spotted owls to barred owls may be avoidance. The rate and extent of spotted owl displacement by barred owls is unknown and other issues may be causing or adding to the displacement (Courtney, Blakesley, et al. 2004, 7-31).

The BLM did not conduct surveys specifically for barred owls in the Project Area, but the species was detected within 4 of the 17 known home ranges during northern spotted owl surveys. BLM biologists observed barred owls at one location within the Project Area.

3.5.4 Environmental Consequences

3.5.4.1 Effects of Alternative 1 (No Action) on Northern Spotted Owl Habitat

Direct and Indirect Effects

Under Alternative 1, no harvest would occur. Stands providing suitable northern spotted owl habitat would be maintained as owl habitat. With no thinning (restoration thinning, small diameter thinning, selection harvest, or density management), the trajectory of some stands to grow into suitable habitat would continue at a slower rate and would remain at a higher risk of stand-replacement fire than if the stands were thinned.

Cumulative Effects

No change from current trends in the Project Area is expected. Timber company lands adjacent to the Project Area would be harvested and most would remain in early to mid-seral conditions.

Suitable spotted owl habitat removed in the last decade by BLM timber sales in the Trail Creek fifth field watershed was included in the analysis for consultation with US Fish and Wildlife Service. Dispersal, roosting/foraging, and NRF habitat was removed on 238 acres through regeneration harvest. This change in habitat is reflected in Figure 3-7, Existing northern spotted owl habitat in the Trail Creek fifth field watershed.

Timber harvest on intermingled private lands is expected to continue. The private lands are not currently considered suitable owl habitat due to previous clearcutting or thinning, but they do provide some dispersal habitat.

The following reports identified greater than expected northern spotted owl population declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California:

- Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney, et al. 2004);
- Status and Trends in Demography of Northern Spotted Owls, 1985-2003 (Anthony, et al. 2006);
- U.S. Fish & Wildlife Service 5-Year Status Review (U.S. Fish and Wildlife Service 2004);

- Northwest Forest Plan–The First Fifteen Years (1994-2008): Status and Trends of Northern Spotted Owl Populations and Habitats (Davis, et al. 2011), and
- Population Demography of Northern Spotted Owls (Forsman, et al. 2011).

The reports were inconclusive as to the cause of the declines. Lag effects from prior harvest of suitable habitat, competition with barred owls, seasonal weather patterns, and habitat loss from wildfire were identified as current threats, while West Nile virus and sudden oak death were identified as potential new threats. Complex interactions are likely among the various factors.

The status of the northern spotted owl population and increased risk to spotted owl populations because of the uncertainties surrounding barred owls and other factors, were reported as not sufficient to reclassify the species as endangered at this time. Barred owls may continue to immigrate into the Project Area, even without proposed actions on BLM lands. Since 1990, the emergence of barred owls as invasive competitors with northern spotted owls suggests an increase in risk to the species. Barred owls are more of a habitat and diet generalist, occupy a wider diversity of habitat types, and have smaller home ranges than spotted owls. The displacement of spotted owls by barred owls is likely occurring, but the rate and extent of this is unknown. Predictions of the potential impacts and long-term threats posed by seasonal weather patterns, barred owls, West Nile virus, and sudden oak death are beyond the scope of this analysis.

3.5.4.2 Effects on Northern Spotted Owl Habitat Common to All Action Alternatives

Direct and Indirect Effects

The BLM wildlife biologist evaluated and identified approximately 700 acres of highly suitable, structurally complex RA32 habitat in proposed project locations. These acres were dropped from further consideration for the activities proposed in this analysis.

The actions proposed under all alternatives meet the Medford District ROD/RMP requirement for retaining 25% late-successional forest in connectivity/diversity blocks. Within connectivity/diversity blocks, harvest treatments are proposed on 213 acres in stands greater than 80 years of age. Table 3-13 shows the amount of late-successional forest that would remain in the connectivity/diversity blocks following timber harvest.

Table 3-13. Connectivity/Diversity Block Late-Successional Forest Habitat Assessment

Location	Preharvest		Post-harvest	
	Acres	Percent	Acres	Percent
T32S, R1W, section 31	431	75	310	54
T34S, R2W, section 3	227	36	227	36

Logging activity disrupts ground-level habitat for prey species, but the shrub layer fills back in within 2 to 5 years, so impacted prey species rebound. The habitat degradation for prey species is of relatively short duration.

Small diameter thinning would treat and maintain 2 acres of roosting/foraging and 175 acres of dispersal habitat. The remaining 8 acres of small diameter thinning would occur in capable habitat.

Hazardous fuels reduction would treat and maintain approximately 100 acres of roosting/foraging habitat, 1,288 acres of dispersal habitat, 400 acres of capable habitat, and 850 acres of non-habitat. The understory tree layers would be thinned and the structure of these stands would be simplified. Overstory canopy covers would be maintained and the function of these stands would still provide for roosting, foraging, and

dispersal opportunities for spotted owls. Additionally, reducing the fire danger in areas adjacent to high quality NRF habitat and known owl activity centers would protect owl nesting opportunities from habitat-degrading, severe wildfires.

Firewood collection would be made available in approximately 65 acres of roosting/foraging, 80 acres of dispersal, 65 acres of capable habitat, and 52 acres of non-habitat. Dead and down trees less than 16" in diameter and dead standing trees less than 12" in diameter would be made available for removal within 100 feet of designated roads. The RMP requirements for snag and down wood retention would be monitored and followed within the Project Area. Overstory canopy covers, large snags, and large, down wood would be maintained. These areas would continue to function as roosting, foraging, and dispersal habitat following harvest.

Meadow restoration treatments would have no effect on northern spotted owl habitat.

Precommercial thinning would occur in dispersal habitat and would maintain the function of the stands as dispersal habitat, while also promoting the stand to develop toward nesting habitat.

Small diameter thinning, hazardous fuels reduction, firewood collection, and precommercial thinning would treat and maintain 115 acres of roosting/foraging and 785 acres of dispersal habitat within northern spotted owl CHU 10. The District has determined the proposed maintenance of spotted owl habitat within critical habitat would have an insignificant effect to northern spotted owl critical habitat and is considered **not likely to adversely affect** critical habitat under ESA because:

- Canopy cover within treated roosting/foraging or dispersal stands would be retained at or above 60% and 40%, respectively.
- Decadent woody material in the treatment area, such as large snags and down wood, would remain post-treatment.
- Any multi-canopy, uneven-aged tree structure that was present prior to treatment would remain post-treatment.
- No northern spotted owl nest trees would be removed.

Road maintenance and decommissioning, off-highway vehicle trail closures, quarry reclamation, meadow restoration, and water source restoration projects would not contribute to northern spotted owl habitat modification or destruction. There will be a seasonal restriction for projects that may cause a noise disturbance to nesting northern spotted owls if owls are found to be nesting within noise disturbance range.

Cumulative Effects

See section 3.5.4.1, Effects of Alternative 1 on Northern Spotted Owl Habitat, Cumulative Effects.

Suitable northern spotted owl habitat removed in the last decade by BLM timber sales in the Trail Creek fifth field watershed was included in the analysis for consultation with US Fish and Wildlife Service. Dispersal, roosting/foraging, and NRF habitat was removed on 238 acres through regeneration harvest. This change in habitat was included in the basin-wide update of the baseline situation. As thinned canopies continue to grow, some of these stands would return to being suitable habitat in the next 30 years.

Most timber company lands that are interspersed with land managed by the BLM would remain in early to mid-seral conditions as harvesting would likely continue on them. Timber company lands are managed for

timber production and harvested as trees reach 40 to 60 years of age. Timber company lands within Trail Creek continue to be logged and very little NRF habitat remains on those lands.

3.5.4.3 Effects of Alternative 2 on Northern Spotted Owl Habitat

Direct and Indirect Effects

Late-successional stands reserved from harvest at this time that contribute to meeting late-successional habitat requirements include 100-acre known northern spotted owl activity centers. Structurally complex RA32 stands, which are also late-successional forest, would also be reserved from harvest at this time.

Alternative 2 meets Medford District ROD/RMP and Northwest Forest Plan requirements for management on matrix and riparian reserve lands, while also considering the Northern Spotted Owl Recovery Plan. Under this alternative, approximately 1,082 acres are proposed for timber harvest. Timber harvest proposed in Alternative 2 would reduce the amount of late-successional habitat by 75 acres (1%) in the Trail Creek fifth field watershed. The watershed would retain 57% after harvest, well over the 15% retention requirement.

Northern and southern GFMA and shelterwood retention harvest would remove 38 acres of roosting/foraging habitat and 37 acres of dispersal habitat. Northern GFMA harvest would retain 6 to 8 trees per acre and southern GFMA harvest would retain 16 to 25 trees per acre. After harvest, these stands would have less than 40% canopy cover and would become capable habitat. These acres are outside of known owl home ranges and were surveyed for owls to protocol in 2012 and 2013 with no detections.

Density management would treat and maintain 303 acres of roosting/foraging and 510 acres of dispersal habitat in timber harvest stands. After harvest, these stands would remain roosting/foraging or dispersal habitat because they would retain at least 60% or 40% canopy cover, respectfully. If present, existing understory tree layers and existing snags and coarse woody debris would be retained.

Commercial thinning would treat and maintain 95 acres of dispersal habitat and downgrade 36 acres of roosting/foraging habitat in timber harvest stands. After harvest, the roosting/foraging habitat would be dispersal habitat because at least 40% canopy cover would be retained. If present, existing understory tree layers and existing snags and coarse woody debris would be retained.

Following proposed harvest, the amount of roosting/foraging habitat would decrease slightly (0.6%), but the amount of dispersal habitat would remain the same (because of the 36 acres of roosting/foraging becoming dispersal habitat) in the entire Project Area. Capable habitat will increase slightly. Spotted owls can still use the remaining roosting/foraging, NRF, and dispersal habitat for dispersing through the landscape. Spotted owls can disperse across a fragmented mosaic of nonforested areas and a variety of forest age classes (Forsman, et al. 2002).

Riparian thinning would treat and maintain 24 acres of roosting/foraging and 39 acres of dispersal habitat. After harvest, these stands would remain roosting/foraging or dispersal habitat because they would retain at least 60% or 50% canopy cover, respectfully. If present, existing understory tree layers and existing snags and coarse woody debris would be retained.

Following proposed harvest, the amount of roosting/foraging habitat would decrease slightly (0.3%) along with a decrease in dispersal habitat (0.7%) in the entire Project Area. Capable habitat would increase slightly. Spotted owls can still use the remaining roosting/foraging, NRF, and dispersal habitat for dispersing through

the landscape. Spotted owls can disperse across a fragmented mosaic of nonforested areas and a variety of forest age classes (Forsman, et al. 2002).

Under Alternative 2, approximately 330 acres of roosting/foraging and 560 acres of dispersal habitat would be treated and maintained within spotted owl CHU 10. The District has determined that the proposed maintenance of spotted owl habitat within critical habitat would have an insignificant effect to spotted owl critical habitat and is considered **not likely to adversely affect** critical habitat under ESA because:

- Canopy cover within treated roosting/foraging or dispersal stands would be retained at or above 60% and 40%, respectively.
- Decadent woody material, such as large snags and down wood, would remain post-treatment.
- Any multi-canopy, uneven-aged tree structure that was present prior to treatment would remain post-treatment.
- No spotted owl nest trees would be removed.

According to the 2012 Final CHU rule (77FR46:14062-14165), Section 7 ESA consultations need to consider the temporal and spatial scale of impacts a proposed action may have on the primary constituent elements. The US Fish and Wildlife Service recommends using a scale that is relevant to the needs and biology of the spotted owl and believes the 500-acre core area scale is a reasonable metric for land managers to use as a screen when assessing effects on critical habitat. This 500-acre analysis approach was recommended in the proposed critical habitat rule. To conduct this analysis, the BLM delineated 500-acre circles (0.5-mile radius) around centroids of proposed treatment units that would remove or downgrade NRF habitat acres within critical habitat. These units represent the areas of critical habitat that would be most impacted by the proposed action and were used to determine potential localized effects to the critical habitat. Pre-and post-treatment NRF habitat amounts within the 500-acre analysis areas were compared to determine effects to primary constituent elements and primary biological features of critical habitat.

Under Alternative 2, up to 11 acres of roosting/foraging habitat would be removed for temporary route and landing construction and up to another 15 acres of roosting/foraging habitat would be removed for northern GFMA regeneration harvest within designated critical habitat. Based on the 500-acre analyses, the BLM determined the roosting/foraging habitat removal associated with the Trail Creek project within critical habitat **may affect, not likely to adversely affect** spotted owl critical habitat under ESA because it would result in an insignificant amount of removal of a primary constituent element. At the 500-acre scale, the impacts to proposed critical habitat primary constituent elements are insignificant and undetectable and adverse impacts are unlikely to occur. Additionally, the proposed downgrade of roosting/foraging habitat within critical habitat would result in a reduction of only 0.07% of roosting/foraging habitat within CHU 10, subunit KLE-3. Substantial habitat would be retained in the subunit to maintain the intended dispersal function of the subunit KLE-3.

Currently, 60% of forested BLM land in the Trail Creek fifth field watershed is late-successional habitat. Alternative 2 would reduce the late-successional habitat by 75 acres in this watershed; nearly 59% of forested BLM lands would remain as late-successional habitat. Most existing coarse down wood and snags, except for those that are safety hazards or are located in new temporary routes, would be maintained. Areas of closed canopy would remain in each section.

Timber harvest proposed in Alternative 2 would be a **may affect, likely to adversely affect** spotted owl ESA determination because 37 acres of dispersal and 38 acres of roosting/foraging habitat would be removed. The

BLM will conduct surveys following the 2011 NSO Survey Protocol in the areas where roosting/foraging downgrade or removal is proposed.

Cumulative Effects

See also section 3.6.4.1 Effects of Alternative 1 (No Action) on Wildlife, Cumulative Effects.

There are 17 known northern spotted owl sites whose home ranges overlap proposed project units. Six of those known sites contained a pair of spotted owls in the past five years. The other 11 sites either had no detection of northern spotted owls or contained single owls during surveys. Each of the owl sites is a mixture of private and public lands. A combination of forest fires, timber harvest on private and BLM lands, and detection of barred owls has occurred in these home ranges. Proposed harvest treatments would not remove or downgrade NRF, roosting/foraging, or dispersal habitat at the core area or nest patch scales; however, 2 acres of roosting/foraging habitat would be removed within the overlapping provincial home ranges of two owl sites as a result of temporary route and landing construction.

Barred owls have been detected within 4 of the 17 known provincial home ranges during spotted owl surveys. Their total numbers in the area are unknown, however. The range of the barred owl completely overlaps that of the northern spotted owl. Barred owls may take advantage of spotted owl habitat disturbance (Courtney, Blakesley, et al. 2004), although it is unclear how the proposed action would affect barred owl presence in the watershed. Even though barred owls are rapidly expanding their range in North America, Courtney, et al. (2004, 7-31) concluded that "habitat loss to timber harvest is often postulated to be a major factor in spotted owl decline, but habitat is still present in the study areas (indeed some areas where spotted owls are in the worst decline, such as Olympic National Park, have never been harvested)."

There are varied opinions among biologists concerning the possible negative effects barred owls may have on spotted owls. Several authors have addressed the effects of barred owls on spotted owl occupancy, persistence, and reproductive success (Courtney, Blakesley, et al. 2004). The report by Courtney, et al. indicated studies on the Olympic Peninsula in Washington found no difference in the reproductive success of spotted owls with and without the presence of barred owls within 1.5 miles of spotted owl activity centers. Other modeling studies, however, found that the presence of barred owls was negatively correlated with spotted owl presence in Coastal Oregon (Weins, et al. 2007). While neither study was able to conclusively determine effects, Courtney, et al. concluded that further study of the demographic consequences of barred owl presence or competition is needed.

The updated methodology presented in the *2011 Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls* (2011 NSO Survey Protocol) is meant to increase the likelihood of detecting the presence of spotted owls in areas where there may be barred owls. Additionally, RA32 habitat is meant to provide spotted owls with refugia from barred owls. Stands that were identified as RA32 habitat would be preserved, decreasing the competition between barred and spotted owls for shared resources.

Cumulative effects to the current spotted owl population from implementing this project would be minimal. Late-successional forest, RA32 habitat, and 100-acre spotted owl activity centers would remain post-harvest, allowing opportunities for future dispersal and nesting. Expansion of the owl population, however, would be slowed in the 75 acres of regeneration and shelterwood retention harvest for up to 80 years as suitable habitat begins to return.

Historic and future timber harvests cumulatively affect wildlife. The lands being analyzed for commercial harvest are matrix and riparian reserve allocations and all alternative proposals fall within the goals and

guidelines of the Medford ROD/RMP and Northwest Forest Plan. The Northwest Forest Plan was designed to provide a network of reserves of late-successional forests surrounded by younger, managed forests. Harvest on matrix lands would continue.

3.5.4.4 Effects of Alternatives 3 and 4 on Northern Spotted Owl Habitat

Direct and Indirect Effects

Late-successional stands reserved from harvest at this time that contribute to meeting late-successional habitat requirements include 100-acre known northern spotted owl activity centers and structurally complex RA32 stands.

Under Alternatives 3 and 4, restoration thinning on 1,082 acres would retain trees 150 years and older, while favoring tree species diversity and older hardwood trees. Riparian thinning would occur on 75 acres of riparian reserves. Restoration thinning and riparian thinning would treat and maintain approximately 385 acres of roosting/foraging and 682 acres of dispersal habitat. After harvest, the roosting/foraging stands would retain at least 60% canopy cover and understory tree layers; existing snags and coarse woody debris would also be retained. These stands could still be used by spotted owls for nesting, roosting, or foraging. The restoration thinning in dispersal habitat would leave 40% canopy cover (50% in riparian reserves) after harvest and would retain the characteristics that allow owls to disperse through them. No actions are proposed in the designated 100-acre northern spotted owl activity centers or RA32 stands.

Restoration thinning would also downgrade approximately 15 acres of roosting/foraging habitat under Alternatives 3 and 4. The overall canopy cover in the stand would be a minimum of 40% or 60% following treatment. These acres are outside of known owl provincial home ranges and were surveyed for owls to protocol in 2012 and 2013 with no detections. These 15 acres are also outside of designated CHU.

Following proposed harvest, the amount of roosting/foraging habitat would decrease slightly (0.1%) in the entire Project Area. Capable habitat would increase slightly. Northern spotted owls can still use the remaining roosting and foraging, NRF, and dispersal habitat for dispersing through the landscape. Spotted owls can disperse across a fragmented mosaic of nonforested areas and a variety of forest age classes (Forsman, Anthony and Reid, et al. 2002).

Under Alternatives 3 and 4, approximately 330 acres of roosting/foraging and 560 acres of dispersal habitat would be treated and maintained within spotted owl CHU 10, subunit KLE-3. The District has determined that the proposed maintenance of spotted owl habitat within critical habitat would have an insignificant effect to spotted owl critical habitat and is **not likely to adversely affect** critical habitat under ESA because:

- Canopy cover within treated roosting/foraging or dispersal stands would be retained at or above 60% and 40%, respectively.
- Decadent woody material in the treatment area, such as large snags and down wood, would remain post-treatment.
- Any multi-canopy, uneven-aged tree structure that was present prior to treatment would remain post-treatment.
- No spotted owl nest trees would be removed.

Under Alternative 3, up to 11 acres of roosting/foraging habitat would be harvested for temporary route and landing construction within designated critical habitat. Based on the 500-acre analyses, the BLM has determined the roosting/foraging removal associated with the Trail Creek project within CHU 10 **may**

affect, not likely to adversely affect spotted owl critical habitat under ESA because it would result in an insignificant removal of a primary constituent element. At the 500-acre scale, the impacts to proposed critical habitat primary constituent elements are insignificant and undetectable and adverse impacts are unlikely to occur. Additionally, the proposed roosting/foraging downgrade within critical habitat would only result in a reduction of 0.03% of roosting/foraging habitat within CHU 10, subunit KLE-3. Substantial habitat would be retained in the subunit to maintain the intended dispersal function of the subunit.

Alternatives 3 and 4 would not reduce the late-successional forest within the Project Area. Overall stand ages would be maintained at 80 years or older.

The remaining acres of proposed timber harvest would occur in habitat capable of becoming dispersal, roosting/foraging, or NRF habitat. There would be no direct impact to spotted owls from treatments in these stands. Indirectly, spotted owls would benefit as these stands progress towards dispersal, foraging, and then nesting habitat in the next 80 years.

Spotted owls can use NRF, roosting/foraging, and dispersal habitat to disperse through the landscape. Spotted owls can disperse across a fragmented mosaic of nonforested areas and a variety of forest age classes (Forsman, Anthony and Reid, et al. 2002).

Proposed timber harvest in Alternatives 3 and 4 is a **may affect, likely to adversely affect** ESA determination because roosting/foraging habitat would be downgraded or removed and dispersal habitat would be removed. Unique features across the Project Area would be retained following the principles of ecological forestry, resulting in spatial variability and structural complexity (Franklin, Mitchell and Palik 2007). Unique features include patches of plant diversity, large snags and down woody debris, seeps, and springs. The retention of these features contributes to prey diversity for spotted owl foraging.

Through protocol surveys and review of historic information, northern spotted owl provincial home ranges have been identified across the Project Area. Seasonal restrictions would be in effect within 0.25 mile of known owl sites. Seasonal restrictions from noise disturbance near spotted owl nest sites would contribute to their ability to incubate eggs and feed their young during the critical nesting period.

Cumulative Effects

The effects considered by the threat of the barred owl invasion in Alternative 2 also apply for Alternatives 3 and 4.

There are 17 known northern spotted owl sites whose provincial home ranges overlap proposed project units. Six of those known sites have contained a pair of spotted owls in the past five years. The other 11 sites either had no detection of northern spotted owls or contained single owls during surveys. Each of the owl sites is a combination of private and public lands. A combination of forest fires, timber harvest on private and BLM lands, and detection of barred owls has occurred in these home ranges.

Proposed harvest treatments would not remove or downgrade NRF, roosting/foraging, or dispersal habitat at the core area (500 acres) or nest patch (70 acres) scale; however, under Alternative 3, temporary route and landing construction would remove 2 acres of roosting/foraging habitat in overlapping home ranges of two owl sites. There would be no habitat removal under Alternative 4.

Cumulative effects to the current spotted owl population from implementing this project would be low, as removal or downgrade of dispersal, roosting/foraging, or NRF habitat would not occur within known

spotted owl home ranges. Late-successional forest, RA32 habitat, and 100-acre spotted owl activity centers would remain post-harvest, allowing for future dispersal and nesting opportunities.

Historic and future timber harvests cumulatively affect wildlife. The lands being analyzed for timber harvest are matrix and riparian reserve land use allocations and all alternative proposals fall within the goals and guidelines of the Medford ROD/RMP and the Northwest Forest Plan. Harvest in matrix lands would continue.

Most coarse down wood and snags, except for those considered safety hazards or located in new temporary spur routes, would be maintained. Areas of closed canopy would remain in each section. The Northwest Forest Plan was designed with a network of reserves of late-successional forests surrounded by younger, managed forests.

3.6 Economics

ISSUE: *How can the BLM provide an economical timber sale while maintaining healthy, diverse, and productive ecosystems?*

This section analyzes the potential impacts from the proposed forest management activities on economics. Terms used in this section are defined as follows:

bone dry ton. Wood pulp or residue that weighs 2,000 pounds at 0% moisture content.

pond value. The amount a mill will pay for a log delivered to the mill location.

3.6.1 Methodology

Economics focuses on the ROD/RMP objective of providing a sustainable supply of forest commodities from matrix lands to provide jobs and contribute to community stability (Bureau of Land Management 1995, 38). In addition to commodity supply, evaluation of the economic feasibility of management actions is a consideration in project design (Bureau of Land Management 1995, 179-180).

Economic values that are assessed include total commodity output (wood fiber harvested), total dollar return to the Federal Treasury, and dollar value per unit of output. Units of output are measured as MBF (thousand board feet) of harvest for sawlog material and BDT (bone dry ton) for forest biomass that is used. The values used per MBF of harvest are based on May 2013 prices for Douglas-fir ($574 per MBF). Level of commodity output provides the basis for assessing commodity supply, resultant employment levels, and estimates of net revenue and revenue per unit of output to the Federal Treasury. Positive net revenue serves as an indicator of economic feasibility and revenue per unit of output indicates the level of economic efficiency.

The economic effects of noncommodity-based activities are only assessed where there is a correlation to commodity supply. Management actions, such as habitat improvement or fuel hazard reduction, have economic effects; however, the primary focus of these actions is not for inputs to the economy but to provide for resource enhancement. As a result, the economic effects of these actions are recognized but are not a primary decision factor in considering implementation of an action alternative.

3.6.2 Assumptions

- Affected employment levels per MMBF (million board feet) processed is 9.07 jobs in the solid wood products industry (Forest Service and Bureau of Land Management 1994a, 3&4-293).

- Economic values are static and intended to provide for a relative comparison among alternatives.
- Average harvest levels are from historical yields of treatments in the Butte Falls Resource Area similar to those proposed in the Trail Creek Project Area. Assumed harvest levels range from 20 MBF per acre, for more intensive regeneration harvest prescriptions, to 4 MBF per acre for lower volume harvest areas such as riparian thinning, density management, and commercial thinning prescriptions.
- The estimated return to the Federal Treasury is based on current pond values excluding estimated logging costs. Logging costs are based on average yarding distances as well as average road renovation, and temporary road construction and reconstruction costs for each alternative.
- Volumes used in this analysis are approximate estimates and actual volume from the proposed action alternatives is estimated to range from 5 to 10 MMBF.

3.6.3 Affected Environment

A regional perspective of the economic setting is provided in the Northwest Forest Plan (Forest Service and Bureau of Land Management 1994a, 3&4 261-319). One primary variation from the economic setting regarding commodity production from Federal lands is that actual timber harvest levels have lagged behind levels projected in the Northwest Forest Plan (Bureau of Land Management 2005, 36). During the first 10 years of Northwest Forest Plan implementation (1995–2004), the total BLM timber volume offered for the Medford District averaged 77% of the planned 571 MMBF levels. Between the years 2005 and 2012, the Medford District BLM has offered 46% of the target harvest level of 456 MMBF. The overall reduction in timber harvest across all ownerships in the region has resulted in a demand for logs in western Oregon that is being filled with log imports (Bureau of Land Management 2005, 35).

Historical and current uses of the Trail Creek Project Area are described in Section 3.1.3, Project Area Background. Over the past 70 years an estimated 10,749 acres of the 15,015 acres of BLM-administered land in the Trail Creek Project Area have had some level of harvest activity. With implementation of the ROD/RMP in 1995, approximately 6,777 acres are currently designated as lands allocated for timber production (matrix).

Merchantable timber on matrix land is highly dispersed and the stocking levels of merchantable-size trees are variable. Individual tracts of BLM ownership within the Trail Creek Project Area are fragmented by a mixed ownership pattern with private lands. Individual BLM tracts range from 40 acres up to 640 acres in size. Matrix lands within each tract are further fragmented by varying land use allocations under the ROD/RMP. This, in conjunction with past harvest treatments on these lands, has resulted in the existing stages of development with respect to potential timber supply. Stages of development by general age and merchantability class on BLM land within the Project Area are summarized in Figure 3-11. Figure 3-11 shows a fairly regulated condition with respect to commodity supply. Approximately 34% of the matrix land base exists in a precommercial (seedling/sapling) and developing commercial (pole/small sawlog) condition. Assuming no disturbance occurs, the larger size classes would be expected to increase in representation over time with younger stands becoming less prevalent on the land base. Treatment under existing management direction would tend to accelerate growth to the next development stage through thinning of the younger size classes. The seedling-to-pole size class would be maintained through regeneration of the large sawlog component.

Economic factors that affect the supply of forest commodities in an economically feasible manner are the amount and distribution of material available for harvest, method of harvest, access to harvest areas, and associated costs to mitigate the effects of harvest such as slash treatment. These factors considered

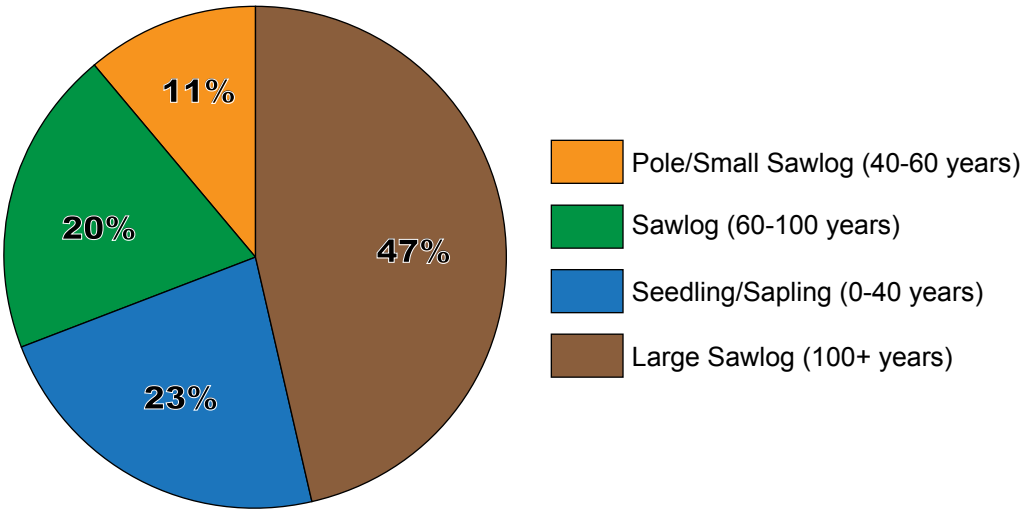


Figure 3-11. Distribution of matrix land by stage of development.

individually or collectively have an effect on the economic feasibility (positive net revenue) and economic efficiency (revenue per unit of harvest) of harvest proposals.

The amount and distribution of commercial forest products existing on matrix lands is interrelated with access and method of harvest. Harvest of timber stands with a relatively higher harvest volume per acre in a concentrated area would result in lower access and removal costs compared to stands with relatively lower harvest volumes located in a more dispersed pattern.

Common methods of harvest (yarding trees from stump to truck) are primary factors affecting actual harvest costs. Tractor yarding is the least-cost method of removal with typical logging costs around $100/MBF, with cable yarding incurring a higher removal cost at around $200/MBF, and helicopter yarding the most costly removal method at approximately $400/MBF. Appropriate harvest methods vary and are generally based on management objectives in conjunction with site conditions such as access, topography, and available harvest volume. Where lower cost harvest methods can be used, economic efficiency is increased. Economic feasibility is affected when relatively lower harvest volumes or values are associated with higher cost yarding methods.

Tractor yarding is proposed in the Trail Creek project. Important factors to consider in determining economic feasibility of ground-based yarding systems (tractor, skidder) are the maximum yarding distance and the average yarding distance to the landing. Maximum yarding distance varies by the type of ground-based equipment used. Typical logging operations in this area would use either crawler tractors or rubber-tired skidders. The maximum yarding distances are 700 feet for tractors and 1,000 feet for skidders (Washington State University Extension 1999, 8). Optimum average yarding distance is in the 500- to 700-foot range for this equipment. Slope is a limiting factor for tractor yarding in Trail Creek. Tractor yarding is limited to slopes generally less 35%.

Skyline-cable yarding is proposed on the steeper-sloped units within the Project Area. Strategically located existing roads or new routes, generally at the top of units, are necessary in order to feasibly harvest units using skyline-cable yarding systems. Optimum yarding distance for skyline-cable yarding systems is 1,000 feet with a maximum yarding distance capability of 4,000 feet. Harvest volume per acre, size of harvest trees, and move-in and move-out costs are other important factors that contribute to an economically feasible skyline-cable yarding operation. Limited road access and topographic features such as convex slopes, uneven terrain, and long, constant slopes can present difficulties for skyline-cable yarding systems. Where these

difficulties cannot be engineered around or where environmental issues limit road construction or ground disturbance, then helicopter yarding can be considered if economically feasible.

Helicopter yarding is proposed in the Trail Creek project. Optimum yarding distance for helicopter yarding is approximately 2,500 to 5,000 feet with maximum distance of 3 to 4 miles. Local experience has shown that operations are optimum at 2,500 feet with a maximum distance of 1 mile. Harvest volume per acre, size, and weight of harvest trees are other important factors that contribute to an economically feasible helicopter operation.

Access to harvest areas is a factor with respect to the number of road systems needed and the condition of those roads. Cost factors include the level of road improvement needed for hauling material, road surface condition with respect to length of operating season, use restrictions during wet conditions, and move-in and move-out costs of equipment where multiple road systems are used for access. Economic feasibility and efficiency is reduced where road improvement costs and the number of road miles or road systems needed for harvest access increase.

Mitigation of harvest effects includes costs such as ripping compacted soils, decommissioning or closing roads, treating harvest slash, and operating under seasonal restrictions. The cost and level of mitigation needed is situation dependent.

3.6.4 Environmental Consequences

3.6.4.1 Effects of Alternative 1 (No Action) on Economics

Direct and Indirect Effects

Under the No Action Alternative, proposed management actions would be deferred. There would be no timber volume from the Project Area in fiscal year 2014 to contribute toward the Medford District's annual allowable sale quantity and there would be no return to the Federal Treasury. Under this alternative, timber harvest would not provide any forestry-related jobs. This would include jobs directly related to the timber harvest such as timber fallers, logging crews, log truck drivers, road crews, and sawmill employees.

The small diameter thinning project would not provide additional timber volume or special forest products resulting in both direct and indirect loss of jobs. Forestry-related jobs for both commercial and noncommercial thinning would not be provided.

Indirectly, fire suppression costs would be higher because fuel loads on planned timber harvest, fuels hazard reduction, and small diameter thinning units would not be reduced. Also, water source restoration would not occur, which would limit access and water availability if a fire occurred in the Project Area. No action would cause the potential for increased fire suppression costs because of higher severity fires, limited safe access to areas, and reduced water availability.

Cumulative Effects

Under the No Action Alternative, there would be no contribution to the Medford District's Allowable Sale Quantity for fiscal year 2014. Given the management direction to produce a sustainable supply of timber from matrix lands, the supply and resulting economic effects would fall short of projected levels for fiscal year 2014. Opportunities for future timber harvest in the short- and long-term would remain unchanged in the Trail Creek fifth field watershed. With no action, there would be a lost opportunity in maximizing growth potential in mature stands (100 years and older) and in younger stands where densities are high.

The Skeleton Mountain Timber Sale harvested 25 acres of timber from the Project Area in 2013. This project provided 142 MBF of harvest volume from the Project Area. Direct employment as a result of harvest was 1 full-time equivalent job.

There are no known future actions within the Project Area.

3.6.4.2 Effects of Alternative 2 on Economics

Direct and Indirect Effects

Under Alternative 2, approximately 7.7 MMBF would be harvested on 1,082 acres resulting in an estimated harvest of 7 MBF per acre. The economic factor that varies by alternative and influences logging costs is volume harvested per acre and yarding system. Volume harvested per acre is a critical consideration in determining feasibility of yarding systems. All action alternatives consider ground-based, skyline-cable, and helicopter yarding systems with only slight differences in acres per alternative. Alternative 2 has the estimated maximum harvest volume per acre of the three action alternatives. Direct employment as a result of timber harvest and processing a commodity would result in approximately 70 full-time equivalent jobs. The estimated return to the Federal Treasury for timber harvest would be $338 per MBF for a total value of approximately $2.6 million for this alternative.

Small diameter thinning on 185 acres would remove an estimated 0.4 MMBF. The estimated employment resulting from the thinning and biomass utilization would be equivalent to 4 jobs.

Indirectly, fire suppression costs would be lower due to the reduced fuel loads on 1,193 acres of commercial thinning, density management, riparian thinning, and small diameter thinning, along with the associated activity fuels treatment. Fire suppression costs would also be reduced in 2,920 acres of hazardous fuels reduction and meadow restoration. Regeneration harvest of 75 acres and precommercial thinning of 263 acres is not expected to reduce fuel loads in the short term. Water source restoration would aid in reducing fire suppression costs by supplying firefighters with better access to larger quantities of water.

Cumulative Effects

Alternative 2 would meet ROD/RMP requirements direction to provide for harvest activity on timber stands available for harvest in the Project Area. This would maximize harvest volume and net revenue to the treasury from commercial stands, and improve future timber supply potential in developing stands through thinning treatments. Harvest would contribute 7.7 MMBF to the Medford District's Allowable Sale Quantity for fiscal year 2014.

Future timber supply from the 75 acres of proposed regeneration harvest would consist of an entry on the 24 acres of planned shelterwood harvests in the next 10 to 15 years to remove shelter trees once reforestation is established. Otherwise, merchantable timber supply would not be provided again from these regeneration treatments until an initial commercial thinning treatment in 40 to 60 years. The 131 acres of commercial thinning, 814 acres of density management, and 185 acres of small diameter thinning could be available for harvest again in 10 to 20 years. In the long-term, volume growth capability would be maximized on areas treated (see Section 3.2, Forest Condition).

The Skeleton Mountain Timber Sale harvested 25 acres of timber from the Project Area in 2013. This project provided 142 MBF of harvest volume from the Project Area. Direct employment as a result of harvest was 1 full-time equivalent job.

The BLM has no timber sales planned in the Project Area within the next 5 years.

3.6.4.3 Effects of Alternative 3 on Economics

Direct and Indirect Effects

Under Alternative 3, approximately 6.7 MMBF would be harvested on 1,082 acres resulting in an estimated harvest of 6 MBF per acre. Direct employment as a result of timber harvest and processing a commodity would result in approximately 61 full-time equivalent jobs. The estimated return to the Federal Treasury for timber harvest would be $328 per MBF for a total value of approximately $2.2 million for this alternative.

For this analysis the same pond value was used to compare all alternatives. Pond value is influenced by the size and grade (quality) of the logs. In Alternatives 3 and 4, trees more than 150 years old would not be harvested. Typically, these older larger trees are of greater value because they would have a greater percentage of higher grade wood than the smaller, younger trees. The economic value of this higher-valued wood would not be recovered in this alternative. This is likely to reduce the pond value of this alternative and lower the estimated return to the Federal Treasury.

Small diameter thinning would remove an estimated 0.4 MMBF. The estimated employment resulting from the combined thinning and biomass utilization would be equivalent to 4 jobs.

Indirectly, fire suppression costs would be lower due to reduced fuel loads on 1,082 acres of restoration thinning and riparian thinning, and 185 acres of small diameter thinning along with associated activity fuels treatment. Fire suppression costs would also be reduced in 2,920 acres of hazardous fuels reduction and meadow restoration. Precommercial thinning of 263 acres is not expected to reduce fuel loading in the short term. Water source restoration would aid in reducing fire suppression costs by supplying firefighters with better access to more sources of water.

Cumulative Effects

Alternative 3 would contribute an estimated 6.7 MMBF to the Medford District's Allowable Sale Quantity for fiscal year 2014.

Future timber supply from 1,019 acres of proposed restoration thinning could be available for harvest again in 10 to 20 years. In the long-term, volume growth capability would not be maximized but would be increased on the areas treated.

The Skeleton Mountain Timber Sale harvested 25 acres of timber from the Project Area in 2013. This project provided 142 MBF of harvest volume from the Project Area. Direct employment as a result of harvest was 1 full-time equivalent job.

The BLM has no additional timber sales are planned in the Project Area within the next 5 years.

3.6.4.4 Effects of Alternative 4 on Economics

Direct and Indirect Effects

Under Alternative 4, approximately 6.7 MMBF would be harvested on 1,082 acres resulting in an estimated 6 MBF per acre harvested. Direct employment as a result of timber harvest and processing a commodity would result in approximately 61 full-time equivalent jobs. The estimated return to the Federal Treasury for timber harvest would be $313 per MBF for a total value of $2.1 million.

The difference in price per MBF between Alternatives 3 and 4 is due to changes in yarding systems resulting from no temporary route construction. Without the access provided by the temporary routes, 59 acres

proposed for tractor or skyline-cable yarding in Alternatives 2 and 3 would be changed to helicopter yarding in Alternative 4.

Small diameter thinning would remove an estimated 0.4 MMBF. The estimated employment resulting from the thinning would be equivalent to 4 jobs.

Indirectly, fire suppression costs would be lower due to reduced fuel loads on 1,082 acres of restoration thinning and riparian thinning, and 185 acres of small diameter thinning along with associated activity fuels treatment. Fire suppression costs would also be reduced in 2,920 acres of hazardous fuels reduction and meadow restoration. Precommercial thinning of 263 acres is not expected to reduce fuel loading in the short term. Water source restoration would aid in reducing fire suppression costs by supplying firefighters with better access to more sources of water.

Cumulative Effects

Alternative 4 would contribute an estimated 6.7 MMBF to the Medford Districts Allowable Sale Quantity for fiscal years 2014.

Future timber supply from 1,019 acres of proposed restoration thinning could be available for harvest again in 10 to 20 years. In the long-term, volume growth capability would not be maximized but would be increased on the areas treated).

The Skeleton Mountain Timber Sale harvested 25 acres of timber from the Project Area in 2013. This project provided 142 MBF of harvest volume from the Project Area. Direct employment as a result of harvest was 1 full-time equivalent job.

The BLM has no additional timber sales planned in the Project Area within the next 5 years.

3.7 Summary of Effects on Other Resources

The following resources did not pertain to the issues identified and analyzed in the EA. Possible effects to Botanical Resources and Fisheries from the actions proposed in each alternative were included in the appendices for this document. A summary of those effects is included below. See the appendices for a complete discussion.

3.7.1 Water Resources

See Appendix E for more information on Water Resources.

3.7.1.1 Water Quantity—Peak Flows

Peak flow increases are not expected as a result of the Trail Creek project because only one subwatershed (Upper Trail Creek) has more than 25% of the area in transient snow zone and the treatments proposed in this watershed would not reduce crown closure below 30%.

Alternative 2 would harvest approximately 75 acres that would result in canopy cover below the range of natural variability with 15 of those acres in the transient snow zone. Because of the low percentage of treatments resulting in crown closure below the range of natural variability within the transient snow zone and the low susceptibility of Upper Trail Creek to peak flow enhancement, there would be a low risk for increased frequency and magnitude of peak flows due to rain-on-snow events.

3.7.1.2 Water Quality—Stream Temperature and Sediment

Stream temperatures would not be affected during riparian thinning because no shade would be removed in the primary shade zone on perennial streams.

Using existing and designated skid trails during ground-based yarding would minimize the area of soil disturbance. Implementation of project design features, the distance of skid trails to stream channels through riparian reserves, and the relative gentle topography of these units would minimize sediment transport and maintain water quality.

3.7.2 Fish

See Appendix I for more information on Fish.

Proposed activities that would be hydrologically connected to the stream network include timber hauling, road renovation, and road decommissioning. Short term (one to five years), there would likely be small inputs of sediment to channel crossings in the Project Area resulting from these actions. Direct inputs of fine sediment resulting from timber hauling would be of insufficient magnitude to meaningfully affect fish or fish habitat and would not be detectable above background levels. Given the dry season haul restriction, inputs would occur only during a precipitation event following a season of haul and would be spatially spread over many input locations. It is extremely unlikely that sediment input from these activities would be detectable above background levels. Sediment increases would be minor and undetectable relative to existing sediment levels and would not contribute measurable or detectable effects above already elevated background levels. Over the long term, road renovation would improve drainage and reduce road-related sediment inputs.

Upland work, including timber harvest and follow up activity slash treatments, would have no effect on fine sediment levels due to the filtering action of riparian reserve buffers, implementation of project design features designed to prevent overland sediment movement, and best management practices. Stream temperatures would not be affected as no riparian vegetation adjacent to perennial streams would be removed.

Future private harvest and private land development are expected to continue existing trends in fine sediment potential and health of riparian areas currently present in the planning area. The Trail Creek Project would, in the short term, contribute a small amount of sediment to channels within the Project Area, in addition to the sediment contributed annually from all other sources. In summary, no measurable changes in the aquatic habitat conditions are anticipated to result from implementation of proposed projects and, as such, there would not be a cumulative effect to aquatic habitats.

3.7.3 Fire and Fuels

The BLM would conduct a fuels assessment within each unit following harvest activity. This assessment would determine the fuel hazard and fire risk based on surface fuel loading, aspect, slope, access, and location of each unit. The fuel management specialist may modify the fuels treatments to meet the objective of fuel hazard reduction. The majority of fuels treatments would begin within 90 days after completion of harvest activities. Prescribed fire treatments may take another year to complete due to the environmental parameters required for implementation.

Immediately following forest management activities and prior to slash disposal, fire behavior potential could increase from the current condition due to increased surface fuels. Following slash disposal treatments, a reduction in potential fire behavior would occur due to the reduction in surface fuel loading and change in horizontal and vertical fuel arrangement.

Forest management activities generally increase the surface fuels within a stand. However, whole tree harvesting with disposal of the tops at the landings is the most effective method of preventing surface fuel increases within the residual stand (Agee and Skinner 2005). At the landings, slash would be piled, chipped, removed for biomass, sold for firewood, or prescribed burned. Slash remaining within the stands would be lopped and scattered or hand piled and burned, or underburned. Surface fuel loads would be reduced because a majority of the slash would be removed from the unit.

Lopping and scattering would reduce the vertical height and horizontal continuity of the fuel bed. However, it would temporarily increase the surface fuel loads. This would put the stand into a slash fuel model resulting in higher predicted flame lengths, fire duration, and intensity. In 10 to 15 years after lopping and scattering, the effect of the slash on fire behavior would be overcome by the effects of decomposition and new vegetation growth (McIver and Ottmar 2006).

Hand piling and burning would decrease fuel loading of material 1 to 6" in diameter by 85 to 95%. Fuels greater than 6" in diameter would be left on the surface and would contribute to the coarse woody debris load. This treatment would move stands from a slash fuel type into a timber fuel type, which would result in a reduced rate of fire spread and average flame length.

Underburning would remove at least 60% of slash less than 3" in diameter and a lesser amount of larger fuel size classes in timbered stands. This treatment would move the stands from a timber understory to a timber litter fuel type. Broadcast burning would be done in grasslands and brushlands without a timbered overstory.

Renovation (including brushing) of approximately 80 miles of road would enhance firefighter access and egress during wildland fire suppression activities. Road renovation would improve firefighter and public safety. Improved access would shorten response time and could reduce resultant fire size.

Renovation and restoration of water sources would increase tactical firefighting capability and potential success for wildland fire suppression objectives within the watershed. More available water would enhance the protection of private property, improvements, and forest resources from wildland fire effects. Resultant fire size may be decreased.

Hazardous fuels reduction on 2,638 acres would thin conifers and hardwoods less than 8 inches in diameter. Overstory canopy closure would be retained. Cutting the noncommercial-sized material in the proposed treatment units would reduce surface and ladder fuels. The proposed fuels reduction treatments would reduce fire behavior such as flame length, rate of spread, and fire duration. With the reduction of flame length and fire duration, the chance of a crown fire initiating in these stands would be reduced. The reduction in fire behavior would lessen the potential damage from a wildfire initiated within or adjacent to the Project Area and would increase tactical opportunities for firefighters to limit fire spread and damage to residential homes during a wildfire.

The proposed action could increase fire resiliency of vegetation within the Project Area. A forest that is fire-resilient has characteristics that allow it to readily recover from a fire event. A forest's resiliency to fire can be increased by managing surface fuels to limit the flame length, removing ladder fuels to keep flames from burning into tree crowns where trees have no defense against fire, and retaining larger diameter trees that are more fire resistant (Agee and Skinner 2005; Agee 1996; Agee 1993). Fire hazard and risk within the watershed would be reduced. Past, current, and future fuels reduction on private and federally-managed public lands would result in beneficial effect of increasing the landscape-scale effectiveness of fuels reduction treatments.

3.7.4 Air Quality

For all prescribed burning activities, the Medford District BLM is required to be in compliance with the Oregon Smoke Management Plan (OAR 629-048-0010). The Oregon Smoke Management Plan designates Smoke Sensitive Receptor Areas, which are areas designated for the highest level of protection under the smoke management plan, as described and listed in OAR 629-048-0140. The SSRAs closest to the Project Area are the Bear Creek Valley, Rogue River Valley, and Grants Pass Urban Growth Boundary, as described in OAR 629-048-0160. The objective of the Smoke Management Plan is to prevent smoke from prescribed burns from entering Smoke Sensitive Receptor Areas.

Medford District BLM is also required to be in compliance with the Oregon Visibility Protection Plan (OAR 340-200-0040, Section 5.2) which mandates that prescribed burning does not affect the visibility of Class I areas. Class I areas are defined in the Clean Air Act as Forest Service wildernesses and national memorial parks over 5,000 acres, National Parks over 6,000 acres, and international parks. Local Class I areas include Crater Lake National Park, Kalmiopsis Wilderness, and Rogue Wilderness. The Project Area is not within a Class I area.

Prior to conducting prescribed burning activities, the BLM must register prescribed burn locations with Oregon Department of Forestry. The specific location, size of the burn, fuel loadings, ignition source, time, and duration of ignition are reported prior to ignition. Smoke management advisories or restrictions are generated on a daily basis by the State Meteorologist. This information is used to determine the appropriate time to conduct the planned prescribed burn. Most prescribed burning on the Medford District is accomplished by slash pile burning. Slash pile burning generally occurs throughout the winter months during storm events when unstable atmospheric conditions are present in order to maximize mixing and lessen smoke impacts to localized areas. All piles would be covered with 4 mil polyethylene plastic sheeting to facilitate rapid ignition and consumption of fuels to minimize residual smoke.

In Alternatives 2, 3, and 4, proposed activity slash treatments include slashing damaged small trees, lopping and scattering, hand-piling and burning, or underburning. Lop and scatter or hand-pile and burn would occur on approximately 3,500 acres. All activity slash would not be treated at the same time. Hand-piles would be burned on less than 1,000 acres each year.

Hand-pile burning and underburning would affect air quality by adding carbon monoxide, PM10, and PM2.5 to the atmosphere. The project fuels specialist estimates that hand-pile fuel loading would be less than 10 tons per acre. In areas where biomass removal occurs, other slash treatment methods would not be necessary. Air quality impact associated with biomass removal would be minimal.

Effects from activity slash burning would be short-term and localized. All units are not burned at the same time or even in the same year. A large portion of particulate matter emissions produced during prescribed burning are “lifted” by convection into the atmosphere where it is dissipated by horizontal and downward dispersion. At distances greater than 5 miles, the air concentrations for these emissions are expected to be small. Under these conditions and by following the prescribed fire management guidelines in the Oregon Smoke Management Plan, there would be negligible direct or indirect effects on air quality within the Project Area.

Prescribed burning would comply with the guidelines established by the Oregon Smoke Management Plan and the Visibility Protection Plan (OAR 340-200-0040, Section 5.2). As a result, prescribed burning emissions are not expected to adversely affect annual PM10 attainment within the Grants Pass and Medford/Ashland Smoke Sensitive Receptor Areas. In addition, the BLM does not expect prescribed burning to affect

visibility within the Crater Lake National Park and neighboring wilderness smoke sensitive Class I areas (Kalmiopsis and Rogue Wilderness Areas) due to the distance from the Project Area and implementation of smoke management guidelines.

3.7.5 Botanical Resources

See Appendix G for more information on Botanical Resources.

3.7.5.1 Special Status and Survey and Manage Plants and Fungi

Part of the Trail Creek project is within the range of one Threatened and Endangered (T&E) plant, Gentner's fritillary (*Fritillaria gentneri)*. In accordance with the protocol in the programmatic consultation (Bureau of Land Management 2008a, 19-21) (U.S. Fish and Wildlife Service 2008), surveys were conducted in suitable habitat in most project areas in 2012 and 2013 and no sites were discovered. Surveys will be completed for all proposed actions in suitable habitat prior to project implementation and any sites discovered would be protected to prevent impacts to the plants. Because actions proposed in Alternatives 2, 3, and 4 would not impact T&E plants, they would be a **no effect** ESA determination.

Surveys for Special Status and Survey and Manage (S&M) vascular and nonvascular plants have been or will be completed in all project areas. As of December 2013, five Sensitive vascular plants (24 sites), two S&M vascular plants (32 sites), and nine S&M nonvascular plants (171 sites) have been discovered in project units. Sites would be buffered to prevent direct or indirect impacts to plants. Therefore, the actions proposed in Alternatives 2, 3, and 4 would not trend Sensitive plant species toward listing or impede the persistence of S&M plant species.

Equivalent Effort surveys for S&M fungi are being conducted in project units 180 years and older. Although predisturbance surveys are not required for Sensitive fungi (Forest Service and Bureau of Land Management 2001, S&G 64-65), sites are documented during the S&M surveys. As of August 2013, surveys have documented 13 S&M fungi (98 sites), one of which also has Sensitive status. Fungi surveys will be completed in spring 2014. Fungi sites would be buffered to prevent direct or indirect impacts.

Habitat for Sensitive and S&M fungi also exists in stands less than 180 years old and if populations occur in those stands, they could be impacted by the actions proposed in Alternatives 2, 3, and 4. Regeneration harvest, proposed in Alternative 2, would have the greatest impact on fungi because it would remove more trees that provide nutrients to fungi through mycorrhizae connections with tree roots. It would also reduce canopy cover to 10 to 40%, resulting in changes in environmental conditions that would indirectly impact fungi. However, the areas proposed for timber harvest are on matrix lands, which are available for timber production. It is anticipated that protecting known and future found sites of Sensitive and S&M fungi, conducting equivalent effort surveys in old growth stands to locate additional populations, and protecting habitat and sites in a system of reserves (riparian, late-successional, and other special management areas) would prevent Sensitive fungi from trending toward listing (Bureau of Land Management 2004, 5-2) and ensure S&M fungi species persistence.

3.7.5.2 Noxious Weeds

Eight category B noxious weeds (Oregon Department of Agriculture 2013, 4) have been documented in the Project Area during surveys or from incidental sightings. The actions proposed in Alternatives 2, 3, and 4 could potentially introduce or spread noxious weeds during implementation, although it is not possible to quantify with any degree of confidence that amount or to distinguish it from the background risk of introduction from ongoing activities in the Project Area. However, because the BLM has an ongoing

program of noxious weed treatments, implements project design features during project implementation, and conducts post-project monitoring, the risk is reduced that the proposed activities in the action alternatives would contribute additional cumulative effects to noxious weeds. Ongoing effectiveness of weed treatments in the Project Area are dependent on continued funding and available staff.

3.7.6 Recreation

There are no developed recreation sites in the Project Area. The nearest developed facilities are a small Forest Service campground located to the north on the Tiller-Trail Highway, a Jackson County campground located to the east on Highway 62, and several private recreational vehicle campgrounds located to the south in Shady Cove.

Recreational use is generally low and dispersed in nature, consisting primarily of hunting, off-highway vehicle riding, and target shooting. The area is designated Open to off-highway vehicles and user-created off-highway vehicle routes have developed over the years. Rock quarries are used for target shooting. Due to the checkerboard nature of ownership, the BLM land in the Project Area is primarily used by adjacent landowners and those familiar with the access routes.

A small area of concentrated recreational use occurs in a volcanic bluffs area called "Rattlesnake," located on BLM and private timber company land at the southwest corner of the Project Area (T33S, R2W, sections 36 and T34S, R2W, section 1). The bluffs are publicized in several climbing guides and on Web sites as having over 100 bolted climbing routes that range in difficulty. A 0.25-mile user-created hiking trail leads from BLM road #33-1-29.1 across BLM land to the bottom of the bluffs; from there, several user-created trails wind up and around the various cliff faces and onto private timber company lands. The climbing area can also be accessed from private land along the top of the bluffs via BLM road #34-2-1.0B2. Use level at the site is unknown. Trail maintenance is informally done by local climbers with occasional organized volunteer groups.

Impacts to dispersed recreation under all alternatives would be similar. During harvest, noise from truck and helicopter activities would discourage recreational use of those areas. Harvest activity during the fall deer, elk, and bird hunting seasons may negatively affect hunters' experiences. Treatments on flatter ground have the potential to 'open up' land to off-highway vehicle intrusions. This would be mitigated with effective barricading adjacent to roadways using boulders, slash, and logs to block vehicle access. The decommissioning of user-created vehicle routes and the closing, gating, and decommissioning of BLM-system roads would prevent off-highway vehicle access. Closed routes would still be available for hiking, equestrian, and bicycle travel opportunities.

3.7.7 Visual Resources

Timber harvest units directly adjacent to Highway 227 would be visible, but would not attract attention. Units further away from the highway would either not be visible or would not be discernable to travelers on the highway. Because the highway goes through private property, USFS land, and BLM land, various types of past and current vegetation treatments are apparent. The harvest proposed in this project may be noticeable to a traveler, but would not be out of character with the typical scenery found along the length of the highway (approximately 26 miles between the communities of Trail and Tiller). Less than 0.5 mile of density management would be dispersed along 1 mile of highway, and a fuels treatment area would be adjacent to another 0.5 mile of highway. The most noticeable difference would be the increased amount of light filtering through the thinned canopy of the density management treatments, allowing more light and visibility further into the trees. The fuels treatment area would also result in a brighter atmosphere and increased visibility into the trees. This would be most noticeable in the first 2 years after treatment.

3.7.8 Land with Wilderness Characteristics

The Trail Creek Project Area contains a portion (1,322 acres) of the 6,254-acre Berry Creek lands with wilderness characteristics unit (see Appendix K, Berry Creek). The Berry Creek unit is on the west-facing side of a 4-mile long north-south ridgeline, generally located east of the Tiller-Trail Highway, that extends from Highway 62 north to a ridgeline running east from Buck Rock. The area rises in elevation from 1,700 feet to 3,900 feet with moderately steep to steep slopes. Areas of open grassland are scattered through mixed conifer/hardwood forest and shrubs. Resistant, layered rock creates cliffs and slopes of variegated forest/grass/brush/rock outcrops.

Dominant human uses of this part of the unit have been timber harvest and silviculture activities, grazing, hunting, and off-highway use. Between 2004 and 2006, 65 acres of density management and regeneration timber harvest using helicopter yarding occurred in T33S, R1W, sections 15, 21, and 22. Stumps and tree markings are visible in the immediate vicinity of the harvested areas and more light reaches the forest floor, but this does not impact the area as a whole; the harvested areas are not visible from the top of Buck Rock or on Google Earth imagery. A 20-foot-tall communication tower with solar panels is located on top of Buck Rock at the site of a previous fire lookout; access to the site is via a steep off-highway vehicle trail from BLM road #33-1-10.2. The tower is not visible from the surrounding area below. A user-created off-highway vehicle trail runs from the end of BLM road #33-1-15 in section 15, past the previously harvested units, southwest to a route in section 27. This second route is visible on Google Earth imagery but its width or condition is unknown due to the inability to access the area; GIS records show it as an unnumbered, natural-surface, unmaintained route. Several vehicle routes are visible on Google Earth imagery that enter this part of the unit from private lands; the size and condition of these routes are unknown, but are assumed to be natural surface and unmaintained. A review of fire records shows the possibility of two water sources of unknown condition just within the unit's west boundary—a spring development in Section 28 and a water tank in Section 21.

Vegetative and topographic screening allows opportunities for solitude throughout most of the unit; roads around the periphery are native or gravel surface, low to medium use, and are screened from the interior of the unit by vegetation and topography. Because of private property along the west, south, and east sides, the area is difficult to access by the public from those directions. The only legal access for the public into the area is from BLM roads along the north boundary.

The 35 acres of proposed timber harvest within the Berry Creek lands with wilderness characteristics unit are located adjacent to 65 acres of density management and regeneration harvest completed in 2006. The proposed treatments are similar to those done previously and are expected to have similar impacts. Stumps and slash would be evident in the immediate vicinity of each unit and would be most evident for the first 5 years after treatment. Because the canopy would be thinned, more light would enter the harvested areas. The impacts from Alternative 2 would be more visible and apparent to the casual viewer than those under Alternatives 3 and 4. However, impacts under all alternatives are anticipated to be visible only from the immediate vicinity of each unit, not from any distance. Harvest activity in the 4-acre helicopter unit located at the end of BLM road #33-1-10.2 would be the most visible unit in all of the action alternatives. Because of its flatter topography, this unit would also have more potential for later off-highway vehicle intrusions after harvest. This would be mitigated if the road is effectively barricaded at its junction with BLM road #33-1-8 after harvest.

4.0 Consultation and Coordination

This section describes any public participation and consultation or coordination with agencies and organizations that occurred during the preparation of this project.

4.1 Public Involvement and Interagency Coordination

4.1.1 Public Involvement

4.1.1.1 Scoping

The BLM promotes public involvement in the planning process by soliciting input to determine the scope of the issues to be addressed. This process, known as scoping, is also used to help identify impacts and potential alternatives that would be analyzed during the development of the project. Scoping input is both internal and external to the Agency. Internal scoping uses an interdisciplinary team of resource specialists to identify issues, alternatives, and data needs.

External scoping involves notifying the public about the proposed project and allowing opportunity for their feedback. The BLM outreach for this project began February 1, 2013 when the BLM mailed prescoping postcards to 246 individuals, businesses, organizations, other government agencies, and tribes. The postcard was used to ascertain interest in the project and establish a list for future project mailings. As a result, the BLM mailed or emailed a scoping notice to 48 interested parties. The purpose of the scoping notice was to solicit public participation in the development of this project. The letter requested comments, issues, or concerns regarding this project that might help in its development. The BLM received a total of five scoping comment letters in return. Comment letters were from Jackson County Commissioners, American Forest Resource Council, Klamath-Siskiyou Wildlands Center, and two individuals.

4.1.1.2 Field Tours

The BLM hosted two field tours for the Trail Creek Project. The first tour occurred May 22, 2013 and included BLM staff and representatives from the Upper Rogue Watershed Association, Klamath-Siskiyou Wildlands Center, American Forest Resource Council, Boise Cascade, Southern Oregon Forest Restoration Collaborative, and US Fish and Wildlife Service. The second tour, on June 6, 2013, included BLM staff and four members of the public (Figure 4-1). Both field tours looked at proposed regeneration harvest, restoration thinning, hazardous fuels reduction, small diameter thinning, stream habitat and riparian enhancement, and riparian thinning projects.

Figure 4-1. Public field tour of Trail Creek project on June 6, 2013.

4.1.1.3 Trail Creek Project Web Site

The BLM also solicited public involvement through a Web site for the Trail Creek project. The Web site provides the public with access to current and background information, timelines, photographs, and project-related documents. The Web site includes a comment form that allows the public to submit comments or questions to the BLM at any time during the life of the project. The Web site is located at http://www.blm.gov/or/districts/medford/plans/trail/index.php.

4.2 Interagency Coordination

4.2.1 ESA Consultation

Section 7 of the ESA requires the BLM to work with the US Fish and Wildlife Service (threatened and endangered plants and wildlife) or NOAA Fisheries (threatened and endangered fish) for actions the BLM funds, authorizes, or proposes to ensure the project is not likely to jeopardize the continued existence of listed plant, wildlife, or fish species or destroy or adversely modify their designated critical habitat.

Before requesting consultation, the BLM determines whether or not the project may affect the listed species or critical habitat. If the project would have no effect, no consultation is required. If the project would affect the species but the effects would be relatively minor, consultation is informal and the Federal agency submits a written request for informal consultation. If the US Fish and Wildlife Service/NOAA Fisheries agree with the BLM's determination, then informal consultation concludes with the US Fish and Wildlife Service/NOAA Fisheries issuing a letter of concurrence.

If the BLM determines a project would is likely to adversely affect a listed species or critical habitat, then formal consultation is required and the BLM submits a written request, or biological assessment, for formal consultation. During formal consultation, the US Fish and Wildlife Service/NOAA Fisheries analyze the project to determine if the project is likely to jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat. The results of the analysis are explained in a biological opinion.

4.2.1.1 T&E Wildlife

The federally threatened northern spotted owl is the only T&E wildlife species in the Trail Creek Project Area. The Medford District prepared a biological assessment for proposed timber harvest projects that included the Trail Creek project and submitted it to the US Fish and Wildlife Service on August 16, 2013. The biological assessment requested concurrence for the actions that **may affect, not likely to adversely affect** the northern spotted owl or the owl's critical habitat. The BLM also requested formal consultation on the actions that **may affect, likely to adversely affect** the northern spotted owl or the owl's critical habitat. The BLM received a biological opinion from the US Fish and Wildlife Service on December 2, 2013 (FWS Reference Number 01EOFW00-2013-F-0195). The remainder of the actions would have **no effect** on northern spotted owls or their critical habitat.

4.2.1.2 T&E Plants

The Trail Creek project is within the range of two T&E plants: large flowered meadowfoam (*Limnanthes flocossa* ssp. *grandiflora*) and Gentner's fritillary (*Fritillaria gentneri*). The Project Area also contains suitable habitat for the Gentner's fritillary. The BLM conducted surveys for these T&E plants and no plants were discovered within project units. Therefore, the proposed actions would have **no effect** on T&E plant species.

4.2.1.3 T&E Fish

The Trail Creek Project Area contains one T&E fish species, the federally threatened Southern Oregon/ Northern California coho salmon. The project fish biologist determined the actions proposed in this project would have **no effect** on coho salmon, coho critical habitat, or essential fish habitat; therefore, consultation was not required.

4.2.2 Tribal Coordination

The BLM mailed scoping flyers to tribes with a connection to lands in southern Oregon. Flyers were mailed to the Cow Creek Band of Umpqua Tribe of Indians, Confederated Tribes of the Grand Ronde Community of Oregon, and Confederated Tribes of the Siletz Indians of Oregon. These tribes will also receive a notice of this EA's availability.

4.3 Document Availability

The Trail Creek Forest Management Project EA is available on the Medford District BLM Web site at http://www.blm.gov/or/districts/medford/plans/trail/index.php.

A letter or e-mail announcing the availability of the EA for review was mailed to those that submitted scoping comments and those that expressed an interest in receiving the EA.

A notice of the EA's availability was published in the Medford *Mail Tribune* and Eagle Point *Upper Rogue Independent* newspapers. Publication of the notice in the Medford Mail Tribune started the 30-day public comment period for this project.

5.0 List of Preparers

This section lists the BLM staff involved in the preparation of the Trail Creek project.

Jon Raby	Butte Falls Resource Area Field Manager	Authorized Officer/Management Direction
Jean Williams	Environmental Coordinator	Team Co-Lead/NEPA Compliance
Al Mason	Fuels Management Specialist	Team Co-Lead/Fuels/Air Quality/ Activity Slash Prescriptions
Jason Tarrant	Forester	Forest Condition/Silviculture Prescriptions
Dave Roelofs	Wildlife Biologist	Northern Spotted Owl/Wildlife
Shawn Simpson	Hydrologist	Sediment from Roads/ACS Compliance/ Water Resources
Alex Benavides	Hydrology Technician	Stream Buffers
Amy Meredith	Soil Scientist	Fragile Soil/Soil
Jen Smith	District Fish Biologist	Fisheries
Nick McDaniel	Forester	Timber Sale Planning/Project Data/Economics
Marcia Wineteer	Botanist	Botany/Noxious Weeds
Trish Lindaman	Outdoor Recreation Planner	Recreation/Visual Resources/ Lands with Wilderness Characteristics
Lisa Rice	Archaeologist	Cultural Resources
Jeff Brown	Engineer	Transportation
Leo Kalvels	Engineer	Transportation
Brandon Sikes	Engineer	Transportation
Terry Garner	Forester	Timber Sale Layout Design
Lisa Meredith	Forester	Small Diameter Thinning Prescription
Scott Loos	Forester	Contract Administration
Dave Orban	Forester	Special Forest Products
Corey Parks	Forester	Timber Cruising and Appraisal
Andy Hill	Timber Clerk	Planning
Robyn Wicks	Natural Resource Specialist	Document Layout/Writing and Editing

Appendices

Appendix A: Issues Considered but Eliminated from Detailed Analysis

The following issues were raised by the public or the BLM during the development of this project. The BLM considered these issues but did not include them in detailed analysis, often because the project's design or implementation of project design features would eliminate or reduce effects on the resource. The project design features are described in section 2.8, Project Design Features.

Would the proposed actions impact the persistence of Special Status Species?

Special Status Species are those species listed under the ESA as threatened or endangered (including proposed or candidate species); listed by a state as threatened, endangered, or candidate species; or listed by the BLM as a sensitive species. Some species may fall into more than one category.

The BLM will complete the required botany and wildlife surveys using current survey protocol. If sites are located during surveys, they will be protected with no-treatment buffers (based on the species, type of treatment proposed, current environmental and ecological conditions at the site, and available management recommendations), seasonal restrictions, or project design features.

Because surveys will be completed and appropriate measures applied before a decision is signed, the proposed action alternatives will not negatively impact the persistence of Special Status Species. For further information on species, refer to Appendix G (Botany) and Appendix H (Wildlife).

How would the proposed projects affect Survey and Manage species?

Surveys will be completed using current survey protocol for wildlife and botany Survey and Manage species. If sites are located during surveys they will be protected with no-treatment buffers, seasonal restrictions (wildlife), and project design features. Proposed projects will not negatively impact the persistence of Survey and Manage species because surveys will be completed and appropriate measures applied before a decision record is signed.

Would the proposed projects affect migratory bird species?

BLM has issued interim guidance for meeting BLM's responsibilities under the Migratory Bird Treaty Act and Executive Order (EO) 13186. Both the Act and the EO promote the conservation of migratory bird populations. The interim guidance was transmitted through Instruction Memorandum (IM) No. 2008-050. The IM relies on two lists prepared by the U.S. Fish and Wildlife Service in determining which species are to receive special attention in land management activities; the lists are *Bird Species of Conservation Concern* (BCC) found in various Bird Conservation Regions and *Game Birds Below Desired Condition* (GBBDC). In December 2008, the USFWS Service released *The Birds of Conservation Concern 2008*. This publication identifies species, subspecies, and populations of migratory and nonmigratory birds in need of additional conservation actions, updating the April 2008 Birds of Conservation Concern List. This list meets US Fish and Wildlife Service mandates for the conservation of migratory nongame birds.

Additionally, the USFWS and the BLM signed a Memorandum of Understanding in April 2010 that identified strategies to avoid or minimize adverse impacts on migratory birds. The Trail Creek Forest Management Project will follow these guidelines where feasible to reduce the impacts to migratory birds. For example, many of the project design features, such as seasonal restrictions, that would mitigate effects to some species would also benefit migratory birds.

The following species have been located, or are likely present, within the Project Area: Band-tailed Pigeon (GBBDC), Mourning Dove (GBBDC), Olive-sided Flycatcher (BCC), Purple Finch (BCC), Rufous Hummingbird (BCC), and Willow Flycatcher (BCC).

The proposed projects would not negatively impact the persistence of these species of concern because of the use of project design features and areas deferred from harvest in the project area. See Appendix H, Wildlife for additional information.

Would the proposed projects retain appropriate densities of coarse woody material?

The projects proposed in all alternatives would meet ROD/RMP guidelines (p. 47) for coarse woody material on matrix land by leaving a minimum of 120 linear feet of logs per acre greater than or equal to 16"in diameter and 16 feet long (decay class 1 and 2) in regeneration harvest units. All other proposed timber harvest prescriptions would exceed RMP guidelines for coarse woody material by:

- Leaving existing snags, stages 1-5. When available, green trees (any diameter) immediately adjacent to snags greater than 20" DBH would be left to provide additional structural and habitat diversity.
- Leaving existing coarse woody debris, decay classes 1-5. When available, green trees (any diameter) immediately surrounding large (greater than 20" DBH and 8 feet long) pieces of coarse woody debris would be left to minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.
- Minimizing the cutting of large (greater than 20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat and future sources of coarse woody debris and snags.

By maintaining the minimum amount of coarse woody debris in Alternative 2 and exceeding the minimum in the other action alternatives, the proposed projects would retain the appropriate amount of coarse woody material as specified in the RMP.

Can the BLM thin riparian reserves and meet Aquatic Conservation Strategy (ACS) objectives?

Riparian reserve thinning in the Trail Creek project would maintain ACS objectives in the short-term and long-term at both the site and watershed scales (see Appendix F—Aquatic Conservation Strategy). Thinning within 63 acres of riparian reserves would promote the development of large diameter conifer trees in the riparian reserve thinning areas, allow riparian reserves to continue to function, and protect streams within the Trail Creek fifth field watershed. Thinning would encourage healthy native riparian forests by reducing stand densities to levels the sites have the resources to support. No riparian hardwood species would be cut and healthy Douglas-fir, incense cedar, ponderosa pine, and sugar pine would be left.

Riparian reserves would continue to provide stream shade, sources of large wood, stream bank stability, and habitat for native riparian species. No vegetation would be cut within the primary shade zone (minimum of 60 feet) of perennial, fish-bearing stream channels, lakes, ponds, springs, wetlands, and meadows. No vegetation would be cut within 35 feet of non-fish-bearing, intermittent streams; mechanized equipment would follow special yarding requirements within the 63 acres proposed for riparian thinning; and additional PDFs would limit effects to soil, water, and plants.

Proposed actions would maintain an adequate distance from streams to avoid sediment deposition harmful to fish habitat. Any effects from riparian thinning are expected to be negligible and within the range of natural variability for maintaining fish populations and habitat.

How does timber harvest affect trees greater than 30″ DBH?

In the development of the Trail Creek project, BLM foresters conducted stand inventories in the Trail Creek Project Area. The inventory provided information about canopy closure, relative density, basal area, number of trees per acre, and the aspect and slope of proposed harvest units. The stand data inventory is not an absolute; it is an estimate based on sampling. It is intended to provide a general description or measure of stand density, composition, and structure to be used in the development of silviculture prescription for each timber stand. Each alternative has specific objectives for the stands to be treated.

Silviculture prescriptions for each stand take into consideration the stand inventory data as it relates to the objectives of the alternative. For instance, restoration thinning in Alternatives 3 and 4 would retain trees 150 year or older. The diameters of same age trees can vary based on their growing conditions. Rather than use tree diameter as an indicator of tree age, the BLM strives to retain older trees by using a tree age rating system (Van Pelt 2008). This rating system takes into account bark condition (fissure depth), knot indicators (lower third of tree), epicormic branching (lower crown), and crown form to determine tree age.

It is important to note that in each silviculture prescription, trees greater than 20" DBH (proportionally representing the total range of tree sizes greater than 20" DBH) would be the target size for retention in each unit. However, a tree greater than 30" DBH could be cut for operational purposes, (i.e., skyline corridors). A tree less than 150 years old but more than 30" DBH could be cut in order to release a legacy pine tree. Because we have not cruised the stands for volume and defect it is unknown the number of trees greater than 30" DBH that would be considered for harvest.

How would the proposed projects affect Northern Goshawk?

Two historic goshawk nesting locations are within the Trail Creek project area. Although goshawks were removed from the BLM special status species list in 2007, the 1995 ROD/RMP (p. 46) guidance for raptors is to protect nest sites and habitat and avoid disturbance during the nesting season. A no-cut buffer of 170' (one site-potential tree) would be placed around known goshawk nests. The following project design feature will be implemented for goshawks:

Seasonally restrict harvest activities from March 1 to August 30 within 0.25 mile of know goshawk sites (0.5 mile for helicopter operations and blasting). The seasonal restriction will be waived if nonnesting is determined. If new goshawks are discovered in harvest units following the timber sale date, activities will be halted until mitigation options are determined.

BLM wildlife biologists will check known nests before harvest activities begin. Appropriate buffers and seasonal restrictions will be applied for known historic and new sites. Because known historic and new goshawk sites will have appropriate buffers and seasonal restrictions applied, the proposed projects would not negatively impact the persistence goshawks.

How would the proposed projects affect water quantity?

Water quantity is of concern in the Trail Creek watershed primarily because much of the main stem habitat is dry throughout most of the summer, creating low or no flow conditions in sections of stream that are dominated by bedrock. Water withdrawals, both permitted and unpermitted, diminish the volume of aquatic habitat as well as the quality.

Proposed Trail Creek Forest Management activities related to commercial timber harvest and yarding operations would not be hydrologically connected to the stream network and, therefore, would not increase peak flows or negatively modify summer base flows.

See Appendix E, Water Resource, and Appendix I, Fish and Aquatic Habitat, for more information.

How would the Trail Creek Forest Management projects affect transient snow zone?

The transient snow zone is an elevation band (3,500 and 5,000 feet) where a mixture of snow and rain occurs. The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Snow packs in this elevation range are often shallow and are quickly melted by rain (rain-on-snow event) and warm winds. Snow tends to accumulate in openings and melts faster during warm rain on snow events. This results in an increase in peak flows in streams. The majority (86%) of BLM-administered lands in the Project Area are located within the rain zone. The remaining 14% of BLM lands are in the transient snow zone.

The risk of peak-flow enhancement is estimated from the Oregon Watershed Assessment Manual risk-assessment graph that uses the percent of the analysis area within the transient snow zone and the percent of the transient snow zone with less than 30% crown closure. According to the risk assessment method, drainages with more than 25% of the area in transient snow zone may be at risk for possible peak flow increases during rain-on-snow events. The Project Area contains only one subwatershed with more than 25% of the area in the transient snow zone; nearly 34% of the Upper Elk Creek subwatershed is in the transient snow zone. No vegetation treatments in Upper Elk Creek are proposed in any alternative that would reduce the crown closure to 30% or less (the lowest is 40%). Therefore, the risk of peak flow enhancement from forest management activities is low in this subwatershed.

See Appendix E, Water Resources, for more information on transient snow zone and water resources in the Project Area.

How will logging slash in the timber harvest units influence potential wildfire behavior prior to slash clean-up?

Forest management activities produce fuels that could remain a fire hazard for 10 to 20 years, if left untreated, until natural decomposition occurs. Following timber harvest, the BLM will conduct a fuels assessment within each unit to determine the fuel hazard and fire risk based on surface fuel loading, aspect, slope, access, and location of each unit. The majority of fuels treatments would begin within 90 days after completion of harvest activities; although, prescribed fire treatments may take another year to complete due to the environmental parameters required for implementation.

Forest management activities generally increase the surface fuels within a stand. Immediately following forest management activities and prior to slash disposal, fire behavior potential could increase from the current condition due to increased surface fuels. Following slash disposal treatments, a reduction in potential fire behavior would occur due to the reduction in surface fuel loading and change in horizontal and vertical fuel arrangement.

Would the proposed projects affect fish and fish habitat?

Major fish species found in the Trail Creek fifth field watershed include coho salmon (*Oncorhynchus kisutch*), steelhead trout (*O. mykiss*), and cutthroat trout (*O. clarkii*). Cutthroat trout have the widest distribution, followed by steelhead trout, and coho salmon.

Southern Oregon/Northern California coho salmon (SONCC) is the only special status fish species present in the Trail Creek fifth field watershed. It was federally listed as a threatened species in the Rogue River in 1997 and coho critical habitat (CCH) was designated in 1999. The Project Area contains 25 miles of CCH.

The majority of the proposed activities would occur more than 0.25 mile from coho streams. Four haul route crossings are located within CCH. These haul route crossings are located on well rocked roads with adequate drainage, topography is relatively flat, and ditches are well vegetated with no sign of sediment, deposition, or hydrologic connectivity. Implementation of project design features and seasonal wet weather restrictions will arrest sediment delivery from these actions. There is no expectation of an effect to the survival or production of coho salmon or their habitat. Any sediment generated would be diluted to a point of being immeasurable and not meaningful to CCH.

Proposed stream habitat enhancement and riparian restoration would improve aquatic habitat by increasing the amount of large wood and boulder habitat in West Fork Trail Creek and decommissioning user-created roads in the riparian reserves. These actions would be beneficial to fish and aquatic systems.

Off-highway vehicle trail closure and restoration is proposed throughout the project area. Most of the proposed segments are located along ridgetops and as such are not hydrologically connected to the stream network and would not impact fish or aquatic habitat. Three segments are located within riparian reserves. The segment closest to CCH is located along the main stem of Trail Creek within five hundred feet of CCH. Project design features would reduce impacts to aquatic habitat.

Would road densities be reduced?

The Trail Creek Forest Management project proposes 10.3 miles of full and partial road decommissioning to protect soils, water, and wildlife and to reduce road densities.

Roads that are not needed for access at this time would be decommissioned by ripping (full decommissioning only), seeding with native grasses, mulching, and planting to reestablish vegetation. Cross-drain culverts, road fills in stream channels, and potentially unstable fill areas would be removed to restore the natural hydrologic flow. Decommissioned roads would be closed with a device similar to an earthen barrier or equivalent and would not be maintained in the future.

The average road density in the Trail Creek watershed would be reduced from 4.7 to 4.6 miles per square mile.

How does the proposed Pacific Connector Gas Pipeline affect the Trail Creek Forest Management project?

The PCGP (Pacific Connector Gas Pipeline) Project is a proposed 230-mile-long natural gas transmission line designed to transport natural gas from existing pipelines at Malin, Oregon to the Jordan Cove liquid natural gas terminal in Coos Bay, Oregon. The proposed pipeline would enter the Trail Creek watershed in the south near Trail Creek's confluence with the Rogue River. It would travel northwest and exit the northern part of the watershed about 3 miles west of the Tiller-Trail Highway. The proposed pipeline right-of-way would cross 10.6 miles of the Trail Creek watershed; 4 miles would be located on BLM lands. The proposed pipeline would be located in T32S, R2W, sections 22, 26, 27, 35, and 36; T33S, R2W, section 1; T33S, R1W, sections 7, 18, 20, 29, 32, and 33; T34S, R1W, sections 2, 3, and 4.

In addition to various above-ground facilities located throughout the extent of the proposed transmission line, the PCGP proposal would install a 36-inch steel pipeline below-ground. During installation, a 95-foot-wide area would be cleared of vegetation for the length of the pipeline. In the long-term, a 30-foot-wide area in the right-of way would be maintained by trimming vegetation to heights no greater than 6 feet tall. The remaining 65 feet in the right-of-way would be left to revegetate naturally and would not be maintained. The proposal also includes use of both existing and newly constructed roads.

The FERC (Federal Energy Regulatory Commission) is the Federal agency responsible for authorizing interstate natural gas transmission facilities. For the PCGP Project, the FERC is the lead Federal agency for the coordination of all applicable Federal authorizations and for the preparation of the Project's EIS (environmental impact statement).

While an FEIS was prepared and completed in 2009, FERC has withdrawn the associated certificate and modified their proposal as the direction the LNG (liquefied natural gas) will travel through the pipeline changed. This, coupled with the 2012 vacation of the 2008 WOPR (Western Oregon Planning Revision), foreseeable amendments to both US Forest Service and BLM Land Use Plans, and the reinstatement of Survey and Manage policies in 2011, will result in both the reissue of a certificate and the completion of a new Project EIS. Because the plan has not been finalized and additional NEPA analysis is required, the eventual effects of the project are largely unknown at this time, as is the anticipated mitigation plan that will result from the aforementioned changes in policy and regulations. Therefore, it would be speculative to attempt to anticipate the potential cumulative effects of the Trail Creek Forest Management Project when combined with the effects of the PCGP project at this time. The cumulative effects of the Trail Creek Forest Management Project will be addressed in the forthcoming PCGP project NEPA analysis.

Appendix B: Landscape Analysis and Restoration Recommendations for the Trail Creek Watershed

B.1 Introduction

The key goals of forest restoration, as outlined in *Restoration of Federal Forests in the Pacific Northwest: Strategies and Management Implications* (Johnson and Franklin 2009) include making forests "more resistant and resilient to wildfire and insects; conserving old-growth forest and trees; and creating an immediate and predictable timber flow to support locally-based restoration economies" (ibid., p. 2). The restoration strategy is based on a landscape approach that assesses the current forest structure, composition, and ecological processes and determines how and where management can occur to ensure the sustainability and resiliency of forest ecosystems now and in the future.

Determining restorative needs within a forest landscape begins with the establishment of baseline conditions at both the historic and current temporal scales. Comparing historic forest vegetation with existing conditions allows management direction to be focused on treatments that ensure spatial complexity, species diversity, and necessary ecological processes are present and trending toward levels that enhance landscape health and resiliency. Improving forest ecosystem health, diversity, and resiliency increases stand resistance to and tolerance of climatic extremes or fluctuations, reduces the potential for major insect and disease outbreaks, reduces the potential for large fires, reduces erosion, and increases soil productivity. Healthy landscapes have the ability to buffer and absorb the effects of disturbances such as wildfire, insects, and climate change; whereas, unhealthy landscapes tend to magnify the detrimental effects of those disturbances.

This analysis assesses the condition of forest vegetation in the West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek sixth field watersheds and provides management recommendations that apply the concepts and principles of ecological restoration.

B.2 Watershed Location

The West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek sixth field subwatersheds are located 1 to 10 miles north and northwest of the town of Shady Cove, Oregon in the Trail Creek fifth field watershed and the Upper Rogue River fourth field subbasin (Map B-1).

B.3 Ownership

The majority of the lands in the 3, sixth field subwatersheds are under public ownership and are intermixed with private lands in a checkerboard pattern (Maps B-2, B-3, and B-4). Public land ownership accounts for 48% of the West Fork Trail Creek subwatershed, 63% Upper Trail Creek, and 44% of the Lower Trail Creek subwatershed (Table B-1).

B.4 Landscape Vegetation

The major vegetative zone within the watersheds is mixed conifer. The mixed conifer zone has forests containing Douglas-fir, sugar pine, ponderosa pine, incense cedar, white fir, Pacific madrone, and oak tree species (Franklin and Dyrness 1973). The mixture and abundance of species varies from stand to stand.

Table B-1. Land Ownership in West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek Sixth Field Subwatersheds.

Subwatershed	Land Ownership						
	Private		BLM		USFS/State		Total Acres
	acres	%	acres	%	acres	%	
West Fork Trail Creek	7,403	52	4,772	33	2,126	15	14,301
Upper Trail Creek	5,713	37	7,547	49	2,224	14	15,484
Lower Trail Creek	3,078	56	2,373	43	79	1	5,530
Total	**16,194**	**46**	**14,692**	**42**	**4,429**	**12**	**35,315**

Typically, Douglas-fir is the most common tree species, followed by white fir, and incense cedar with lesser amounts of ponderosa pine, sugar pine, and hardwood species.

Within this forest zone, further classification of plant series and plant associations have been described in *Field Guide to the Forested Plant Associations of Southwestern Oregon* (Atzet, et al. 1996). Plant series are based on plant species, geology, soils, terrain, topographic features, and plant response to management activities. Using this guide, two plant series, Douglas-fir and white fir, are present in the watershed. Douglas-fir and white fir are the predominant plant series that fall within the dry forest classification (Johnson and Franklin 2009, 14). Although the white fir plant series "spans the threshold between the dry and moist forest," climate change is expected to increase the occurrence of wildfire and drought to levels more characteristic of drier forests.

B.4.1 Seral Stages

The landscape pattern of seral stages has largely been the result of timber harvest. The interface between private and Federal lands typically represents the area of greatest contrast of stand structure. The existing vegetative condition (age/size/density) affects the diversity, vigor, and resiliency within the watersheds. The distribution of age classes (forest structure) across the landscape is described below (Table B-2; Maps B-5, B-6, and B-7; Figures B-1, B-2, and B-3).

Table B-2. Stand Age Classes in West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek Sixth Field Subwatersheds for all Ownerships

Subwatershed	Stand Age Class (years)										
	0-10		20-40		50-80		90-200		200+		Total Acres
	acres	%	acres	%	acres	%	acres	%	acres	%	
West Fork Trail Creek	1,111	8	3,623	25	4,157	29	4,293	30	1,117	8	**14,301**
Upper Trail Creek	1,768	11	3,166	20	4,012	26	4,450	29	2,088	14	**15,484**
Lower Trail Creek	840	15	1,618	29	1,282	23	1,574	29	216	4	**5,530**
Total	**3,719**	**10**	**8,407**	**24**	**9,451**	**27**	**10,317**	**29**	**3,421**	**10**	**35,315**

NOTE: Acres are estimates based on aerial photograph interpretation and BLM inventory data.

B.4.2 Landscape Pattern

Three structural elements—matrix, patches, and corridors—within a forest ecosystem are essential in maintaining ecological diversity and complexity. The structure, amount, and spatial arrangement of these three elements affect the resiliency, species diversity, and biological and physical processes within a forest landscape.

B.4.2.1 Matrix

NOTE: As used here, "matrix" is not the same as the matrix land use allocation used in the Northwest Forest Plan and 1995 ROD/RMP.

The matrix is the most connected portion of the landscape. It is the predominant vegetative type and, therefore, exerts the strongest influence over the movement of living and nonliving things (e.g., fire, wind, plant, animals, people, insects, disease) across the landscape. The matrix pattern is largely determined by the checkerboard ownership boundaries.

Approximately 52% of the West Fork Trail Creek subwatershed, 37% of the Upper Trail Creek subwatershed, and 56% of the Lower Trail Creek subwatershed are privately owned. Most of the private land is owned by industrial timber companies and has been heavily harvested. The majority of merchantable trees has been removed in some locations and has resulted in stands that are younger, with high amounts of submerchantable Douglas-fir (<8" DBH) and lesser amounts of ponderosa pine, incense cedar, sugar pine, white fir, and scattered hardwoods. Most of the timber company lands are currently 80 years old or less. Short rotations and intensive harvest practices are likely to shift any remaining older stands toward early successional conditions. Few private stands are expected to contribute to late-successional conditions within the subwatersheds.

BLM-administered lands occupy about 33% of the West Fork Trail Creek subwatershed, 49% of the Upper Trail Creek subwatershed, and 43% of the Lower Trail Creek subwatershed. Harvest practices on BLM lands have ranged from individual tree salvage to clearcuts. Approximately 26% of BLM lands in the West Fork Trail Creek subwatershed, 21% of BLM lands in the Upper Trail Creek subwatershed, and 21% of BLM lands in the Lower Trail Creek subwatershed consist of stands 40 years old or less. Forest Service lands occupy about 15% of the West Fork Trail Creek subwatershed and 14% of the Upper Trail Creek subwatershed and have had harvest practices ranging from individual tree salvage to clearcuts. Approximately 25% of Forest Service lands in the West Fork Trail Creek watershed and 30% of Forest Service lands in the Upper Trail Creek watershed consists of stands 40 years old or less. Approximately 65% of the 79 acres of State land in the Lower Trail Creek watershed consists of stands 40 years or less.

For all lands in the Trail Creek watershed, the dominant vegetative type (matrix) is early successional forest (less than 40 years old) created through past harvest practices (Forest Service 1993) (Ripple 1994) (Johnson and Franklin 2009). These stands provide the strongest influence over landscape processes (e.g., fire, tree growth, nutrient cycling, disease, insects, wind, snow storms, water flow, and erosion). These stands are either recent clearcuts or small diameter, even-aged plantations that have little structural diversity. The species composition, structure, and function in these early successional stands are different than conditions created by natural causes such as fire. These young stands have fewer large snags, greater soil disturbance and compaction, lower amounts of large coarse woody debris, linear versus random tree spacing, fewer hardwoods or shrubs, and lack of large remnant overstory trees. These stands have typically been planted with a species mix containing a high percentage of ponderosa pine.

The rate of structural change in young stands is relatively rapid compared to slow-changing mature or old growth stands. Tree growth and vigor within young stands is generally good until tree canopy closure. Crown closure reduces sunlight and, along with increased tree competition for nutrients and moisture, results in slower growth and sometimes tree mortality. As tree vigor declines, insect and disease problems can begin to play a role in stand health.

B.4.2.2 Patches

Patches are areas distinctly different from the landscape around them. As a result of past harvest practices, stands of mature timber (>80 years old) have become the patches within the Trail Creek watershed. These stands are the result of periodic fires, both low to moderate underburns and stand-replacement fires. These older patches are considered stable in the absence of disturbance. As these older stands age, there is less likelihood the structure and composition of the stand will change quickly; although, unexpected disturbances such as fire, insects, disease, and windstorms can quickly alter this stability.

The checkerboard ownership pattern has resulted in a highly fragmented landscape, with the majority of the mature stands located on federally managed lands. The location and amount of older stands within the matrix has created a high degree of contrast, porosity, and edge effect across the watersheds. Contrast is the degree of difference between adjacent forest stands and is typically represented by changes in the tree species or structural attributes present. Porosity is the amount of fragmentation present within the landscape. Edge represents the interface area between two distinctive vegetative size classes. Environmental conditions (e.g., temperature, light, wind, and humidity) are different within this area, resulting in a drier, windier microclimate along the stand edge. Generally a 500-foot-wide strip adjacent to the edge is affected. The altered microclimate in this area causes a change in species mix and density of herbaceous vegetation and shrub species. Patches that are 25 acres or less are, in effect, all edge.

B.4.2.3 Corridors

Corridors provide travel routes for plants, animals, and people between similar size classes or vegetative types. Roads, riparian reserves, and streams are the primary corridors in the Trail Creek watershed.

B.4.3 Historic Vegetation Conditions

Forest ecosystems are complex, dynamic, and always changing. Changes occur as elements and processes are altered by both coarse filter (i.e., stand-replacement fires) and fine filter (i.e., individual tree mortality) events. Ecosystems can adapt to these changes and can function well under a range of conditions. Within this “natural range of variability,” biological and ecological functions are sustainable. When an element or process is outside of this range, that element and those depending on it may not be sustainable (Forest Service 1993).

Using fire history information, existing age-class distribution, and forest survey documents, general vegetative conditions prior to logging can be re-created. From this baseline information, assumptions and inferences specific to individual elements, processes, or components and how they may have functioned under “natural” conditions can be made. In the Trial Creek watershed, it has been estimated that prior to logging, approximately 75 to 88% of the forest land within the watershed contained large-size forests. Large size class is defined as Douglas-fir and ponderosa pine greater than 22" in diameter, and white fir greater than 16" diameter. This estimate is based on detailed forest surveys completed during the 1930s. The prelogging timeframe includes the period prior to late 19th century and early 20th century logging (Bureau of Land Management 1999).

The natural range of variability is further defined in the Trail Creek Watershed Analysis, which contains the West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek subwatersheds. Analysis in this document addressed the historic range of aquatic, riparian, and terrestrial elements within the Trail Creek fifth field watershed. The historic range was defined as the conditions that existed before timber harvest began in the early 1900s. The analysis used data sets from early forest surveys that conclude “historic” landscape supported contiguous stands of primarily older forests.

The landscape pattern was uniform with late-successional forests providing large contiguous areas of interior forest habitat. Fragmentation of late-successional forests was limited and occurred in areas where stand-replacement fires left large patches of "green" stands interspersed with fire-killed stands. The amount of edge between early and late-successional vegetation was low and occurred in areas where stand-replacement fires provided the abrupt transition between early and late-successional forests. Canopy openings were not uniform, but variable in size.

Widespread vegetative changes due to disease, insects, or both were most likely minimal. Mortality was probably limited to individual trees or small groups of trees. Dwarf mistletoe, specifically in the Douglas-fir overstory, was likely common but with minimal intensification. Periodic underburning maintained open stands of mixed conifers and hardwoods. Mistletoe brooms on smaller Douglas-fir trees probably increased torching and tree mortality, thereby regulating mistletoe severity and spread in the understory. Some insect populations may have increased to moderate levels following fires due to fire-induced stress (cambial damage or crown scorch) or during long periods of drought. Root diseases were present and provided small gaps in the forest canopy. Large areas of root rot were probably minimal due to periodic underburns that maintained disease-resistant seral species and wider tree spacing.

Table B-3. Historic Range of Riparian and Terrestrial Vegetation Conditions in the Trail Creek Watershed

Riparian Vegetation—Percent of the Stream Length	
Early successional conditions	10 to 40%
Late-successional conditions	60 to 90%
Terrestrial Vegetation—Percent of the Landscape	
Early successional/no snags	less than 5%
Early successional/snags	10 to 40%
Late-successional/single layer	less than 5%
Late-successional/multiple layers	60 to 90%

Early successional conditions are the stages in forest development that includes seedlings, saplings and poles. Late-successional conditions are the stages in forest development that includes mature stands, generally greater than 80 years of age.

Summary

The historic range of variability provides insight into landscape conditions in which organisms and populations evolved and persisted prior to widespread human intervention. Although forest conditions are dynamic and organisms and populations have the ability to adjust to changes, certain limits exist. The ability to adapt is not limitless and when certain thresholds are reached, the behavior of organisms and populations may fundamentally change and ecosystems may begin to unravel.

B.5 Landscape Changes from Historic Conditions

The trend within these subwatersheds over the past 70 years has been one of structural, habitat, and species simplification. Some of the changes from historic levels include the following:

- The current landscape pattern has been shaped predominantly by past harvest practices. Historically, the landscape pattern was a result of disturbances such as fire, windthrow, insects, and disease that were partially regulated by environmental gradients such as climate, soil, and landform.

- Past harvest practices and road construction have created a landscape that is more fragmented and has greater edge and patch densities than historic levels. Large blocks of mature forests are now mosaics of young plantations, mature forests, and stands modified in varying degrees by past harvest practices.
- Reduced interior habitat is available for species associated with late-successional forests.
- A shift in abundance and species composition of soil and canopy arthropods toward those most associated with early successional stands.
- In older forests, a shift from stands containing early seral species, such as ponderosa pine and sugar pine, to mid- to late seral species, such as Douglas-fir and white fir, due to fire exclusion and the harvest of high value, early seral overstory trees.
- Post-harvest treatments have modified the natural process of vegetative succession; the temporal and spatial occurrence of herbaceous, shrub, and hardwood species has been altered by management treatments (e.g., slashing, burning, brushing, girdling, applying herbicides, scalping, and fertilizing). The treatments are not always representative of natural processes and their effects upon long-term forest health and ecological processes are unclear.
- In remaining older stands, densities have increased, thereby increasing soil moisture and nutrient demands resulting in increased tree stress and larger numbers of trees predisposed to insect or disease attack.
- The low thinning effect of fire is absent.
- Vertical canopy structure has increased in existing late-successional stands.
- Simplification of forest landscape pattern, structure, and diversity tends to increase pest populations, disease, and pathogen occurrence. Larger areas of early successional stands are present today than historically occurred. These stands have limited structural and species diversity and, if stressed, may be more susceptible to insect and disease outbreaks.
- Homogenizing forest landscapes reduces natural controls and barriers that regulate the kind and extent of insects and disease. Climate change may exacerbate these problems.

Cumulatively, these changes have affected the ecological processes within this landscape. The extent and degree of change can be assessed by comparing the current conditions with the "natural range of variability." Within this "natural range of variability," biological and ecological functions are sustainable. Elements and processes outside of this range and those depending on it may not be sustainable.

Table B-4. Historic Range of Conditions and Current Conditions in the Trail Creek Watershed

Landscape Forest Condition	Historic Range	Current Conditions		
		West Fork Trail Creek	Upper Trail Creek	Lower Trail Creek
Early Successional/No Snags	< 5%	48%	43%	55%
Early Successional/ With Snags	10-40%	14%	15%	13%
Late-Successional/ Single Layer	< 5%	16%	9%	10%
Late-Successional/ Multiple Layers	60-90%	22%	33%	22%

The percentages shown for current conditions are estimates based on aerial photograph interpretation and BLM stand data, and the assumption that the average rotation length on private industrial lands is 60 years. In this analysis, stands that are 80 years old and less are considered early successional, while stands over 80 years old are considered late-successional.

B.6 Restoration Strategy

Simplification of forest structure and pattern in the Trail Creek watershed has reduced biological diversity, connectivity, and landscape function. Ecological processes inherent to the landscape have been altered to levels different than the historic range of natural variability. The kind, amount, and spatial distribution of plants, animals, and forest organisms across the landscape may affect long-term landscape health and sustainability and the ability to adapt to the effects of climate change and environmental disturbances.

Assumptions:

- Intensive harvest practices on private industrial lands will likely continue to shift any remaining older stands toward earlier successional conditions. The amount of late-successional forests on private lands is expected to decrease from existing levels.
- Older, structurally diverse stands within this watershed will predominantly occur on Federal lands.
- Ownership patterns and differing management objectives, past and present, have and will continue to dictate landscape pattern and condition.

Restoration Recommendations:

- Maintain a diversity of age/size classes throughout the landscape. Promote contiguous areas of mature forest stands. Use existing McKelvey 1 stands, RA32 stands, and northern spotted owl cores to delineate areas in the watersheds to provide habitat for late-successional plant and animal species (see Map B-8). In areas with high quality late-successional habitat, evaluate landscape conditions and, where possible, apply management treatments that reduce the potential for the loss or degradation of the habitat.
- Minimize the creation of early seral stands on BLM-administered lands. Limit to areas experiencing epidemic levels of insects or disease, large fires, or stands that are deteriorating to the point that the integrity of the stand is threatened.
- Retain or develop multilayer, late-successional stands containing a variety of tree diameters, heights, and species, and varying amounts of snags and coarse woody debris. Retain trees 150 years or older. Create within-stand diversity by promoting structural heterogeneity. Reduce stand densities to the levels the site has resources to support. Consider for treatment stands that have relative densities of 60% or greater (see dry forest restoration prescription and Maps B-9, B-10, and B-11). The long-term benefits of treatment should outweigh any short-term detrimental effects. NOTE: Mapped stands are in addition to those proposed for restoration treatment in this EA.
- Within designated northern spotted owl critical habitat areas, management activities should be focused toward management actions that treat and maintain habitat. Where dispersal, nesting, roosting, and foraging habitat exist, management actions would maintain the primary constituent elements while allowing activities that increase stand health and resiliency to environmental disturbances. Short-term negative impacts may occur if the actions provide long-term benefits to the sustainability of spotted owl habitat.

- Promote and improve species diversity by encouraging natural levels of diversity found in native plant communities; use plant association principles to describe and define desired levels of species diversity. Species diversity, a key component of healthy forests, provides unique habitats, increased genetic variability, and vegetative conditions that are more resilient to environmental extremes and disturbances. Favor early successional species (ponderosa pine, sugar pine, incense cedar, Douglas-fir, black oak, and madrone) within the Douglas-fir and white fir plant series.
- In 50- to 60-year-old pine plantations, assess the physical attributes of the pines to evaluate overall tree vigor. Most of the plantations planted in the 1960s were planted with seedlings from an unknown seed source that was often not adapted to the site. Seedlings planted outside of their seed zone are often more susceptible to environmental extremes and insect and disease problems. Within pine plantations that exhibit off-site characteristics, such as trees with thin, chlorotic foliage and slow growth rates, thin to release established natural regeneration of Douglas-fir, incense cedar, and sugar pine or to create space for planting site-adapted ponderosa pine, Douglas-fir, and incense cedar (see Maps B-9, B-10, and B-11).
- Improve horizontal and vertical diversity in young, dense, homogenous stands, create canopy gaps, encourage species diversity (hardwoods and conifers), and maintain unthinned clumps. High stand densities have resulted in slow or stagnant growth rates. These stands are overstocked with more trees than the site has water, nutrients, and growing space to sustain. Thin to differing residual densities, depending on site productivity and conifer species targeted. Target stands that are 10 to 40 years old. Treat competing brush and incorporate fuels treatment to reduce fire hazard (see Maps B-9, B-10, and B-11). NOTE: Mapped stands are in addition to those proposed for treatment in this EA.
- Reduce detrimental impacts to important invertebrates, fungi, mosses, and lichens by minimizing litter and topsoil disturbance during management activities. Use predesignated skid trails, cable systems, small ground-based equipment, and winter log on slopes less than 35% when snow depth is sufficient to provide ground protection.
- Provide environmental conditions that are beneficial for insect predators (salamanders, bats, birds) by leaving woody debris, down logs, and snags for habitat. Minimize the movement/disturbance of existing large coarse woody debris and snags.
- Stabilize soil by reducing compaction and erosion; use harvest systems that minimize impacts during harvest activities.
- Root rot areas may be used to provide either gaps or skips. Gaps can be created to mitigate pathogen spread; within the gaps, retain any unsusceptible tree species. When root rot areas are left as skips, it is anticipated they would provide a short-term periodic pulse of large snags and coarse woody debris.
- In high quality, late-successional habitat areas, owl cores, and designated RA32 stands, accept natural disturbances that cause mortality. Do not remove large snags or logs from the site.

B.7 Dry Forest Restoration Prescription

- reduces stand density
- retains old trees
- favors drought-tolerant species
- provides for structural diversity
- increases average stand diameter

- maintains canopy cover (40% or more)

The objective of restoration thinning is to increase stand resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change). High stand densities, high surface and ladder fuels, and low tree vigor tend to magnify rather than buffer the effects of environmental disturbances or changes. Density reduction that emphasizes the removal of smaller trees and vegetation reduces competition for nutrients and water and increases overall tree and stand vigor.

Retain trees 150 years or older. Determination of tree age can be made using a variety of sources such as increment core samples, rating systems for determining the general age of trees (Van Pelt 2008), counting tree stump rings, or stand birthdate from the Micro*Storm data base. In most instances, visual attributes (Van Pelt rating system) would be used to determine if a tree is younger or older than 150 years. The visual rating system is not absolute but generally a reliable indicator of tree age. In rare instances, an older tree may be considered for removal if the tree's removal would benefit the long-term health and resiliency of the stand.

- Remove competing vegetation (<150 years old) underneath the dripline of healthy Douglas-fir and incense cedar trees to increase survival potential.
- Specific to healthy full-crowned ponderosa and sugar pine, remove all trees less than 150 years old within the root zone that is below the dripline and 10 feet from the edge of the dripline (approximately 20 to 30 feet from the bole of the tree). Pine species are more sensitive to high stand densities, particularly on sites less than 3,500 feet in elevation.
- If the tree has a poor crown (crown ratio less than 25% and a crown that has a thin, ragged appearance when viewed against the sky, poor needle color, and dead and dying twigs or branches forming holes in the crown), do not remove all the understory trees below the dripline; instead, thin the trees. There is minimal to no benefit from understory removal if crown vigor is poor and there is a high probability of tree mortality.

Retain the largest hardwoods with full vigorous crowns for species diversity, canopy layers, and natural drought tolerance. Remove competing vegetation underneath the dripline to increase survival potential.

Increase within-stand structural diversity by leaving small, unthinned patches and creating small openings. Unthinned patches and small openings should range in size from 0.1 to 0.25 acre (equal to 37- to 59-foot radius). The patch size recommendation is an approximation; use the inherent diversity within a stand to identify and locate patches and openings. The shape of patches and openings should be irregular and spatially random in occurrence within the stand.

- Approximately 10 to 15% of the area should be a combination of unthinned patches and small openings. For example, a 20-acre stand would have 2 to 3 acres of patches and openings. In previously logged stands, canopy gaps are typically present so most of the structural diversity should be added by retaining unthinned patches.
- When available, use existing stand characteristics to locate unthinned patches and openings. For example, unthinned patches could be left adjacent to snags; large coarse woody debris; deformed trees; and existing dense pockets, seeps, or hardwoods clumps. Overstory canopy openings could be created where vigorous understory regeneration is present, in root rot pockets, or in areas of lower site productivity.

Stocking would be reduced to relative density targets ranging from 25 to 45% with a residual basal area ranging from 80 to 200 square feet. Leave tree spacing would vary and depend on the **existing** spatial

arrangement of the desired trees within the stand. Uniform spacing is not desired; meeting the target basal area with trees having the desired characteristics (crown class, species, and vigor) is the primary objective. Relative densities and residual basal areas would be determined considering stand attributes such as site class, aspect, elevation, available precipitation, habitat thresholds, and plant series. Residual canopy cover would be at least 40% under all relative density targets that range between 25 and 45%.

Leave dominant, codominant, and intermediate trees with the best crown ratios.

Favor healthy ponderosa pine, sugar pine, incense cedar, and Douglas-fir over white fir.

Favor healthy ponderosa pine, sugar pine, and incense cedar over equally healthy Douglas-fir. The crowns of the retained pines and cedars should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Pine species with poor crowns, characterized by a ragged appearance as well as foliage that is bunchy and of poor color, should be removed if less than 150 years of age; do not retain.

When a “leave” tree has an adjoining tree that originates from the same root collar, leave all trees regardless of crown class or condition.

Retain neighboring trees that have their crowns intertwined with “leave” trees. Removing these associated trees can cause crown damage, reduce wind stability, and increase overall tree stress.

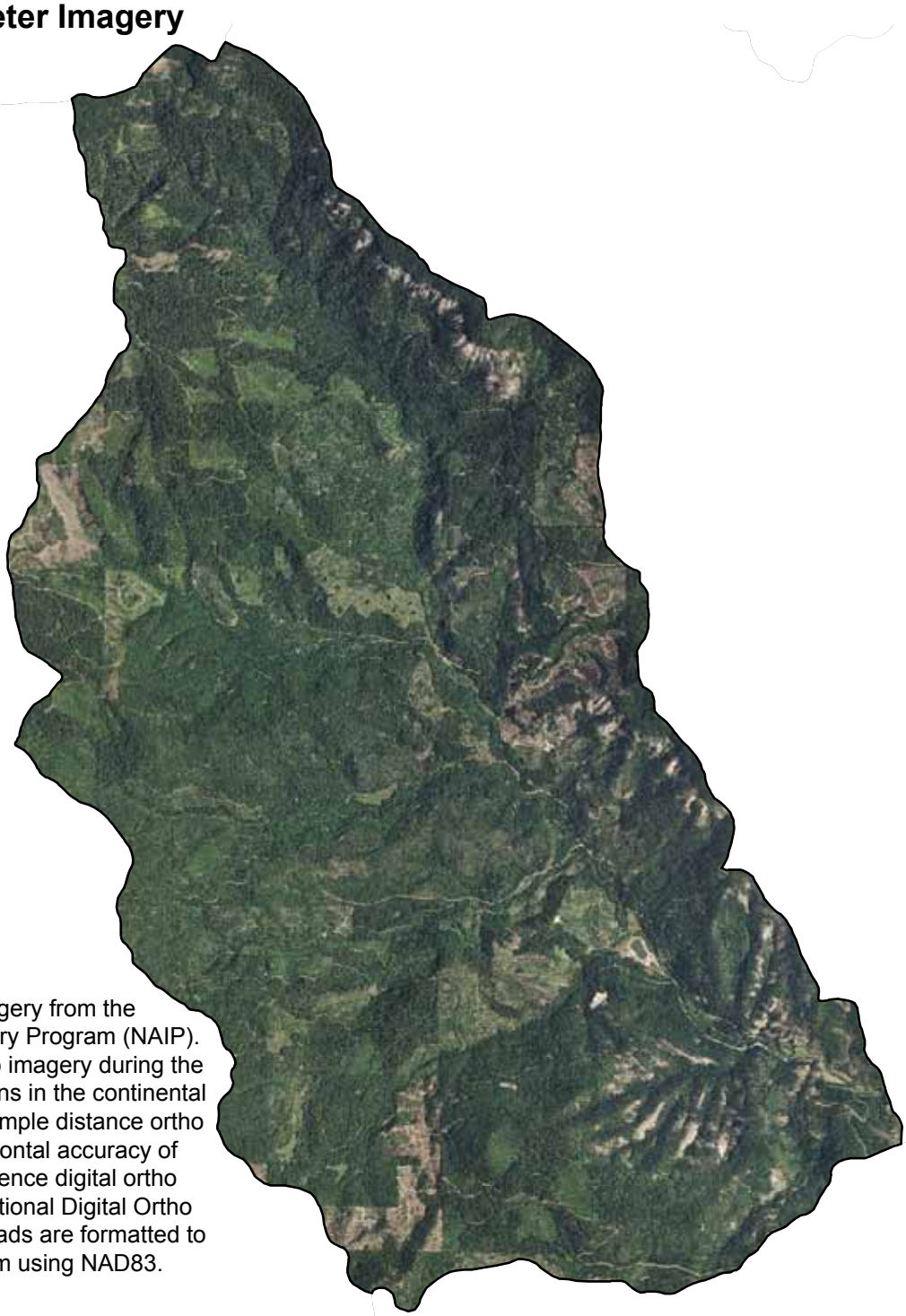
Leave existing snags, stages 1-5. When available, leave green trees (any diameter) immediately adjacent to snags that are greater than 20" DBH. These trees will provide additional structural and habitat diversity.

Leave existing coarse woody debris, decay classes 1-5. When available, leave green trees (any diameter) immediately surrounding large (greater than 20" DBH and 8" in length) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.

Leave large (greater than 20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat, as well as future sources of coarse woody debris and snags.

Smaller understory trees should be maintained for stand diversity and complexity. Small trees (<8" in diameter) should be thinned to reduce tree competition for site resources. Smaller trees contain a larger proportion of sapwood (living tissue) and require more site resources (nutrients and water) compared to older trees that proportionally have more nonliving heartwood.

Figure B-1. West Fork Trail Creek Subwatershed 2011 NAIP One Meter Imagery



This data set contains imagery from the National Agriculture Imagery Program (NAIP). NAIP acquires digital ortho imagery during the agricultural growing seasons in the continental U.S. One meter ground sample distance ortho imagery rectified to a horizontal accuracy of within +/- 5 meters of reference digital ortho quarter quads from the National Digital Ortho Program. NAIP quarter quads are formatted to the UTM coordinate system using NAD83.

N

0 0.5 1

miles

Trail Creek Forest Management Project
Environmental Assessment

Butte Falls Resource Area
December 2012

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

Figure B-2. Upper Trail Creek Subwatershed 2011 NAIP One Meter Imagery

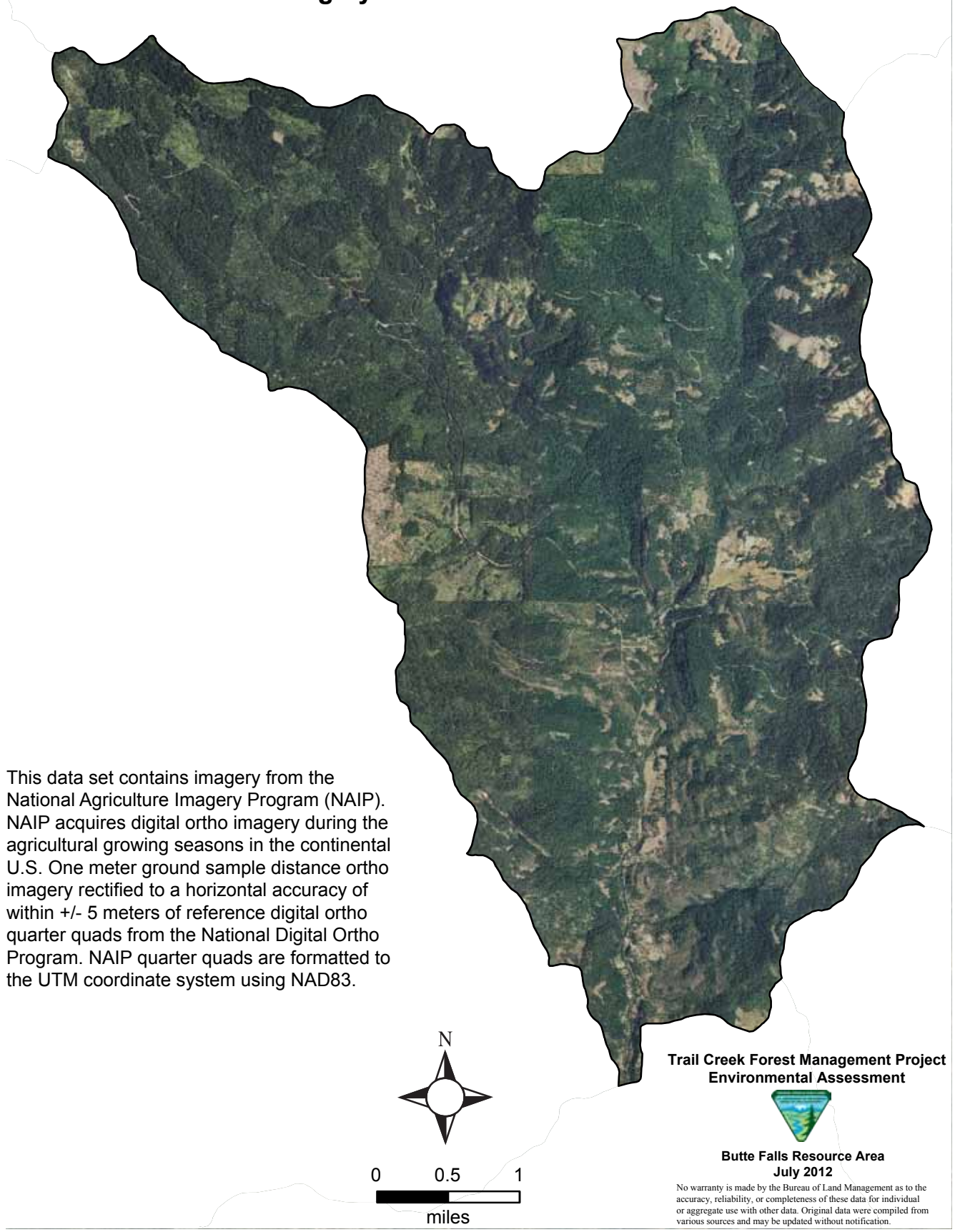


Figure B-3. Lower Trail Creek Subwatershed 2011 NAIP One Meter Imagery

This data set contains imagery from the National Agriculture Imagery Program (NAIP). NAIP acquires digital ortho imagery during the agricultural growing seasons in the continental U.S. One meter ground sample distance ortho imagery rectified to a horizontal accuracy of within +/- 5 meters of reference digital ortho quarter quads from the National Digital Ortho Program. NAIP quarter quads are formatted to the UTM coordinate system using NAD83.

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miles

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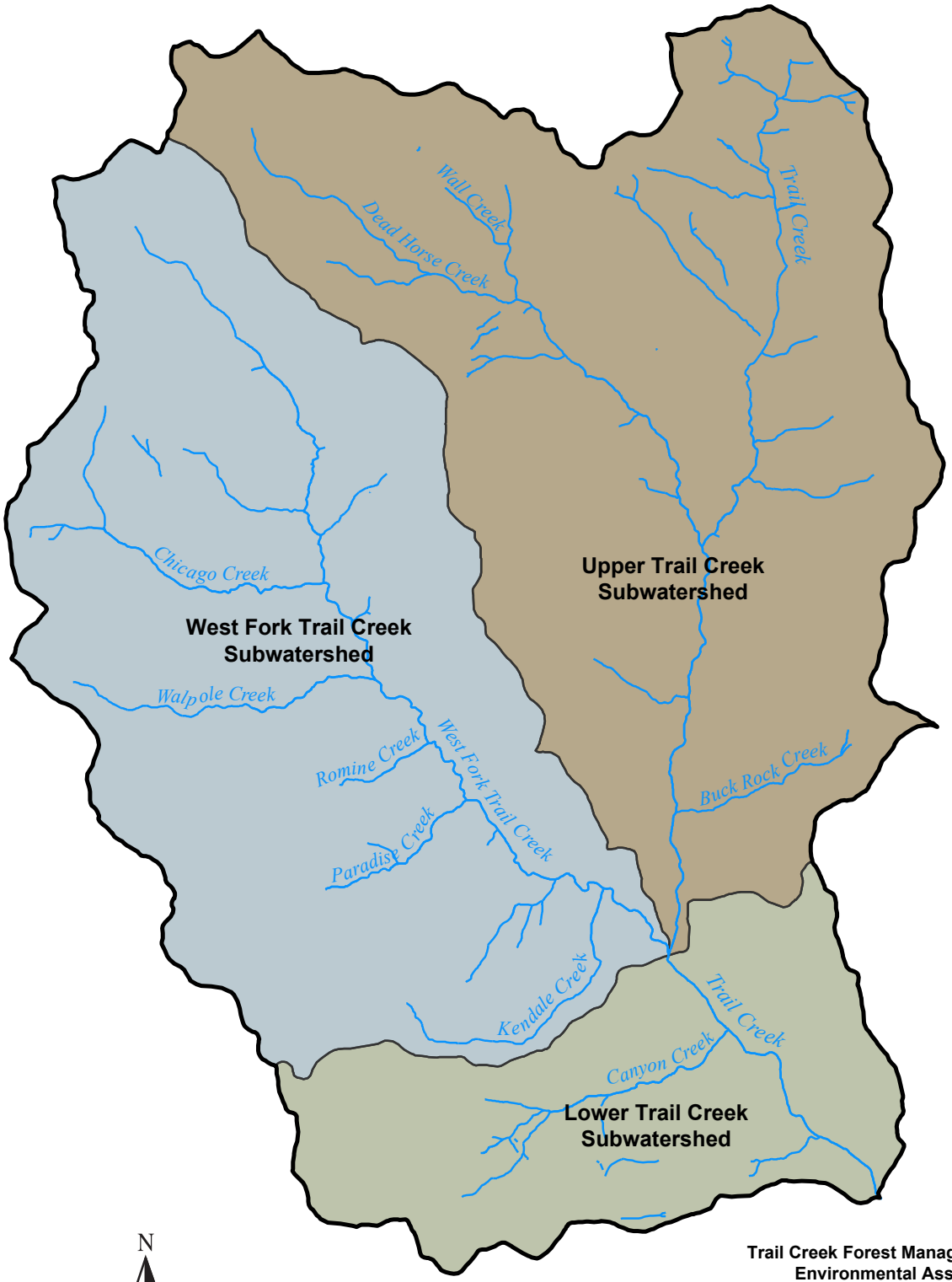
Map B-1. Trail Creek Watershed



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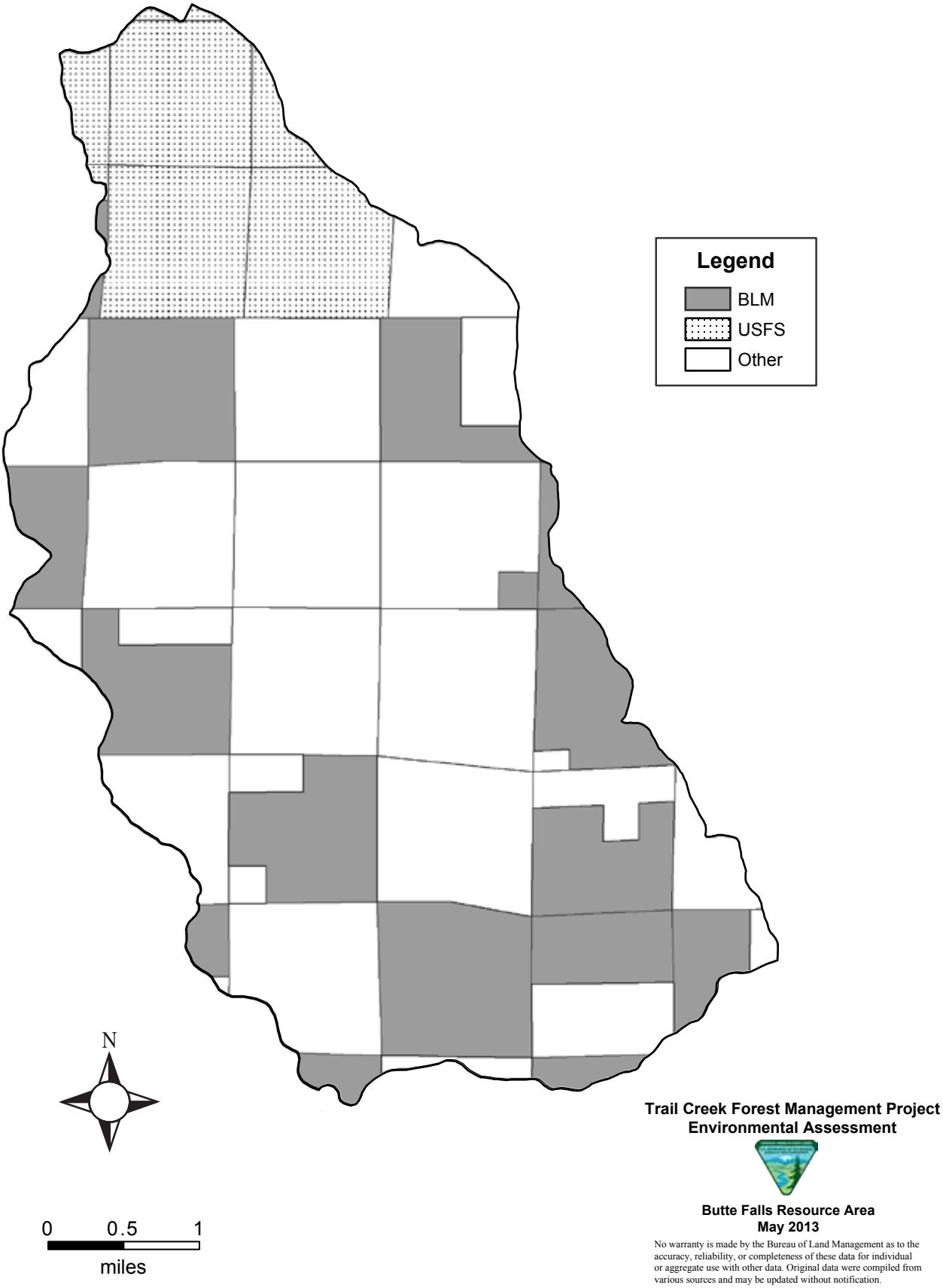
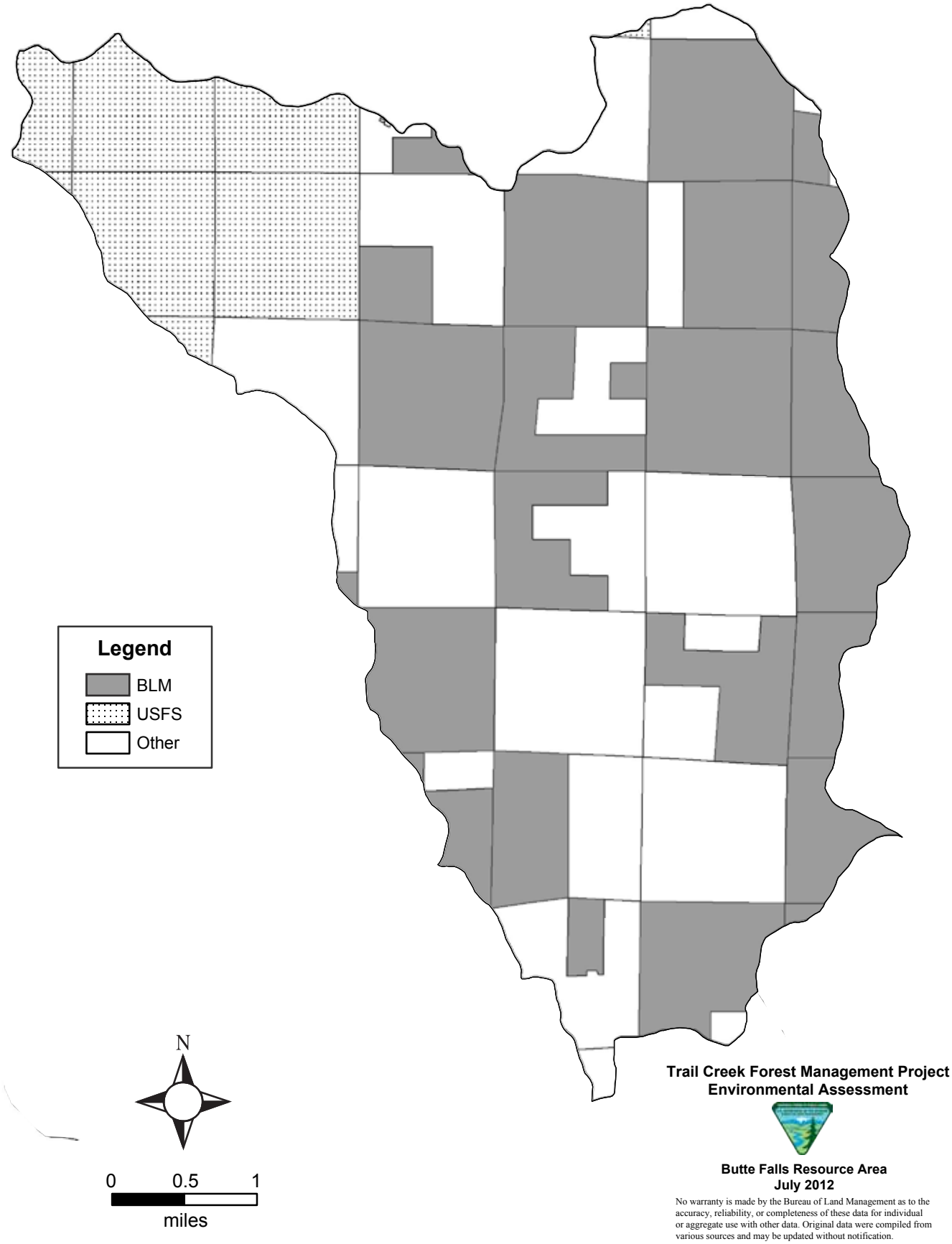
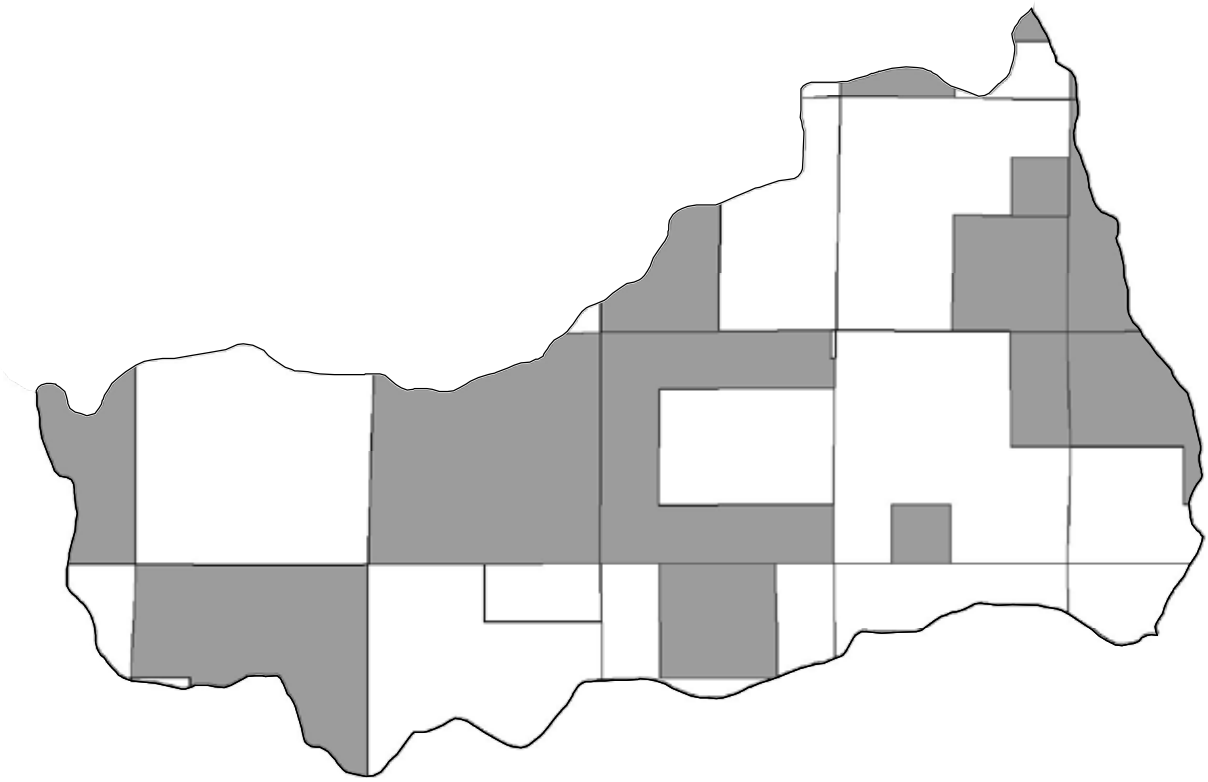
Map B-2. West Fork Trail Creek Subwatershed Land Ownership



Map B-3. Upper Trail Creek Subwatershed Land Ownership



Map B-4. Lower Trail Creek Subwatershed Land Ownership



Legend

- BLM
- USFS
- Other

N

0 0.5 1

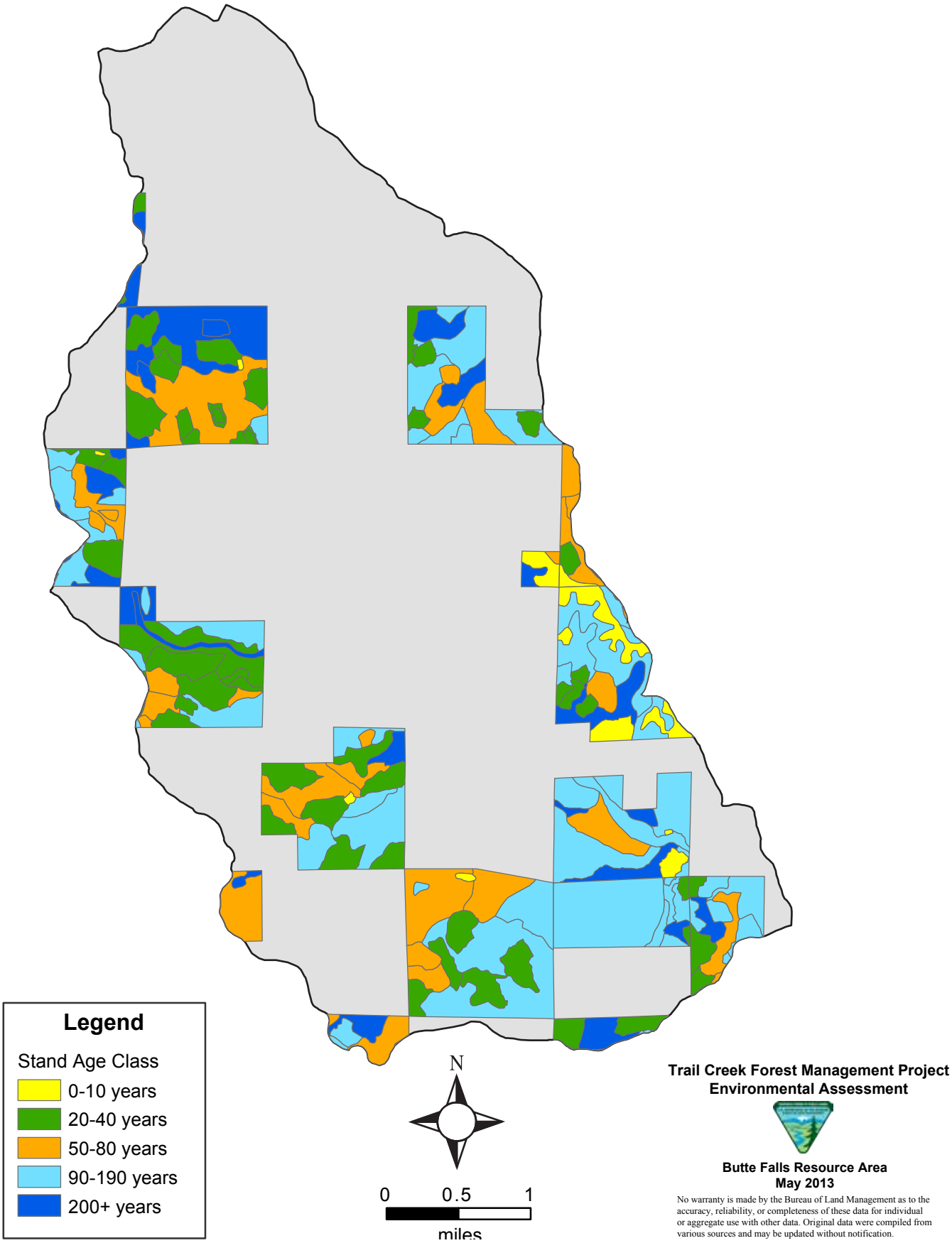
miles

Trail Creek Forest Management Project
Environmental Assessment

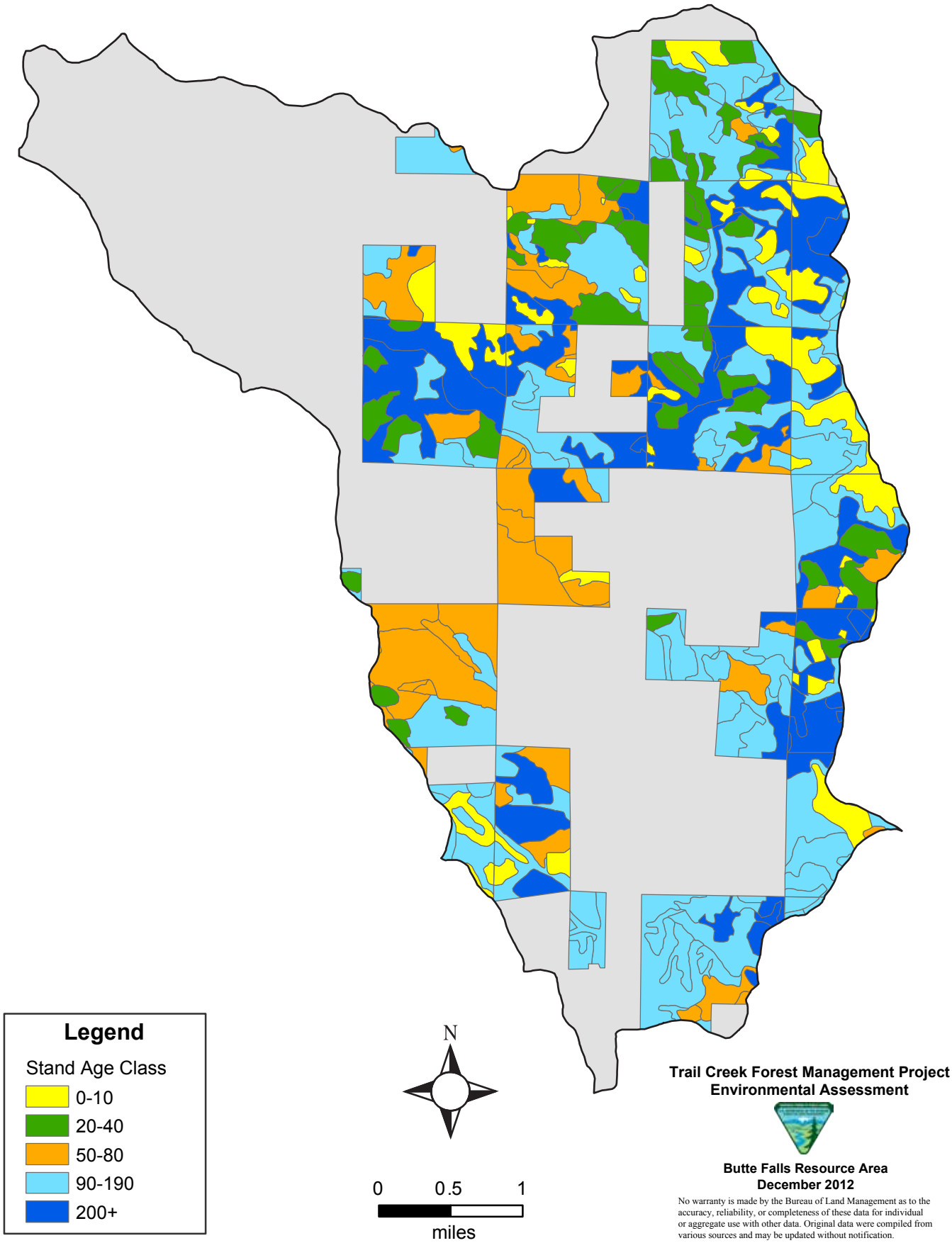
Butte Falls Resource Area
May 2013

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

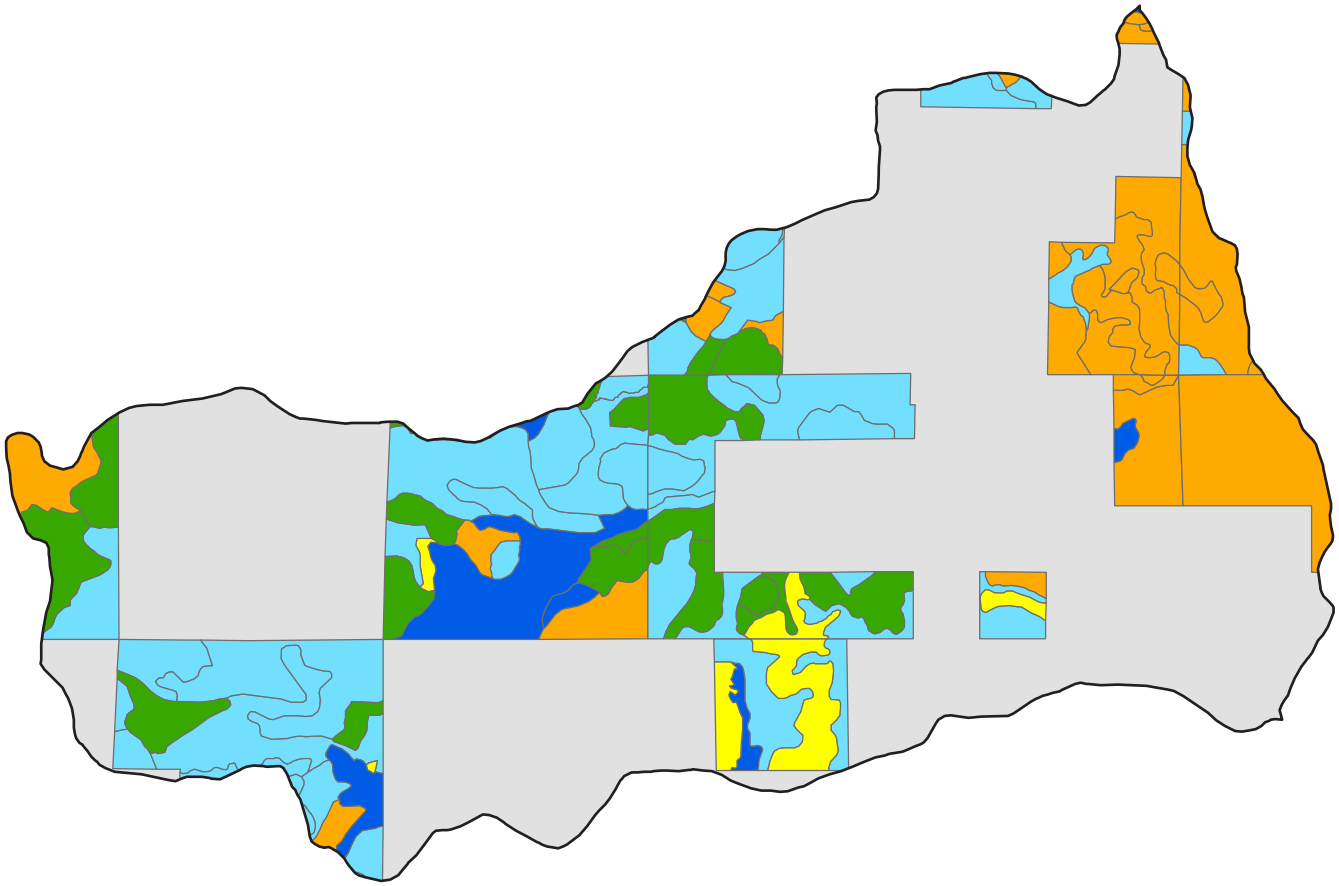
Map B-5. West Fork Trail Creek Subwatershed Stand Age Classes



Map B-6. Upper Trail Creek Subwatershed Stand Age Classes



Map B-7. Lower Trail Creek Subwatershed Stand Age Classes



Legend

Stand Age Class

- 0-10
- 20-40
- 50-80
- 90-190
- 200+

N

0 0.5 1

miles

Trail Creek Forest Management Project
Environmental Assessment

Butte Falls Resource Area
December 2012

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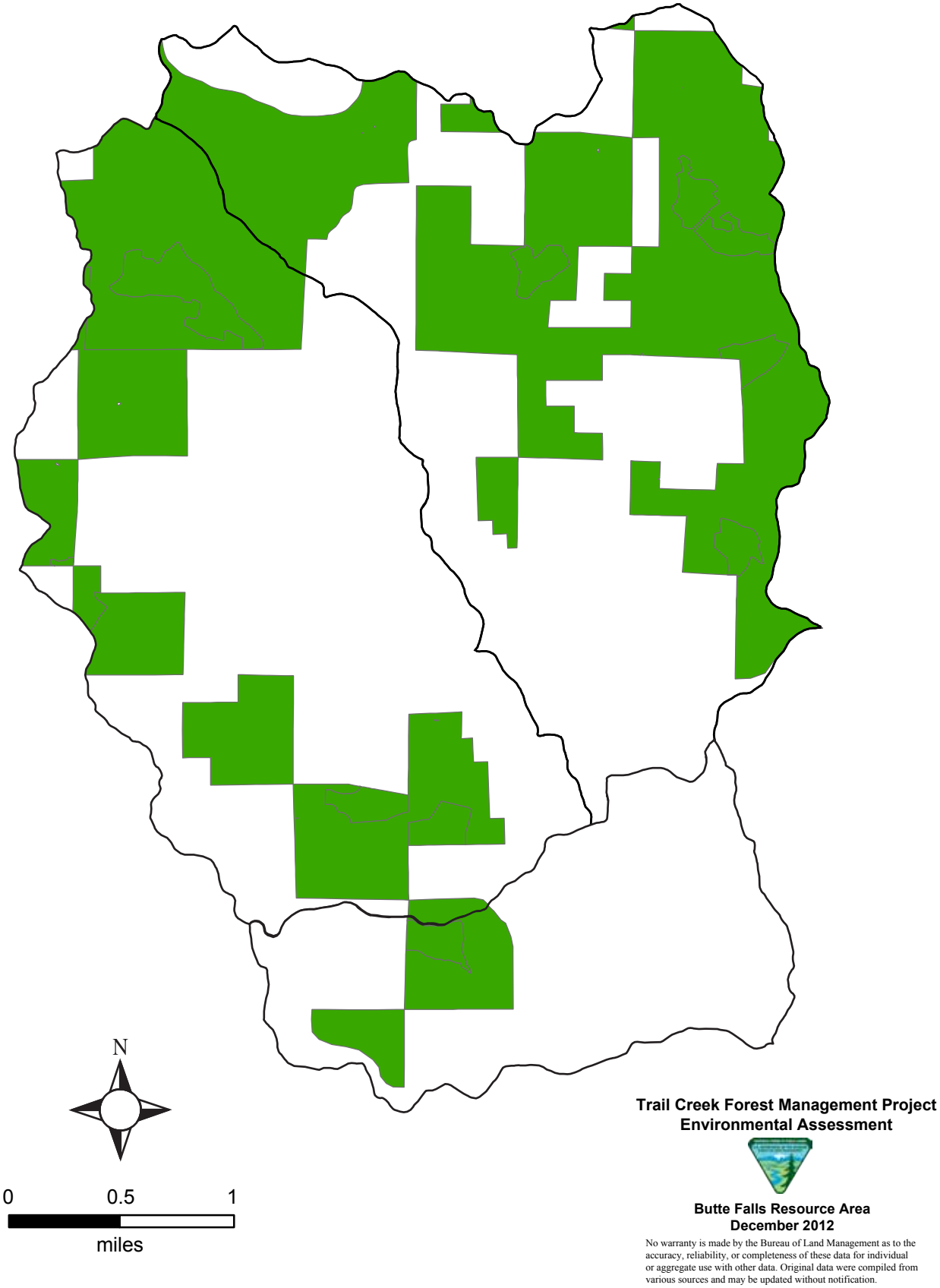
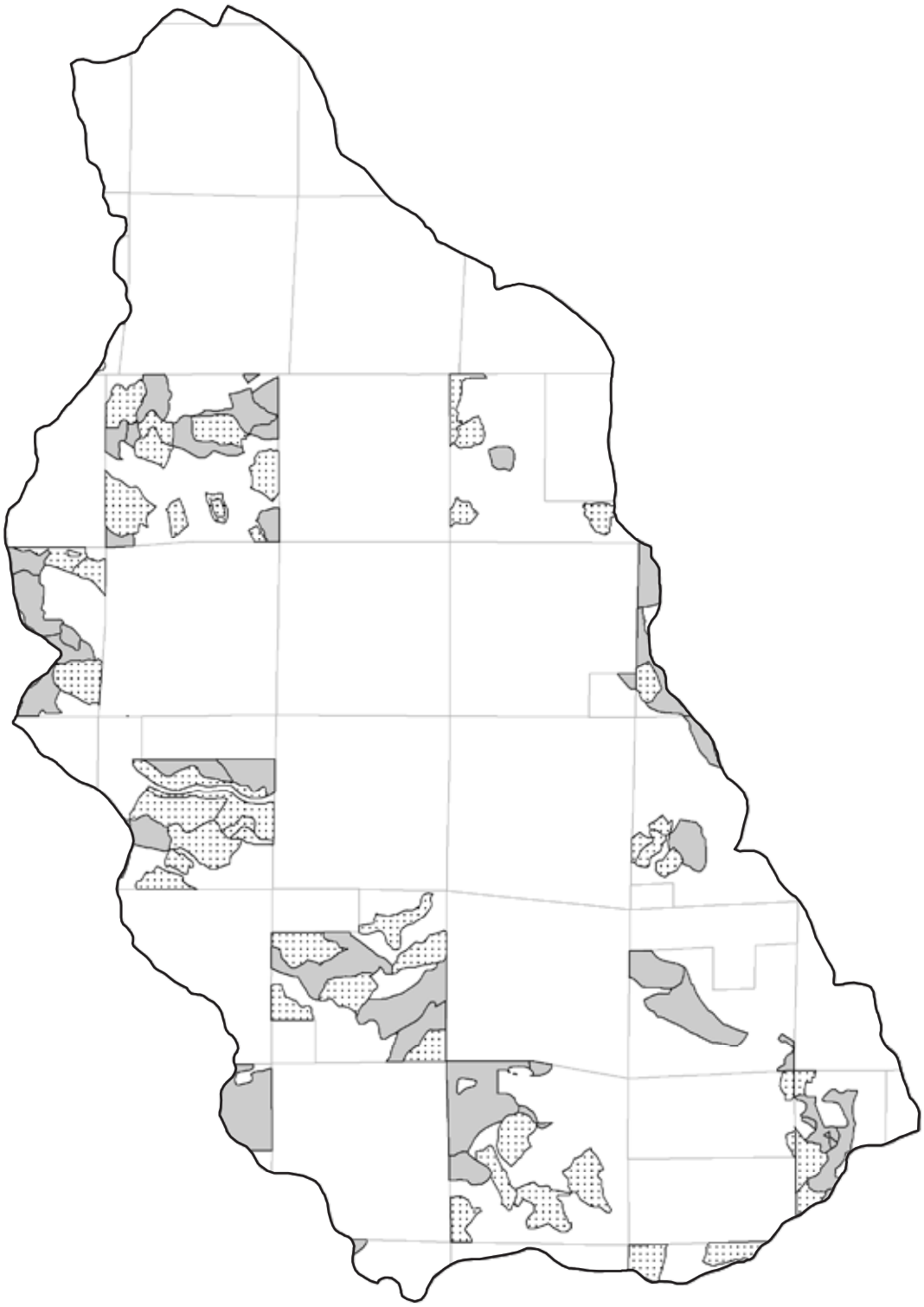
Map B-8. Trail Creek Watershed Northern Spotted Owl Critical Habitat



Map B-9. West Fork Trail Creek Subwatershed Potential Restoration



Legend

- Young Stand Restoration
- Late-successional Restoration

N

0 0.75 1.5
miles

Trail Creek Forest Management Project
Environmental Assessment

Butte Falls Resource Area
December 2012

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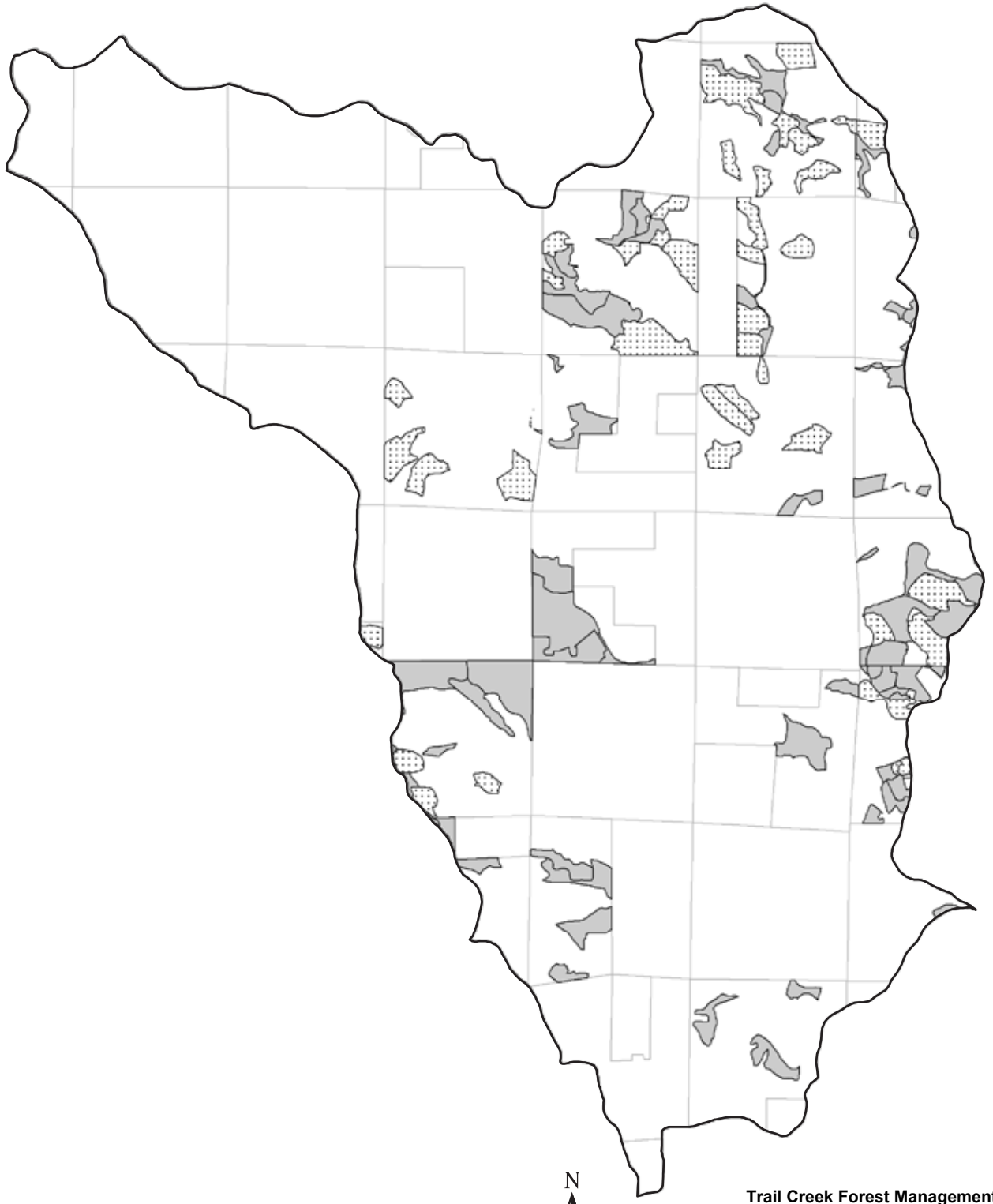
Map B-10. Upper Trail Creek Subwatershed Potential Restoration



Legend

- Young Stand Restoration
- Late-successional Restoration

N

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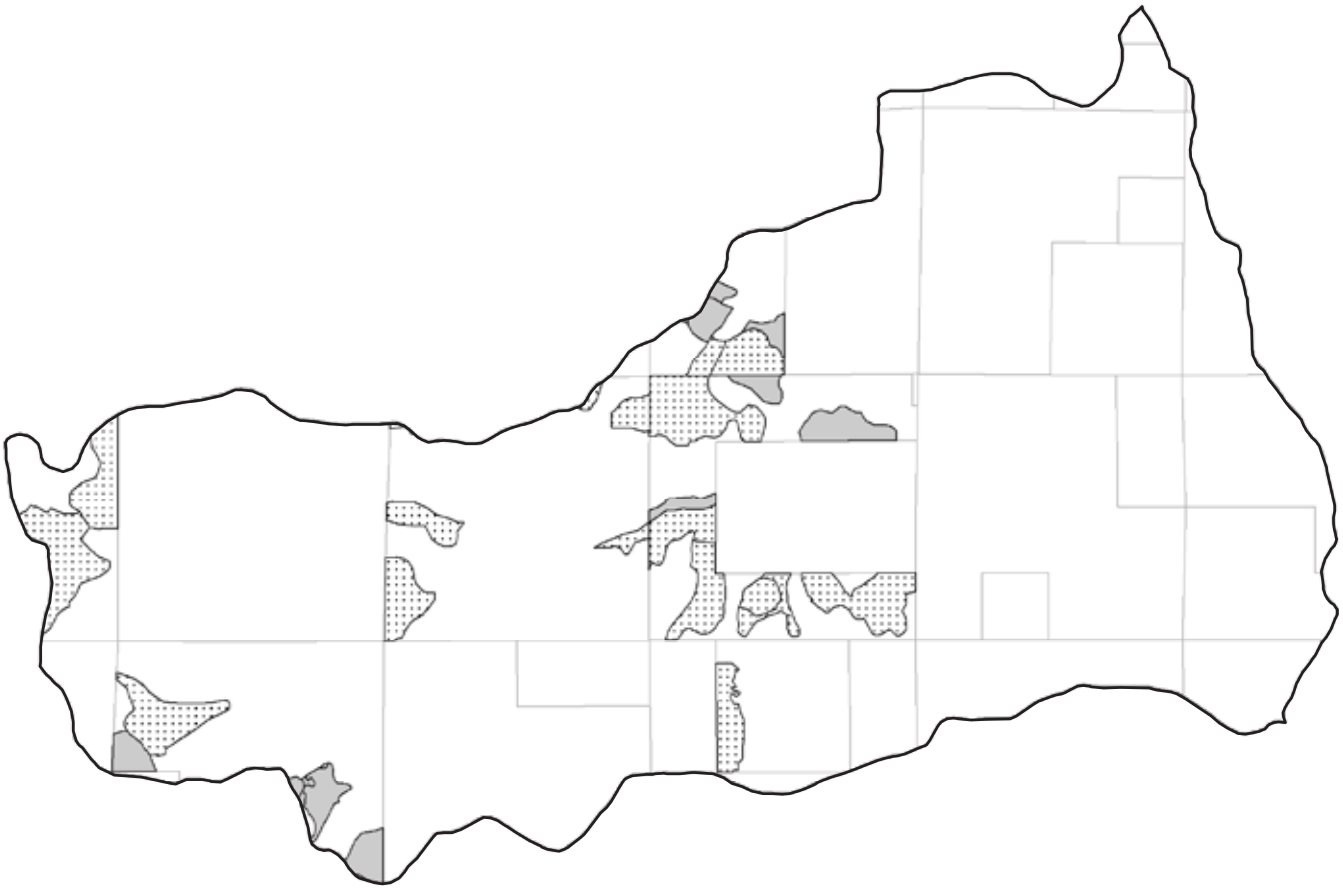
Map B-11. Lower Trail Creek Subwatershed Potential Restoration



Legend

- Young Stand Restoration
- Late-successional Restoration

N

0 0.5 1

miles

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Appendix C: Trail Creek Silviculture Prescriptions, Marking Guidelines, and Stand Inventory

Definitions

abiotic. Nonliving basic elements and compounds of the environment.

apical dominance. The dominance of the main central stem of a plant over side stems.

biotic. Living components of an ecosystem.

codominant trees. Trees with crowns forming the general level of the crown canopy and receiving full light from above but comparatively little from the sides.

crown ratio. The ratio between the length of the green crown of a tree and its total height.

dominant trees. Trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the side.

home range. The area annually traversed by spotted owls that provides important habitat elements. Represented by a circle based on the physiographic province: 1.2-mile radius for Western Cascades Province is and 1.3-mile radius for the Klamath Mountains Province.

inoculum. A pathogen or pathogen part (e.g., spores, mycelium) that infects plants.

intermediate trees. Trees shorter than dominant or codominants with crowns below or barely reaching into the main canopy.

operations inventory (OI). An intensive, site-specific forest inventory of forest stand location, size, silviculture needs, and recommended treatment based on individual stand conditions and productivity.

operations inventory unit. An aggregation of trees occupying an area that is sufficiently uniform in composition, age, arrangement, and condition to be distinguishable from vegetation on adjoining areas.

ORGANON. An individual tree growth computer model developed for areas of the Pacific Northwest.

photosynthesis. The production of carbohydrates from carbon dioxide and water.

relative density. The degree of crowding in a forest stand. It compares the number of trees present to the number of trees the site has resources (water, nutrients, and sunlight) to support.

seral stages. The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage. The age classes for the five seral stages are (1) early seral, 0–10 years; (2) mid-seral, 10–40 years; (3) late seral, 40–80 years; (4) mature seral, 80–200 years, and (5) old growth, greater than 200 years.

stocking. A quantitative measure of the area occupied by trees, usually measured in terms of well-spaced trees or basal area, relative to an optimum or desired density level.

stomate. An opening in the surface of a leaf through which water vapor, carbon dioxide, and oxygen pass.

suppressed trees. Trees with crowns entirely below the general canopy and receiving no direct light from above or from the sides.

thin from below. Thinning in which the smallest trees are removed and the largest are retained.

C.1 Management Direction and Objectives

C.1.1 Medford District RMP Management Direction

The management objectives on matrix lands as defined by the Medford District ROD/RMP (p. 38-39) are to

- produce a sustainable supply of timber and other forest commodities to provide jobs and contribute to community stability;
- provide connectivity (along with other allocations such as riparian reserves) between late-successional reserves;
- provide habitat for a variety of organisms associated with both late-successional and younger stands;
- provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees; and
- provide early successional habitat.

C.1.2 Silviculture Prescription Objectives

C.1.2.1 Timber Harvest

Treatment objectives are dependent on the alternative chosen.

The primary objective of Alternative 2 is to apply silviculture treatments that benefit stand health while maintaining owl habitat within the home range of the northern spotted owl. Within the home range, spotted owl habitat currently defined as structurally complex (RA32); dispersal; or nesting, roosting, and foraging would not be altered to the extent that the current habitat designation would be downgraded. This objective applies to all proposed treatment area stands. Outside of the home range, this alternative would implement Medford District RMP management direction for matrix land.

The purposes of Alternatives 3 and 4 are to increase landscape resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change) by reducing stand densities, retaining old trees, favoring drought-tolerant species, and increasing structural complexity while maintaining northern spotted owl habitat. Owl habitat that is currently defined as structurally complex; dispersal; or nesting, roosting, and foraging would not be altered within the home range of northern spotted owls to the extent that the current habitat designation is downgraded. No regeneration harvests are proposed.

C.1.2.2 Small Diameter Thinning

To reduce the density of forest stands with the objectives of increasing species diversity and stand vigor, reducing mortality of desired stand components, releasing drought-tolerant species in a dry forest restoration, and reducing susceptibility to insects and disease attack and spread.

High stand densities in younger ponderosa pine plantations, Douglas-fir progeny test sites, and mixed conifer stands have resulted in slow or stagnant growth rates. These stands are overstocked with more trees than the site has water, nutrients, and growing space to sustain. High densities result in declining tree vigor and growth, increased tree mortality, and increased susceptibility to insect attack, root disease infection, and stand-replacing wildfires. To reduce competition-related mortality and to increase forest health and tree vigor, the number of trees per acre needs to be reduced. By decreasing stand densities, more water, nutrients, and growing space would be available for the remaining trees.

To restore these stands toward a more historic species mix, thinning is needed to release established natural regeneration of Douglas-fir, incense cedar, and pine, or to create space for the planting of Douglas-fir, incense cedar, and pine. Species diversity is a key component of healthy forests by providing unique habitats, increased genetic variability and vegetative conditions that are more resilient to environmental extremes and disturbances.

C.2 Site and Stand Condition

C.2.1 General Site Description

The proposed treatment area is located in Jackson County approximately 1 to 10 air miles north and northwest of the town of Shady Cove, Oregon. The timber harvest area is located in portions of sections 19, 21, 22, and 27–34 in T32S, R1W; sections 3, 7, 9, 10, 15, 17–19, 21, 22, 27, and 29–34 in T33S, R1W; sections 1, 3, 15, 23, and 25 in T33S, R2W; and section 1 in T34S, R2W.

Small diameter thinning is proposed in portions of sections 3 and 9 in Township 33 South, Range 1 West; sections 3 and 15 in Township 33 South, Range 2 West; and section 1 in Township 34 South, Range 2 West.

C.2.2 Subwatersheds/Watershed

The proposed treatment area is located in the West Fork Trail Creek, Upper Trail Creek, and Lower Trail Creek sixth field subwatersheds within the Trail Creek fifth field watershed.

C.2.3 Abiotic Conditions

C.2.3.1 Soil Type

Soils within the watershed were formed and derived predominately from volcanic rocks of lava flows from the Western Cascade Geologic Unit. The main Trail Creek portion of the watershed is dominated by the moderately deep (20 to 40") and skeletal (>35% rock fragments in the subsoil) soils of the Shippa-straight complex, Geppert, and McMullin series. The soils in the West Fork Trail Creek portion of the watershed contain highly weathered clays. The dominant soil series present are Medco and McNull. These soils are shallow to moderately deep and have a high amount of shrink-swell clays (>30%). The high amount of clay in these soils greatly influences the vegetation communities that are supported.

C.2.3.2 Site Index

Site index is the average height of the dominant trees at 50 years. The site index for Douglas-fir within the timber harvest treatment area averages 78, based on Hann-Scrivani site index equations (Hann and Scrivani 1987). The site index for the small diameter thinning area is 76. Height growth is relatively independent of stand density and provides a comparable measure of site productivity between different forest stands.

C.2.3.3 Topography/Precipitation

The landforms within this area are highly variable and range from very steep to gentle slopes. The watershed is characterized by rugged topography with irregular ridges and deep narrow canyons. Ridge formations are primarily aligned southeast to northwest. The Trail Creek watershed elevation ranges from 1,400 to 4,700 feet above sea level. Precipitation averages approximately 40" per year, with most of the precipitation occurring in the late fall, winter, and early spring as rainfall, except in the higher elevations where snow accumulates.

C.2.3.4 Existing Site Problems

High growing-season temperatures, high evaporative demands, and drought characterize the climate of the Project Area. The high demand for moisture during prolonged hot and dry summer days increases tree stress, particularly in overstocked forest stands. During hot, dry periods, the uptake of moisture cannot keep up with the loss through transpiration. When this occurs, the plant closes leaf stomates to maintain adequate cell water content. Plants require at least 75% water content in functional cells (Bradford and Hsiao 1982). With the leaf stomates closed, carbon dioxide is not taken into the plant through photosynthesis and the conversion of carbon dioxide and water into carbohydrates, or "food," does not occur. Without the creation of "food," the life processes of the tree are interrupted resulting in increased tree stress and a higher risk of insect attack or disease infection. Reduced resin flow in water-stressed trees enables insects to successfully attack the tree (Kramer and Kozlowski 1979).

C.2.4 Biotic Conditions

C.2.4.1 Plant Series

Within the Trail Creek watershed, Douglas-fir is the dominate plant series. The white fir series is restricted to the upper elevations of the Project Area. Ponderosa pine, sugar pine, incense cedar, Pacific madrone, and Douglas-fir represent the early seral component of these series. Douglas-fir generally dominates the overstory of most stands with sugar pine, ponderosa pine, and incense cedar occurring on a scattered basis. Ponderosa pine and white oak plant series are common on lower elevation and shallow soil sites. Oaks or pine generally dominate the overstory with varying levels of Douglas-fir on more moist pine sites. White oak and ponderosa pine are early seral tree species. Increasing levels of Douglas-fir and ponderosa pine develop in the understory in more developed stands.

The majority of the plant communities within the northeast portion of the Project Area and above 3,000 feet elevation are at the moderate to moist end of the environmental gradient for the Douglas-fir series with some sites grading into the white fir series. Within the southwestern portion of the Project Area and at elevations below 2,500 feet, plant communities tend toward the moderate to dry end of the Douglas-fir series. Much drier ponderosa pine and white oak communities are common as well. These plant communities are found on drier aspects and where soil depth is reduced. The highly intermixed nature of the drier plant communities serves to fragment the vegetation types across the landscape. Dry site indicators such as white oak and poison oak are common understory species. Pacific madrone is common throughout the Project Area and often competes with developing conifers where openings have been created. Douglas-fir and incense cedar are the primary conifer species regenerating within unmanaged conifer stands. Slope, aspect, elevation, soil depth, and geology further define the extent and occurrence of various species.

C.2.4.2 Stand History

Historically, fire was the primary large-scale, natural-disturbance event. Within the Project Area, the majority of timber stands commonly experience high temperatures, moderate precipitation, and low fuel moisture in the summer. Historically, this provided conditions conducive to frequent fire occurrence with variable levels of severity. Frequent fire often provided for a low thinning effect and retention of fire-resistant species such as ponderosa pine, sugar pine, and incense cedar. Intense stand-replacement fires have occurred occasionally in lower elevations and are evidenced by the development of stands dominated by madrone or even-aged Douglas-fir with little to no variation in structure. Moderate to high severity fires were more infrequent in occurrence and would typically occur on northern aspects and at higher elevations (above 3,500 feet) where higher productivity levels, relatively cooler summertime temperatures, and higher levels of moisture would work in combination to provide for a longer fire return interval. Intense stand-replacing wildfires burned

every 8o to 100 years or more; less intense underburns were more frequent and occurred every 10 to 50 years. Frequent fire often provided for a low thinning effect and retention of fire-resistant species such as ponderosa pine, sugar pine, and incense cedar.

During the past century, logging has replaced fire as the primary event that has shaped stand condition and structure. Timber harvest in the Project Area has consisted of individual tree selection, overstory removal, clearcutting, commercial thinning, density management, regeneration harvest, and salvage of dead and dying trees (Thies and Sturrock 1995).

Clearcutting in the late 1950s through the 1980s created two types of stands proposed for small diameter thinning:

- Ponderosa pine plantations: Even-aged stands of ponderosa pine with an average dominant tree diameter of 11". These plantations are intermixed with overstory Douglas-fir and white fir. Varying amounts of smaller, natural Douglas-fir, white fir, ponderosa pine, and incense cedar are present in the understory. Stands have a density of 175 trees per acre 8" DBH or greater and 1,450 trees per acre less than 8" DBH.
- Douglas-fir progeny test sites: Even-aged stands of Douglas-fir with an average dominant tree diameter of 10". Douglas-fir is the only species present and is in a single layer with smaller diameter, suppressed Douglas-fir below. The majority of the stand is in the 6- to 8-inch diameter class. These stands have a density of 200 tree per acre 8" DBH or greater, and 350 trees per acre less than 8" DBH.

Another silviculture harvest method used between the 1950s and 1970s was commonly referred to as partial cutting. In partial cut stands, selected trees were harvested leaving some merchantable trees. Often some of the larger, more vigorous or otherwise more desired trees were removed, or high-graded, leaving the less vigorous and less desired trees behind. This action created the last type of stand proposed for treatment:

- Mixed conifer stands: Residual mixed conifer stands 100 years and greater that remain from stands that were partially cut between the 1950s and 1970s. At the time of harvest, selected merchantable trees were removed leaving pockets of trees greater than 8" in diameter. Trees less than 8" in diameter remained after harvest because they were not merchantable and remained in pockets due to the mechanics of logging. Douglas-fir, ponderosa pine, hardwoods, and other conifer species naturally seeded in. In some of the stands, ponderosa pine seedlings were interplanted following harvest. The average dominant tree diameter ranges from stand to stand, with a low of 12" to a high of 17". Currently, the stands are a mosaic of species, diameters, and density levels. These mixed conifer stands presently have a density of 100 to 140 trees per acre 8" DBH or greater, and 500 to 2,000 trees per acre less than 8" DBH.

Stand densities in the proposed small diameter thinning areas are high and are considered overstocked. Overstocked stands have more trees than the site has moisture, nutrients, and growing space to sustain. Without adequate resources, tree growth and vigor declines, increasing the probability of tree mortality from insects or disease, with subsequent potential increase in the likelihood and intensity of fire.

The vigor and health of the planted ponderosa pine is further influenced by the unknown origin of the seed source. Prior to the mid-1960s, seed zones were not used and collected seed was often planted on sites that the seed source was not adapted. Seedlings planted outside of their seed zone are often more susceptible to environmental extremes and insect and disease problems. Tree conditions very; some ponderosa pine exhibit off-site characteristics such as thin, chlorotic foliage that is susceptible to fungus diseases, while other ponderosa pines have full vigorous crowns that appear adapted to the site.

The BLM has harvested timber on 1,267 acres within the Trail Creek fifth field watershed since the completion of the PRMP/EIS in 1994. This represents 3.6% of all land and 8.6% of BLM land in the Trail Creek watershed. Density reduction treatments (e.g., commercial thinning, density management, and individual tree selection) occurred on 76% (958 acres) of the treatment acres, regeneration harvest on 22% (276 acres), mortality salvage on 2% (32 acres), and clearcut on less than 1% (1 acre). Density management has redistributed growth from many small trees to fewer large healthy trees. The remaining trees have adequate site resources to maintain good growth rates with tree vigor at levels necessary to minimize mortality due to competition or insects and disease. Regeneration harvesting has replaced stands that have passed the point of optimum wood production with young, fast-growing conifer stands that maximize the volume growth capability of the site.

C.2.4.3 Structure Description

The structural characteristics of the stands within the proposed treatment areas vary from single layer, even-aged stands to multi-layer, uneven-aged stands. Where wildfires burned intensively, crown fires occurred and even-aged stands became established. The majority of the even-aged stands are 100 years old or less. When wildfires burned at a lower level of intensity and were confined to ground level, multi-layered, uneven-aged stands developed. Multi-canopy stand conditions are the norm where stands are mature (150 years or greater). In general, 2-storied and multi-storied stands have understories that are suppressed and usually dominated by Douglas-fir or incense cedar. In most stands, widely scattered 30 to 40" or greater Douglas-fir, sugar pine, ponderosa pine, and incense cedar trees are also present as fire remnants of previous stands. With decades of fire suppression, stand development has stagnated and stand densities have increased.

C.2.4.4 Coarse Woody Debris

Coarse woody debris provides habitat for wildlife, invertebrate, microbial, and fungal species, as well as important ecological functions such as moisture retention, soil stabilization, and nutrient recycling. The amount and decay class of woody debris reflects the stage of stand development (Table C-27). In a natural cycle, two stages (stand initiation and old growth) typically have the greatest amounts of coarse woody debris. Older decay classes (3, 4, and 5) are more common and reflect coarse woody debris created since stand initiation wildfires in the early 1900s. Where coarse woody debris does occur, it will not be removed from the site and will be protected from disturbance. In forest stands identified for regeneration harvest, trees will be designated and reserved to meet the coarse woody debris requirements of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long, decay class 1 or 2 (Table C-28).

The ponderosa pine plantations and Douglas-fir progeny test sites are less than 60 years old and have yet to develop large diameter trees that would provide large coarse woody debris. Past intensive harvest practices typically machine piled all slash and woody debris and burned the pile, leaving minimal coarse woody debris. Where coarse woody debris does occur, it will not be removed from the site and will be protected from disturbance. In stands over 100 years of age, the large coarse woody material would not be removed from the site.

C.2.4.5 Snags

RMP standards and guidelines require that one to two snags per acre will be present over time to meet the requirement for cavity nesting birds at 40% of potential population levels (ROD/RMP, p. 40). All deterioration stages of snags (Table C-29) will be retained as part of the silviculture prescription. During harvest operations, existing snags will be reserved from felling where they are not a safety hazard and, where necessary, additional green trees will be reserved to meet the target levels. If a snag needs to be fallen for safety concerns, the snag will be left on-site to function as coarse woody debris.

C.2.4.6 Tree and Stand Health, Insects, and Disease

- Bark beetle activity is currently low within the Project Area. Flatheaded wood borers (*Melanophila drummond*), western pine beetles (*Dendroctonus brevicomis*), and mountain pine beetles (*Dendroctonus ponderosae*) have been active in the last 3 years at natural levels in and adjacent to the Project Area. High stocking levels and low moisture availability will continue to create environmental conditions favorable to bark beetle infestation of stressed trees.
- Root pathogens are not a widespread problem but do occur in the area. Infection centers of root pathogens such as *Phellinus weirri*, *Phomes annosus*, and *Armillaria* spp. are present. Small pockets of white fir and Douglas-fir are affected.
- Stem rots (Phellinus pini, Oligoporus amarus, and Phaelos schweinitzii) are present in a small number of trees, but do not pose a serious concern for stand health. The trees infected with stem rots enhance forest diversity by providing trees with unique structural defects that serve as plant and wildlife habitat, as well as future coarse woody debris.
- Douglas-fir mistletoe, white fir mistletoe, and dwarf mistletoe are present and affecting tree vigor in some of the stands in this Project Area. Mistletoe is host-specific and may cause tree mortality; growth loss; alteration of crown and canopy structure; increased fire hazard; and increased susceptibility to bark beetles, root rots, and drought stress. Mistletoe brooms, although detrimental to tree growth, provide habitat for mammals and birds. Throughout the Project Area, mistletoe occurs at low levels and is a concern with respect to future stand development considerations. Lightly infected mature stands with an understory of host species have the greatest potential for severe mistletoe infection and spread. Removal of infected trees, thinning to favor non-host species, regeneration of non-host species, or both will minimize the potential for increased levels of mistletoe infection.
- High stand densities are affecting individual tree vigor and stand health. Overstocked stands contain more trees than the site has resources (e.g., moisture, nutrients, and growing space) to provide (Figure C-1). This leads to increased tree stress, particularly during prolonged hot summer days without any precipitation. Decreased tree vigor is magnified during periodic drought years when the cumulative effects of below average amounts of precipitation causes the interruption of basic functional processes (e.g., photosynthesis, transpiration, respiration, translocation, and assimilation) over an extended period of time. Intertree competition for limited site resources has resulted in declining tree vigor and growth, tree mortality, and increased fire intensity. Low elevation drier sites, which were historically thinned by fire, are in the most critical condition with respect to stand densities and forest health. The result is stagnated stands in which Douglas-fir or suppressed incense cedar is becoming the dominant species. The structure of the vegetation is also such that low thinning effect wildfire regimes are shifting to where stand-replacement fires will become the norm. Maintenance of species diversity is important on these sites to ensure resilience and stability to drought, fire, or insect and disease infestation.

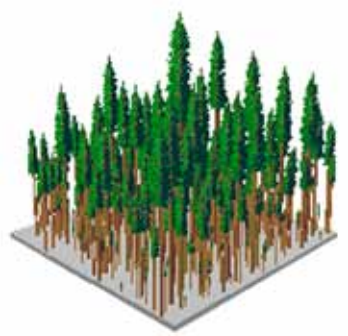
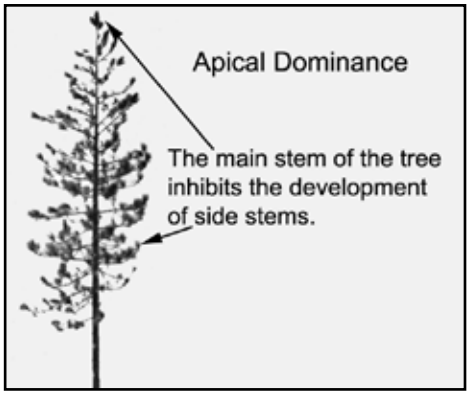


Figure C-1. Current Stand Conditions. Forest stands are overstocked with more trees than the site has water, nutrients, and growing space to sustain.

- Relative density is a measure of crowding in a stand of trees. It compares the number of trees present to the number of trees the site has resources to support. In forest stands proposed for timber harvest, stand exams were completed to determine the "relative density." The average relative density levels within the units proposed for thinning are approximately 85%. As a point of reference, crowns begin to close when the relative density approaches 15% and the mortality of suppressed trees begins after

the relative density reaches 60% (Perry 1994) (Hann and Wang 1990). Maintaining the relative density in forest stands between an upper end of 50% and a lower end of 25% prevents excessive tree loss from competition.

- In stands proposed for small diameter thinning, most stands have relative densities near or above 60%. Maintaining the relative density index in mixed conifer forest stands between and upper end of 50% and a lower end of 40% prevents excessive tree loss from competition. The lower limit of full site occupancy is a relative density index of 40%. In pine and white oak plant series or in areas of lower precipitation (<35" per year) located on south and west aspects a lower target relative density index of 30% may be used. On these lower drier sites, tree competition for moisture is greater and the number of trees the site can sustain is lower. An RDI target of 30% reduces the number of trees per acre to levels the site has moisture to sustain.
- Tree senescence, or aging, also plays a role in the condition and vigor of individual trees. As a tree increases in size and builds up a complex branch system, it shows a decrease in metabolism; gradual reduction in growth of vegetative and reproductive tissues; loss of apical dominance; increase in dead branches; slow wound healing; heartwood formation; increased susceptibility to injury from certain insects, diseases, and unfavorable environmental conditions; and loss of geotropic responses (growth of stems upward and of roots downward in response to gravity). There is also a decrease in the proportion of photosynthetic to non-photosynthetic tissue; this reduction results in the production of fewer carbohydrates (Kramer and Kozlowski 1979). Movement of food, water, and minerals becomes more difficult as the distance from the roots to the top of the tree increases. The problem is magnified when water becomes a limiting resource in tall trees. Water deficits may cause needle and stem mortality as evidence by snag tops or dead branches and needles in the upper part of the crowns



- In addition to tree aging and the high numbers of trees per acre, other factors contribute to individual tree health and vigor. Factors such as the amount of understory shrub growth, soil type, precipitation, aspect, crown position in the canopy, topography, root pathogens, and insects combine to affect tree vigor and its ability to maintain basic functional processes.

C.3 Analysis in Support of the Prescription

The target stand reflects not only what is planned for the future but also what is expected immediately after treatment. The target stand represents optimum conditions to strive for through management.

Depending on the alternative selected, one or more of the following silviculture treatments may be implemented: regeneration harvest, commercial thinning, riparian thinning, density management, or restoration thinning. Individual OI (operations inventory) units have been grouped under one of these categories based on the proposed treatment.

C.3.1 Regeneration Harvest

The OI units proposed for regeneration harvest are listed in section C.5.1.

Three regeneration silviculture methods are recommended: (1) northern general forest management area (NGFMA), (2) shelterwood retention, and (3) southern general forest management area (SGFMA). The

target stand conditions for each of these methods are the same except for the number of green trees per acre greater than 20" DBH that will remain (Figures 2, 3, and 4):

- Northern GFMA—6 to 8 trees
- Shelterwood Retention—12 to 25 trees
- Southern GFMA—16 to 25 trees

C.3.1.1 Present Conditions

Many of the stands were tractor logged in the past. Individual tree selection was the primary harvest method applied. This resulted in the development of stands with multiple canopy layers. Varying levels of the overstory tree component are declining due to high stand density levels, root pathogens, and tree senescence. Overstory tree species are primarily Douglas-fir with lesser amounts of white fir; the minor species include sugar pine, incense cedar, and ponderosa pine. All stands have reached the targeted rotation age of 100 years on northern GFMA designated lands and 120 years on southern GFMA designated lands. The rotation age is set at the culmination of mean annual increment, which is the peak of average yearly growth in the volume of a forest stand.

The shrub species present in most units are baldhip rose, dwarf Oregon grape, creeping snowberry, and poison oak. In most units, shrub cover is low to moderate, occurring in patches or as a scattered vegetative component. Hardwood species include Pacific madrone, California black oak, canyon live oak, Pacific yew, and chinquapin. Generally, the hardwoods are widely scattered or occur in small clumps and are a minor compositional component of the stands.

Natural regeneration (seedlings and saplings) in most units are dominated by Douglas-fir, followed by white fir, with lesser amounts of incense cedar, ponderosa pine, and sugar pine, with density levels varying from stand to stand.

C.3.1.2 Target Stand—Regeneration Harvest

The minimum number of remaining large (greater than 20" DBH), overstory green trees will vary from 6 to 25 trees per acre, depending on the regeneration harvest method (Figures C-2, C3, and C- 4). Douglas-fir, sugar pine, ponderosa pine, incense cedar, and hardwood species will be the preferred leave species. Leave trees will be the largest full-crowned, healthy trees. In areas of root rot, healthy codominant and dominant Douglas-fir, incense cedar, sugar pine, and hardwood species will be favored. In stands infected with Douglas-fir mistletoe, remove all Douglas-fir. If other conifer species (white fir, incense cedar, ponderosa pine, and sugar pine) cannot provide enough trees to meet the regeneration tree count, mistletoe-

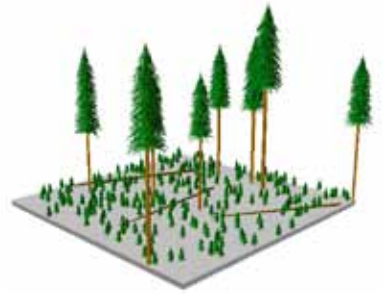


Figure C-2. Northern GFMA Regeneration Harvest.
The target stand structure is 6 to 8 green trees per acre greater than 20" DBH, a minimum of 1.8 snags per acre, and a minimum of 120 linear feet of coarse woody debris

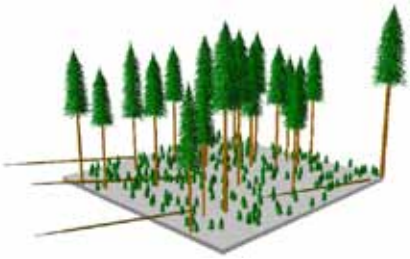


Figure C-3. Southern GFMA Regeneration Harvest.
The target stand structure is 16 to 25 green trees per acre greater than 20" DBH, a minimum of 1.8 snags per acre, and a minimum of 120 linear feet of coarse woody debris.

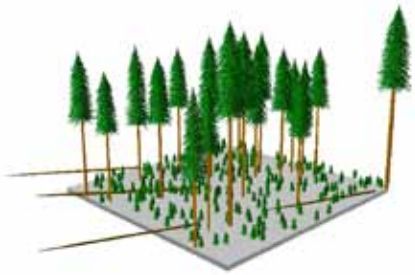


Figure C-4. Shelterwood Retention.
Target stand structure is 12 to 25 green trees per acre greater than 20" DBH, a minimum of 1.8 snags per acre, and a minimum of 120 linear feet of coarse woody debris.

infected Douglas-fir trees can be left as long as they are clumped near the perimeter *and* in the lowest topographic areas of the stand. If mistletoe-infected Douglas-fir trees are left within a harvest unit, do not plant any Douglas-fir seedlings within 50 feet of the infected trees.
Preharvest snags will be left and additional healthy or cull green trees greater than 20" DBH will be reserved if needed to meet the required 1 to 2 wildlife snags per acre, or to meet coarse woody debris requirements. Two to four of the largest hardwoods per acre will be reserved for wildlife and stand diversity. Tree form (height and crown condition) will determine which hardwoods to leave.

Special status species may occur within the stands. These species will be buffered and protected. These buffer patches will provide additional structural diversity within stands.

To prepare nonstocked sites for tree planting, logging slash will be underburned or hand piled and burned. To promote species diversity within these units where planting is required, a mixture of Douglas-fir, resistant sugar pine, ponderosa pine, and incense cedar will be planted following site preparation activities.

Approximately 300 to 500 trees per acre will be planted. Species mix will be 70% Douglas-fir, 20% sugar or ponderosa pine, and 10% incense cedar. In stands with root rot, no ponderosa pine will be planted. Instead a mix of Douglas-fir, sugar pine, and incense cedar will be planted. In regeneration harvest units adjacent to stands infected with Douglas-fir mistletoe, do not plant any Douglas-fir within 50 feet of the perimeter. This will minimize the potential mistletoe infection of newly planted Douglas-fir seedlings.

Table C-1. Regeneration Harvest Treatment Schedule

Year	Regeneration Harvest Treatment
0	Harvest: Leave target number of green conifer trees per acre greater than 20" DBH • Northern GFMA: 6 to 8 • Shelterwood: 12 to 25 • Southern GFMA: 16 to 25 Leave a minimum of 1.8 snags per acre (stage 1 and 2) and 120 linear feet of coarse woody debris (decay class 1 and 2, 16" x 16'). Site preparation: Slash trees 1 to 6" DBH damaged from logging activities. Leave all healthy, unmerchantable trees. Treat brush and hardwoods by slashing. Underburn or hand pile and burn. Limit piling of logging slash to pieces less than 16" DBH.
0-1	Plant with a mix of ponderosa pine, Douglas-fir, sugar pine, and incense cedar. Apply appropriate maintenance (e.g., vexar tubing, mulching, shading, scalping, baiting) treatments to ensure planting success.
1	Conduct 1st year survival survey. Assess need for supplemental planting or additional maintenance treatment.
3	Conduct 3rd year survey. Assess need for replanting, additional maintenance needs, or both.
5	Conduct 5th year stocking survey. Target stand will have a minimum of 280 well-spaced trees per acre. Competing vegetation will have been controlled, with trees growing rapidly.

Table C-1. Regeneration Harvest Treatment Schedule

Year	Regeneration Harvest Treatment
10	Precommercially thin the understory if density is more than 400 trees per acre. Favor pine species, Douglas-fir, and incense cedar. Thin to approximately 200 trees per acre.
15-20	In shelterwood retention units only, overstory trees in excess of 6 to 8 green trees per acre may be harvested after 15 to 30 years if the understory is well established and frost damage is no longer a concern.
35	Trees average 10" DBH. Commercial thin if stand density is appropriate. Otherwise, delay until crown closure and competition reduces growth rates. Thin to approximately 200 trees per acre.
45-80	Commercial thin, if appropriate. Favor leaving the pines, Douglas-fir, and incense cedar. Use relative density target of 35%; on low elevation sites on south or west aspects, the target relative density may be lowered to 25%.
100	Assess stand and watershed conditions for possible regeneration harvest.

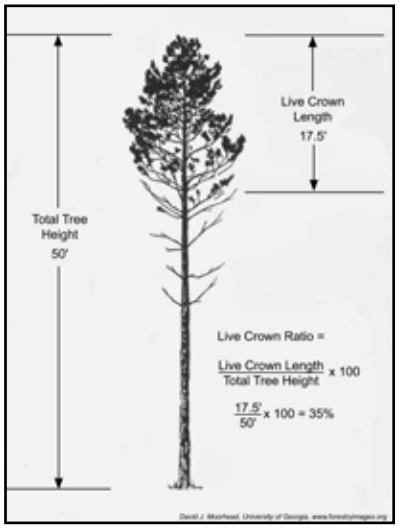
C.3.2 Commercial Thinning, Riparian Thinning, and Density Management

The OI units proposed for these treatments are listed in sections C.5.2 and C.5.3.

C.3.2.1 Present Conditions

Stand densities are high, with the number of trees per acre above the long-term carrying capacity of the site. In the forest stands identified for this type of treatment, the average relative density is 85% in the Trail Creek Project Area. At relative density levels greater than 60%, the following tree and stand changes begin to occur: competition-related mortality becomes significant, sensitivity to the effects of drought increases, self-thinning begins, growth declines, volume growth per acre is offset by mortality, and susceptibility to insect and disease attack increases. The tree species composition of these stands is a mixture of Douglas-fir, white fir, and minor amounts of ponderosa pine and sugar pine. Hardwood species include madrone and black oak.

C.3.2.2 Target Stand



The main objective within these stands is to improve individual tree and stand health. Harvesting within these units will be targeted toward reducing the stocking levels in those areas where overstocked conditions of sapling, pole, and mature timber exists. Density levels will be reduced by removing the suppressed crown class trees and increasing the spacing of the intermediate and dominant/codominant crown classes. Remaining trees will have crown ratios greater than 35% and will be the better-formed trees. Ponderosa pine, sugar pine, incense cedar, and Douglas-fir will make up the preferred leave species. Large (greater than 20" DBH), healthy ponderosa and sugar pine will be favored over equally healthy Douglas-fir (Figure C-5). The crowns of the retained pines should be full, with a minimum crown ratio of 35%, needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. The residual crown cover

Figure C-5. Density Management/Commercial Thinning/Riparian Thinning.
The target stand structure has reduced density levels with healthy ponderosa and sugar pine greater than 20" DBH favored.

of these stands will range within 40 to 60%. Large (greater than 12" DBH), healthy hardwoods (madrone and black oak) will remain as a scattered stand component. Removal of competing trees will provide the necessary top light required for the continued growth of these trees.

Survey and manage species may occur within the stands. Where species do occur, sites will be buffered and protected. These buffer patches will provide for additional structural diversity within stands.

All stage 1 and 2 snags greater than 20" DBH will remain for wildlife, future coarse woody debris, and structural diversity. To provide structural habitat and to maintain the existing microenvironment, trees immediately surrounding these stand components will be left.

Table C-2. Commercial Thinning, Riparian Thinning, and Density Management Treatment Schedule

Year	Treatment
0	Harvest Thin from below first, removing the suppressed component of the stand, followed by thinning the main canopy to reduce densities and remove any trees that are insect- or disease-infected or otherwise declining (based on crown ratio and form). Maintain residual stocking with a relative density of 25 to 45% or more and the following crown closures: **Commercial Thinning and Density Management**—minimum of 40% to a minimum of 60% **Riparian Thinning**—minimum of 50% (60% in riparian NRF habitat) Favored leave species are ponderosa pine, sugar pine, incense cedar, and Douglas-fir. Reserve ponderosa and sugar pine >20" DBH to maintain genetic and structural diversity. Use existing and widely spaced skid trails and directional falling to reduce impacts to the site and residual stands. Reserve 2 to 4 of the largest hardwoods (12" DBH or greater) per acre. As needed, hand pile heavy concentrations of slash; otherwise, lop and scatter. Slash all sprung, severely damaged, spindly crowned, low crown ratio (less than 40%) conifers and hardwoods between 1 and 7" DBH. **In Riparian Thinning units:** No logging equipment is allowed within riparian thinning areas. All logs would be cable winched to adjacent upland matrix lands. No trees greater than 20" DBH would be removed. No riparian hardwood species such as willow, ash, maple, alder, and black oak would be removed.
10-30	**Commercial Thinning and Density Management:** If the stand is less than 100 years old, conduct a stand exam to determine density levels. Evaluate the health of the stand for excess tree mortality and reduced radial growth. A second thinning entry would likely occur to maintain tree vigor and species diversity. If the stand is greater than 100 years old, it meets the RMP stand age requirement for a regeneration harvest. Evaluate for regeneration harvest. **Riparian Thinning:** No future treatments.

C.3.3 Restoration Thinning

The OI units proposed for this treatment are listed in section C.5.4.

C.3.3.1 Present Condition

The tree species composition of these stands is a mixture of Douglas-fir, ponderosa pine, sugar pine, incense cedar, and white fir at higher elevations. Hardwood species include madrone, chinquapin, and lesser amounts of black oak.

The shrub species present consists of Oregon grape (dwarf and piper's), deerbrush ceanothus, hazel, and oceanspray. In most units, shrub cover is low to moderate, occurring in patches or as a scattered vegetative component.

Many of the stands have been partially harvested over the past 40 years, resulting in the development of stands with multiple canopy layers. Stand densities are high, with the number of trees per acre above the long-term carrying capacity of the site. In high density stands, the following tree and stand changes are beginning to occur: competition-related mortality becomes significant, sensitivity to the effects of drought increases, self-thinning begins, growth declines, volume growth per acre is offset by mortality, and trees become more susceptible to insect and disease attack.

C.3.3.2 Target Stand

The objective of restoration thinning is to increase landscape resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change). High stand densities, high surface and ladder fuels, and low tree vigor tend to magnify rather than buffer the effects of environmental disturbances or changes. Density reduction that emphasizes the removal of smaller trees and vegetation reduces competition for nutrients and water and increases overall tree and stand vigor. Restoration treatments reduce stand susceptibility to excessive mortality from environmental disturbances (fire, insects, and disease) and increase the ability of forests to adapt to long-term environmental changes (climate). Following the harvest entry, stands will have reduced stand densities, continuous forest canopy, and structural diversity (Figure C-6). Trees greater than 150 years will be retained to provide structural complexity and a fire-resistant stand component. Vegetation below and adjacent to these larger and older trees would be removed to reduce competition-related stress by increasing available site resources. Structural diversity would be provided by retaining small unthinned patches and small openings (about 0.1 to 0.25 acre) within the stand. Coarse woody debris is present and provides conditions favorable for nutrient recycling, soil mychorrizae, and development of nitrogen-fixing bacteria. Cull trees have been left to ensure that a near-term "pulse" of coarse woody debris and snags will be available. All snags have been left and where available, large (>12" DBH), healthy hardwoods will remain as a scattered stand component. The estimated canopy cover following harvest will range from 45 to 75%.

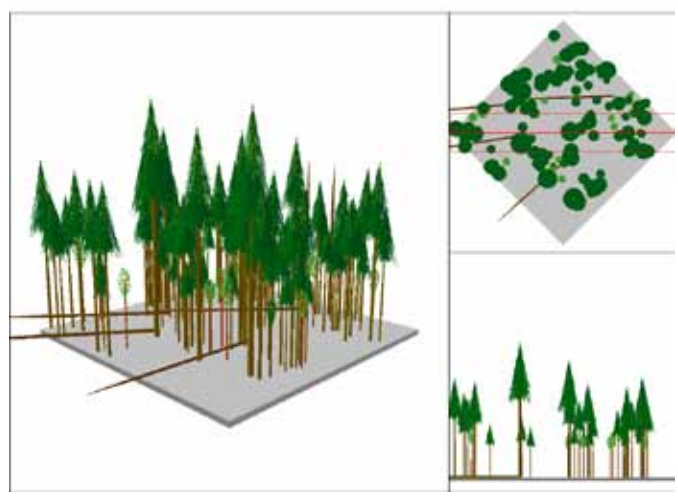


Figure C-6. Restoration Thinning.
The target stand structure has reduced stand densities, strives to retain old trees >150 years, maintains continuous canopy cover, favors drought-tolerant species, provides for structural diversity, and increases the average stand diameter.

Table C-3. Restoration Thinning Treatment Schedule

Year	Treatment
0	Harvest • On sites that receive 35" or less of precipitation per year (low elevation, generally less than 3,000 feet), stocking would be reduced to a relative density of 25% with an average residual basal area of 80 to 120 square feet. On sites that receive more than 35" of precipitation per year, stocking should be reduced to a relative density of 35% with an average residual basal area of 110 to 160 square feet. Spacing of remaining trees will vary and depend on the existing spatial arrangement of the desired trees within the stand. Residual canopy cover would be at least 40% under both relative density targets. • Strive to retain trees 150 years or older regardless of condition. • Remove competing vegetation (<150 years old) underneath the drip line of healthy Douglas-fir and incense cedar trees to increase survival potential. • For healthy, full-crowned ponderosa and sugar pine, strive to remove trees <150 years old within the root zone that are below the drip line and 10 feet from the edge of the drip line (approximately 20–30 feet from the bole of the tree). Pine species are more sensitive to high stand densities, particularly on sites less than 3,500 feet in elevation. • If the tree has a poor crown (crown ratio less than 25% and the crown has a thin, ragged appearance when viewed against the sky, poor needle color, and dead and dying twigs or branches forming holes in the crown), do not remove all the understory trees below the drip line; instead, thin the trees. • Increase within stand structural diversity by leaving small unthinned patches and creating small openings. Unthinned patches and small openings should range from 0.1 to 0.25 acre in size. Use existing stand diversity to identify and locate patches and openings. The shape of patches and openings should be irregular and spatially random in occurrence within the stand. Approximately 10–15% of the area should be a combination of unthinned patches and small openings. • Leave dominant, codominant, and intermediate trees with the best crown ratios. • Favor healthy ponderosa pine, sugar pine, incense cedar, and Douglas-fir over white fir. • Favor healthy ponderosa pine, sugar pine, and incense cedar over equally healthy Douglas-fir. The crowns of the retained pines and cedars should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Pine species with poor crowns, characterized by a ragged appearance as well as foliage that is bunchy and of poor color, should be removed if they are less than 150 years of age; do not retain. • When a “leave” tree has an adjoining tree that originates from the same root collar, leave all trees regardless of crown class or condition. • Retain neighboring trees that have their crowns intertwined with “leave” trees. Removal of these associated trees can cause crown damage, reduce wind stability, and increase overall tree stress. • Retain the largest hardwoods with full vigorous crowns to provide species diversity, canopy layers, and natural drought tolerance. Remove competing vegetation underneath the drip line to increase survival potential. • Leave all snags, stages 1–5. • Leave all coarse woody debris, decay classes 1–5. • Leave large (>20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat as well as future sources of coarse woody debris and snags.

Table C-3. Restoration Thinning Treatment Schedule

Year	Treatment
	• Thin or remove small trees <8” in diameter to meet residual stand density targets. • Hand pile heavy concentrations of slash. Otherwise, lop and scatter. • Slash all sprung, severely damaged, spindly crowned, low crown ratio (less than 40%) conifers and hardwoods between 1 and 7” DBH.
20-30	Conduct a stand exam to determine density levels. Evaluate the health of the stand for excess tree mortality and reduced radial growth. A second thinning entry may occur to maintain tree vigor and species diversity.

C.3.4 Small Diameter Thinning

The OI units proposed for this treatment are listed in section C.5.5.

C.3.4.1 Present Conditions

The ponderosa pine plantation was established on land that was clearcut in the 1960s. The plantation was established on a Douglas-fir series site where Douglas-fir is the dominant overstory tree as the stand approaches maturity. Over the past 50 years, the ponderosa pine has grown to an average dominant tree diameter of 11". Naturally seeded and planted conifer regeneration is present in the understory, creating a two-storied stand structure. The understory of smaller seedling to sapling size (0 to 5" diameter) Douglas-fir, incense cedar, ponderosa pine and white fir trees are present at varying density levels. This stand has a density of 175 trees per acre 8" or greater in diameter at breast height (DBH), and approximately 1450 trees per acre less than 8" DBH.

The Douglas-fir progeny test sites were established on land that was clearcut in the 1980s. The plantations were established on a Douglas-fir series site where Douglas-fir is the dominant overstory tree as the stand approaches maturity. Over the past 30 years, the Douglas-fir has grown to an average dominant tree diameter of 10". The stand has an even-aged structure, with few naturally seeded Douglas-fir present. The understory is primarily suppressed Douglas-fir. These stands have a density of approximately 200 trees per acre 8" DBH or greater, and approximately 350 trees per acre less than 8" DBH.

Mixed conifer stands are residual mixed conifer stands 100 years of age and greater that remain from stands that were partially cut between the 1950s and 1970s. At the time of harvest, selected merchantable trees were removed leaving pockets of trees greater than 8" in diameter. Trees less than 8" in diameter remained after harvest because they were not merchantable, and remained in pockets due to the mechanics of logging. Douglas-fir, ponderosa pine, hardwoods and other conifer species naturally seeded in. In some of the stands ponderosa pine seedlings were interplanted following harvest. The average over story diameter ranges from 12 to 17". Currently the stands are a mosaic of species, diameter**s**, and density levels. These mixed conifer stands presently have a density of approximately 100 to 140 trees per acre 8" DBH or greater, and 500 to 2,000 trees per acre less than 8" DBH.

C.3.4.2 Target Stand

The main objective within these stands is to improve individual tree health, increase species diversity and create within stand structure. This prescription aims to release dry forest species to create a stand more resilient to stand replacing wildfires and changing climate. Density levels will be reduced to levels the site has resources to support.

Ponderosa pine plantations: The stand density of conifers 8" DBH or greater would be reduced to 90-110 trees per acre, with a basal area range between 80-100 square feet per acre. The pine with off-site characteristics and smaller crowns would be removed. White fir 24" DBH and under would be removed. Rather than a grid harvesting pattern, the leave tree spacing would vary by focusing on leaving the healthiest most vigorous trees. The species preference for leave trees is (1) sugar pine, (2) Douglas-fir, (3) incense cedar, (4) ponderosa pine, and (5) white fir.

Hardwood tree species less than 12" DBH would be cut to reduce competition with remaining conifers. Hardwoods greater than 12" in diameter would remain. If ANY brush within an 8-foot radius of a leave conifer tree is more than half the height of the leave tree, then ALL the brush greater than 1 foot in height within the 8-foot radius would be cut. However, if NO brush within an 8-foot radius of a leave conifer tree is more than half the height of the leave tree, then NO brush within the 8-foot radius would be cut. Survey and manage species may occur within the stands. Where species do occur, sites would be buffered and protected. These buffer patches would provide for additional structural diversity within stands. Stage 1 and 2 snags greater than 16" DBH would remain for wildlife, future coarse woody debris, and structural diversity. No riparian species such as willow, ash, yew, maple, and California black oak would be removed.

Douglas-fir progeny test sites: The stand density of Douglas-fir would be reduced from 540 trees per acre to 200 trees per acre. The majority of Douglas-fir less than 8" DBH would be cut and the majority of Douglas-fir 8" and greater would remain. The primary focus is retaining a basal area between 100-110 square feet per acre of the larger, most vigorous Douglas-fir. Cut trees 4"DBH and greater would be extracted from stand and brought to the landing. The spacing would be roughly 16 feet by 16 feet, but the focus is on the basal area range and vigorous crown retention.

Mixed conifer stands: Varying amounts of precipitation in the mixed conifer stands affect the appropriate relative density for the stand. On sites that receive 35" of precipitation or more per year, stocking would be reduced to a relative density index of 40% with an average residual basal area of 140 square feet per acre (80-100 trees per acre). On south or west aspect sites that receive less than 35" of precipitation per year (low elevation, generally less than 3,000 feet), stocking would be reduced to a relative density of 30% with an average residual basal area of 80 to 120 square feet per acre (65-100 trees per acre). The average overstory diameter would range from 15 to 17" after harvest. Leave tree spacing would vary and depend on the existing spatial arrangement of the desired trees within the stand. Uniform grid spacing is not necessary; meeting the target basal area with trees having the desired characteristics (crown class, species and vigor) is the primary objective. The species preference for leave trees is (1) ponderosa pine, (2) sugar pine, (3) incense cedar, (4) Douglas-fir, and (5) white fir.

If necessary, brush greater than 1 foot high and cut conifers or hardwood trees less than 12" DBH that are significantly competing with the residual trees would be cut. Natural regeneration of Douglas-fir, incense cedar, sugar pine, ponderosa pine, and white fir less than 8" DBH would be thinned to leave approximately 200 trees per acre (16 foot by 16 foot spacing) in the understory. Rather than a grid harvesting pattern, the leave tree spacing would vary by focusing on leaving the healthiest most vigorous trees. The species preference for leave trees follows is (1) ponderosa pine, (2) sugar pine, (3) incense cedar, (4) Douglas-fir, and (5) white fir. Survey and manage species may occur within the stands. Where species do occur, sites would be buffered and protected. These buffer patches would provide for additional structural diversity within stands. Stage 1 and 2 snags greater than 16″ DBH would remain for wildlife, future coarse woody debris, and structural diversity. Riparian species such as willow, ash, yew, maple, and California black oak would not be removed.

Table C-4. Small Diameter Thinning Treatment Schedule

Year	Treatment
0	Harvest • Thin from below first, removing the suppressed component of the stand, followed by the thinning of the main canopy to reduce densities and remove trees that are insect- or disease-infected or otherwise declining (based on crown ratio and form). In pine stands, remove pine showing off-site characteristics. Leave tree spacing will vary and depend upon the health of the trees, and the areas that show off-site characteristics. In mixed conifer stands, uniform spacing is not desired. Leave tree spacing will vary and depend on the existing spatial arrangement of trees with the desired leave tree characteristics (crown class, species, and vigor). • In mixed conifer stands that receive 35" of precipitation per year or more and in Douglas-fir progeny test sites, maintain residual stocking with a relative density of 40% and minimum crown closures of 40 to 60%. • In ponderosa pine and white oak plant series and in mixed conifer stands on south and west aspects that receive less than 35" of precipitation per year, maintain residual stocking with a relative density index of 30% and crown closures approximately 40%. • Increase within stand structural diversity by leaving unthinned patches and creating small gaps. Patch size should range in size from 0.1 to 0.25 acre (equal to 37- to 59-foot radius). Approximately 10 to 15% of the treatment area should be in unthinned patches and gaps. • Species preferences for the ponderosa pine plantations are sugar pine, Douglas-fir, incense cedar, ponderosa pine, and white fir. • Species preferences for mixed conifer stands are ponderosa pine, sugar pine, incense cedar, Douglas-fir, and white fir. • Avoid cutting trees >24" DBH. • Use existing skid trails to reduce impacts to the site and the residual trees. • Reserve hardwoods 12" DBH and greater. • Hand pile heavy concentrations of slash. Otherwise, lop and scatter.
30	Conduct a stand exam to determine density levels. Evaluate the health of the stand for excess tree mortality and reduced radial growth. A second thinning entry would likely occur to maintain tree vigor and species diversity

C.4 Monitoring

Implementing the Standards and Guidelines in the Northwest Forest Plan and management direction contained within the Medford District ROD/RMP requires a monitoring system to ensure effective on-the-ground results. The Northwest Forest Plan (p. E-1) states “Monitoring is an essential component of natural resource management because it provides information on the relative success of management strategies. The implementation of these standards and guidelines will be monitored to ensure that management actions are meeting the objectives of the prescribed standards and guidelines, and that they comply with laws and management policy. Monitoring will provide information to determine if the standards and guidelines are being followed (implementation monitoring), verify if they are achieving the desired results (effectiveness monitoring), and determine if underlying assumptions are sound (validation monitoring). Some effectiveness and most validation monitoring will be accomplished by formal research.”

Monitoring of the proposed actions will follow the outline in the Medford District's 1995 ROD/RMP (p. 225–248). Monitoring will be specific to the land allocations and resources affected in the Trail Creek fifth field watershed.

Monitoring should

- detect changes in ecological systems from both individual and cumulative management actions and natural events,
- provide a basis for natural resources policy decisions,
- provide standardized data,
- compile information systematically,
- link overall information management strategies for consistent implementation,
- ensure prompt analysis and application of data in the adaptive management process, and
- distribute results in a timely manner.

Monitoring begins with resource assessment and data collection, which describes the existing conditions prior to management actions. Data collection is in the form of sampling which provides a representative description of the proposed treatment area. ORGANON data plots were established in the proposed Project Area. Within stands, a systematic sampling grid was used to establish plot centers. From the plot centers a variable plot and two nested fixed plots were used to record tree and site data.

This information is used in the ORGANON program to generate a variety of analysis reports. These reports provide a description of stand characteristics (e.g., species composition, diameter distribution, densities, and canopy closure). Post-harvest monitoring can then be implemented, using the preharvest stand information to determine if the objectives have been met.

C.5 Trail Creek Marking Guidelines

Table C-5. Summary of Timber Harvest Objectives

Alternative 2—Maintain dispersal and NRF habitat within the home ranges of the northern spotted owl. Outside of the 1.3-mile home ranges (approximately 206 acres), this alternative would implement Medford District RMP management direction for Matrix land.
Alternatives 3 and 4—Increase landscape resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change) by reducing stand densities, retaining old trees, favoring drought-tolerant species, and increasing structural complexity while maintaining northern spotted owl habitat within known home ranges.

Table C-6. Summary of Small Diameter Thinning Objectives

Management Direction from Medford District ROD/RMP
On Matrix lands, produce a sustainable supply of timber and other forest commodities to provide jobs and contribute to community stability. Emphasis would be placed on use of intensive forest management practices and investments to maintain a high level of sustainable resource production while maintaining long-term site productivity, biological legacies (retained green trees, snags, and coarse woody debris), and a biologically diverse forest matrix. In NGFMA forest stands less than 100 years old, small diameter thinning would reduce the density of forest stands with the objectives of increasing stand vigor, reducing mortality of desired stand components, increasing stand structure, and reducing susceptibility to insects and disease attack and spread. On TPCC withdrawn lands, a majority of the acreage is on ground that cannot produce viable commercial volume due to the low productivity of the site or the topography, such as rocky ground. Portions of OI units on TPCC withdrawn lands have become overgrown, possibly due to better conditions; those stands are proposed for thinning. The objective of this treatment is increasing species diversity and multi-layered structure important for wildlife, increasing stand vigor, reducing mortality of desired stand components, and reducing susceptibility to insects and disease attack and spread. These stands are lacking structure important for the northern spotted owl. Most of the stand is in a single-layer structure. Small diameter thinning in these TPCC withdrawn stands would release larger diameter trees and produce a multi-layered structure by creating space for a new group of trees. Thinning the stand would increase diameter growth in the remaining trees; their growth may be stagnated if untreated. Larger diameter trees are a component of functioning northern spotted owl habitat. The TPCC withdrawn stands proposed for treatment are in close proximity to other vegetative treatments (fuels, timber units) and would contribute to more of a landscape-level restoration treatment for the watershed. Landscape-level treatments are important for fire resiliency and in providing more continuity in the fragmented landscape. With these stands bordering timber sale units that have potential NSO habitat or will be managed to enhance NSO habitat, the fire threat should be reduced in the withdrawn stands so fire can be slowed, or not carry into the potential NSO habitat. Within the RMP (p. 72), timber harvest in TPCC withdrawn ground can be used to enhance resources such as wildlife habitat and riparian habitat. Thinning within riparian areas would release larger diameter trees for future recruitment of large woody material in the streams, which is necessary for complex riparian habitat. The creation of structure through these riparian reserves helps promote more complex, healthy riparian habitat.
Treatment Objectives
High stand densities in younger ponderosa pine plantations, Douglas-fir progeny test sites, and mixed conifer stands have resulted in slow or stagnant growth rates. These stands are overstocked with more trees than the site has water, nutrients, and growing space to sustain. High densities result in declining tree vigor and growth, increased tree mortality, and increased susceptibility to insect attack, root disease infection, and stand-replacing wildfires. To reduce competition-related mortality and to increase forest health and tree vigor, the number of trees per acre needs to be reduced. By decreasing stand densities, more water, nutrients, and growing space would be available for the remaining trees. To restore these stands toward a more natural species mix, thinning is needed to release established natural regeneration of Douglas-fir, incense cedar and pine, or to create space for the planting of Douglas-fir and incense cedar. Species diversity is a key component of healthy forests by providing unique habitats, increased genetic variability, and vegetative conditions that are more resilient to environmental extremes and disturbances.

C.5.1 Regeneration Harvest—Alternative 2

C.5.1.1 Northern GFMA Regeneration Harvest

The following are minimum requirements for northern GFMA regeneration harvest:

- Leave 1.8 snags per acre. Snags are any standing dead (stage 1 and 2) (Table C-29, partially dead, or defective (conks) tree.
- Maintain 120 linear feet of coarse woody debris (see Table C-28).
- Retain 6 to 8 green conifers per acre greater than 20" DBH (proportionally representing the total range of tree sizes greater than 20" DBH). Spatial distribution of leave trees should be based on tree condition (live crown ratio and crown form), as opposed to leaving trees based on a distance grid. Let tree condition dictate where trees are left. Leave trees should have the following attributes: (a) low susceptibility to wind, snow, and ice damage measured by a height-to-diameter ratio of 70 or below; (b) crown ratio greater than 35% with a healthy crown, dark foliage, and dense needles; (c) disease-free (specifically mistletoe-free) Douglas-fir; and (d) healthy seral species such as ponderosa pine, sugar pine, and incense cedar, where possible. Discriminate against white fir.
- Retain large hardwoods greater than 16" DBH.
- Use crown vigor, not tree diameter, as the deciding factor for marking a tree.
- Promote stand diversity and patchiness; units do not have to be uniform in appearance.

Table C-7. NGFMA Regeneration Harvest Units

T32S, R1W, Section 21; T33S, R1W, Sections 22 and 29			
21-3	21-4	22-1	29-1

C.5.1.2 Shelterwood Retention Regeneration Harvest

The following are minimum requirements for shelterwood retention regeneration harvest:

- 1.8 snags per acre. Snags are any standing dead (stage 1 and 2) (Table C-29), partially dead, or defective (cull) tree.
- 120 linear feet of CWD (see Table C-28).
- 12-25 green conifers per acre greater than 20" DBH (proportionally representing the total range of tree sizes greater than 20" DBH). To the greatest extent possible the spatial distribution of leave trees should be based on a grid pattern to provide “shelter.” Variances in spacing are allowed in order to leave the best conifers with the largest crowns. It is more important to leave a healthy, full-crowned overstory tree than to meet rigid spacing criteria. Leave trees should have the following attributes: (a) low susceptibility to wind, snow, and ice damage, as measured by a height-to-diameter ratio of 70 or below; (b) crown ratio greater than 35% with a healthy crown, dark foliage, and dense needles; (c) disease free; and (d) healthy seral species such as Douglas-fir, ponderosa pine, sugar pine, and incense cedar.
- Retain large hardwoods greater than 16" DBH.

Table C-8. Shelterwood Retention Regeneration Harvest Unit

T33S, R2W, Section 23
23-1

C.5.1.3 Southern GFMA Regeneration Harvest

The following are minimum requirements for southern GFMA regeneration harvest:

- Leave 1.8 snags per acre. Snags are any standing dead (stage 1 and 2) (Table C-29), partially dead, or defective (conks) tree.
- Maintain 120 linear feet of coarse woody debris (see Table C-28).
- Retain 16 to 25 green conifers per acre greater than 20" DBH (proportionally representing the total range of tree sizes greater than 20" DBH). Spatial distribution of leave trees should be based on tree condition (live crown ratio and crown form), as opposed to leaving trees based on a distance grid. Let tree condition dictate where trees are left. Leave trees should have the following attributes: (a) low susceptibility to wind, snow, and ice damage measured by a height-to-diameter ratio of 70 or below; (b) crown ratio greater than 35% with a healthy crown, dark foliage, and dense needles; (c) disease-free (specifically mistletoe-free) Douglas-fir; and (d) healthy seral species such as ponderosa pine, sugar pine, and incense cedar, where possible.
- Retain large hardwoods greater than 16" DBH.
- Use crown vigor, not tree diameter, as the deciding factor for marking a tree.
- Promote stand diversity and patchiness; units do not have to be uniform in appearance.

Table C-9. SGFMA Regeneration Harvest Units

T34S, R2W, Section 1	
1-1	1-2

C.5.2 Commercial Thinning, Density Management, and Riparian Thinning—Alternative 2

C.5.2.1 Commercial Thinning with a Minimum 40% Canopy Cover After Harvest

- Reduce density to accelerate the growth of dominant, codominant, and minor amounts of intermediate trees is the primary objective in these stands.
- Thin from below in second growth stands/clumps; low vigor codominant or dominant trees may be removed to reduce density and if tree vigor is lower than adjacent trees.
- Reduce stocking to a relative density ranging from 25 to 35% with the average residual basal area of treated stands between 90 and 140 square feet per acre. Spacing will vary depending on tree diameter and vigor. See Table C-10 for the target basal area for each stand.
- Leave dominant and codominant trees with the best crown ratios.
- Favor healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar over white fir.
- Favor large (>20" DBH), healthy ponderosa and sugar pine over equally healthy Douglas-fir. The crowns of the retained pines should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Pine species with poor crowns, characterized by a ragged appearance and foliage that is bunchy and of poor color should be removed; do not retain.
- Leave existing snags, stages 1-5 (Table C-29). When available, leave green trees (any diameter) immediately adjacent to snags greater than 20' DBH. These trees will provide additional structural and habitat diversity.

- Leave existing coarse woody debris, decay classes 1-5 (Table C-27). When available, leave green trees (any diameter) immediately surrounding large (>20" DBH and 8-feet long) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.
- Minimize felling large (>20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat as well as future sources of coarse woody debris and snags.

Table C-10. Alternative 2—Target Basal Area for Commercial Thinning Units

T32S, R1W, Section 19; T33S, R1W, Section 7; T33S, R2W, Section 3; T34S, R2W, Section 1								
Unit	**19-1**	**19-2**	**19-3**	**19-4**	**19-5**	**19-6**	**19-7**	**19-8**
Target Basal Area (sq. ft./acre)	130	130	130	130	130	130	140	140
Unit	**19-9**	**19-10**	**7-1**	**7-2**	**3-8**	**1-1**	**1-2**	
Target Basal Area (sq. ft./acre)	130	130	100	100	140	90	90	

C.5.2.2 Density Management with a Minimum of 40% or 60% Canopy Cover After Harvest

- Reduce stand density while maintaining dispersal habitat (40% canopy closure minimum) and nesting, roosting, and foraging habitat (60% canopy closure minimum) for the northern spotted owl. Density reduction will accelerate growth of dominant, codominant, and minor amounts of intermediate trees.
- Thin from below in second growth stands/clumps; low vigor codominant or dominant trees may be removed to reduce density and if tree vigor is lower than adjacent trees.
- Reduce stocking to a relative density ranging from 25 to 45% with residual basal area of treated stands ranging between 90 and 190 square feet per acre. Spacing will vary depending on tree diameter and vigor. See Tables C-11 and C-12 for the target basal area for each stand.
- Leave dominant and codominant trees with the best crown ratios.
- Favor healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar over white fir.
- Favor large (>20" DBH), healthy ponderosa and sugar pine over equally healthy Douglas-fir. The crowns of the retained pines should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Pine species with poor crowns, characterized by a ragged appearance as well as foliage that is bunchy and of poor color, should be removed; do not retain.
- Leave existing snags, stages 1-5 (Table C-29). When available, leave green trees (any diameter) immediately adjacent to snags that are greater than 20" DBH. These trees will provide additional structural and habitat diversity.
- Leave existing coarse woody debris, decay classes 1-5 (see Table C-27). When available, leave green trees (any diameter) immediately surrounding large (>20" DBH and 8-feet long) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.
- Minimize the harvest of large (>20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat, as well as future sources of coarse woody debris and snags.

Table C-11. Alternative 2—Target Basal Area for Density Management with a Minimum 40% Canopy Cover After Harvest

T32S, R1W, Sections 21, 27, 29, 30, 31, and 33; T33S, R1W, Sections 3, 7, 9, 10, 15, 17, 18, 19, and 31; T33S, R2W, Sections 3, 23, and 25										
Unit	**21-2**	**21-6**	**21-8**	**21-10**	**27-2**	**29-1**	**29-2**	**29-4**	**29-7**	**29-8**
Target Basal Area (sq. ft./acre)	140	160	150	160	170	130	130	150	140	120
Unit	**29-9**	**29-10**	**30-2**	**30-3**	**31-3**	**31-4**	**31-5**	**31-6**	**31-8**	**31-9**
Target Basal Area (sq. ft./acre)	120	130	140	140	140	150	150	150	130	130
Unit	**31-10**	**31-11**	**33-2**	**33-4**	**33-5**	**3-1**	**3-2**	**3-3**	**7-3**	**7-4**
Target Basal Area (sq. ft./acre)	120	120	130	120	120	160	160	160	100	100
Unit	**9-2**	**9-3**	**9-4**	**9-5/6**	**10-2**	**10-3**	**10-4**	**15-1**	**15-2**	**17-2**
Target Basal Area (sq. ft./acre)	90	90	90	100	150	150	150	140	90	90
Unit	**18-1**	**19-1**	**31-1**	**3-1**	**3-2**	**3-6**	**3-8**	**3-9**	**23-1**	**25-1**
Target Basal Area (sq. ft./acre)	100	120	90	150	150	140	140	140	100	100
Unit	**25-2**	**25-3**								
Target Basal Area (sq. ft./acre)	110	110								

Table C-12. Alternative 2—Target Basal Area for Density Management with a Minimum 60% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, 27, 28, 29, 30, 31, 33, and 34; T33S, R1W, Sections 7, 9, 10, 17, 18, 19, and 30; T33S, R2W, Section 3; T34S, R2W, Section 1									
Unit	**19-8**	**21-1**	**21-2**	**21-3**	**21-4**	**21-5**	**21-7**	**21-8**	**21-9**
Target Basal Area (sq. ft./acre)	150	150	140	180	150	160	150	140	170
Unit	**27-1**	**27-2**	**28-1**	**29-3**	**29-5**	**29-7**	**29-8**	**29-11**	**30-1**
Target Basal Area (sq. ft./acre)	190	190	180	140	160	140	140	140	140
Unit	**30-2**	**31-1**	**31-2**	**31-5**	**31-7**	**31-9**	**31-12**	**33-1**	**33-3**
Target Basal Area (sq. ft./acre)	140	150	140	150	160	140	160	130	150
Unit	**34-1**	**7-3**	**7-4**	**9-1**	**10-1**	**10-4**	**10-5**	**17-1**	**18-1**
Target Basal Area (sq. ft./acre)	160	140	140	160	150	150	130	130	130
Unit	**19-2**	**30-1**	**30-2**	**3-3**	**3-4**	**3-5**	**3-7**	**3-10**	**1-1**
Target Basal Area (sq. ft./acre)	150	130	130	160	160	160	170	160	120

C.5.2.3 Riparian Thinning

- Within the 170-foot riparian reserve, establish a 60-foot-wide or larger no-treatment area on each side of the stream channel; the outer 110 feet or less will be thinned.
- Retain a minimum 50% canopy cover (60% in northern spotted owl nesting, roosting, and foraging habitat).
- Thin from below in second growth stands/clumps; low vigor codominant or dominant trees (<20" DBH) may be removed to reduce density and if tree vigor is lower than adjacent trees.
- Stocking will be reduced to a relative density ranging from 25 to 35% with the average residual basal area of treated stands between 130 and 180 square feet per acre. Spacing will vary depending on tree diameter and vigor. See Table C-13 and 14 for the target basal area for each stand.
- Leave dominant and codominant trees with the best crown ratios.
- Leave riparian hardwood species such as willow, ash, maple, alder, and black oak.
- Favor healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar over white fir.
- Leave existing snags, stages 1-5 (Table C-29). When available, leave green trees (any diameter) immediately adjacent to snags that are greater than 20" DBH. These trees will provide additional structural and habitat diversity.
- Leave all coarse woody debris, decay classes 1-5 (see Table C-27). When available, leave green trees (any diameter) immediately surrounding large (>20" DBH and 8-feet long) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.

Table C-13. Alternative 2—Target Basal Area for Riparian Thinning Units with a Minimum 50% Canopy Cover After Harvest

T32S, R1W, Section 19, 21, and 31							
Unit	**19-1**	**19-2**	**19-3**	**19-5**	**19-6**	**19-7**	**19-8**
Target Basal Area (sq. ft./acre)	130	130	130	130	130	140	140
Unit	**19-9**	**19-10**	**21-2**	**21-6**	**21-8**	**31-11**	
Target Basal Area (sq. ft./acre)	130	130	140	160	150	120	

Table C-14. Alternative 2—Target Basal Area for Riparian Thinning Units with a Minimum 60% Canopy Cover After Harvest

T32S, R1W, Sections 21 and 29							
Unit	**19-8**	**21-2**	**21-3**	**21-4**	**21-5**	**29-3**	**29-11**
Target Basal Area (sq. ft./acre)	150	140	180	150	160	140	140

C.5.3 Restoration Thinning with a Minimum 40% and 60% Canopy Cover After Harvest—Alternatives 3 and 4.

The primary objective for these stands is to increase landscape resiliency to environmental disturbances (e.g., fire, insects, disease, and climate change) and create structural diversity. Restoration thinning will maintain dispersal (minimum 40% canopy closure) and nesting, roosting and foraging (minimum 60% canopy

closure) habitat for the northern spotted owl. Restoration thinning will accelerate growth of dominant, codominant, and minor amounts of intermediate trees. Thin from below in second growth stands/clumps; low vigor codominant or dominant trees may be removed to reduce density and if tree vigor is lower than adjacent trees.

- Reduce stocking to an average relative density of 35% in sites that receive more than 35" of precipitation annually, and 25% in sites that receive 35" or less precipitation annually.
- The residual basal area of treated stands will range between 90 and 190 square feet per acre. Spacing will vary depending on tree diameter and vigor. See Tables C-15 and C-16 for the target basal area for each stand.
- Leave dominant and codominant trees with the best crown ratios.
- Favor healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar over white fir.
- Favor large (>20" DBH), healthy ponderosa and sugar pine over equally healthy Douglas-fir. The crowns of the retained pines should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Pine species with poor crowns, characterized by a ragged appearance as well as foliage that is bunchy and of poor color, should be removed; do not retain.
- Strive to retain trees 150 years or older regardless of condition.

Increase within stand structural diversity by leaving small unthinned patches and creating small openings.

- Unthinned patches and small openings should range in size from 0.1 to 0.25 acre (equal to 3- to 59-foot radius). They should be irregular in shape and spatially random in occurrence within the stand.
- Approximately 10 to 15% of the area treated should be a combination of unthinned patches and small openings.
- Unthinned patches could be left adjacent to snags; large coarse woody debris; deformed trees; and existing dense pockets, seeps, or hardwood clumps. Canopy openings could be created where vigorous understory regeneration is present, in root rot pockets, or in areas of lower site productivity.

Retain the largest hardwoods with full vigorous crowns for species diversity, canopy layers, and natural drought tolerance.

Leave snags, stages 1-5 (Table C-29). When available, leave green trees (any diameter) immediately adjacent to snags that are greater than 20" DBH. These trees will provide additional structural and habitat diversity.

Leave coarse woody debris, decay classes 1-5 (Table C-27). When available, leave green trees (any diameter) immediately surrounding large (greater than 20" DBH and 8" in length) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.

Minimize the harvest of large (>20" DBH), broken, forked-top, and deformed trees. Retain for plant and animal habitat, as well as future sources of coarse woody debris and snags.

Table C-15. Alternatives 3 and 4—Target Basal Area for Restoration Thinning with a Minimum 40% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, 27, 29, 30, 31, and 33; T33S, R1W, Sections 3, 7, 9, 10, 15, 17, 18, 19, 22, and 31; T33S, R2W, Sections 3, 23, and 25; T34S, R2W, Section 1									
Unit	**19-1**	**19-2**	**19-3**	**19-4**	**19-5**	**19-7**	**19-8**	**19-9**	**19-10**
Target Basal Area (sq. ft./acre)	130	130	130	130	130	140	140	130	130
Unit	**21-2**	**21-6**	**21-8**	**21-10**	**27-2**	**29-1**	**29-2**	**29-4**	**29-7**
Target Basal Area (sq. ft./acre)	140	160	140	160	170	130	130	150	140
Unit	**29-8**	**29-9**	**29-10**	**30-2**	**30-3**	**31-3**	**31-4**	**31-5**	**31-6**
Target Basal Area (sq. ft./acre)	120	120	130	140	140	140	150	150	150
Unit	**31-8**	**31-9**	**31-10**	**31-11**	**33-2**	**33-4**	**33-5**	**3-1**	**3-2**
Target Basal Area (sq. ft./acre)	130	130	120	120	130	120	120	160	160
Unit	**3-3**	**7-2**	**7-4**	**9-2**	**9-3**	**9-4**	**9-5**	**9-6**	**10-2**
Target Basal Area (sq. ft./acre)	160	100	100	90	90	90	100	100	150
Unit	**10-3**	**10-4**	**15-1**	**15-2**	**17-2**	**18-1**	**19-1**	**22-1**	**31-1**
Target Basal Area (sq. ft./acre)	150	150	140	90	90	100	120	100	90
Unit	**3-1**	**3-2**	**3-6**	**3-8**	**3-9**	**23-1**	**25-1**	**25-2**	**25-3**
Target Basal Area (sq. ft./acre)	150	150	140	140	140	100	100	110	110
Unit	**1-1**	**1-2**							
Target Basal Area (sq. ft./acre)	90	90							

Table C-16. Alternatives 3 and 4—Target Basal Area for Restoration Thinning with a Minimum 60% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, 27, 28, 29, 30, 31, 33, and 34; T33S, R1W, Sections 7, 9, 10, 17, 18, 19, and 30; T33S, R2W, Section 3; T34S, R2W, Section 1									
Unit	**19-6**	**19-7**	**19-8**	**21-1**	**21-2**	**21-3**	**21-4**	**21-5**	**21-7**
Target Basal Area (sq. ft./acre)	140	150	150	150	140	180	150	160	150
Unit	**21-8**	**21-9**	**27-1**	**27-2**	**28-1**	**29-3**	**29-5**	**29-7**	**29-8**
Target Basal Area (sq. ft./acre)	140	170	190	190	180	140	160	140	140
Unit	**29-11**	**30-1**	**30-2**	**31-1**	**31-2**	**31-5**	**31-7**	**31-9**	**31-12**
Target Basal Area (sq. ft./acre)	140	140	140	150	140	150	160	140	160
Unit	**33-1**	**33-3**	**34-1**	**7-1**	**7-3**	**7-4**	**9-1**	**10-1**	**10-4**
Target Basal Area (sq. ft./acre)	130	150	160	130	140	140	160	150	150

Table C-16. Alternatives 3 and 4—Target Basal Area for Restoration Thinning with a Minimum 60% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, 27, 28, 29, 30, 31, 33, and 34; T33S, R1W, Sections 7, 9, 10, 17, 18, 19, and 30; T33S, R2W, Section 3; T34S, R2W, Section 1									
Unit	**10-5**	**17-1**	**18-1**	**19-2**	**30-1**	**30-2**	**3-7**	**3-10**	**1-1**
Target Basal Area (sq. ft./acre)	130	130	130	150	130	130	170	160	120
Unit	**3-3**	**3-4**	**3-5**						
Target Basal Area (sq. ft./acre)	160	160	160						

C.5.4 Riparian Thinning—Alternatives 3 and 4

- Within the 170-foot riparian reserve, establish a 60-foot-wide or larger no-treatment area on each side of the stream channel; the outer 110 feet or less will be thinned.
- Retain a minimum 50% canopy cover (60% in northern spotted owl nesting, roosting, and foraging habitat).
- Thin from below in second growth stands/clumps; low vigor codominant or dominant trees (<20" DBH) may be removed to reduce density and if tree vigor is lower than adjacent trees.
- Reduce stocking to a relative density ranging from 25 to 35% with the average residual basal area of treated stands between 120 and 180 square feet per acre. Spacing will vary depending on tree diameter and vigor. See Table C-17 and 18 for the target basal area for each stand.
- Increase within stand structural diversity by leaving small unthinned patches and creating small openings.
    - Unthinned patches and small openings should range in size from 0.1 to 0.25 acre (equal to 3- to 59-foot radius). They should be irregular in shape and spatially random in occurrence within the stand.
    - Approximately 10 to 15% of the area treated should be a combination of unthinned patches and small openings.
    - Unthinned patches could be left adjacent to snags; large coarse woody debris; deformed trees; and existing dense pockets, seeps, or hardwood clumps. Canopy openings could be created where vigorous understory regeneration is present, in root rot pockets, or in areas of lower site productivity.
- Leave dominant and codominant trees with the best crown ratios.
- Leave riparian hardwood species such as willow, ash, maple, alder, and black oak.
- Favor healthy ponderosa pine, sugar pine, Douglas-fir, and incense cedar over white fir.
- Leave all snags, stages 1-5 (Table C-29). When available, leave green trees (any diameter) immediately adjacent to snags that are greater than 20" DBH. These trees will provide additional structural and habitat diversity.
- Leave all coarse woody debris, decay classes 1-5 (Table C-27). When available, leave green trees (any diameter) immediately surrounding large (>20" DBH and 8-feet long) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.

Table C-17. Alternatives 3 and 4—Target Basal Area for Riparian Thinning with a Minimum 50% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, and 31								
Unit	**19-1**	**19-2**	**19-3**	**19-5**	**19-7**	**19-8**	**19-9**	**19-10**
Target Basal Area (sq. ft./acre)	130	130	130	130	140	140	130	130
Unit	**21-2**	**21-6**	**21-8**	**31-10**	**31-11**			
Target Basal Area (sq. ft./acre)	140	160	140	120	120			

Table C-18. Alternatives 3 and 4—Target Basal Area for Riparian Thinning with a Minimum 60% Canopy Cover After Harvest

T32S, R1W, Sections 19, 21, and 29					
Unit	**19-6**	**19-7**	**19-8**	**21-2**	**21-3**
Target Basal Area (square feet/acre)	140	150	150	140	180
Unit	**21-4**	**21-5**	**21-8**	**29-3**	**29-11**
Target Basal Area (square feet/acre)	150	160	140	140	140

C.5.5 Small Diameter Thinning—Alternatives 2, 3, and 4

Density reduction and increasing species diversity and creating stand structure are the primary objectives in these stands. Thin from below to accelerate the growth of dominant and codominant trees and to release smaller understory seedling and sapling-sized Douglas-fir, incense cedar, sugar pine, and ponderosa pine.

- Reduce stocking to a residual basal area between 80 and 100 square feet per acre in ponderosa pine stands. This basal area target is flexible and allows heavier thinning in parts of the stand that have ponderosa pine with off-site characteristics such as see-through crowns, multiple tops, fox tail bunching of needles at branch ends, branch dieback, and light green foliage. Remove pine that show off-site characteristics and remove most of white fir. Retain all healthy Douglas-fir. Reduce stocking to 80-110 trees per acre greater than 8" DBH for all species.
- Reduce stocking to a residual basal area between 100 and 110 square feet per acre in the Douglas-fir plantations. The stand density of Douglas-fir would be reduced from 540 trees per acre to 200 trees per acre. Cut the majority of Douglas-fir less than 8" DBH and leave most Douglas-fir 8" DBH and greater. Extract harvested trees 4" DBH and greater from the stand and bring to the landing. The spacing would be roughly 16 feet by 16 feet, but the focus is on the retaining the 100-110 square-foot basal area with the most vigorous, larger diameter Douglas-fir.
- In mixed conifer stands that receive 35" of precipitation or more per year, reduce stocking to a 40% relative density index with the average residual conifer basal area of 140 square feet per acre (or ranging between 80-150 trees per acre). In mixed conifer stands on south or west aspects that receive less than 35' of precipitation per year, reduce stocking to a 30% relative density index with the average residual conifer basal area of treated stands between 60 to 110 square feet per acre (or ranging from 60-130 trees per acre). See Table C-20 for individual stand basal areas. Leave tree spacing will vary and depend on the existing spatial arrangement of the desired trees within the stand. Uniform grid spacing is not necessary; meeting the target basal area with trees having the desired characteristics (crown class, species and vigor) is the primary objective. Thin heavier

around healthy dry forest species (sugar pine, ponderosa pine, incense cedar, Oregon white oak, and California black oak) to help their release.

- Leave dominant and codominant trees with the best crown ratios.
- Favor healthy ponderosa pine, sugar pine, incense cedar, and Douglas-fir over white fir. The crowns of the retained trees should be full, with a minimum crown ratio of 35%. Needles should be dark green, crown tops should be pointed (not rounded), and there should be no evidence of resin flow on the upper bole of sugar pine. Leave trees greater than 24" DBH.
- In stands greater than 5 acres, increase within-stand structural diversity by leaving unthinned patches and creating small gaps. Patch size should range from 0.1 to 0.25 acre (equal to 37- to 59-foot radius). Approximately 10-15% of the treatment area should be in unthinned patches and gaps. The gaps can be created by clearing around large, healthy dry forest species such as ponderosa pine, sugar pine, and incense cedar, and Oregon white oak. May also be created in pockets of trees with short, see-through crowns, and in insect or disease pockets.
- In post-harvest stands that have a dense conifer understory present, thin trees less than 8" in diameter to leave approximately 200 trees per acre (16-foot by 16-foot spacing). Favor healthy ponderosa pine, sugar pine, incense cedar, and Douglas-fir over white fir. Uniform grid spacing is not necessary; consider the crown class, species, and vigor of leave trees.
- Leave snags 12" and greater, stages 1-5 (Table C-29), if they are not considered a hazard to operations and unit access. When available, leave green trees (any diameter) immediately adjacent to snags greater than 16" DBH. These trees will provide additional structural and habitat diversity.
- Leave coarse woody debris 12' and greater, decay classes 1-5 (Table C-27). When available, leave green trees (any diameter) immediately surrounding large (greater than 20" DBH and 8' long) pieces of coarse woody debris. Retention of green trees would minimize coarse woody debris disturbance and maintain the functional integrity of the coarse woody debris.
- Do not remove riparian species such as willow, ash, yew, maple, and California black oak.

Table C-19. Trail Creek Proposed Small Diameter Thinning Units

Legal Description	OI Unit	Acres	Stand Type	RMP Land Allocation
T33S, R1W, sec. 3	3-1*	22	Ponderosa Pine	Matrix
T33S, R1W, sec. 9	9-1	4	Mixed Conifer >35" precipitation	TPCC Withdrawn
T33S, R2W, sec. 3	3-2A*	4	Douglas-fir	Matrix
	3-2B*	4	Douglas-fir	Matrix
T33S, R2W, sec. 15	15-1	57	Mixed Conifer <35" precipitation	Matrix
T34S, R2W, sec. 1	1-1*	33	Mixed Conifer <35" precipitation	TPCC Withdrawn
	Total	**124**		

* Stands have an adjacent riparian reserve area to be thinned. A no-disturbance buffer of 35 feet adjacent to either side of non-fish-bearing streams and 60 feet adjacent to either side of fish-bearing streams would be maintained.

Table C-20. Trail Creek Small Diameter Thinning Unit Targets

Legal Description	Unit #	Basal Area >8″ DBH (sq. ft./acre)		Canopy Closure (%)	
		Current	Target	Current	Target
T33S, R1W, sec. 3	3-1	120	80-100	87	40
T33S, R1W, sec. 9	9-1	200	140	84	40-60
T33S, R2W, sec. 3	3-2 A/B	110	100-110	79	50-60
T33S, R2W, sec. 15	15-1	140	100-120	90	40
T34S, R2W, sec. 1	1-1	105	80-100	79	40

C.6 Stand Inventory Data

The stand inventory data is not absolute. It is an estimate based on sampling. It is intended to provide a general description/measure of stand density, composition, and structure.

Table C-21. Trail Creek Timber Harvest Stand Inventory Data

Unit#	Section-OI #	Trees per Acre <8″ DBH	Trees per Acre >8″ DBH		Basal Area	Canopy Closure	Aspect/ Slope %	Relative Density %
			Conifers	Hardwoods				
T32S, R1W								
19-3	19-001A	235	122	4	190	100	NW/40%	66
19-5/8	19-001B	306	163	3	221	100	NW/34%	79
19-8	19-002A	279	111	0	198	100	NW/35%	70
19-6	19-003E	29	179	0	206	100	W/20%	63
19-1/2	19-003W	258	140	38	221	100	SE/49%	77
30-2/3	30-001	229	92	30	242	100	E/31%	80
30-1	30-002N	153	107	4	225	100	S/48%	71
31-10	31-09E/6	493	134	27	226	100	SE/23%	85
31-8/9	31-009W	1,088	141	28	239	100	E/26%	100
31-2/3	31-010A	1,031	140	29	244	100	NE/39%	100
31-1/4/5/6	31-010B	1,117	169	27	269	100	E/28%	93
31-7	31-010C	61	100	7	236	100	E/42%	68
31-9	31-010D	700	141	4	274	100	E/36%	100
17-1	17-002A	115	121	62	270	100	E/35%	85
17-2	17-009A	100	229	46	233	100	E/18%	78
T33S, R1W								
18-1	18-002A	1,234	167	47	251	100	W/40%	100
19-1	19-003	153	133	10	271	100	SW/52%	85
19-2	19-007	649	98	0	279	100	S/37%	100
29-1	29-001A	1,298	155	31	238	100	NE/50%	100
30-1/2	30-005/8	248	248	10	255	100	NE/27%	90
31-1	31-007	344	208	8	195	100	NW/15%	74
T33S, R2W								
3-7	3-001A	687	142	0	264	100	SE/53%	100

Table C-21. Trail Creek Timber Harvest Stand Inventory Data

Unit#	Section-OI #	Trees per Acre <8″ DBH	Trees per Acre >8″ DBH		Basal Area	Canopy Closure	Aspect/ Slope %	Relative Density %
			Conifers	Hardwoods				
3-6	3-001B	680	117	7	234	100	S/58%	92
3-3/4/5	3-001C	687	92	43	256	100	E/48%	99
3-1/2	3-001D	716	132	51	272	100	E/33%	87
3-5	3-001E	745	151	21	294	100	SE/36%	100
3-8/9	3-002A	1,139	84	29	205	100	S/35%	90
23-1	23-001E	878	80	2	148	100	E/13%	66
23-1	23-001W	427	93	9	191	100	SE/12%	72
23-1	23-016	1,145	73	10	155	100	NW/42%	71
25-2	25-004A	1,508	158	37	278	100	W/14%	100
25-1	25-004B	313	128	19	216	100	E/12%	77
25-3	25-004C	120	135	26	173	100	NE/18%	58
T34S, R2W								
1-1/2	1-003A	1,050	97	23	169	100	SE/23%	76
1-1/2	1-004A	573	169	22	210	100	SE/20%	83
T32S, R1W								
21-3	21-003W	57	84	9	266	100	SE/49%	73
21-10	21-009E	172	54	0	226	87	W/46%	69
21-5/6	21-009N	229	73	6	242	100	SE/52%	78
21-4/7	21-009W	387	118	27	241	100	E/50%	86
21-9	21-019A	19	70	0	246	98	W/43%	62
21-8	21-020N4	1,002	31	0	200	100	NW/44%	85
21-8	21-020N6	372	140	0	271	100	NW/40%	94
21-1	21-022E	248	110	0	238	100	SW/30%	79
21-2	21-024/02	859	212	0	291	100	SW/38%	100
27-1/2	27-007/08	1,677	78	0	268	100	W/47%	100
28-1	28-005	76	100	42	253	100	SW/52%	72
29-5/6	29-006	2,076	55	0	245	100	E/22%	100
29-7/8/9	29-007	673	123	13	196	100	SE/27%	80
29-3	29-008E	267	171	6	259	100	E/19%	88
29-1/2	29-008W	338	185	0	252	100	SE/20%	73
29-4	29-010N	745	111	5	262	100	S/27%	100
29-10	29-010S	794	92	5	194	100	SW/28%	80
29-5/6/7	29-014	578	119	14	226	100	SE/25%	87
33-3	33-007N	286	115	3	235	100	W/40%	80
33-4/5	33-007S	305	231	29	265	100	NW/24%	94
33-1/2	33-011E	606	102	25	201	100	SE/21%	80
34-1	34-008A	859	58	8	212	100	NW/55%	87
T33S, R1W								
3-1/2	3-005A	344	67	33	265	100	NW/42%	90

Table C-21. Trail Creek Timber Harvest Stand Inventory Data

Unit#	Section-OI #	Trees per Acre <8″ DBH	Trees per Acre >8″ DBH		Basal Area	Canopy Closure	Aspect/ Slope %	Relative Density %
			Conifers	Hardwoods				
3-3	3-005W	143	93	39	274	100	NW/30%	84
7-1/2	7-006S	466	177	9	239	100	S/31%	89
7-3/4	7-011A	210	161	21	217	100	E/26%	75
9-2/3	9-006	339	138	28	198	100	NE/25%	73
9-4	9-007	14	116	5	132	83	NW/28%	41
9-1	9-008A	267	182	32	295	100	NW/50%	100
9-5/6	9-011N	286	130	6	196	100	NW/32%	70
10-1/2/3/4	10-002A	1,253	49	1	203	100	N/35%	90
10-5	10-008A	153	215	94	291	100	W/58%	98
15-2	15-007A	221	128	31	180	100	NW/46%	64
15-1	15-013A	592	136	2	217	100	W/23%	85
22-1	22-008	473	142	0	197	100	NW/42%	76

Table C-22. Trail Creek Small Diameter Thinning Units Inventory Data

Legal Description	Unit #	Trees per Acre <8″ DBH	Conifer Trees per Acre >8″ DBH	Average Stand Diameter >8″ DBH	Basal Area >8″ DBH (sq. ft./acre)	Canopy Closure	Aspect/ Slope	Relative Density
T33S, R1W, sec. 3	3-1	1,450	175	11"	120	87%	NE/ 20-50%	96%
T33S, R1W, sec. 9	9-1	445	205	13"	200	84%	E/15%	90%
T33S, R2W, sec. 3	3-2 A/B	340	200	10"	110	79%	S/25%	67%
T33S, R2W, sec. 15	15-1	2,000	135	13"	140	90%	SE/ 20-50%	100%
T34S, R2W, sec. 1	1-1	2,035	100	14"	105	79%	SW/10%	80%

Relative density is a measure of crowding in a stand of trees. It compares the number of trees present to the number of trees that the site has resources (water, nutrients, and sunlight) to support. At relative densities from 35 to 50% in stands dominated by Douglas-fir, stand vigor and growth is maximized. At relative densities greater than 60% the following conditions begin to occur: competition-related mortality becomes significant, self-thinning starts, growth declines, volume growth per acre is offset by mortality, and susceptibility to insect and disease attack increases (USFS 1983; Curtis 1982; Hann and Wang, 1990). Relative density uses a maximum density of 100, with relative densities ranging from 0 to 100. To calculate relative density, stand basal area is divided by the square root of the stand quadratic mean diameter. For example, a stand with 100 square feet basal area and a quadratic mean diameter of 16" would have a relative density of 25 (100 divided by 4). Quadratic mean diameter (QMD) is the diameter of the tree of average basal area in the stand.

Basal area is the proportion of ground covered by the cross-sectional area of trees present. Basal area is expressed as square feet per acre.

C.7 Characteristics of Low Vigor Trees

C.7.1 Low Vigor Trees

C.7.1.1 Low Vigor Ponderosa Pine

Trees meeting the following criteria:

- Crowns are ragged and thin.
- Foliage in parts of crown is thin, bunchy, or unhealthy; needles are average to shorter than average length.
- Needle color is poor to fair.
- Some twigs or branches lack foliage and some twigs or branches are fading or dead.
- Localized weakened parts of crowns are present.
- Crown top is rounded, and the crown width is narrow or flat on one or more sides.

C.7.1.2 Low Vigor Douglas-fir and White Fir

Trees meeting the following criteria:

- Crown has thin appearance when viewed against the sky.
- Needle length is short.
- Needle color is very poor and yellowish.
- Dead or dying twigs or branches form holes in the crown; sparse and ragged crown appearance.
- Poor crown ratio.
- Mistletoe infected, with a rating of 4, 5, or 6 (see section C.6.3).

C.7.1.3 Trees Affected by Root Disease

Trees have the following visual characteristics:

- Groups of trees affected, with trees showing variable levels of decline.
- Reduced height growth; look at top of trees for reduced increment growth.
- Yellow foliage; decline of the crown is from the top to the bottom.
- Distress cone crop.
- Bark beetles sometimes present because of the stressed trees.

Windthrown trees common; wood at the base of the downed trees is soft and stringy or has begun to delaminate.

Table C-23. Root Diseases found in Project Area and Affected Tree Species

Root Disease	Severely Affected	Moderately Affected	Resistant
Laminated Root Rot *Phellinus weirri*	Douglas-fir White fir	Sugar pine Ponderosa pine	Incense cedar
Annosum Root Rot *Heterobasidion annosum*	White fir	Ponderosa pine	Douglas-fir Sugar pine Incense cedar
Armillaria Root Rot *Armillaria* ssp.	White fir	Douglas-fir Ponderosa pine Sugar pine	Incense cedar

C.7.2 Insect-Infested Trees

Douglas-fir and white fir trees undergoing attack from bark beetles, as identified by red boring dust present in bark crevices or on the ground near the base of the tree. Borers typically begin their attack in the top of the tree, and then may spread to the lower bole. Foliage is thinning and yellowish in appearance. Pitch streamers on Douglas-fir may also be present on the mid- to upper bole.

Ponderosa pine trees currently undergoing attack from western pine beetle or red turpentine beetle. Pitch tubes should contain reddish/brown granular frass. Pitch tubes clear in color indicate the tree has been successful in expelling the beetle; these trees should not be marked if otherwise healthy.

C.7.3 Douglas-fir Mistletoe-Infested Trees

Target the removal of Douglas-fir trees with a mistletoe rating of 4, 5, or 6.

To determine the mistletoe rating for individual trees use the 6-class rating system.

Step 1: Divide the live crown into thirds.

Step 2: Rate each third separately. Each third should be given a rating of 0, 1, or 2.

0—no visible infection.

1—light infection (one-half or less of total number of branches are infected).

2—heavy infection (more than one-half of the total number of branches is infected).

Step 3: Add ratings of each third together to obtain a rating for the tree.

NOTE: Snags and coarse woody debris would be maintained as they presently occur; snags that are safety hazards may be felled but would be left on-site.

C.8 Leave Tree Spacing Guidelines

C.8.1 Timber Harvest—Relative Density (35%)

Estimate the average diameter of potential leave trees and determine the desired spacing in feet by referring to Table C-24. Follow the basal area and spacing table as closely as possible. Once the area has been marked verify the leave basal area using a relaskop or prism; adjust basal as necessary. As the average diameter changes, spacing will also change, holding stand density constant.

Table C-24. Average Leave Tree Spacing by Basal Area and Average Diameter to obtain a Relative Density of 35%

Average Leave Tree DBH (inches)	Leave Tree Basal Area (square feet/acre)	Average Leave Tree Spacing (feet)
8	99	12 x 12
10	111	15 x 15
12	121	17 x 17
14	131	19 x 19
16	140	21 x 21
18	148	23 x 23
20	157	25 x 25
22	164	26 x 26
24	171	28 x 28
26	178	30 x 30
28	185	32 x 32
30	191	33 x 33

C.8.2 Small Diameter Thinning—Mixed Conifer (Relative Density 30% and 40%)

Estimate the average diameter of potential leave trees and determine the desired spacing in feet by referring to Tables C-25 and C-26. Follow the basal area and spacing table as closely as possible. Once the area has been marked verify the leave basal area using a relaskop or prism; adjust basal as necessary. As the average diameter changes, spacing will also change, holding stand density constant.

Table C-25. Average Leave Tree Spacing by Basal Area and Average Diameter to obtain a Relative Density Index of 30%

Average Leave Tree DBH (inches)	Leave Tree Basal Area (square feet/acre)	Average Leave Tree Spacing (feet)
8	85	13 x 13
10	95	16 x 16
12	104	18 x 18
14	112	20 x 20
16	120	23 x 23
18	127	25 x 25
20	134	27 x 27
22	141	29 x 29
24	147	31 x 31

Table C-26. Average Leave Tree Spacing by Basal Area and Average Diameter to obtain a Relative Density Index of 40%

Average Leave Tree DBH (inches)	Leave Tree Basal Area (square feet)	Average Leave Tree Spacing (feet)
8	113	12 x 12
10	126	14 x 14
12	139	16 x 16
14	150	18 x 18
16	160	20 x 20
18	170	21 x 21
20	179	23 x 23
22	188	25 x 25
24	196	26 x 26

C.9 Coarse Woody Debris and Snags

Trees designated for coarse woody debris should have characteristics of decay class 1 and 2 (e.g., bark intact, limbs intact, texture mostly sound, round shape) (Table C-27). To meet the ROD/RMP guidelines, leave a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long (120 linear feet is equivalent to 7.5, 16-foot logs) (Table C-28).

Table C-27. Coarse Woody Debris Decay Classes

Log Characteristics	Decay Class				
	1	2	3	4	5
Bark	Intact	Intact	Trace	Absent	Absent
Twigs (<3 cm.)	Present	Absent	Absent	Absent	Absent
Texture	Intact	Intact to partly soft	Hard, large pieces	Small, soft blocky pieces	Soft and powdery
Shape	Round	Round	Round	Round to oval	Oval
Color of wood	Original color	Original color	Original color to faded	Light brown to reddish brown	Red brown to dark brown
Portion of log on ground	Tree elevated on support points	Tree elevated on support points but sagging slightly	Tree is sagging near ground	All of tree on ground	All of tree on ground
Invading roots	None	None	In sapwood	In heartwood	In heartwood

To meet RMP requirements, leave a minimum of 1.8 snags per acre in regeneration harvest units. A snag is any standing dead (stage 1 and 2), partially dead, or defective tree (Table C-29). In all other harvest prescriptions, all snags (stages 1-5) would be left.

C-28. Number of 16-foot Logs Produced by Tree Diameter Class

Diameter Class (inches)	Number of Logs per Tree (16″ by 16′)
16	1
20	1
22	2
24	3
26	4
28	4
30	5
32	5
34	6
36	6
38	6
40	6
42	7
44	7
46	7

Table C-29. Physical Characteristics of Snags by Deterioration Stage

Stage	Characteristics
1	• Limbs and branches all present • Pointed tree top • Tight bark • Recently dead
2	• Few limbs • No fine branches • Pointed or broken tree top • Variable level of bark remaining
3	• Limb stubs only • Decay in upper bole • Some decay at base of bole • Variable level of bark remaining
4	• Few or no stubs • No fine branches • Broken top • Loose or no bark
5	• No limbs or branches • No sapwood present • Broken top • 20% or less of bark remaining

Appendix D: Soil

Table D-1. Field Review Notes for Tractor Yarding Units in Fragile Soil

Tractor Unit Location	Description of Unit Area
T34S, R2W sec. 1	No recorded past slumps. Most of this unit is on a gentle ridge, which is acceptable for tractor yarding. The portion north of BLM road #34-2-1 in the western part of the unit is too steep and rocky. It was changed to skyline-cable yarding.
T33S, R2W, sec. 25	No recorded past slumps. Field review indicated stability. Suitable for tractor yarding.
T33S, R1W, sec. 30	No recorded past slumps. Tiny portion of tractor unit is east of road. Tractor yarding and spur road okay.
T33S, R2W, sec. 23	No recorded past slumps. Field review indicated stability. Suitable for tractor yarding.
T33S, R1W, sec. 18	No recorded past slumps. Field review indicated stability. Suitable for tractor yarding.
T33S, R1W, sec. 15	No recorded past slumps. The topography of this unit is uneven with benchy topography. No active slumps in the unit. There are areas that are probably too steep for tractor.
T33S, R1W, sec. 9	No recorded past slumps. Northern portion of the western unit is fragile. Suitable for tractor yarding. Slumps in the area are associated with water.
T33S, R1W, sec. 7	No recorded past slumps. Fragile soils in southern portion of unit. The portion of unit in fragile soils east of BLM road #33-1-7 is suitable for tractor yarding. There are some unstable areas in the southwest part of the section. These areas would be buffered or not included in units.
T33S, R2W, sec. 3	No recorded past slumps in the unit. There is a recent slump close in this section outside of the unit.
T32S, R1W, sec. 33	The tractor unit south of BLM road #32S-1W-33.01 has one active slump and historic slumps right below the road. The active slump will be buffered.
T32S, R1W, sec. 29	This section has several unstable areas. Tractor yarding units are located on stable slopes. There are unstable areas throughout other portions of the section.
Section 32S-1W-19	No recorded past slumps. Suitable for tractor yarding.

Table D-2. Proposed Temporary Route Construction

Location	Length	Description	Fragile Soil?
T33S, R2W, sec. 3, 4	0.1 mile	Road contour to slope on a gentle gradient.	No
T32S, R1W, sec. 31	0.2 mile	Gentle, stable slope.	No
T32S, R1W, sec. 30	0.1 mile	Gentle ridge away from steeper slope. Past skid trail on soil surface and is stable.	No
T32S, R1W, sec. 30	0.1 mile	Located on gentle shoulder. Although fragile, no evidence of instability. Reviewed the road footprint and no resulting soil instability there.	Yes
T32S, R1W, sec. 19	0.3 mile	On a shoulder. The beginning of the proposed spur may be higher gradient and a narrower shoulder. However, further down the route, the shoulder becomes broader and gentler.	No
T32S, R1W, sec. 33	Dropped	For small diameter thinning.	

Soil Series Found in the Trail Creek Project Area

Bybee Series

The Bybee soil series is very deep and somewhat poorly drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 0.5-inch thick. The surface layer is very dark grayish brown loam about 4" thick. The next layer is very dark grayish-brown clay loam about 6" thick. The upper 4" of the subsoil is brown clay. The lower 24" is light yellowish-brown clay. The substratum is light yellowish-brown clay about 22" thick. The depth to bedrock is 60" or more. Permeability is very slow in the Bybee soil. Available water capacity is about 9". The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20". Runoff is medium, and the water erosion hazard is moderate. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

Farva Series

The Farva soil series is a moderately deep, well-drained soil on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 0.5-inch thick. The surface layer is dark brown, very cobbly loam about 12" thick. The subsoil is brown, extremely cobbly loam about 15" thick. The substratum is brown, extremely cobbly loam about 8" thick. Weathered bedrock is at a depth of about 35". The depth to bedrock ranges from 20 to 40". In some areas, the surface layer is stony. Permeability is moderately rapid in the Farva soil. Available water capacity is about 3". The effective rooting depth is 20 to 40". Runoff is medium and the water erosion hazard is moderate.

Freezener Series

The Freezener soil series is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves and twigs about 1.5" thick. The surface layer is a dark reddish-brown, gravelly loam about 9" thick. The next 9" are a dark reddish brown clay loam. The next 42" are a dark reddish-brown and dark brown clay and clay loam. The depth to bedrock is 60" or more. In some areas the surface layer is cobbly or stony. Permeability is moderately slow. Available water capacity is 9". The effective rooting depth is 60" or more. Runoff is rapid and the water erosion hazard is high.

Geppert Series

The Geppert soil series is moderately deep, well-drained soil on hillslopes. It formed in colluvium derived from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs approximately 0.5" thick. The surface layer is dark reddish-brown, very cobbly loam about 13" thick. The subsoil is dark reddish-brown, extremely cobbly clay loam about 17" thick. Weathered bedrock is at a depth of about 30". The depth to bedrock ranges from 20 to 40". In some areas, the surface layer is stony. Permeability is moderate in the Geppert soil. Available water capacity is about 3". The effective rooting depth is 20–40". Runoff is rapid and the water erosion hazard is high.

Goolaway Series

The Goolway soil series is moderately deep, well-drained soil on hillsides. It is formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves and twigs about 2" thick. The surface layer is a very dark grayish-brown, silt loam about 3" thick. The next layer is a dark grayish brown silt loam about 8" thick. The subsoil is an olive gray and olive silt loam about 18" thick. Weathered bedrock is about 29" deep. Depth to bedrock ranges from 20 to 40". Permeability is moderate. Available water capacity is about 6". The effective rooting depth is 20 to 40". Runoff is medium and the water erosion hazard is moderate or high.

McMullin Series (with Rock outcrop)

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is a gravelly loam about 7" thick. In some areas the surface layer is stony. The subsoil is a gravelly clay loam about 10" thick. The depth to bedrock ranges from 12 to 20". Permeability is moderate in the McMullin soil. Available water capacity is about 2". The effective rooting depth is 12 to 20". Runoff is slow and the water erosion hazard is slight. Slopes range from 1 to 75%. The Rock Outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

McNull Series

The McNull soil series is moderately deep, well-drained soil on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. In some areas the surface layer is stony or cobbly. The surface layer is dark reddish-brown loam about 6" thick. The upper 6" of the subsoil is dark reddish-brown clay loam. The lower 20" is dark reddish-brown cobbly clay. Weathered bedrock is at a depth of about 32". The depth to bedrock ranges from 20 to 40". Permeability is slow in the McNull soil. Available water capacity is about 4". The effective rooting depth is 20 to 40". Runoff is rapid and the water erosion hazard is high.

Medco Series

The Medco soil is moderately deep and moderately well-drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish-brown, cobbly clay loam about 7" thick. In some areas, the surface layer is stony. The next layer is very dark, grayish-brown, cobbly clay loam, about 5" thick. The subsoil is brown clay about 18" thick. Weathered bedrock is at a depth of about 30". The depth to bedrock ranges from 20 to 40". Permeability is very slow in the Medco soil. Available water capacity is about 4". The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18". Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

Medford Series

The Medford soil is very deep and moderately well drained. It formed in alluvium derived dominately from metamorphic rock. Typically, the surface layer is a very dark brown, silty clay loam about 12". In some areas the surface layer is gravelly or cobbly. The subsoil is a very dark brown, silty clay for 10". The next 31" is dark brown and dark yellowish-brown silty clay loam and clay loam. The next 18" is a dark yellowish-brown sandy clay loam. Permeability is moderately slow. Available water capacity is 10". The effective rooting depth is 60" or more. Runoff is slow and the water erosion hazard is slight. The water table fluctuates between depths of 4 to 6 feet from December through April.

Shippa Series

The Shippa soil is shallow and well drained. It formed from colluvium derived from igneous rock. Typically, the surface layer is a dark brown extremely gravelly loam about 4" thick. The subsoil is a brown extremely cobbly loam about 12" thick. At 16" there is rotten, fractured andesite with some roots and soil material in upper inches but bedrock is approximately 12 to 20". Permeability is moderately rapid. The available water capacity is about 1". The effective rooting depth is 12 to 20". Runoff is rapid and the water erosion hazard is high.

Straight Series

The straight soil is moderately deep and well drained. It formed in colluvium derived mainly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, twigs and leaves about 1.5" thick. The surface horizon is a dark reddish-brown, extremely gravelly loam about 9" thick. In some places the surface layer is gravelly or stony. The subsoil is a dark brown, very gravelly loam about 21" thick. The next 5" are a dark brown, very cobbly clay loam. Weathered bedrock is at a depth of about 35". Permeability is moderate. Available water capacity is about 3". The effective rooting depth is 20 to 40". Runoff is rapid and the water erosion hazard is high.

Tatouche Series

The Tatouche soil is very deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 2" thick. The surface layer is very dark brown, gravelly loam about 11" thick. In some areas the surface layer is stony or cobbly. The upper 8" of the subsoil is dark brown gravelly clay loam. The lower 41" is dark brown clay. The substratum (to a depth of 73") is strong brown clay loam. The depth to bedrock is 60" or more. Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8". The effective rooting depth is 60" or more. Runoff is medium, and the water erosion hazard is moderate.

Terrabella Series

The Terrabella soil is very deep and poorly drained soils in basins. It formed in alluvium derived dominantly from andesite, tuff and breccia. Typically, the surface layer is a very dark brown clay loam that is 10" thick. In some areas, the surface layer is gravelly or cobbly. The next 18" of subsoil is dark reddish brown and dark reddish gray clay. The next 22" is a dark brown clay. The next 10" are a yellowish-brown gravelly clay loam. The depth to bedrock is 60" or more. Permeability is slow. Available water capacity is 11". The effective rooting depth is limited by the water table, which is 0.5 foot above to 1 foot below the surface from December to May. Runoff is ponded and the water erosion hazard is slight. This soil is subject to flooding.

Soil Liquid and Plastic Limits

liquid limit. The minimum moisture content at which a soil begins to behave as a liquid material and begins to flow.

plastic limit. The moisture content at which soil begins to behave as a plastic material.

plasticity. The response of a soil to change in moisture content.

Depending on changes of moisture content, the fines in a soil have four different states: solid, semisolid, plastic, and liquid. For slumping concerns, the liquid limit is important. When the soil has a moisture content at the liquid limit, it acts as a liquid. Depending on the clay mineralogy and texture, the liquid limits vary among different soils. Due to the susceptibility to slumping, these limits will be paid close attention to. Some soils are nonplastic. The plasticity index (PI) is the moisture content of the soil in between the plastic limit (PL) and the liquid limit (LL) (PI=LL-PL). Soils with a high PI tend to be clay, those with a lower PI tend to be silt, and those with a PI of 0 (nonplastic) tend to have little or no silt or clay.

The liquid and plastic limits should be avoided when using ground-based equipment. Equipment use is restricted when soils are not in the solid to semisolid state. The liquid limit and plasticity index varies by soil series (Table D-3).

Table D-3 Liquid Limit and Plasticity Index by Soil Series

Soil Series	Liquid Limit (% water content)	Plasticity Index (% water content)
Bybee	30–35, 35–45, 4–55	10–15, 15–25, 25–35
Farva	15–25, 20–25	Nonplastic–5, Nonplastic–5
Freezener	25–35, 30–40, 35–50	5–10, 10–15, 15–30
Geppert	25–35, 30–40	5–10, 10–15
Goolaway	25–35, 25–35	5–10, 5–10
McMullin*	20–30, 30–40	Nonplastic–5, 10–15
McNull*	20–35, 40–55	5–15, 20–30
Medco*	35–45, 40–50, 55–65	10–20, 15–25, 30–40
Medford	35–40, 40–50, 35–40	15–20, 20–25, 15–20
Rock outcrop		Nonplastic
Shippa	25-35, 25-35	5-10, 5-10
Straight	25-35, 25-40	5-10, 5-15
Tatouche	25-35, 35-45, 30-40	5-15, 15-25, 10-15
Terrabella	35-45, 50-60, 40-60	10-20, 25-35, 15-35

*Listed as fragile for mass movement (pyroclastics).

NOTE: The liquid limits and plasticity index for each soil series are listed by differences in depth. The upper soil surface (top 10") is typically where the soil moisture is tested.

Effects of Projects on Soil

The key soil properties directly affected by management actions are site organic matter and soil porosity. A sustained flow of organic matter from primary producers to the forest floor and into the soil is vital to sustained site productivity through its influence on soil protection, the activity of beneficial soil organisms, soil water holding capacity, soil structure and aggregate stability, and nutrient supply. Organic matter is the ultimate source of substances that bind soil particles together into stable aggregates that resist erosion.

Some locations in the Project Area contain minimal organic matter or organic horizon. This primarily occurs in areas where the soil is unstable or close to rock outcrops where the vegetation does not provide enough organic debris to accumulate an organic horizon. These areas are outside of proposed projects.

Organic matter is abundant on all sites in the Project Area that are planned for treatment. Most of the organic matter is in the form of down wood, leaf litter, and needle cast, and was produced from trees, shrubs, grasses, and moss. Soil organic matter appears typical for the region with most of the sites having about 0.5" or less of litter (leaf and needles); however, the Medco, McMullin, and Shippa soils do not tend to have an organic horizon. Except for areas disturbed by roads and trails, and sites with gravels and cobbles surfaces, most of the soil in the proposed project area has at least a thin ground cover of organic material. On most sites, soil organic matter consumption appears normal with a very thin layer of decomposing matter at the soil and litter layer interface.

Roads

Natural-surface roads contribute the highest amount of sediment of the road surface types (Bureau of Land Management 2008, 346). Proposed road decommissioning would reduce the miles of natural-surface roads in the Trail Creek watershed by 5 miles. An estimated 9.61 tons of sediment is delivered to streams from natural-surface roads per square mile per year (ibid.). By decommissioning 5 miles of natural-surface road, sediment would be reduced by 2.23 tons each year. (Note: this number is an average of many different soil types throughout western Oregon; it does not account for the higher concentration of FM soils in this Project Area.) The decrease in the number of road miles in the Trail Creek watershed, especially a decrease in roads in fragile soils and natural-surface roads, is expected to reduce sedimentation rates from roads.

These activities have the potential to produce sediment; however, implementation of the following PDFs would reduce erosion and keep sediment from entering streams:

- Minimize disturbance to existing riparian vegetation in order to maintain slope stability.
- Use sediment control measures such as straw bales, filter cloth, or sediment fences.
- Limit instream work to the period from June 15 to September 15.
- Maximize maintenance activities during late summer and early fall to best avoid wet conditions.
- Temporarily suspend work if monitoring indicates rain storms have saturated soils to the extent there is potential for causing excessive stream sedimentation.
- Apply mulch as soon as possible after excavation or ripping to reduce erosion.

Meadow Restoration

Six meadows are proposed for restoration. Four of the 6 meadows are weathered from colluvium from metasedimentary or igneous rock. These are found to be shallow and support only meadow-like vegetation. One of the meadows is colluvium derived from igneous rock, which is not commonly found in meadow locations throughout the watershed. One of the meadows is colluvium derived from tuff breccia and/or andesite.

Meadow restoration is not expected to have an effect on soils. There may be a temporary impact from burning piles on the soil surface Soil productivity loss from the consumption of the duff layer is the most common adverse effect on the soil resource from pile burning. Even though burn piles are typically ignited during the wet winter season, the duff layer and the soil surface directly under the piles can be exposed to high intensity heat that can consume the duff layer. The loss in soil productivity resulting from this

severely burned soil could last for more than 5 years, depending on size of the pile, soil type, vegetation type, slope configuration, aspect, and climate. The factors that would moderate this effect are the widely spread distribution and small size of the piles over the landscape. This allows for more biological interaction between the small islands of burned soil and the surrounding undisturbed areas, which helps to promote and accelerate recovery in soil productivity when compared to one large continuous burn area of the same acreage.

Vegetation Removal

Whole tree harvesting of trees less than 24" in diameter is proposed for the majority of the harvest acres. Removal of vegetative biomass (tree boles, branches and foliage) may alter the existing nutrient pool, although it is not expected to be detrimental to long-term site productivity. Whole tree harvesting removes more nutrients compared to harvesting the main tree bole only. About half of the above-ground nutrients of a conifer tree is in the branches and needles and the other half is in the bole and bark up until the stand canopy closes. The effect on the nutrient pool is dependent on the amount of vegetation removed, rotation length, and the productivity of the site. It is expected that regeneration harvests would have a greater loss of nutrients compared to other silvicultural systems (commercial thinning, density management or selection harvest). The greatest impact of nutrient loss on site productivity occurs on low quality sites (Daniel, Helms and Baker 1979) and in forests that are managed on short (<60 years) rotations (Poff 1996). Neither of these conditions exists in the Trail Creek Project Area. The site quality is considered good (average site class 3) and the rotation length is a minimum of 100 years. Both of these factors allow for relatively rapid nutrient recovery. The effects of slash removal on nutrient budgets are short term with sites recovering to preharvest nutrient levels within approximately 5 years (Hacker 2005).

Northern and southern GFMA regeneration harvest is proposed in Alternative 2. Northern GFMA regeneration harvest leaves the fewest trees after harvest (8–12 green trees per acre) of all the proposed treatments. Northern GFMA regeneration harvest is proposed on 37 acres. Southern GFMA regeneration harvest is similar to northern GFMA regeneration harvest in its effects but southern GFMA leaves more trees after harvest (16–25 green trees per acre). Southern GFMA regeneration harvest is proposed on 26 acres in Alternative 2.

The removal of vegetation may result in minor losses in productivity. Maintaining the coarse woody debris requirements in the Medford District ROD/RMP, (p.45) would help to minimize the loss of organic material and help to stabilize the surface of the soil. Implementing best management practices would reduce the amount of surface disturbances.

Maintaining productivity through maintaining a healthy nutrient pool is beneficial to soil recovery from compaction. Biotic functions in the soil are in large part what contribute to the natural recovery of soil. By maintaining coarse woody debris and the nutrient pool, the soil biotic life may still be supported. In addition, the more biotic functions and organic matter in the soil, the more resistant to compaction a soil would be.

Tractor Yarding

Timber Harvest

Restricting mechanical equipment to existing and designated skid trails would maintain the current level of soil compaction in all treatment units.

By implementing project design features, the percentage of soil compaction would not increase from using ground-based equipment. Compaction would not decrease and these skid trails may be used again in the future. The final entry into these stands is the most appropriate time to rip all the skid trails for replanting in order to decrease the risk of damage to the roots of nearby trees.

Landings would be decompacted after use as well. If the landings are on preexisting compacted ground, it would result in less compacted area after treatment than before.

Mechanical equipment (feller bunchers or cut-to-length systems) may be allowed off designated skid trails using project design features. If the equipment operator needs to access ground between designated skid trails, harvest equipment would be restricted to 1 or 2 passes on trails not less than 50 feet apart. A study by Lucklow and Guldin (2004) compared how different variables affect the amount of bulk density change during timber harvest. Variables included the number of passes by equipment, soil textures, amount of rock, and soil moisture. The rocky or nonrocky loam in the study is the best comparison to the soils found in the Friese Camp Project Area. When comparing the 1- or 2-pass impacts to the undisturbed ground, it was found that soil bulk density changed from 1.28 g/cm3 (grams per cubic centimeter) to 1.33 g/cm3 (4% increase) in a dry, nonrocky, loam soil; 1.32 g/cm3 to 1.40 g/cm3 (6% increase) in a dry, rocky loam soil in one unit; and 1.28 g/cm3 to 1.26 g/cm3 (1.6% decrease) in another rocky loam unit. When yarding in moist conditions, both rocky and nonrocky loams had a 9% increase in bulk density from 1 to 2 passes. The mean increase in bulk density across all the studied soil textures for 1 to 2 passes in the units was 7% for nonrocky soils and 5% for rocky soils (Lucklow and Guldin 2004).

As the Lucklow and Guldin study demonstrates, allowing 1 or 2 passes by mechanical equipment between designated skid trails during dry conditions would result in soil bulk densities well below the 15% bulk density increase identified in the Medford District PRMP/EIS (p. 4-13) as the threshold of detrimental bulk density. In addition, the study noted (from visual observation) that only the first few inches tended to be compacted where 1 or 2 passes had been made, whereas 8" were compacted in primary skid trails, native-surface roads, or log decks (Lucklow and Guldin 2004). Mechanical equipment walks over the ground, it does not need to displace material from the surface (unless it is large) and some, if not most, of the low-growing vegetation as well as the organic horizon on the surface would remain on site and would not be displaced.

Soil surface displacement by ground-based equipment affects soil productivity by removing or altering the nutrient-rich topsoil. Like soil compaction, limiting the aerial extent of soil displacement is effective at reducing soil displacement and maintaining current long-term soil productivity. Where compaction occurs, if it does, if the organic horizon and other low-growing vegetation remains on site, the degree of compaction and the time period it takes for compaction to alleviate is less as opposed to if all the vegetation and organic horizon was removed. Soil organic matter, decaying vegetation, and root systems are beneficial in resisting compaction as well as aiding in the recovery of compacted soil.

A reduction in soil productivity (compaction) from ground-based yarding would be avoided or would remain under the 12% compaction threshold because:

- PDFs for the use of mechanical equipment would result in less than 12% of the unit area being detrimentally compacted.
- PDFs restricting ground-based equipment use to dry soil conditions would reduce the soil's susceptibility to compaction.

In proposed regeneration harvest units (Alternative 2), skid trails and landings would be decompacted after harvest to a depth of 18" or bedrock, whichever is shallower. This is standard operation for final entry harvest.

Small Diameter Thinning

Stand conditions in the small diameter thinning units would result in a high amount of slash that would be available for ground-based yarding equipment to travel on. The slash acts to absorb much of the equipment weight and decreases the amount of compaction to the soil. Additionally, it prevents the topsoil from being scraped off and lessens possible soil displacement. The following PDFs would minimize soil compaction and minimize risk to slope stability:

- Restrict all tractor yarding and soil ripping operations from October 15 to May 15, or when soil moisture exceeds 25%.
- To minimize soil disturbance, mechanized felling equipment must have an arm capable of reaching at least 20 feet.
- In order to restrict the amount of compacted soil to less than 12% in a timber harvest unit,
    - Allow mechanized equipment capable of creating and walking on slash (such as a cut-to-length system) to work off designated skid trails for one or two passes on at least 8" of slash and under dry soil conditions (less than 25% soil moisture content).
    - Equipment must be 8 psi or less.
    - Limit skid trails to a minimum of 50-foot spacing off designated skid trails. All other use of ground-based equipment will be restricted to designated skid trails.
    - Other ground-based equipment is limited to designated skid trails and should use existing footprints where possible.

Skyline-cable Yarding

Skyline-cable yarding uses the partial suspension of logs during yarding operations to reduce the amount of ground disturbance. This yarding system typically has much less ground disturbance than tractor yarding because suspension of the lead end of the log during haul back reduces the amount of gouging and lateral swing from the log.

The amount of estimated ground disturbance from skyline-cable yarding is very difficult to quantify because slope configuration (convex slopes, benched ground) along with the lift capability of the cable machine determines the amount of ground disturbance for a given harvest unit. This is reflected in the variability of the research results where Dyrness (1967) found 12.1% ground disturbance and Klock (1975) found 2.8% soil disturbance after skyline-cable yarding. The differences in results are mostly due to differences in topography, soil types, and cable machines used in study areas. Ground disturbance may result in soil compaction although it is unlikely. If a tree is yarded up a corridor and is dragged across the soil surface, there is a downward force made by that tree that could compress the soil particles together resulting in compaction. Where this occurs, if it does, it would be only be in the yarding corridors and would be well below the 12% compaction threshold.

The following project design features would eliminate or minimize soil compaction and risk to soil stability from skyline-cable yarding:

- Use full or partial suspension when cable yarding (Bureau of Land Management 1995, 166). This would minimize soil damage and erosion caused by displacement or compaction.
- Avoid downhill yarding (Bureau of Land Management 1995, 166).
- Restrict all tractor yarding and soil ripping operations from October 15 to May 15, or when soil moisture exceeds 25%.

Appendix E: Water Resources

E.1 Background

Average annual precipitation in the Trail Creek Project Area ranges from 34" at the mouth of Trail Creek to 52" at the northwestern watershed divide (Bureau of Land Managment, 1999) with a mean of 40". Precipitation generally falls from November through March and summer months are typically very dry. The rain patterns in the winter months are widespread and are relatively low intensity and long duration in contrast to the localized, short duration, and high intensity summer storms that occasionally occur. There are no gauging stations located in the Trail Creek watershed.

Elevations in the Trail Creek watershed range from 1,400 feet to 4,700 feet. Within the Project Area, rain predominates in the lower elevations (generally below 3,500 feet). The majority (86%) of BLM-administered lands in the Project Area are located within the rain zone (Table E-1). A mixture of snow and rain occurs between approximately 3,500 and 5,000 feet elevation; this area is referred to as the TSZ (transient snow zone). The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Snow packs in this elevation range are often shallow and are quickly melted by rain (rain-on-snow event) and warm winds. The Trail Creek watershed contains no lands in the snow zone (above 5,000 feet elevation).

Table E-1. Precipitation Zones by Subwatershed in the Project Area

Subwatershed	Precipitation Zone (acres)			Total	Percent in Transient Snow Zone
	Rain Zone	Transient Snow Zone	Snow Zone		
Indian Creek-Rogue River	25,215	2	0	25,217	0.0
Upper Elk Creek	11,639	5,932	0	17,571	33.8
Lower Trail Creek	5,484	47	0	5,530	0.8
Upper Trail Creek	12,018	3,465	0	15,484	22.4
West Fork Trail Creek	12,700	1,601	0	14,301	11.2
Total	**67,056**	**11,047**	**0**	**78,103**	**14.1**

Peak flows occur during the winter when periodic snowfall totally or partially melts during warm, mid-winter rain-on-snow events. Low flows normally coincide with the period of low precipitation from July through October. Significant flows can also be produced by local, high-intensity summer storms, although these events are relatively rare and their effect is limited to the local area.

The risk of peak-flow enhancement is estimated from the OWAM (Oregon Watershed Assessment Manual) risk-assessment graph (Figure E-1) that uses the percent of the analysis area within the transient snow zone (see Table E-1) and the percent of the transient snow zone with less than 30% crown closure.

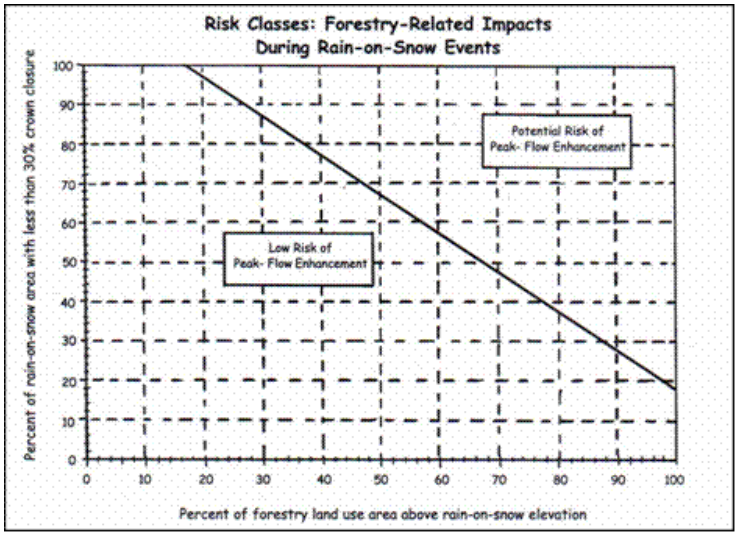


Figure E-1. Estimating the risk of peak-flow enhancement from forestry-related impacts during rain-on-snow events (Watershed Professionals Network 1999:IV-11).

The historic crown closure for the planning area varies by ecoregion. The analysis areas associated with the proposed project are in the Southern Cascades ecoregion (Watershed Professionals Network 2001, A-80, A-204). Forest types within the Southern Cascades ecoregion historically had 40-45% canopy crown closure (Watershed Professionals Network 2001, A-83). For analysis purposes, historic crown closure is assumed to be approximately 40% for forested lands in the Southern Cascades ecoregion.

According to the OWAM risk assessment method, drainages with more than 25% of the area in transient snow zone may be at risk for possible peak flow increases during rain-on-snow events. There is only one subwatershed in the project area with greater than 25% of the area in the transient snow zone; nearly 34% of the Upper Elk Creek subwatershed is in the transient snow zone (Table E-1). There are no proposed treatments in any alternative in Upper Elk Creek that would reduce the crown closure to 30% or less (the lowest is 40%) so the risk of peak flow enhancement from forest management activities is low in this subwatershed.

The Oregon Department of Environmental Quality is required by the Clean Water Act to maintain a list of impaired stream segments that do not meet water quality standards for one or more beneficial uses. This list is called the 303(d) list for the section of the Clean Water Act containing the requirement. The Project Area contains 23.6 miles of streams on the 303(d) list (Table E-2).

Section 303(d) of the Clean Water Act also requires states to develop TMDLs (Total Maximum Daily Loads) for impaired water bodies. A TMDL is a calculation of the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. The Rogue Basin TMDL addresses temperature and bacteria (*E. coli*) impairments for an area that contains the Project Area. The Project Area contains an additional 20 miles of impaired streams that are water quality limited and also have an approved TMDL. The Trail Creek Project Area contains a total of 43.7 miles of streams identified as water quality impaired (Table E-2).

Table E-2. 303(d) and Water Quality Limited Streams in the Trail Creek Project Area by Listing Parameter and Subwatershed

Listing Parameter	303(d) Listed (miles)	Water Quality Limited (TMDL Approved) (miles)	Total
Indian Creek-Rogue River			
Dissolved Oxygen	5.2	0	5.2
E. coli	0	0.1	0.1
Total	5.2	0.1	5.3
Lower Trail Creek			
Dissolved Oxygen	2.7	0	2.7
E. coli	0	2.7	2.7
Total	2.7	2.7	5.4
Upper Elk Creek			
Temperature	0	9.3	9.3
Total	0	9.3	9.3
Upper Trail Creek			
Dissolved Oxygen	7.4	0	7.4
E. coli	0	7.8	7.8
Total	7.4	7.8	15.2

Table E-2. 303(d) and Water Quality Limited Streams in the Trail Creek Project Area by Listing Parameter and Subwatershed

Listing Parameter	303(d) Listed (miles)	Water Quality Limited (TMDL Approved) (miles)	Total
West Fork Trail Creek			
Dissolved Oxygen	8.3	0	8.3
E. coli	0	0.1	0.1
Total	8.3	0.1	8.4
Grand Total	23.6	20.0	43.7

E.2 Effects of the Trail Creek Project on Water Resources

E.2.1 Effects of Alternative 2 on Water Resources

E.2.1.1 Direct and Indirect Effects

Under Alternative 2, regeneration harvest, commercial thinning, density management, and riparian thinning are proposed on 1,082 acres. Water quantity is not expected to be affected by harvest activities because of the amount of canopy retained after harvest would be within the range of natural variability (40% canopy cover). Approximately 93% (1,007 acres) of the acres proposed for harvest would be thinned to a 40% or greater canopy closure. Under Alternative 2, 75 acres of regeneration harvest would occur: 32 acres of NGFMA regeneration harvest (10 to 15% canopy cover), 19 acres of SGFMA regeneration harvest (25 to 40% canopy cover), and 24 acres of shelterwood retention harvest (20 to 40% canopy cover). The 75 acres of proposed regeneration harvest would result in canopy cover below the range of natural variability. Of those, 15 acres are within the transient snow zone. Because of this low percentage (< 1%) of treatments resulting in canopy cover below the range of natural variability within the transient snow zone and the low susceptibility of Upper Trail Creek to peak flow enhancement, there would be a low risk for increased frequency and magnitude of peak flows due to rain-on-snow events.

Table E-3. Alternative 2—Timber Harvest in Precipitation Zones by Subwatershed and Harvest Type

Subwatershed	Rain Zone	Transient Snow Zone	Total
Indian Creek-Rogue River Subwatershed			
Commercial Thinning	17	0	17
Density Management (60% canopy cover)	7	0	7
Total	37	0	37
Upper Elk Creek			
Commercial Thinning	26	32	58
Density Management (60% canopy cover)	0	6	6
Riparian Thinning	21	8	29
Total	46	47	93
Lower Trail Creek			
Commercial Thinning	3	0	3
Density Management (40% canopy cover)	9	0	9

Table E-3. Alternative 2—Timber Harvest in Precipitation Zones by Subwatershed and Harvest Type

Subwatershed	Rain Zone	Transient Snow Zone	Total
SGFMA Regeneration	6	0	6
Total	18	0	18
Upper Trail Creek			
Commercial Thinning	19	6	25
Density Management (40% canopy cover)	286	40	325
Density Management (60% canopy cover)	121	100	221
NGFMA Regeneration	7	15	22
Riparian Thinning	19	16	34
Total	452	176	628
West Fork Trail Creek			
Commercial Thinning	27	0	27
Density Management (40% canopy cover)	156	21	177
Density Management (60% canopy cover)	59	10	68
NGFMA Regeneration	10	0	10
Shelterwood Retention	24	0	24
Total	275	31	306
Grand Total	**828**	**254**	**1,082**

Riparian thinning would occur on 63 acres: 34 acres in Upper Trail Creek and 29 acres in Upper Elk Creek (Table E-3). Projects proposed under Alternative 2 would not affect stream temperatures because no shade would be removed in the primary shade zone on perennial stream as a result of timber harvest; therefore, this alternative would not affect temperature on water quality limited streams.

Skid trails would be ripped on 75 acres regeneration harvest units after final entry to help ameliorate compacted conditions by increasing porosity and infiltration. Ripping skid trails would not occur in commercial thinning, density management or riparian thinning units in order to protect the roots of the remaining live trees.

Upland timber harvest would occur on 557 acres (about half of the total acres) using ground-based skidders or tractors. Ground-based machinery would use existing and designated skid trails and operate on slopes less than 35% to minimize the area of soil disturbance. Water quality would be maintained while using ground-based equipment through the use of PDFs, distance from stream channels through riparian reserves, and the relative gentle topography of these units.

E.2.2 Effects of Alternative 3 on Water Resources

Under Alternative 3, restoration thinning and riparian thinning are proposed on 1,082 acres with the majority of the harvest (628 acres) proposed in Upper Trail Creek subwatershed (Table E-5). Water quantity is not expected to be affected by harvest activities because all of the proposed harvest acres would be thinned to a minimum 40% or greater canopy cover, which is within the range of natural variability.

Table E-5. Alternatives 3 and 4—Proposed Harvest by Subwatershed

Subwatershed	Riparian Thinning	Restoration Thinning		Total
		40% Canopy Cover	60% Canopy Cover	
Indian Creek-Rogue River	0	30	7	37
Upper Elk Creek	29	41	23	93
Lower Trail Creek	0	18	0	18
Upper Trail Creek	34	345	249	628
West Fork Trail Creek	0	224	82	306
Total	63	658	361	1,082

A total of 255 acres of timber harvest is proposed in the transient snow zone (Table E-6). No treatments would result in canopy cover below the range of natural variability within the transient snow zone; therefore, there would not be a risk for increased frequency and magnitude of peak flows.

Table E-6. Alternatives 3 and 4—Proposed Harvest in the Transient Snow Zone by Subwatershed

Subwatershed	Riparian Thinning	Restoration Thinning		Total
		40% Canopy Cover	60% Canopy Cover	
Indian Creek-Rogue River	0	0	0	0
Upper Elk Creek	8	16	23	47
Lower Trail Creek	0	0	0	0
Upper Trail Creek	16	40	121	177
West Fork Trail Creek	0	21	10	31
Total	24	77	154	255

E.2.3 Effects of Alternative 4 on Water Resources

E.2.3.1 Direct and Indirect Effects

Under Alternative 4, restoration thinning and riparian thinning are proposed on 1,082 acres with the majority of the harvest (628 acres) proposed in Upper Trail Creek subwatershed (Table E-5). Water quantity is not expected to be affected by harvest activities because all of the proposed acres would be thinned to a minimum 40% or greater canopy cover, which is within the range of natural variability.

A total of 255 acres of timber harvest is proposed in the transient snow zone. No treatments would result in canopy cover below the range of natural variability within the transient snow zone; therefore, there would not be a risk for increased frequency and magnitude of peak flows.

Appendix F: Aquatic Conservation Strategy

The Record of Decision for the Northwest Forest Plan contains Standards and Guidelines for the management of the land use allocations designated in the Northwest Forest Plan and incorporated into the 1995 Medford District ROD/RMP. The ACS (Aquatic Conservation Strategy) provides clarification of the intent of the Standards and Guidelines "in order to provide guidance for situations not specifically covered by the standards and guidelines" (Forest Service and Bureau of Land Management 1994, B-1).

F.1. Components of the Aquatic Conservation Strategy

The following are four main components of the ACS: Riparian Reserves, Key Watersheds, Watershed Analysis (WA), and Watershed Restoration.

F.1.1 Riparian Reserves

The 1995 Medford District ROD/RMP (p. 27) states, "As a general rule, management actions/direction for riparian reserves prohibits or regulates activities that retard or prevent attainment of Aquatic Conservation Strategy and riparian reserve objectives."

ROD/RMP Management direction for timber management within riparian reserves (p. 27) states, "Apply silvicultural practices for riparian reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy and riparian reserve objectives."

F.1.2 Key Watersheds

Key watersheds serve as refugia for "maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species" (Bureau of Land Management 1995, 22). Key watersheds were designated in the 1995 ROD/RMP (p. 23). The Trail Creek fifth field watershed is not a key watershed. Vegetation management is proposed on 93 acres in the South Umpqua fifth field watershed, which is designated a key watershed.

F.1.3 Watershed Analysis

The relevant watershed analysis for this project is the 1999 Trail Creek Watershed Analysis (Bureau of Land Management 1999). Watershed analysis is intended to enable the planning of watershed- or landscape-scale projects that achieve ACS objectives. Watershed analysis will serve as the basis for the design of Best Management Practices during project-specific planning (ROD/RMP, p. 152).

F.1.4 Watershed Restoration

The ROD/RMP (p. 23) states, "Watershed restoration will be an integral part of a program to aid recovery of fish habitat, riparian habitat, and water quality. The most important components of a watershed restoration program are control and prevention of road-related runoff and sediment production, restoration of the condition of riparian vegetation, and restoration of instream habitat complexity."

F.2 Project Summary

The BLM is proposing forest management activities on 1,082 acres of matrix lands and 63 acres of riparian reserves. Forest management activities could include regeneration harvest (northern GFMA, southern

GFMA, and shelterwood retention), commercial thinning, density management, restoration thinning, riparian thinning, and slash disposal activities such as piling and burning and biomass utilization. Proposed road projects include road renovation, road decommissioning, temporary route construction, and water source restoration.

F.2.1 Project Design Features (PDFs) that would Maintain or Restore ACS Objectives

- Do not treat vegetation within two site potential trees of fish-bearing streams, and within one site potential tree of non-fish-bearing, perennial and intermittent streams.
- In timber harvest units, designate skid trails an average of 150-foot spacing. In order to minimize ground disturbance, use existing trails and avoid creating new skid trails where feasible.
- Rip skid trails in all tractor-yarded regeneration harvest units.
- In timber harvest and small diameter thinning units, restrict ground-based equipment to slopes 20% or less within 100 feet of a stream. Equipment generally would be limited to one skid trail parallel to the stream within the 100 feet. These trails may be ripped if it would not affect remaining vegetation. On slopes greater than 20%, no equipment is allowed within 100 feet of the stream, although, trees may be bull-lined to outside of the 100 feet.
- In timber harvest and small diameter thinning units, do not treat vegetation within 60 feet of fish-bearing, perennial streams and within 35 feet of non-fish-bearing, intermittent streams.
- Use existing skid trails in harvest units, where feasible. All other skid trails must be designated prior to falling timber at an average spacing of 100 feet.
- Do not remove riparian hardwood species such as willow, ash, yew, maple, California black oak, and Oregon white oak.
- Restrict all culvert removal and placement and all road construction, improvement, renovation, closure, and decommissioning work from October 15 to May 15, or when soil moisture exceeds 25%.
- Block or barricade identified roads after use and before beginning of the rainy season (generally by October 15).
- Rip all temporary spur routes and associated landings (new construction or reconstruction) to a depth of 18" or bedrock (whichever is shallower), apply native grass seed and weed-free mulch, water bar, and block upon completion of use. If hauling is not completed in the same year the route is constructed, the route will be storm proofed and blocked by October 15 or when soil moisture exceeds 25%.
- Rip roads identified for decommissioning to a depth of 18" using a subsoiler or winged-toothed ripper, apply native grass seed and weed-free mulch, and block.
- Apply native seed and weed-free mulch to fill slopes and disturbed areas of roads to be fully decommissioned. Seeding and mulching will occur in the same operational season that construction activities occur.
- Apply native seed and weed-free mulch to soils that are disturbed or exposed during stream culvert removal, replacement, and installation in the same operational season the work is completed.

- Restrict the application of dust abatement materials, such as lignin, Mag-Chloride, or approved petroleum-based dust abatement products, during or just before wet weather, and at stream crossings or other locations that could result in direct delivery to a water body (typically not within 25 feet of a water body or stream channel).
- Place waste stockpile and borrow sites resulting from road construction or reconstruction in a location where sediment-laden runoff can be confined, at least one site-potential tree height from a stream and on stable slopes.
- When removing culverts, pull slopes back to the natural slope, or at least 1:1, to minimize sloughing and erosion, and to minimize the potential for the stream to undercut streambanks during periods of high streamflows. Apply weed-free mulch and native plant seed on all sideslopes of the stream where the culvert was removed in the same season the culvert was removed.
- Dewater streams during culvert placement and replacement to maintain optimum bedding material moisture content and to minimize the movement of sediment downstream.
- Remove all possible excess sediment from stream channels during culvert removal, replacement, and installation in the same operational season the work is completed.
- Use approved rip rap, aggregate, and borrow material for road construction, renovation, and surfacing. BLM material sources will be surveyed prior to use and will be free of noxious weeds. If noxious weeds are found, they will be treated prior to material extraction and use.
- Restrict all quarry development and rock crushing operations whenever soil moisture conditions or rainstorms could cause the transport of sediment resulting from quarry operations to nearby stream channels (generally October 15 to May 15).
- Construct silt fences or other preventative structures (diversion ditches, settling ponds) as needed to prevent the potential for runoff from quarry operations into nearby stream channels.
- Plant native grass seed, native vegetation, or both within the same operating season to stabilize exposed soil in overburden areas from quarry operations.
- Do not hand or excavator pile slash or burn slash piles within the channel bottom of intermittent streams, or within the bottom of dry draws.
- In small diameter thinning units:
    - Stack slash piles more than 60 feet from fish-bearing, perennial streams and more than 35 feet from non-fish-bearing, intermittent streams. Piles will not be placed in channel bottoms.
    - Do not treat vegetation within 60 feet of fish-bearing, perennial streams and within 35 feet of non-fish-bearing, intermittent streams.
- In timber harvest units:
    - Stack slash piles more than 60 feet from fish-bearing, perennial streams and more than 35 feet from non-fish-bearing, intermittent streams. Piles will not be placed in channel bottoms.
    - Do not treat vegetation within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing, intermittent streams.
    - Prohibit the use of foam agents within two site-potential trees of fish-bearing, perennial streams and within one site-potential tree of non-fish-bearing, intermittent streams during prescribed burning and mop-up activities.

    - Dispose of end-haul material in stable sites outside of floodplains, as identified by the BLM Authorized Officer. Apply erosion control measures at disposal sites to minimize sediment delivery to water bodies.
- During water source restoration:
    - Meet Medford District ROD/RMP and Oregon Department of Fish and Wildlife standards for replacement culvert design and installation.
    - Minimize disturbance to existing riparian vegetation in order to maintain slope stability and shade. Limit vegetation clearing to the vehicular access point.
    - Use sediment-control measures such as straw bales, filter cloth, or sediment fences.
    - Limit instream work to the period from June 15 to September 15.
    - Maximize maintenance activities during late summer and early fall to best avoid wet conditions.
    - Temporarily suspend work if monitoring indicates rain storms have saturated soils to the extent there is potential for causing excessive stream sedimentation.
    - Apply native plant seed and weed-free mulch as soon as possible after excavation or ripping to reduce erosion.
    - Install, operate, and maintain fish screens on water withdrawal equipment in accordance with NOAA Fisheries.

F.3 ACS Consistency Analysis

The following discussion is based on the proposed project activities combined with specific PDFs that will maintain or restore each ACS objective. ACS objectives are analyzed based on short- (10 years or less) and long- (over 10 years) term effects of the project, and are analyzed at a project scale and watershed scale.

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.

Project Scale

Short-Term: The Trail Creek project would maintain and, in some cases, enhance the distribution, diversity, and complexity of the watershed and landscape-scale features. PDFs will ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted. PDFs include no-cut buffers on all streams, lakes, wetlands, ponds, springs, and meadows; no new landing construction in riparian reserves; wet season restrictions on hauling and road construction; mechanized equipment following special yarding requirements in riparian reserves; and blocking and decommissioning temporary routes in the same season the route is used.

Long-Term: The Trail Creek project is expected to maintain watershed features in the long term. A total of 10.3 miles of road would be fully and partially decommissioned. The road segments to be abandoned would be fully decommissioned by ripping, water barring, and planting. A total of 1.1 miles of temporary route construction and reconstruction would provide temporary access to timber harvest units and would be decommissioned after use. No new permanent or temporary road construction is proposed in this project.

Riparian reserves would continue to function because no-cut buffers would be implemented on all streams, wetlands, ponds, lakes, springs, and meadows and the 63 acres of proposed riparian reserve thinning would increase long-term large wood recruitment.

Watershed Scale

Short-Term: Riparian reserves are expected to maintain the distribution, diversity, and complexity of watershed- and landscape-scale features primarily because restoration through riparian thinning would occur on 63 acres of riparian reserves; no-cut buffers would be implemented on all streams, lakes, ponds, wetlands, springs, and meadows.

Long-Term: There would be no long-term impacts from this project at the watershed scale because of the implementation of no-cut riparian buffers, road decommissioning, and special yarding requirements for mechanized equipment during riparian thinning.

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.

Project Scale and Watershed Scale

Short-Term/Long-Term: No physical or chemical barriers associated with the proposed forest management activities and associated projects are expected to occur either in the short-term or long-term.

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

Project Scale and Watershed Scale

Short-Term/Long-Term: No-cut buffers would be in place on all streams, wetlands, ponds, lakes, and springs; therefore, all banks and stream configurations would remain unchanged. The Trail Creek project would not affect the physical integrity of the aquatic system in the short- or long-term at either the site or watershed scale.

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.

Project Scale

Short-Term/Long-Term: Water quality would be maintained through the use of riparian reserves and no-cut buffers in the Project Area. Water quality would be improved in the short-term as a result of road renovation, although small amounts of sediment could be mobilized and transported to streams when the work begins. There are no point sources of pollution associated with this project. PDFs to maintain water quality include storing hazardous materials and petroleum products and fueling equipment outside of riparian reserves.

Water quality would be maintained in the long-term. Road renovation and decommissioning would reduce sediment input from roads. There would be a slight improvement in water quality at the project scale as a result of the adding crushed rock to 9.2 miles of road and decommissioning a total of 10.3 miles of road.

Watershed Scale

Short Term/Long Term: Water quality would be maintained at the watershed scale because riparian reserves would continue to function and protect riparian, aquatic, and wetland ecosystems. Road renovation would reduce sediment input to local stream channels but would have little effect at the watershed scale.

Water quality would be maintained as riparian reserves continue to grow large conifers. Road work would help maintain or improve water quality; although, the effect at the watershed scale would be small because of the large number of road miles in the watershed.

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.

Project Scale

Short Term/Long Term: The current sediment regime would be maintained because riparian reserves would continue to filter sediment and protect aquatic systems from additional sediment loads that may result from management actions.

The current sediment regime would be improved as a result of 26 miles of proposed road renovation and 10.3 miles of road decommissioning. The volume of sediment would be reduced as a result of adding crushed rock to 9.2 miles of road and adding rock to depleted spots on 16.8 miles of road within the watershed.

Watershed Scale

Short Term/Long Term: The current sediment regime would be maintained during implementation of the Trail Creek project because timber harvest would occur outside of riparian reserves, with the exception of riparian reserve thinning. Riparian reserve thinning would maintain the sediment regime through the use of no-cut buffers along the streams. The sediment regime would be maintained or improved through 26 miles of road renovation and 10.3 miles of road decommissioning.

The sediment regime would be maintained at the watershed scale. Although the road work would reduce the volume of sediment at the site scale, this would be immeasurable at the watershed scale when compared to the volume of sediment generated from roads throughout the watershed.

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.

Project Scale

Short-Term: Riparian reserves throughout the Project Area would continue to function. Patterns of sediment, nutrient, and wood routing would be unchanged. The project would not diminish large wood recruitment, alter the flow regime, reduce flood-prone areas, or impinge on watershed function. Vegetation canopy removal, soil compaction, roads, and stream crossings (four risk assessment factors) would not

approach risk thresholds of peak or base flows because full riparian reserves will be retained on all but 63 acres, mechanized equipment would follow special yarding requirements inside riparian reserves, and a total of 10.3 miles of road would be decommissioned.

Long-Term: In the long-term, it is expected that large wood recruitment would increase within the 63 acres of riparian reserves proposed for thinning due to reducing stand densities and promoting large diameter conifer trees. In the riparian reserves within the project area not being treated, large wood recruitment and patterns of sediment and nutrient routing would remain unchanged.

Watershed Scale

Short-Term/Long-Term: Riparian reserves throughout the Trail Creek fifth field watershed would continue to recover and maintain patterns of sediment, nutrient, and wood routing. Peak high and low flows would remain unchanged at the watershed scale. At the watershed scale, there would be no effects detectable from the background levels because PDFs would be implemented to ensure instream flows are maintained. PDFs include no-cut riparian buffers, no new landings in riparian reserves, mechanized equipment following special yarding requirements within riparian reserves, restrictions on wet season hauling and road construction, and decommissioning temporary routes in the same season of use.

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

Project Scale

Short-Term/Long-Term: The Trail Creek project would maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands because canopy removal, soil compaction, roads, and stream crossings (four risk assessment factors) will not exceed risk thresholds for altering hydrology. No-cut buffers would be applied to all streams, wetlands, ponds, and springs. Except for meadow restoration, project activities would be restricted within 300 feet of meadows. There would be no mechanical disturbance within meadows or wetlands.

Watershed Scale

Short-Term/Long-Term: The Trail Creek project would maintain the timing, variability, and duration of floodplain inundation and the water table elevation in meadows and wetlands because project activities would not increase the risk of peak flows or water accumulations. Project activities would not occur in meadows and no-cut buffers would be implemented on all streams, lakes, ponds, springs, 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.

Project Scale

Short-Term: The Trail Creek project would maintain species composition and structural diversity of plant communities in riparian areas and wetlands because no-cut buffers would be in place on all streams, wetlands, ponds, and springs. Restoration activities in riparian reserves include riparian thinning on 63 acres of riparian reserves. Temporary route reconstruction would use the existing footprint of old skid trails or roads. Riparian reserves would continue to ensure nutrient filtering and appropriate rates of surface erosion,

bank erosion, and channel migration. Riparian reserves would supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Long-Term: The Trail Creek project would restore species composition and structural diversity of plant communities in treated riparian reserves because this project would encourage healthy riparian forests by reducing stand densities to levels the sites have the resources to support. In untreated riparian areas, species composition and structural diversity would be maintained through full riparian reserves on all streams, ponds, lakes, springs, and wetlands.

Watershed Scale

Short-Term/Long-Term: The Trail Creek project is not expected to affect species composition and structural diversity in riparian areas or wetlands at the watershed scale because thinning would occur on only 63 acres of riparian reserves.

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

Project Scale

Short-Term/Long-Term: The Trail Creek project would maintain populations of native plant, invertebrate, and vertebrate riparian-dependent species because no-cut buffers would be implemented on all streams, wetlands, ponds, lakes, and springs. PDFs such as restrictions on wet season hauling and road construction, special yarding requirements for mechanized equipment during riparian thinning, no new landings in riparian reserves, decommissioning temporary routes in same season of use, and ripping and planting new landings and skid trails associated with regeneration harvest would be implemented. PDFs will minimize disturbance to plants, soil, and water; keep project activities from causing large disturbances at the project scale; and limit the risk of spreading noxious weeds.

Watershed Scale

Short-Term/Long-Term: The Trail Creek project is not expected to affect populations of native plant, invertebrate, and vertebrate riparian-dependent species at the watershed scale because there no-cut buffers would be implemented on all stream, wetlands, ponds, and springs. Riparian reserve thinning would be limited to 63 acres and mechanized equipment would follow special yarding requirements within riparian reserves during riparian thinning.

F.4 ACS Summary

The Trail Creek project will maintain all ACS objectives in the short-term and long-term at both the site and watershed scales because of no permanent road construction; no-cut buffers on all stream channels, lakes, ponds, springs, wetlands, and meadows; special yarding requirements for mechanized equipment within the 63 acres proposed for riparian thinning; and additional PDFs to limit effects to soil, water, and plants. This project is not expected to affect the aquatic environment. It would promote the development of large diameter conifer trees in the riparian reserve thinning areas, allow riparian reserves to continue to function, and protect streams within the Trail Creek fifth field watershed.

Full riparian reserves would continue to provide shade to streams. Proposed actions would maintain an adequate distance from streams to avoid sediment deposition harmful to fish habitat. Any effects from all proposed actions are expected to be negligible and within the range of natural variability for maintenance of fish populations and habitat.

Appendix G: Botanical Resources

G.1 Affected Environment

G.1.1 Special Status and S&M Plants and Fungi

Special status species are listed under the ESA as threatened or endangered (including proposed and candidate species); listed by a state as threatened, endangered, or candidate species; and listed by the BLM as sensitive species. BLM's policy for special status plants is to (1) conserve, protect, and manage T&E and Special Status plants and the ecosystems on which they depend, and (2) ensure that actions authorized on BLM lands do not contribute to the need to list Special Status species under the provisions of the ESA (Bureau of Land Management 1995, 50-53).

S&M species are rare and little known species thought to be associated with late-successional and old growth forests in the Northwest Forest Plan area.

G.1.1.1 Threatened and Endangered Plants

Two T&E plants have their ranges within the Trail Creek Project area: large flowered meadowfoam (*Limnanthes flocossa* ssp. *grandiflora*) and Gentner's fritillary (*Fritillaria genterni*).

Large flowered meadowfoam occurs in vernal pools and vernally wet areas in the Agate Desert on non-BLM lands. One proposed harvest unit in the Trail Creek project (T34S, R1W, section 5) is located within the range of this species. It contains vernally wet areas and eight sites of a closely related species, Bellinger's meadowfoam (*Limnanthes flocossa* ssp. *bellingeriana*), were discovered, but no large-flowered meadowfoam sites were found.

Gentner's fritillary occurs in chaparral and oak woodland plant communities and in the transition areas between those plant communities and mixed hardwood-conifer forests. Part of the species' range falls within the Trail Creek project and some harvest units contain suitable habitat. Proposed projects located in T33S, R2W; T34S, R2W; and T34S, R1W are within the range of Gentner's fritillary. The units include areas proposed for timber harvest, fuels reduction, precommercial thinning, small diameter thinning, and meadow restoration. No Gentner's fritillary sites were discovered in any of the units during surveys in 2012 and 2013. One Gentner's fritillary site was known in the Trail Creek area prior to the project initiation. It was discovered in 2006 on the road shoulder of the West Trail Creek Road on timber company lands. No flowering plants have been observed in subsequent years; it is assumed the site is extirpated because it has been impacted by road work.

No T&E plants have been discovered in the proposed treatment areas.

G.1.1.2 Bureau Sensitive Plants and Fungi

Bureau sensitive plants are those species not federally listed as Threatened or Endangered or Proposed for Federal listing, but designated by the BLM State Director, usually in cooperation with the State agency responsible for managing the species and State Natural heritage programs, as sensitive. They are species that (1) could become endangered in or extirpated from a State, or within a significant portion of its distribution; (2) are under status review by the US Fish and Wildlife Service; (3) are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution; (4) are undergoing significant current or predicted downward trends in population or density such that Federal listed, proposed, candidate, or State listed status may become necessary; (5) typically have small and

widely dispersed populations; (6) inhabit ecological refugia or other specialized or unique habitats; or (7) are State listed by may be better conserved through application of BLM sensitive species status for special management consideration. The BLM's policy for Sensitive plants and fungi is to (1) conserve, protect, and manage them and the ecosystems on which they depend and (2) ensure that actions authorized on BLM-administered lands do not contribute to the need to list them under the provisions of the Endangered Species Act (Bureau of Land Management 1995, 50-53).

Surveys for Sensitive vascular and nonvascular (lichens and bryophtyes) plants were completed in 2012 and 2013 for timber harvest, fuels, small diameter thinning, meadow restoration, pump chance restoration, and road decommissioning. Additional surveys will be completed as needed before project implementation for OHV trail closures and restoration, roadside firewood cutting areas, riparian restoration, quarry restoration, and stream habitat enhancement projects.

Special Status and S&M Plants and Fungi Documented in the Trail Creek Project Area

Six Sensitive vascular plant species have been discovered in the Trail Creek units (Table G-1). Two of them also have S&M status. No Sensitive nonvascular plants were documented in the units, but seven S&M lichens and one S&M bryophyte were discovered. Thirteen S&M fungi were discovered, with one also having Sensitive status. It should be noted that only old growth (180-plus years old) stands have been surveyed for fungi. It is likely Sensitive or S&M fungi could also be present in stands less than 180 years old. It is also likely additional sites will be detected when fungi surveys are completed in old growth stands and when vascular and nonvascular surveys are completed for the unsurveyed projects.

Table G-1. Special Status and S&M Plants and Fungi in or adjacent to Trail Creek Treatment Units (as of June 30, 2013)

Scientific and Common Names	Habitat in the Trail Creek Project Area	Proposed Treatment	Status[1]	Number of Sites[2]	
				Project Area	Trail Creek Units
Vascular Plants					
Cypripedium fasciculatum Clustered lady-slipper orchid	Forested mid-seral to old growth stands in Douglas-fir series with 60 to 100% canopy cover.	timber harvest, fuels reduction	Sensitive S&M C	15	11
Cypripedium montanum Mountain lady-slipper orchid	Forested later seral stands in the Douglas-fir series with 60 to 80% canopy cover.	timber harvest, fuels reduction	S&M C	38	21
Illiamna latibracteata California globe-mallow	Shallow dry draw in mid-seral mixed hardwood-conifer forest with 50% canopy cover. Often in forest openings or earlier seral stands.	timber harvest	Sensitive	8	2
Limnanthes flocossa ssp. *bellingeriana* Bellinger's meadowfoam	Vernally wet meadows, usually with clay soils.	fuels reduction	Sensitive	10	8

Table G-1. Special Status and S&M Plants and Fungi in or adjacent to Trail Creek Treatment Units (as of June 30, 2013)

Scientific and Common Names	Habitat in the Trail Creek Project Area	Proposed Treatment	Status[1]	Number of Sites[2]	
				Project Area	Trail Creek Units
Romanzoffia thompsonii Thompson's mistmaiden	Vernally wet rocky hillsides with open canopies.	meadow restoration	Sensitive	3	2
Solanum parishii Parish's horsenettle	Wedgeleaf ceanothus chaparral, oak/pine woodlands, meadows, and brush land in dry Douglas-fir or Oregon oak communities. Also present in young conifer plantations and along road banks.	meadow restoration	Sensitive	4	1
Lichens					
Bryoria tortuosa Tortured horsehair lichen	Grows on trees and shrubs in well-lit, open stands and shrublands. Commonly found on ponderosa pine, Oregon white oak, and white leaf manzanita.	fuels reduction	S&M A (Western Cascades) S&M D (Klamath)	5	5
Chaenotheca chrysocephala Canary whiskers	Grows on 20 to 40" DBH Douglas-fir trunks in semi-open forests at relatively low elevations (263 to 3,783 feet). Most abundant on conifer trunks in mixed forests and in edge habitats. In later successional stands or mid-seral stands with legacy trees.	fuels reduction	S&M B	21	13
Chaenotheca ferruginea Blood whiskers	Frequent over bark and wood of 20 to 60" DBH Douglas-fir and incense cedar in semi-open montane forests and foothills.	timber harvest, fuels reduction, small diameter thin	S&M B	79	65
Chaenotheca subroscida Lemondrop whiskers	Grows on mostly larger (26 to 38" DBH) white fir and Douglas-fir trunks in later seral or mixed-age stands.	fuels reduction, timber harvest	S&M E	53	27
Dendriscocaulon intriculatum	Grows on the bark of hardwoods in mixed hardwood-conifer forests.	timber harvest, fuels reduction	S&M B	51	28

Table G-1. Special Status and S&M Plants and Fungi in or adjacent to Trail Creek Treatment Units (as of June 30, 2013)

Scientific and Common Names	Habitat in the Trail Creek Project Area	Proposed Treatment	Status[1]	Number of Sites[2]	
				Project Area	Trail Creek Units
Leptogium rivale	Grows on bark of hardwoods.	outside units	S&M B	7	0
Leptogium teretiusculum Shrubby vinyl	Grows on madrone, golden chinquapin, canyon live oak, and Oregon white oak in open mixed hardwood-conifer stands in drier sites or in oak savannas.	fuels reduction	S&M E	34	20
Peltigera pacifica	Growing over moss in mixed hardwood-conifer forest with dense canopy and scattered old growth trees.	small diameter thin	S&M E	2	2
Bryophytes					
Buxbaumia viridis Green bug moss, Bug on a stick	Grows on rotten logs in dense, shady coniferous forest.	timber harvest, fuels reduction	S&M D	40	11
Fungi					
Bondarzewia mesenterica Gelatinous pored polypore	Grows on stumps or duff and litter in late seral mixed conifer stands.	timber harvest	S&M B	2	2
Clavariadelphus occidentalis Club coral	Grows in duff in old growth Douglas-fir/white fir forest with 80-90% canopy cover.	timber harvest	S&M B	1	0
Clavariadelphus sachalinenesis Club coral	Grows in duff under conifers in old growth stands in the white fir and Douglas-fir series, both moist and dry sites. Mostly 60 to 90% canopy cover, but some sites with 25 to 60% canopy cover. May also occur in earlier seral stands.	fuels reduction, timber harvest	S&M B	83	52
Clavariadelphus truncatus Truncate club coral	Grows in duff in moist white fir/Douglas-fir old growth stands with 50 to 80% canopy cover.	timber harvest	S&M B	17	5
Cudonia monticola Earth tongue	Growing in duff in late seral conifer stands.	timber harvest	S&M B	1	0

Table G-1. Special Status and S&M Plants and Fungi in or adjacent to Trail Creek Treatment Units (as of June 30, 2013)

Scientific and Common Names	Habitat in the Trail Creek Project Area	Proposed Treatment	Status[1]	Number of Sites[2]	
				Project Area	Trail Creek Units
Otidea leporina Rabbit ears	Growing in duff in Douglas-fir mixed hardwood-conifer old growth stand in association with Douglas-fir, sugar pine, incense cedar, and hardwoods. Open canopy and moderately dense shrubs.	fuels reduction	S&M B	2	1
Phaeocollybia californica	Growing in loamy soil in late seral conifer stand.	timber harvest	S&M B, Sensitive	1	1
Phaeocollybia pseudofestiva[3]	Growing in loamy soil in moist white fir late seral stands with old growth Douglas-fir and sugar pine and 70 to 95% canopy cover.	timber harvest	S&M B	2	2
Ramaria rubripermanens Coral mushroom	Growing on duff in opening of old growth white fir/Douglas-fir stand with 40% canopy cover.	timber harvest	S&M B	1	1
Rhizopogon truncatus False truffle	Growing in duff under 30 to 48" DBH sugar pine in previously harvested old growth white fir or mixed conifer/hardwood stands with 50 to 95% canopy cover.	timber sale, fuels reduction	S&M D	15	9
Sarcodon fuscoindicus Tooth fungus	Growing on litter and duff in late seral white fir/dwarf Oregon grape stand.	timber sale	S&M B	1	1
Spathularia flavida Fairy fan	Growing in duff in opening of late seral Douglas-fir stand with large legacy trees and 5% canopy cover.	fuels reduction	S&M B	2	2
Tremiscus helvelloides Apricot jelly mushroom	Growing in duff in later seral or old growth Douglas-fir and white fir mixed conifer/hardwood stands with 40 to 90% canopy cover or in mixed conifer/white oak woodland with 55% canopy cover.	fuels reduction, timber harvest	S&M B	37	22

Table G-1. Special Status and S&M Plants and Fungi in or adjacent to Trail Creek Treatment Units (as of June 30, 2013)

Scientific and Common Names	Habitat in the Trail Creek Project Area	Proposed Treatment	Status[1]	Number of Sites[2]	
				Project Area	Trail Creek Units

[1]2001 Survey and Manage, 2012 Oregon Special Status Species List

[2]Source – Geographic Biotic Observations database

[3]Tentative identifications; waiting confirmation from taxa expert

G.1.2 Noxious Weeds

The Medford District objectives for noxious weeds are to continue to survey for, avoid introducing or spreading, and contain or reduce infestations on BLM-administered land (Bureau of Land Management 1995, 92-93).

Noxious weeds are plants growing outside their native lands or habitats that are injurious to public health, agriculture, recreation, wildlife, or public or private property (Oregon Department of Agriculture 2013, 4). The Oregon Department of Agriculture designates and classifies noxious weeds according to their detrimental effects, reproductive strategies, distribution, and difficulty of control (Table G-2).

Table G-2. ODA Noxious Weed Control Rating System

Category	Criteria	Recommended Action
A	Weeds that occur in the state in small enough infestations to make eradication or containment possible; or are not known to occur, but their presence in neighboring states makes future occurrence in Oregon seem imminent.	Infestations subject to eradication or intensive control when and where found.
B	Regionally abundant weed, but which may have limited distribution in some counties.	Limited to intensive control at the state, county, or regional level as determined on a case-by-case basis. Where implementation of a fully integrated statewide management plan is not feasible, biological control (when available) shall be the main control approach.
T	A select group of A or B designated weeds.	Identified by the Oregon State Weed Board as a priority target on which the Oregon Department of Agriculture will develop and implement a statewide management plan.

Source: Oregon Department of Agriculture, Plant Division, Noxious Weed Control Program. 2013. http://www.oregon.gov/ODA/PLANT/WEEDS/lists.shtml

Noxious Weeds Documented in the Trail Creek Project Area

Vascular plant surveys and incidental sightings in the Trail Creek Project Area have found 8 noxious weed species:

- Armenian (Himalayan) blackberry (*Rubus armeniacus*)
- Canada thistle (*Cirsium arvense*)

- Meadow knapweed (*Centaurea pratensis*)
- Scotch broom (*Cytisus scoparius*)
- Spotted knapweed (*Centaurea stoebe*)
- St. John's wort, Klamath weed (*Hypericum perforatum*)
- Tansy ragwort (*Senecio jacobaea*)
- Yellow star-thistle (*Centaurea solstitialis*)

All weeds are Category B on ODA's list, which means the recommended treatment is for intensive control at the state, county or regional level as determined on a site-specific, case-by-case basis. Weed treatments are ongoing in Trail Creek and would be concentrated in the next couple of years in areas proposed for treatment in this EA, including quarries, haul routes, areas where new routes or landings would be constructed, and within units. For the Trail Creek project, the strategy for the eight noxious weeds is to treat all species except Himalayan blackberry and St. John's wort. These two species are widespread and treatment of all populations is not practical, given limited time and funding. However, Himalayan blackberry would be treated in restoration areas and St. John's wort would be treated in rock quarries.

G.2 Environmental Consequences

G.2.1 Effects of Alternative 1 on Botanical Resources

Direct and Indirect Effects

Special Status and S&M Plants and Fungi

Under the No Action Alternative, conditions in plant communities in Trail Creek would continue their current pace of stand development. No timber harvest would occur that would move stand ages in some stands to earlier seral stages or reduce the amount of suitable habitat for Special Status and S&M plants and fungi associated with later-seral conifer stands. There would be no potential impacts to Sensitive or S&M plants or fungi from ground disturbance, removal of host trees, or changes in environmental conditions.

Alternatively, existing conditions in dense stands would not improve to benefit Special Status and S&M plants and fungi. Canopy closure would remain high and understory vegetation would continue to be suppressed due to a lack of light in those stands. Species diversity would remain low and conditions for rare plants that require more light would not improve.

Noxious Weeds

There would be no actions beyond the existing and expected activities that would introduce or spread noxious weeds in the Project Area. Impacts to native vegetation and the risk of introducing or spreading noxious weeds from off-road OHV use would continue. Weed treatments would continue as planned on known populations in the project area, depending on funding and staffing.

Cumulative Effects

Special Status and S&M Plants and Fungi

The BLM does not have data on the presence or abundance of rare plants in the Trail Creek Project Area prior to botanical surveys conducted over the past 20 years. Preproject surveys and incidental sightings have discovered a number of Special Status and S&M plants sites. It is possible rare plants may have been impacted by past activities on both private and public lands. Activities that altered conditions on the land

and may have affected rare plant species include road building, timber harvest, livestock grazing, agriculture, wildfire, fire suppression, rural development, changes to hydrological processes, utility line construction, and the spread of noxious weeds.

The BLM anticipates present and foreseeable future actions in the Trail Creek project area under the No Action Alternative would include continued forest management on private industrial lands. Construction of the Pacific Connector Gas Pipeline through the Project Area is proposed. If constructed, mitigation measures to prevent Special Status species from trending toward listing and to ensure the persistence of S&M species would be applied to the project design and implementation.

Under the No Action alternative, late-successional conifer stands on BLM-managed lands in the Project Area would continue to provide suitable habitat for species associated with that habitat. In the Trail Creek subwatersheds, 57% of conifer stands on BLM-managed lands are 80 years old or older. Mid-seral stands would continue developing toward later seral stages. Other activities expected to occur in the future on BLM-managed lands in the project area include traffic on BLM roads, grazing, and recreation.

The No Action alternative would not contribute additional effects to Special Status or S&M plants or fungi when added to past, present and foreseeable future actions in the Trail Creek Project Area because it would not authorize any actions that would potentially cause impacts.

Noxious Weeds

Present and foreseeable future activities on private or public lands that could introduce noxious weeds into the Trail Creek project area include road or utility line building, timber harvest, recreation, vehicular traffic, and natural processes such as wind, seasonal flooding, and movement of birds and animals.

Added to past, present, and foreseeable future actions, Alternative 1 would not contribute additional effects to noxious weeds in the Trail Creek project area beyond existing conditions because no physical disturbance would occur. The BLM will continue to survey for, document, and treat noxious weeds on BLM-managed lands in the Project Area as part of the Medford District Noxious Weed Program.

G.2.2 Effects of Alternatives 2, 3, and 4 on Botanical Resources

Direct and Indirect Effects

Special Status and S&M Vascular Plants

Potential impacts on Special Status and S&M plants and fungi from the three action alternatives would not be substantially different because the BLM has conducted surveys and would protect known sites by establishing no treatment buffers around the plants. The buffer sizes would vary depending on the type of treatment, the species and their environmental requirements, and the existing conditions at the sites. Differences among the alternatives that result in different impacts to Special Status or S&M plants or fungi are discussed separately under each proposed action.

No T&E plants were discovered in the project area during surveys conducted in 2012 and 2013; therefore, the proposed actions would be **"no effect"** to T&E plant species determination under ESA. If T&E plants are discovered during future surveys for other projects covered under this EA, the sites would be managed so the action would be "no effect" to the population.

Because the BLM surveys for Special Status and S&M vascular and nonvascular plants prior to project implementation and manages documented sites, the proposed actions would not trend Sensitive species toward listing nor prevent the persistence of S&M species.

Predisturbance surveys are not required for Sensitive fungi, but sites are documented in old growth stands during surveys for S&M fungi in 180-plus year old stands. It is possible Sensitive or S&M fungi populations may occur in stands less than 180 years old that were not surveyed for fungi. If present, timber harvest and associated activities could impact them. However, the Trail Creek project area is on matrix lands, which are lands available for timber harvest. It is anticipated that protecting known and future found sites of Sensitive and S&M fungi, conducting equivalent effort surveys in old growth stands prior to habitat disturbing activities, and protecting habitat and sites in a system of reserves (Riparian, Late-successional, and other special management areas), would prevent Sensitive fungi from trending toward listing and ensure S&M fungi species persistence (Bureau of Land Management 2004, 5-1).

Forest Management: The results of thinning dense stands or stands lacking multiple ages or layers would benefit Special Status, S&M, and native vascular plants over the long term by enhancing forest health and increasing resiliency to environmental disturbances. These proposed actions include density management and commercial, restoration, riparian, small density, and precommercial thin prescriptions that leave 40 to 60% canopy cover. Species that are vulnerable to damage from high severity wildfire, such as the lady-slipper orchids, would benefit from thinning that reduces the risk of stand-replacing fires. Species that grow in more open canopy conditions, such as the California globe-mallow, would benefit from reducing tree densities.

Timber harvest and associated activities also pose potential impacts to Special Status or S&M vascular plants; therefore, protection measures and project design features would be implemented. Proposed harvest units were surveyed and no-treatment buffers would be established around plants on a site-specific basis. The buffer sizes would vary depending on the species and its environmental requirements, proposed treatment, and current environmental conditions at the site. Buffers would be large enough to protect plants from direct impacts from equipment or other vehicles used during timber harvest or road building. They would also prevent negative effects from changes in environmental conditions due to reductions in canopy cover. Reducing overstory tree canopy cover or understory tree or shrub cover results in an increase in light and solar radiation, an increase in ambient and soil temperatures, and a reduction in relative humidity at a microsite level. Buffers would be larger for species that require shady and moist conditions, like clustered and mountain lady-slipper orchids. For species that grow better in more open conditions, like Parish's nightshade and California globe-mallow, buffer sizes would be smaller to allow benefits to the populations from reducing the canopy cover of the surrounding forest stands.

Alternative 2 proposes regeneration harvest of 75 acres in six stands, which would reduce canopy cover to 10 to 40%. The stands, which are spread across the Project Area, are in the mature seral stage (110 to 160 years old) and are 6.5 to 24 acres in size. Regeneration harvest would return these stands to an early seral stage after harvest, but 6 to 25 large overstory trees would be retained per acre. One California globe mallow population was documented in a northern GFMA unit. The site would be buffered to prevent direct or indirect impacts to the plants. This small amount of regeneration harvest spread across the fifth field watershed would not affect the persistence of Special Status or S&M vascular plants because the BLM surveyed for these species and would protect sites from impacts.

Returning these 75 acres of conifer forest to an early seral stage would not negatively affect the persistence of Special Status or S&M vascular plants because no sites would be impacted and because 57% of the fifth field watershed would remain in later successional stages.

Reforestation after regeneration would not negatively impact Special Status or S&M vascular species because the units were surveyed and trees would not be planted where the sites occur.

Post-harvest slash treatments would not impact Special Status or S&M vascular plants because units were surveyed and plant sites would be avoided. Slash would not be piled on top of plants, burn piles would not be placed within plant buffers, and trees removed for biomass would not be dragged through sites. Underburning would occur when plants are not vulnerable to direct damage from flames and when it would not interfere with seed development and dispersal or sites would be buffered to prevent direct impacts.

Timber harvest activities that disturb the soil or remove vegetation could result in an increase in noxious weeds which compete with native species for space, light, water, and nutrients. Noxious weeds often crowd out Special Status or S&M vascular plants, resulting in reduced vigor or reproductive ability. Small sites are especially vulnerable to extirpation from competing nonnatives. To reduce the risk of introducing or spreading noxious weeds, equipment would be washed before moving onto BLM lands, bare soil on ripped roads and landings would be seeded and mulched with native species, and noxious weed populations discovered during post-harvest monitoring would be treated.

Road Work: Road and landing construction and decommissioning pose potential impacts to Special Status and S&M vascular plants because they cause ground disturbance. They also increase the risk of noxious weeds being introduced or spread and impacting vascular plant populations. The proposed routes and landings were surveyed in 2013 and no Special Status or S&M vascular plant sites were discovered; therefore, this road work would cause no impacts to Special Status or S&M vascular plants.

Hazardous Fuels Reduction: Thinning or pruning small diameter conifers and hardwoods and shrubs would not alter the overstory canopy cover. However, removing small diameter trees and shrubs would change environmental conditions in the understory. It would create openings with more light and would result in drier, hotter air and soil temperatures. This would benefit species that require more light, such as Parrish's horsenettle, but would stress species that require shadier, moister, and cooler environmental conditions, such as the lady-slipper orchids. This stress could cause a decline in plant numbers or vigor. Special Status or S&M vascular plants could also be impacted if burn piles were placed on plants. The high temperatures and concentration of the fires would damage plants, bulbs, or roots. In order to avoid these impacts, the BLM has conducted surveys in the proposed treatment units and would protect Special Status and S&M vascular plants from direct and indirect impacts by buffering sites.

Hazardous fuels treatments can benefit Special Status and S&M vascular plants in two ways: First, reducing the risk of stand-replacing fire that would negatively impact species vulnerable to damage from high intensity fire. Second, reducing stand density would free up resources for the remaining trees and for development of the understory vegetation. Enabling a diverse native understory plant community benefits existing populations and provides suitable habitat for expansion or colonization of new populations.

Removing vegetation opens areas to invasion by noxious weeds, which compete with Special Status and S&M vascular plants. To reduce this risk, areas containing existing noxious weed populations would be seeded with native species after hand pile burning or broadcast or underburning. Establishing native species would reduce the risk of noxious weeds becoming established in those disturbed sites.

Public Roadside Firewood Cutting: Firewood cutting is proposed along approximately 12 miles of road in the Project Area. Roughly 10% of the proposed roadside firewood cutting area has been surveyed for Special Status and S&M vascular plants for current or past projects. No sites have been documented in the surveyed areas. The risk of impacting Special Status or S&M vascular plants in nonsurveyed areas during the proposed

roadside firewood cutting is small. Vehicles would stay on main roads. The only ground disturbance would occur when trees are dragged to the road. Removing dead downed trees would not change the overstory canopy cover. Removing standing dead trees would change the canopy cover slightly but those trees would eventually fall and leave small gaps. The scope and scale of the proposed roadside firewood cutting project and the risk of impacting Sensitive or S&M species would not be great enough to trend Sensitive species toward listing or to impede the persistence of S&M species.

Water Source Restoration: No Special Status or S&M vascular plants were detected at the Trail Creek pump chances during botanical surveys in 2013. There would be no direct or indirect effects to these species during the proposed water source restoration work.

Off-highway Vehicle Trail Closure and Restoration: Surveys have not been conducted for Special Status or S&M vascular plants on the trails proposed for closure and restoration. Because they are disturbed areas, it is unlikely rare plants occur on the trails. Closing them would benefit vascular plants by stopping the ongoing compaction from repetitive passes. Seeding with native plants and allowing the areas to revegetate would also benefit Special Status and S&M vascular species. The only risk to Special Status or S&M plants would be if there were populations located next to the trails that were impacted during ripping. To prevent this, the trails proposed for ripping would be checked for Special Status and S&M plant populations prior to decommissioning. If populations are discovered, they would be avoided during ground-disturbing restoration work.

Meadow Restoration: The meadows proposed for restoration were surveyed for Special Status and S&M vascular plants in 2012. Two sites of Thompson's mistmaiden and one site of Parish's horsenettle were discovered. To prevent direct damage to these species, slash piles would be stacked and burned away from plants. If broadcast burning were implemented, it would be conducted during the late fall or early winter when plants are dormant. Prescribed fire has been found to have a neutral to positive effect on Parish's horsenettle mean size, reproductive status, and survival (Gray 2012, 14). The effects of fire on Thompson's mistmaiden have not been studied. The populations in Trail Creek are on steep, rocky, south-facing slopes with annual nonnative grasses that would not carry fire. Fire would not burn through this area in the late fall to winter months without sufficient dried fuel, but would more likely burn around the meadow in the shrubs and small trees of the surrounding wooded stands. Therefore, the sites would not be negatively affected by the restoration actions.

Stream Enhancement and Riparian Restoration: Surveys would be conducted for Special Status or S&M vascular plants at sites where ground disturbance would occur—where wood structures and rock jetties would be placed, in the vicinity of roads that would be ripped, where trees would be planted, and at culvert replacement sites if work occurs outside the road prism. If populations are discovered, protection measures would be implemented to prevent direct damage to plants from the equipment used during the restoration activities or from indirect effects from changes in habitat conditions as a result of removing trees for the wood structures. Over the long term, rehabilitating natural surface, user-built roads and planting the riparian area with native species would improve habitat that Special Status and S&M plant species could occupy.

Quarry Reclamation: The Romine Creek quarry would be surveyed for Special Status or S&M vascular plants prior to reclamation work. It is unlikely Special Status plant populations occur there because it is a highly disturbed site. However, if populations are discovered, they would be buffered to protect against damage during ripping and recontouring. Seeding and planting would also be strategized to be compatible with the habitat requirements for Special Status species. The reclamation work would benefit Special Status and S&M vascular species in the long-term by restoring native habitats that they could occupy.

Special Status and S&M Nonvascular Plants

Forest Management: Thinning dense stands that reduce fuel loads would benefit nonvascular species by reducing the possibility of a high intensity wildfire that would damage them. Prescriptions that leave larger-sized conifers and hardwoods and that thin to reduce competition for resources for the remaining trees would also benefit nonvascular species by promoting development of future host trees.

Potential impacts to Special Status or S&M nonvascular plants from forest management include damage to lichens or mosses from logging equipment, removal of the host trees or shrubs, or damage from fire during slash pile burning or underburning. Plants could also be indirectly impacted from changes in microsite conditions, including increased light and temperature regimes and reduced moisture. To prevent these impacts, surveys were conducted and sites would be buffered. Buffer sizes for the S&M nonvascular sites would vary depending on the species, environmental requirements, proposed treatments, and existing habitat conditions. Thinning prescriptions would leave between 40 and 60% canopy cover after harvest. Buffer sizes would be smaller for lichens that grow in more open conditions, such as *Dendriscocaulon intriculatum, Bryoria tortuosa,* and *Leptogium teretiusculum* and larger for lichens that prefer shadier conditions, such as *Chaenotheca subroscida* and *Peltigera pacifica.*

The six stands where regeneration harvest is proposed in Alternative 2 were surveyed for Special Status and S&M nonvascular species. Three S&M species (*Chaenotheca subroscida, Chaenotheca ferruginea,* and *Chaenotheca chrysophylla*) at nine sites were documented in three NGFMA units. All three species are pin lichens that grow on conifers or hardwoods. The sites would be buffered to prevent direct or indirect impacts to the plants.

Reforestation after regeneration harvest would not impact Special Status or S&M nonvascular species because no terrestrial species occur in the units that would be impacted by digging and there would be no disturbance to species that occur on trees. Promoting the development of the new stand would benefit nonvascular species because it would provide future host trees.

Special Status or S&M nonvascular plants would not be negatively affected by flames or heat from slash pile burning because slash piles would not be placed within buffers. The risk of impacting nonvascular species during underburning would be reduced by putting in hand lines around the buffers or burning when flame lengths would not reach the lichens on the tree boles.

Road Work: Temporary road construction and reconstruction, landing construction, and road decommissioning could impact nonvascular species by removing their host trees or by damaging species that grow on the ground. The proposed temporary route construction and reconstruction and landing construction sites have been or will be surveyed for Special Status or S&M species and any sites discovered would be avoided. Road and landing construction would not impact Special Status or S&M nonvascular species.

Hazardous Fuels Reduction: Special Status or S&M nonvascular plants could be impacted during hazardous fuels treatments if the host trees or shrubs were cut, if environmental conditions change that would negatively affect them, if piles are burned close to the trees they occupy, or if piles are burned on top of terrestrial species. In order to avoid those impacts, the BLM conducted surveys for these species and would protect sites with buffers.

Public Roadside Firewood Cutting: Approximately 10% of the proposed roadside firewood cutting area has been surveyed for Special Status and S&M nonvascular plants for current or past projects. No sites have been documented. The risk to Special Status and S&M nonvascular plants in areas that have not

been surveyed would be low because the species that occur in the project area—*Chaenotheca subroscida, Chaenotheca ferruginea, Chaenotheca chrysophylla, Leptogium teretiusculum, Dendriscocaulon intriculatum,* and *Buxbaumia viridis*—typically grow on live or downed conifers or hardwoods greater than 16" DBH. Because the scope and scale of the project is small, it would not trend nonvascular Sensitive species toward listing or impede the persistence of nonvascular S&M species.

Water Source Restoration: The Trail Creek pump chances are previously disturbed sites and do not contain suitable habitat for Special Status or S&M nonvascular plants. No surveys were conducted and there would be no effects to Special Status or S&M nonvascular plants.

Off-highway Vehicle Trail Closure and Restoration: Surveys for nonvascular species would be conducted prior to the trail closures and restoration activities. Special Status or S&M nonvascular species that grow on trees would not be impacted because standing trees would not be affected. If Special Status or S&M species that grow on the ground are detected, the sites would be avoided during the restoration work to prevent direct impacts to them. Closing the trails would benefit nonvascular species in the long-term by preventing future impacts from OHVs.

Meadow Restoration: Surveys were conducted in summer 2013 for Sensitive and S&M nonvascular species. Eight sites of the lichen *Leptogium teretiusculum* and one site of *Dendriscocaulon intriculatum* were discovered on scattered canyon live oak and Oregon white oak within the oak savanna. Potential impacts to these species could occur during broadcast burning if flame lengths reach up the tree boles to where they are located. To prevent these direct impacts, trees would be buffered with hand lines or prescribed burning would occur when flame lengths could be kept low enough not to damage the lichens.

Stream Enhancement and Riparian Restoration: Surveys would be conducted for Special Status and S&M nonvascular plants at stream enhancement and riparian restoration sites that contain suitable habitat for these species and where restoration work could impact populations. Sites would be protected to avoid impacts to plants. Over the long term, planting trees in riparian areas would create or improve habitat for Special Status and S&M nonvascular species.

Quarry Reclamation: The areas in the quarry that would be ripped or recontoured do not contain suitable habitat for Special Status or S&M nonvascular plants because they are highly disturbed areas. The reclamation work would cause no direct or indirect effects to these species.

Special Status and S&M Fungi

Forest Management: The S&M equivalent effort surveys conducted in 285 acres of old growth stands discovered 13 S&M fungi with around 100 sites as of early fall 2013 and more will likely be discovered before the surveys are completed in spring 2014. Known sites would be protected through no-treatment buffers of varying sizes, depending on the species, their environmental requirements, proposed prescription, and existing stand conditions. Some species, such as *Clavariadelphus sachalinensis, Spathularia flavida, Otidea leporina,* and *Rhizopogon truncates,* are found in more open, drier forest communities. Buffers would be large enough at these sites to prevent direct impacts from logging equipment to mycelium around the fruiting bodies, but small enough that thinning the surrounding stand would benefit the species by opening up the canopy. Buffer sizes would be larger for species that require shadier and moister conditions.

Units under 180 years old, approximately 800 acres, have not been surveyed for fungi, although they contain suitable habitat for S&M and four Sensitive fungi species. Based on the large number of sites and species found during the equivalent effort surveys in the old growth stands, it is reasonable to assume there are some

S&M fungi populations on the 800 acres. If present, they could be directly or indirectly adversely affected by timber harvest and associated activities.

Timber harvest can have varying degrees of adverse effects on fungi, depending on the level of tree removal and ground disturbance. Because of their mycorrhizal association with conifers, removing host trees during timber harvest could indirectly affect fungi. Removing host trees halts the transfer of nutrients produced during photosynthesis to the fungi. Presumably mycorrhizal associations would reestablish as new conifers grow if the fungal hyphae persist through the period of stress caused from disruption of the mycorrhizal connections and changes in environmental conditions.

Activities that remove, disturb, or compact the top layer of organic material and mineral soil negatively impact fungi. The main and most extensive part of a fungus consists of a mycelial network that resides in the top few inches of mineral soil. Mycelial networks are often connected to multiple trees through their root systems. In one study, mycelial networks ranged in size from 1.5 to 27 square meters (Dahlberg and Stenlid 1995). During timber harvest, tractors and yarding equipment disturb and compact soil, which could damage fungal mycelia. All three action alternatives propose approximately the same amount of tractor and yarding methods. Potential impacts to Sensitive or S&M fungi, if present, would be similar among the alternatives.

Reducing the overstory canopy during timber harvest changes environmental conditions and indirectly affects fungi. Relative humidity drops, light increases, and air and soil temperatures rise. Hotter, drier conditions inhibit sporocarp production and fungal persistence. Regeneration harvest, including northern GFMA, southern GFMA, and shelterwood, results in greater changes in environmental conditions because it reduces canopy cover to 10 to 40%, compared to thinning prescriptions, which reduce canopy cover to 40 to 60%. Potential impacts to rare fungi that grow in late-successional forests would be greater in the regeneration units, if present, than in units that are thinned. Under Alternative 2, the BLM would regeneration harvest 75 acres. All six regeneration harvest units are less than 180 years old, so S&M fungi surveys were not conducted. Conifer stands that are regeneration harvested would not provide suitable habitat for Sensitive or S&M fungi associated with late-successional forest for 80-plus years. No regeneration harvest would occur in Alternatives 3 or 4; therefore, the potential effects to Sensitive or S&M fungi, if present, would be less in these alternatives.

Burning slash piles poses potential impacts to rare fungi if present. The mycelia and spores would be damaged or destroyed by the intense heat generated during burning. Other detrimental effects to fungi from slash pile burning include loss of litter and organic matter, resulting in reduced moisture retention capability and a loss of nutrient sources. The effect of these activities on fungi is a loss of species diversity and abundance (Amaranthus, et al. 1996). It is unknown how many acres would be impacted in each alternative by post-harvest fuels treatments because they would be based on assessments made after timber harvest is completed. It is assumed the treatments and effects to fungi would be comparable under Alternatives 3 and 4 because the acres treated and the harvest methods are similar. The effects to fungi would be slightly more under Alternative 2 because regeneration harvest would result in more post-harvest slash. Lop and scatter would not negatively impact fungi because it would not cause ground disturbance.

Although fungi surveys were not conducted in stands less 180 years old, the stands are on matrix lands, which are available for timber harvest. It is anticipated that protecting known and future found sites of Sensitive and S&M fungi, conducting equivalent effort surveys in old growth stands to locate additional populations, and protecting habitat and sites in a system of reserves (riparian, late-successional, and other

special management areas) will prevent Sensitive fungi from trending toward listing and ensure S&M fungi species persistence.

Road Work: Surveys for S&M and Sensitive fungi are being conducted for two proposed temporary routes (0.2 mile total) and two landings that are located in stands 180-plus years old. Surveys will be completed in spring 2014. No sites have been discovered so far. Fungi surveys are not required for the other proposed roads and landings because they are less than 180 years old.

Alternatives 2 and 3 propose construction of 0.6 mile of temporary route, reconstruction of 0.5 mile of temporary route, construction of 11 new landings, and reconstruction of 1 landing. Ten existing landings would also be used. Alternative 4 proposes reconstruction of 0.2 mile of temporary route, construction of 9 new landings, and reconstruction of 1 landing. Thirteen existing landings would be used.

During road and landing construction, trees and shrubs would be removed and soil disturbed. Repetitive use of the area would compact soil. After use the landings would be ripped and planted. If Sensitive or S&M fungi populations were present, it is unlikely they would persist at the sites after these activities because of the high level and concentrated disturbance to the soil where the fungal mycelia reside. Although ripping landings after use would break up the soil and fungal hyphae could eventually recolonize the areas, it would be 80-plus years before trees reestablished and provided suitable habitat for late-successional rare fungi.

Impacts to Sensitive or S&M fungi during construction, use, and decommissioning of the landings would depend on the presence of fungi. Because of their rarity and lack of definitive habitat information, their presence and locations cannot be predicted. However, based on the number of new landings proposed for construction, Alternatives 2 and 3 would create more risk to fungi than Alternative 4, although the actual acres affected is small in all 3 action alternatives.

Hazardous Fuels Reduction: Of the 2,638 acres proposed for fuels treatments, 295 acres are conifer stands that are 180-plus years old; the rest of the stands are 30 to 170 years old. The BLM is conducting surveys for S&M and Sensitive fungi in the 180-plus year old stands. As of August 2013, 20 fungi sites were documented in the fuels reduction units. These sites would be buffered to prevent direct impacts from burning slash piles or from changes in environmental conditions when trees and shrubs are removed.

Public Roadside Firewood Cutting: Two units that intersect the roadside firewood cutting area have been surveyed for Special Status and S&M fungi. Only one fungi site was discovered within 100 feet of the road during the surveys. This area would be excluded from the wood cutting area. Firewood cutting would pose a low risk of impacts to Special Status and S&M fungi because the only ground disturbance would be caused when trees or partial trees are dragged to the road. The percentage of ground disturbed would be small because the dead trees are dispersed along the road system and only trees within 100 feet of the road would be removed. Fungal mycelium occurs in the duff or top mineral soil layers and creates a web that can extend many meters throughout an area (Dahlberg and Stenlid 1995, S1222-S1230). It is unlikely that the disturbance in the dispersed yarding corridors would impact the entire extent of the fungal mycelia. Removing dead trees would not interrupt the exchange of nutrients, carbohydrates, or water between the fungi and their host trees because this exchange would no longer be occurring.

Water Source Restoration: The pump chances do not contain suitable habitat for Special Status or S&M fungi. No surveys were conducted and there would be no effects to these species.

Off-highway Vehicle Trail Closure and Restoration: Closing and restoring unauthorized OHV trails would not negatively affect Special Status or S&M fungi. Fungi surveys would not be required because the

proposed actions would not be habitat disturbing. Damage to fungi would have occurred from OHV traffic and compaction. Preventing continuous use of these trails by closing them, ripping, and replanting would benefit Special Status and S&M fungi by allowing the areas to return to native vegetation and providing suitable habitat for fungi in forested stands.

Meadow Restoration: Fungi surveys were not conducted because the meadows do not contain suitable habitat for S&M or Sensitive species, which occur in forested habitats.

Stream Enhancement and Riparian Restoration: No fungi surveys are required in the stream enhancement and riparian restoration areas because there is no suitable habitat in the user-built roads, the meadow where the fence would be replaced, the areas along the creek where trees would be planted, or the culvert location. Removing snags to create the wood structures and creating rock jetties would result in minimal habitat disturbance that would be highly unlikely to negatively affect Special Status or S&M fungi.

Quarry Reclamation: No fungi surveys are required in the quarry because it does not contain suitable habitat for fungi. The reclamation work would not result in any effects to fungi.

Noxious Weeds

Forest Management: Noxious weeds could be introduced or spread during timber harvest or post-harvest slash pile burning. Weed seeds could be brought in on vehicles or equipment and moved along roads and into units or between units. Removing canopy cover or ground cover leaves areas open for invasion by noxious weeds. Regeneration harvest would create the most open conditions and therefore the most area vulnerable to weed infestations. Alternative 2 proposes 75 acres of regeneration harvest. Alternatives 3 and 4 would present less risk of increasing noxious weeds in the Project Area because there would be no regeneration harvest. Project design features and other precautions would be implemented before, during, and after timber harvest and associated activities to reduce the risk of introducing or spreading noxious weeds in the Trail Creek project area. Mitigation measures would include washing equipment before moving into an area, seeding and mulching highly susceptible disturbed areas with native grasses, and pre- and post-harvest monitoring and weed treatments. Seeding slash burn scars with native grasses or forbs in areas containing non-native species would also help prevent weeds from occupying those disturbed sites.

Road Work: Noxious weeds could potentially be introduced or spread in the Project Area during new temporary road or landing construction or reconstruction, use of the roads and landings, and decommissioning of the areas. Weed seed could blow in from nearby locations or be carried in on equipment or vehicles and quickly become established on the newly disturbed soil. To reduce this risk, proposed roads were surveyed in 2013 and noxious weed populations would be treated. Project design features that would be implemented include washing equipment and vehicles before moving into an area, seeding routes after use with native grass seed and mulching with weed-free hay or straw. Roads and landings would be monitored after use and noxious weeds treated. The risk of introducing or spreading noxious weeds during road and landing construction and use would be less in Alternative 4 because fewer acres would be affected and there would be less ground disturbance.

Hazardous Fuels Treatments: Removing vegetation leaves gaps that noxious weeds can occupy. Burning slash piles scorches the ground and kills all vegetation, also leaving open areas that weeds can readily occupy. In order to reduce the risk that weeds would increase as a result of the proposed fuels treatments, the units have been surveyed for noxious weeds and populations would be treated before and monitored and treated after fuels work.

Public Roadside Firewood Cutting: Noxious weeds could be carried into the project area on vehicles used to transport firewood. They could be spread when vehicles park on a road shoulder that contains weeds and then move to an unoccupied site. Seed could also be spread from roadside populations into the units where they could become established. In order to reduce these risks, the roadsides were surveyed in 2013 for noxious weeds and populations would be treated and monitored.

Water Source Restoration: Pump chances are previously disturbed sites that receive ongoing vehicular use, which makes them likely to contain noxious weeds and to be vulnerable to weed invasions. Weed surveys conducted in 2013 at the Trail Creek pump chances detected two noxious weed populations—a Canada thistle population at one pump chance and a Himalayan blackberry population at another. These populations will be treated in 2013 and monitored after the restoration work is finished. To minimize the risk of introducing new populations or spreading existing populations, equipment would be washed before moving into the area and work would be done at noninfested pump chances first. Pump chances would be monitored after work is completed and weed populations would be treated.

Off-highway Vehicle Trail Closure and Restoration: The OHV trails have not been surveyed for noxious weeds, but surveys would be completed prior to ripping. If noxious weed populations are detected, they would be treated and monitored. It is possible that OHVs have transported noxious weed seed on their tires or other parts of the vehicles from occupied sites to the trails. Continual passes over the trails have removed native vegetation and left bare areas along the trails where weeds can become established and then move into unoccupied areas. Closing trails and treating weed populations would benefit native plant communities and reduce avenues for weed spread.

Meadow Restoration: Removing vegetation leaves bare areas that are vulnerable to invasion by noxious weeds. Cutting shrubs or trees, burning slash piles, and broadcast burning in the meadows would remove vegetation. The Trail Creek meadows are dominated by nonnative annual grasses, especially in open rocky areas where soils are shallow, but there are also scattered perennial native bunchgrasses, especially growing around oaks and in moister draws. No noxious weeds were detected in the meadows during surveys. To minimize the risk of increasing nonnative grasses or introducing noxious weeds, burn pile scars would be seeded with native grasses. If areas that contain nonnative grasses are broadcast burned, they would also be seeded with native grasses.

Stream Enhancement and Riparian Restoration: The BLM has treated yellow star-thistle in the meadow containing the user-created roads and will continue monitoring and treating plants before and after rehabilitation actions. In order to reduce the potential for weed spread during road ripping and culvert replacement, equipment would be washed before use. The rehabilitated areas would also be monitored after ground disturbance and weed populations treated as detected.

Quarry Reclamation: The BLM has been treating yellow star-thistle in the Romine Quarry for several years and will continue to monitor and treat plants before and after the reclamation work. The use of PDFs, such as washing equipment before ripping and recontouring and seeding and mulching after ground disturbance, would reduce weed spread during and after the reclamation work. Ripping could stimulate noxious weed seed germination, but monitoring and treating plants before they flower will eventually result in the elimination of weeds at the site. In the long term, reclamation of the quarry would reduce noxious weeds because the area would not continue to be disturbed through removal of rock products, it will be blocked to vehicular traffic. Seeding and planting native species would reduce the amount of bare ground for weeds to inhabit.

Cumulative Effects of the Action Alternatives

Special Status and S&M Vascular Plants

With the exception of the proposed actions, the past, present, and future activities in the Trail Creek project area are the same under the action alternatives as under the no action alternative. Because the BLM surveys for Special Status and S&M vascular species and protects sites from impacts, the proposed actions would not contribute negative cumulative effects to those species. It would provide positive cumulative effects because it would reduce fuel loads, which would increase resiliency of the treated forested stands to catastrophic wildfire and increase species diversity. These changes would benefit vascular plants. The only cumulative effect of the proposed actions would be in Alternative 2 with the loss of 75 acres of suitable habitat for rare vascular plants associated with late-successional forest habitat. These stands would return to an early seral stage and would not provide suitable habitat for expansion of existing *Cypripedium fasciculatum* or *Cypripedium montanum* populations or establishment of new populations for 80-plus years. However, riparian reserves and other later seral stands on BLM-managed lands in the area would continue to provide suitable habitat for these populations. Mid-seral stands in the project area would also continue developing toward later seral stages. The amount of late-successional habitat on BLM-managed lands in the Project Area would drop from 57 to 56% in Alternative 2, which is above the 15% minimum set in the Northwest Forest Plan for all Federal lands within a fifth field watershed. Because BLM surveys for rare plants and protects known sites, S&M vascular plant species in the project area would persist and no Special Status vascular plants would trend toward listing as a result of implementing the proposed actions alternatives.

Special Status and S&M Nonvascular Plants

All areas proposed for treatment under the action alternatives were or will be surveyed for Special Status and S&M nonvascular plants and documented sites would be protected. The only negative cumulative effect to Special Status or S&M nonvascular species added by the proposed actions would be the loss of 75 acres of late-successional forest as a result of regeneration harvest proposed in Alternative 2. The stands currently provide suitable habitat for expansion of existing populations or colonization by new populations. After regeneration harvest the stands would be returned to an early seral stage and would not provide suitable habitat for Special Status or S&M nonvascular species for 80-plus years. The *Chaenotheca ferruginea* and *Chaenotheca subroscida* sites would be buffered, conifers greater than 20" diameter would remain within the buffers, and 6 to 25 large overstory trees would be left after harvest. These species have not been found on smaller diameter trees. Their persistence depends on the presence of large diameter Douglas-fir and incense cedar in riparian reserves and owl cores that will not be cut in the future and that are within dispersal distance of existing occurrences. After regeneration harvest in Alternative 2, 56% (8,307 acres) of the total forested stands on BLM-managed lands would remain in late-successional seral stages. This is above the 15% minimum set in the Northwest Forest Plan for all Federal lands within a fifth field watershed. Because the Special Status and S&M nonvascular plant sites would be protected, the proposed activities would not trend these species toward listing or affect their persistence.

Special Status and S&M Fungi

The potential for cumulative negative effects on fungi is in the forested stands where they occur. Timber harvest or fuels treatments are proposed in those areas. Old growth stands are being surveyed, sites would be buffered to prevent impacts, and no regeneration harvest is proposed in those units. Therefore, the proposed actions would not add cumulative effects to Sensitive or S&M fungi when added to past, present, and reasonably foreseeable future activities in those old growth stands.

For stands that have not been surveyed for fungi, the proposed timber harvest, temporary route and landing construction, and fuels reduction activities could affect Sensitive or S&M species if present. The proposed regeneration harvest in Alternative 2 would remove suitable habitat for fungi species. However, the proposed activities would occur on matrix lands, which are designated for timber production and harvest. Across the Northwest Forest Plan area, approximately 14% of the 8 million acres of late-successional forest are designated as matrix and are available for harvest, while 86% are designated as late-successional reserves, congressionally reserved areas, administratively withdrawn areas, or riparian reserves. This reserve system across the landscape is intended to provide protection and development of mature and old growth forests for the protection and expansion of late-successional associated rare plants, animals, and other organisms. Under the Northwest Forest Plan, at least 15% late-successional (80 years or more) conifer forest must be maintained in each fifth field watershed (U.S. Forest Service and Bureau of Land Management 1994, C-44). Within the Trail Creek project area, located in three subwatersheds, 57% of conifer forests on BLM-managed lands are currently in late-successional stages. That amount would remain the same in Alternatives 3 and 4 and would be reduced to 56% in Alternative 2. This figure is well above the minimum 15% set by the NWFP. The BLM and Forest Service assume that protecting known sites (current and future found), in addition to conducting equivalent effort surveys, will ensure this project and future projects would not contribute to the need to list Sensitive fungi (Bureau of Land Management 2004, 5-2) and would ensure the persistence of S&M fungi.

Noxious Weeds

Past, present, and foreseeable future activities in the Project Area that could contribute to the introduction and spread of noxious weeds in the Trail Creek project area are the same as those described under the No Action Alternative. The actions proposed in Alternatives 2 through 4 could potentially introduce noxious weeds into the Project Area, although it is not possible to quantify with any degree of confidence that amount or to distinguish it from the background risk of introduction from ongoing activities in the project area. However, because the BLM treats noxious weed populations on BLM-managed lands as detected and implements project design features and monitoring, the risk is reduced that the proposed activities in the action alternatives would contribute additional cumulative effects to noxious weeds.

Appendix H: Wildlife

Table H-1. Sensitive Wildlife Species Analysis for the Trail Creek Projects

Species	Presence on BLM Land		Habitat
	Butte Falls Resource Area	Project Area	
Federal Threatened and Endangered			
Northern spotted owl	Present	Present	Use high canopy cover, late-successional, old-growth forests for nesting.
Vernal pool fairy shrimp	Present	Absent	The only suitable vernal pools on Medford District BLM lands are on the Table Rocks. There is no vernal pool fairy shrimp habitat in the Project Area.
Bureau Sensitive			
Bald eagle	Present	Present	Nest in dominant and codominant trees at forest edges and ridges, in meadows, and near rivers and lakes.
Fisher	Present	Suspected	Primarily use late-successional forested areas with high canopy cover for denning.
Fringed myotis (bat)	Present	Suspected	Roost in caves, abandoned buildings, rock crevices, and trees.
Lewis' woodpecker	Present	Migrant	Associated with open woodlands near streams and rivers. Habitat preference includes hardwood oak stands with scattered ponderosa pine near grassland shrub communities.
Northwestern pond turtle	Present	Present	Spend the majority of their life cycle in aquatic environments, but must leave the water to dig terrestrial nests and lay their eggs.
Oregon spotted frog	Suspected	Absent	Live where there is abundant aquatic vegetation in slow streams, permanent ponds, marshes, or lake edges, and breed in very shallow water in early or mid-spring.
Pallid bat	Present	Suspected	Restricted to drier interior valleys in brushy, rocky terrain, or edges of woodlands. They have not been found during mist-net surveys in the Project Area.
Peregrine falcon	Present	Present	Nesting habitat is on cliffs. Present near Project Area, but outside harvest units.
Siskiyou Hesperian *Vespericola sierrianus* (mollusk)	Present	Present	Seek refuge in moist areas under rocks and large woody debris during the summer and late winter seasons, and are generally associated with mixed conifer forests with a high percentage of canopy cover.

Table H-1. Sensitive Wildlife Species Analysis for the Trail Creek Projects

Species	Presence on BLM Land		Habitat
	Butte Falls Resource Area	Project Area	
Townsend's big-eared bat	Present	Suspected	Hibernate and rear their young in sites such as caves, mines, and buildings. Rimrock, cliffs, bridges, boulder fields, and possibly bark of large trees have the potential to be used as day roosts.
Travelling sideband *Monadenia fidelis celeuthia* (mollusk)	Present	Present	May be found seeking refuge and hibernating under mosses in notches of trees and under leaf litter at the bases of bigleaf maples. They are active during the spring when temperatures are warm and soils are moist.
Johnson's Hairstreak Butterfly Callophrys johnsoni	Present	Unknown	Coniferous forest/mistletoe obligate during egg, caterpillar, and chrysalis stages. Adults sip flower nectar and frequent mud patches
Survey and Manage Species			
Siskiyou sideband[1, 2] *Monadenia chaceana* (mollusk)	Suspected	Absent	Occupy late-successional forest and open talus or rocky areas, especially the lower one-third of a talus slope, and timbered stands in leaf litter and duff near coarse woody debris.
Oregon shoulderband[1, 2] *Helminthoglypta Hertleini* (mollusk)	Present	Absent	Found in basalt rockslides (talus), under rocks and woody debris in moist conifer forests, and in shrubby areas in riparian corridors. No strong riparian association has been identified (Burke et al. 1999). They have been found in oak woodlands and dry conifer forests west of Lost Creek Lake.
Crater Lake tightcoil[2] *Pristoloma articum crateris* (mollusk)	Suspected	Absent	Generally found within 10 meters of streams, springs, and perennially wet areas.
Great gray owl	Present	Present	Forage in open areas such as meadows, recent clearcuts, and woodlands. Nest in large snags, broken-top trees, and abandoned raptor nests.
Red tree vole	Present	Present	Nest and forage in Douglas-fir trees northwest of the Rogue River in the Butte Falls Resource Area.

Status:

Bureau Sensitive —eligible for addition to Federal Notice of Review, and known in advance of official publication. Generally these species are restricted in range and have natural or human-caused threats to their survival.

[1]Also Bureau Sensitive

[2]Protocol surveys conducted finding none of these species present.

Table H-2. Habitat for Neotropical Migratory Birds found in the Trail Creek Project Area

Species	General Habitat Requirements
Game Birds	
Band-tailed Pigeon (*Columba fasciata*)	Nest primarily in closed Douglas-fir stands with canopy cover >70%. Key food sources include red elder, cascara and other berry, and fruit- and mast-producing shrubs and trees. Mineral springs/seeps are important and provide essential calcium for nesting.
Mourning Dove (*Zenaida macroura*)	Abundant in grass, shrub, juniper steppe, and agricultural areas. Tend to frequent edges where trees are present. A nesting generalist, most often on ground under shrubs but tree nests are not uncommon.
Birds of Conservation Concern	
Rufous Hummingbird (*Selasphorus rufus*)	Primarily associated with forest edges and openings with a diversity of flowering plants for feeding and open space. Frequently occurs in shrub-dominated open habitats and late-successional forest habitat, particularly within large openings, with a highly developed and diverse understory of herbaceous plants and shrubs. Need flowering plants and shrubs.
Purple Finch (*Carpodacus purpureus*)	Breeds primarily in moderately moist open or semi-open coniferous forests. Also frequently found in mixed coniferous-deciduous forest, edges of bogs, and riparian corridors at low to mid-elevations. Also in vigorously regenerating clear-cuts. In Klamath Ecoregion, the presence of ponderosa pine and oak provides a unique habitat component.
Willow Flycatcher (*Empidonax trailii*)	Nesting and migratory habitat in southwest Oregon consists primarily of riparian zones, typically willows. Generally favor early seral forests with natural openings where tall shrubs and a moderate herbaceous layer occur; nests are built within a few feet of the ground.
Olive-sided Flycatcher (*Contopus cooperi*)	Oregon distribution: Breeds primarily in coniferous forests with open to semi-open forest stands with a low percentage of canopy cover. Forest burns and edge between late-successional and early successional forest such as meadows and harvest units provide this habitat. Nests vary in height above the ground on conifer limbs. Forages from high atop snag trees.

Appendix I: Fish and Aquatic Habitat

I.1 Fish and Aquatic Habitat

I.1.1 Methodology

Information used in this analysis includes:

- GIS, Oregon Department of Fish and Wildlife Aquatic Habitat Inventories (1996), BLM field observations, Trail Creek Watershed Analysis (1999), ODFW fish distribution database (2013), and StreamNet (2013)
- The fisheries and aquatic habitat analysis area corresponds to the Trail Creek fifth field watershed.

I.1.2 Assumptions

- Future timber harvest on private lands would occur within the analysis area. Private lands are governed under State of Oregon forestry regulations and, as such, receive a different level of protection than Federal lands. Analysis of effects from private timber harvest generally considers the worst case scenario (i.e., all suitable forested lands would be logged at 60-year tree-growing rotations). At this time, it is not known when or where private timber harvest would occur in the area. This analysis assumes that all suitable private lands would continue to be subject to timber harvest. The amount of disturbance to aquatic systems as a result of this harvest would continue similar to present rates.
- Off-highway vehicle use is currently creating disturbance throughout parts of the Trail Creek Project Area, especially on private land. Where these trails are hydrologically connected to stream channels, they are contributing sediment. Unauthorized off-highway vehicle use would continue as trails are used and created. It is anticipated these activities would continue to occur and would continue to contribute sediment to the stream network.
- Water withdrawals would continue to limit summer flows in this drainage. Low flow conditions would negatively impact water quality by increasing stream temperature. This activity is unlikely to change and would continue to limit water quantity and quality in the watershed, specifically in the lower reaches of Trail Creek and West Fork Trail Creek.

I.1.3 Affected Environment

I.1.3.1 Introduction

The Trail Creek Project Area contains 35,646 acres in the Trail Creek (35,315 acres), Shady Cove-Rogue River (178 acres), and Elk Creek (153 acres) fifth field watersheds. The Trail Creek fifth field watershed consists of 3, sixth field subwatersheds: Upper, Lower, and West Fork Trail Creek. In addition, the Trail Creek Project Area is located within the Indian Creek-Rogue River (Shady Cove-Rogue River fifth field) and Upper Elk Creek (Elk Creek fifth field watershed) sixth field subwatersheds.

The Fisheries analysis area does not include the acres located outside the Trail Creek fifth field; however, the analysis area is representative of the outlying areas because of their proximity to the Trail Creek watershed boundary, the lack of proximal fish habitat to the proposed treatment acres, and the similarity in existing conditions between the outlying areas and the Trail Creek watershed.

The proposed project acres outside the Trail Creek fifth field watershed are located on ridge tops within 0.5 mile of the watershed boundary. These acres make up 1% of the Trail Creek Project Area. The conditions in

the 2, sixth field subwatersheds are not notably different than those in the Trail Creek fifth field watershed. In the Indian Creek-Rogue River subwatershed, fish distribution ends approximately 3 miles downstream of proposed activities. In the Upper Elk Creek subwatershed, fish distribution also ends approximately 3 miles downstream of proposed activities.

The majority of the analysis area is comprised of private land with more than half of the perennial stream reaches located on private land (see Table I-1). Private land encompasses most of the main stem reaches of Trail Creek, West Fork Trail Creek, and most of the West Fork Trail Creek tributaries. Upper Trail Creek headwaters are in somewhat blocked BLM ownership. The remaining BLM ownership is scattered throughout the drainage. Most of the fish habitat including Coho Critical Habitat (CCH) is on private land in the lower reaches of the watershed.

Table I-1. Stream Type by Ownership in the Trail Creek Watershed

Ownership	Ownership (%)	Perennial Streams (miles)	Intermittent Streams (miles)	Dry Draws (miles)
Private	46	36	58	79
BLM	42	29	59	37
USFS and State	12	8	19	11
Total	**100**	**73**	**136**	**127**

I.1.3.2 Fish and Designated Habitat

Major fish species found in the Trail Creek fifth field watershed include coho salmon (*Oncorhynchus kisutch*), steelhead trout (*O. mykiss*), and cutthroat trout (*O. clarkii*). Cutthroat trout have the widest distribution, followed by steelhead trout, and coho salmon (see Map I-1).

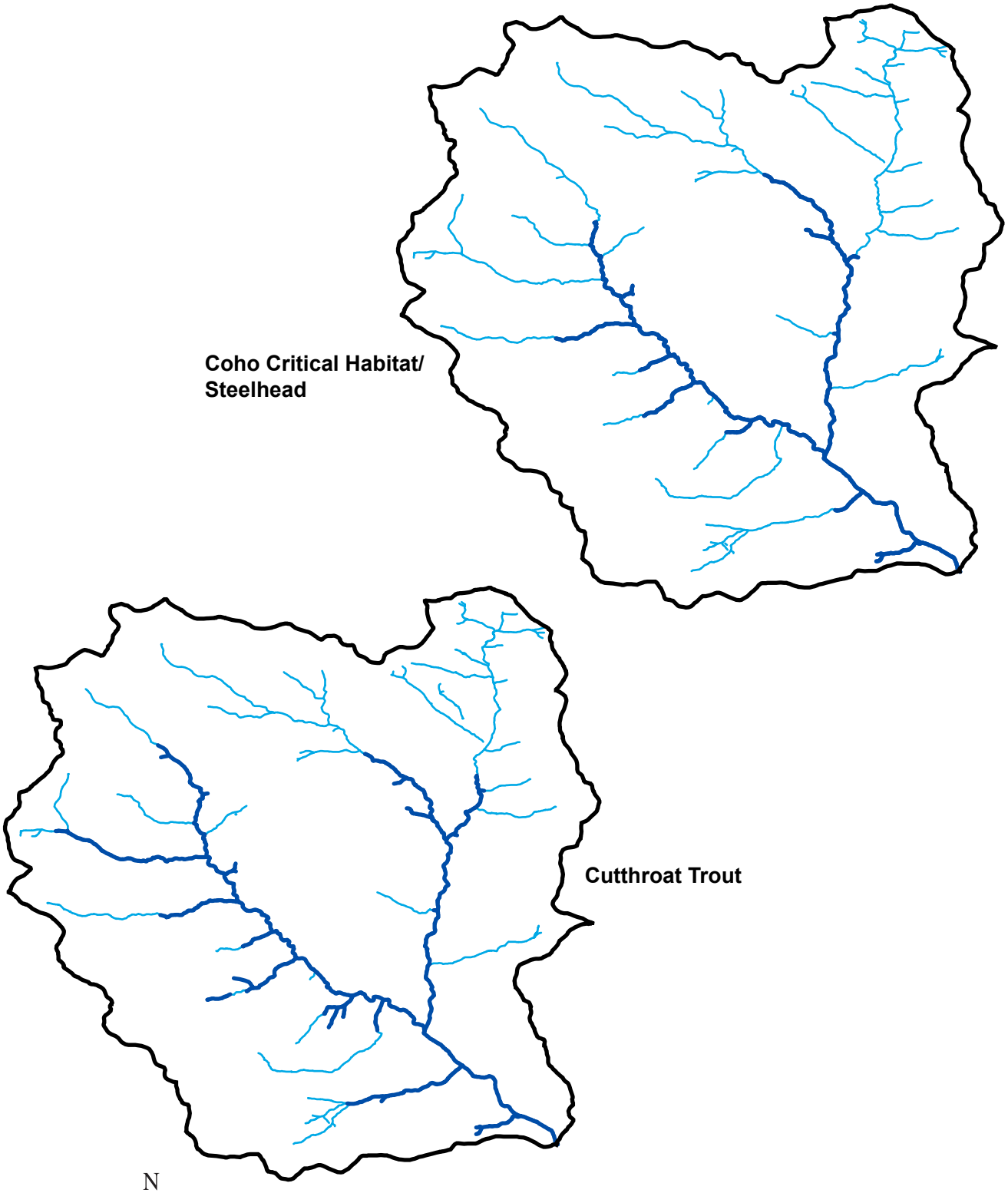
SONCC salmon (Southern Oregon/Northern California coho) is the only special status fish species present in the Trail Creek fifth field watershed. It was federally listed as a threatened species in the Rogue River in 1997 in accord with the ESA. CCH (coho critical habitat) was designated in 1999. Essential fish habitat, in accord with the Magnuson-Stevens Fishery Conservation Act, was designated for salmon, and includes water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California. In the Trail Creek Project Area, the range of essential fish habitat is very similar to that of CCH; therefore, any reference to CCH in this analysis includes essential fish habitat.

Table I-2 shows CCH in the Trail Creek watershed by stream. The Trail Creek fifth field watershed contains about 30 stream miles of fish habitat; approximately 25 stream miles are classified as CCH.

CCH is often determined by fisheries biologists using available information and professional judgment to make an educated estimate of the historical upper limit. Determinations are usually based on stream conditions such as stream size, gradient, and presence and nature of natural barrier. Lacking information regarding historical

Table I-2. Miles of Coho Critical Habitat by Stream in the Trail Creek Watershed

Stream	Coho Critical Habitat
Trail Creek	8.0
West Fork Trail Creek	7.4
Canyon Creek	1.7
Paradise Creek	1.2
Romine Creek	0.6
Walpole Creek	1.1
Chicago Creek	2.0
Wall Creek	2.1
Buck Rock Creek	0.8
Total	**24.9**



Trail Creek Forest Management Project
Environmental Assessment

Map I-1. Fish Distribution in the Trail Creek Project Area

Butte Falls Resource Area
2013

distribution of coho salmon, and in the absence of natural fish migration barriers, fisheries managers often consider CCH to include stream reaches known to be accessible to other migratory fish, particularly to steelhead.

Fish populations are influenced by natural and human-caused disturbances. Factors such as habitat loss or degradation, commercial fishing, and variable ocean conditions are primarily responsible for the depressed status of most fish species (Nehlsen, Williams and Lichatowich 1991).

I.1.3.3 Aquatic Habitat

Salmon and trout species need cool water temperatures, hiding cover, clean spawning gravels, rearing pools, adequate food supply, and unimpaired passage for good fish production. Large wood in the streams provides cover for fish and traps fine sediment, and can create rearing pools.

ODFW conducted physical aquatic habitat inventories over all land ownerships on about 33 miles of perennial streams in the Trail Creek fifth field watershed. Major habitat features found to be in impaired condition are spawning gravel quantity and quality, pool complexity, high stream temperatures, and large wood abundance. BLM direction is to maintain or enhance the fisheries potential of streams and other waters (Bureau of Land Management 1995, 49).

Temperature

Water temperature is one of the most important variables controlling habitat suitability for salmonids. Sun exposure is the largest cause of increasing temperatures. Other factors, such as climate, stream size, elevation, and groundwater flows, also influence stream temperature (Beschta, et al. 1987). Optimum temperatures for coho salmon, steelhead trout, Chinook salmon, and cutthroat trout are 50 to 65°F during different life stages from egg to adult (Bjornn and Reiser 1991). The Oregon DEQ established a 7-day average maximum temperature limit of 64.4°F for juvenile and adult fish.

Water Quantity

Water quantity is an issue that negatively affects fish and fish habitat in this project area. Water withdrawals, both permitted and unpermitted, diminish the volume of aquatic habitat as well as the quality. This issue is of concern primarily because much of the main stem habitat in the Trail Creek catchment is dry throughout most of the summer, creating low or no flow conditions in sections of stream that are dominated by bedrock. Low flow conditions over bedrock substrate contribute to elevated stream temperatures.

Stream Substrate

Aquatic habitat inventories conducted in 1996 indicate that many of the streams in the analysis area have high fine sediment levels though most of the streams lack spawning gravel. Stream reaches in the Trail Creek watershed in general exceed 20% fine sediment, which is not preferred by salmon and trout. A large quantity of bedrock was observed throughout the entire system specifically in the main stem of Trail Creek and the lower portions of Upper and West Fork Trail creeks. The inventories detected stable banks though active landslides were observed in many of the drainages. Landslides, if naturally occurring and not the result of failed roads, can contribute grave, used by fish for spawning and large wood to retain sediment and provide cover for fish. The majority of sediment moves out of this stream system quickly due to high gradients and a lack of large wood and associated channel complexity that would capture and store such sediments. There is a moderate amount of gravel and pools to sustain survival and production for fish. Nearly all streams in the Trail Creek watershed have simplified fish habitat primarily because of the lack of large wood to retain

sediment and create pools for juvenile fish. Additionally, except for the lower main stem reaches, most of the streams in the analysis are high gradient with cascades, rapids, and riffles the dominant habitat type.

Large Wood

Large wood is important for providing cover for fish, forming pools, stabilizing channels, and trapping and sorting fine sediment (Bjornn and Reiser 1991). Large wood also provides pools, habitat complexity and channel roughness to dissipate stream energy that causes bank erosion and increases channel widths (Mongomery and Buffington 1997). Reductions in large wood through past wood removal and timber harvest in streams caused more simplified stream channels and reduced cover for fish. Wood helps trap sediment, which provides nutrients to aquatic life. Aquatic habitat inventories indicate the majority of streams surveyed in the Trail Creek fifth field watershed were in undesirable condition for volume of large wood (Oregon Department of Fish and Wildlife 1996). Wood volumes increase from main channel to headwaters.

Fish Passage

Fish access to all available habitat is important for fish production. Restoring fish passage is an effective way to increase the availability of habitat (Roni, et al. 2002). It is common for fish to move within streams and between stream systems throughout the year (Kahler, Roni and Quinn 2001).

Naturally occurring waterfalls and bedrock chutes occur throughout this watershed and are often associated with upstream limits to anadromy if not the upstream limit of resident fish distribution.

I.1.3.4 Riparian Habitat

Riparian areas are important for fish and the aquatic ecosystem. Riparian vegetation provides large wood to streams and cover for fish. Streamside vegetation provides bank stability and shade to maintain cool water temperatures (Beschta, et al. 1987) (Meehan 1991) on perennial streams during summer months. Riparian areas provide terrestrial insects for fish food. When substantial riparian vegetation is removed, increasing stream temperatures (Johnson and Jones 2000) and declining large woody debris levels can result in less fish production (Hartman, Scrivener and Powell 1987). Most of the shade in the lower portions of Trail Creek fifth field watershed is coming from smaller hardwoods, brush species, and small diameter conifers. In the upper watershed, larger conifers and hardwoods dominate the riparian areas.

I.1.3.5 Aquatic and Riparian Habitat Trends

Timber harvest has decreased significantly since 1995 on BLM-administered land in the Trail Creek fifth field watershed and timber harvest that has occurred has protected riparian reserves as designated by the Northwest Forest Plan (Bureau of Land Management 2008, 240).

Trail Creek maintains populations of coho salmon, steelhead, and resident trout despite simplified habitat, high water temperatures, and water withdrawals creating dry or uninhabitable conditions throughout much of the main stem channels in the summer months.

I.1.4 Environmental Consequences

I.1.4.1 Effects of Alternative 1 on Fish and Aquatic Habitat

The No Action Alternative would have no direct or indirect effects because no ground-disturbing activities would occur. Aquatic habitats within the watershed would continue to exist in their current state. Road

densities would remain at the current level within the Project Area. Fish habitat would continue to be impacted as a result of past and ongoing activities, as described in the current condition section.

Urban and agricultural lands would likely remain in their current state, impacting fish habitat in the watershed as described. It is unknown at this time what additional development may occur on private lands, but increased development of the area would place greater stresses on aquatic habitats.

I.1.4.2 Effects of Alternatives 2, 3, and 4 on Fish and Aquatic Habitat

Direct and Indirect Effects

Ground-disturbing activities in or near stream channels and roads have the greatest potential to impact fish habitat; it is these activities that could increase erosion and sediment transport to, and storage in, stream channels. Timber hauling, road renovation, road decommissioning, water source restoration, and stream habitat enhancement are the project elements proposed under this alternative that have been identified as having the greatest potential to add sediment to streams.

Timber Harvest and Small Diameter Thinning

The Water Resources analysis documented that harvest operations would not reduce canopy cover within any of the Project Area subwatersheds enough to measurably affect or alter the timing of peak or base flows or shade. No hydrological connectivity would exist between harvest units and stream channels because harvest and yarding operations would not occur within the no-treatment buffers identified within standard riparian reserves. Proposed riparian reserve treatments are discussed below. Fine sediment mobilized from units or skid trails would be filtered by vegetation within the riparian reserves and deposited on the forest floor before reaching aquatic habitat. Activities related to timber harvest and yarding operations would not be hydrologically connected to the stream network and would therefore not contribute any sediment to stream channels, decrease stream shade, reduce future wood inputs, increase peak flows, negatively modify summer base flows, or input sediment into aquatic habitats. They would not directly or indirectly affect the perennial aquatic environment and, therefore, would not impact fisheries resources or contribute a cumulative effect. In summary, no connectivity and, hence, no causal mechanism would exist for timber harvest to input sediment through the riparian reserve buffers and into perennial stream channels.

Riparian Thinning

Riparian thinning is proposed in 63 acres within riparian reserves. A 60-foot no-treatment buffer would be established on both sides of the stream channel to protect stream channels from harvest-related impacts. Trees would be directionally felled away from the stream channel and end lined from outside the riparian reserve. Ground-based equipment would only be used during the dry season, as identified in the project design features, and would not be hydrologically connected to the stream network. These vegetation treatments would increase species diversity within existing stands that exhibit uncharacteristic stand structure and species composition. Stands would be thinned to a canopy cover minimum of 50 to 60%. This would remove fuel accumulations in patches while thinning lower and middle tree layers to accelerate development of a mature multilayered stand structure. There is no causal mechanism for effects from thinning to reach the stream network because there is no hydrologic connectivity.

Thinning would occur outside the primary shade zone and would not be expected to affect water temperatures. Providing for future large wood recruitment is an important riparian objective that would be accomplished by maintaining a 60-foot no-treatment buffer.

Activities related to commercial timber harvest and yarding operations would not be hydrologically connected to the stream network and, therefore, would not contribute any sediment to stream channels, decrease stream shade, reduce future wood inputs, increase peak flows, negatively modify summer base flows, or input sediment into aquatic habitats. They would not directly or indirectly affect the perennial aquatic environment, not impact fisheries resources, or add a cumulative effect. In summary, no connectivity and no causal mechanism would exist for timber harvest to input sediment through the riparian reserve buffers and into perennial stream channels.

Roads

Of all forest management activities, roads typically have the greatest potential to influence aquatic habitat in forested watersheds. Impacts include both near-term and ongoing (chronic) impacts. Near-term impacts stem from activities which include new ground disturbance, such as construction or maintenance of road segments. These activities lead to increased potential for erosion and transport of sediment to channels. Sediment contribution to channels stemming from these activities generally diminishes after 1 to 3 years (Luce and Black 2001) (Megahan 1974).

Long-term and indirect effects are more pervasive and may persist even beyond the life of the road. For example, new road construction requires clearing along the road right-of-way. Where a road crosses a stream, this means the removal of shade-producing riparian vegetation, which would not fully recover until long after the road is decommissioned or abandoned. Road segments located away from stream channels can also greatly influence aquatic habitat. Numerous studies have shown how roads may increase the length of the drainage network by intercepting ground or surface flow and precipitation, resulting in disruption of natural flow paths. This, in turn, may lead to increases in peak flow or timing to peak flows (Jones, et al. 1999) (Wemple, Jones and Grant 1996). Increased peak flows, if great enough, can cause channel adjustments that physically alter aquatic habitat. Additionally, roads cut through steep side slopes or in unstable areas are at risk of failure, which can trigger mass wasting events such as debris torrents that are capable of scouring out channels and transporting and depositing tons of material, including large wood and sediment of all size classes, in large episodic pulses.

Weathering of road surfaces can lead to chronic sediment and turbidity contributions to aquatic habitats, and maintenance and use of roads (such as for timber hauling) can accelerate rates of erosion, particularly during the wet season (Black and C.H. 1999) (Reid and Dunne 1984). Intercepted runoff that becomes concentrated over erodible road surfaces mobilizes and transports sediment with it. Surfaces armored by pavement do not experience this type of chronic weathering, while rocked roads are more resistant than natural-surface roads. For these reasons, natural-surface (or depleted rocked surface) roads with a high degree of hydrological connectivity are particularly problematic to aquatic habitat.

It is important to note that not all roads or road segments contribute deleterious effects to aquatic habitat. Many variables interact to determine the potential for any given stretch of road to influence aquatic habitat, with the most important being the degree to which the road is hydrologically connected with the aquatic system (Furniss, Roelofs and Yee 1991) (Jones, et al. 1999) (MacDonald and Coe 2008). Hydrological connectivity is present at any point where roads and streams interface. Midslope and valley bottom roads constructed in areas of high drainage density (which necessitates many crossings) have a high degree of connectivity, while ridge top segments that do not cross channels have no connectivity. Segments with high connectivity have high potential to affect aquatic habitat, while those with no connectivity have no potential. Note that none of the proposed new routes in Trail Creek Project would be hydrologically connected to the aquatic system.

In addition to channel crossings, the design of the road also plays into the degree of hydrological connectivity. Roads that are designed to shed intercepted water quickly off their surface and back to the forest floor have connectivity only from the point of the last turn-out device to where the road crosses the stream. Examples of such designs include outsloped road surfaces, rolling dips, and water bars, which are effective and common designs used to reduce connectivity between roads and the aquatic system when constructed and maintained properly (Luce and Black 2001) (MacDonald and Coe 2008). Contrast this with an insloped road drained by an inboard ditch with few cross drains; such a road would have a greater portion of its length directly connected to the stream and would have a greater potential to impact aquatic habitat. Connectivity also changes in response to climactic conditions, with the greatest road-stream hydrological connectivity occurring during the wettest period of the year when soil moisture contents are high, ground water tables are elevated, and runoff is more likely (Furniss, Flanagan and McFadin 2000). For this reason, wet season use of a given road system would have a higher potential to contribute impacts to aquatic habitat than dry season use. In the Trail Creek Project, proposed road renovation and timber hauling would be restricted to the dry season.

Timber Hauling and Road Renovation

The main line haul routes include the paved road along portions of Trail Creek and West Fork Trail Creek and well-rocked roads throughout most of the Project Area. Timber hauling would occur on 79 miles of road within the 35,315-acre Trail Creek fifth field watershed: 75 miles are rocked roads and 4 miles are natural-surface roads. Haul routes are distributed throughout the Project Area and are located on BLM and private timber company roads. Approximately 21 miles of unpaved haul roads exist within a riparian reserve width distance of stream channels (includes riparian areas on private lands) most of which (20 miles) are rocked. The primary mechanism by which road-derived sediment is most likely to enter streams as a result of timber hauling is from storm runoff, not directly through airborne contributions. Table I-3 describes haul-related stream crossings in the Project Area.

Table I-3. Haul Route Stream Crossings by Road Surface and Stream Type on BLM Land

Stream Type	Road Surface	
	Rocked	Natural
Perennial	37	0
Intermittent	45	1
Dry Draw	22	1
Total	**104**	**2**

This table captures stream crossings on BLM land. In addition, there are 8 perennial, 10 intermittent, and 17 dry draw crossings on private and state land within the Trail Creek Project Area; all are rocked.

Crossings on perennial streams are scattered throughout the Trail Creek Project. Crossings on paved roads are not considered to be sediment sources and will not be analyzed further. There are four crossings on BLM-controlled gravel roads within CCH and they are all in the West Fork Trail Creek. These crossings are located on well-rocked roads with adequate drainage, topography is relatively flat, and the ditches are well vegetated with no sign of sediment or deposition or hydrologic connectivity. Project design features require a seasonal restriction for hauling and limited ditch blading within 200 feet of CCH. If the ditch must be bladed, then straw mulch would be added to trap sediment and would further limit sediment from entering CCH. One perennial crossing occurs approximately 0.25 mile from CCH; the remaining crossings occur at least 1.0

mile from CCH. Project design features are in place to minimize sediment transport into the ditches by adding cross drains and water dips to disconnect the ditch system from the stream network.

Crossings on intermittent stream channels are scattered throughout the Project Area. There are 46 intermittent crossings identified within the haul route for this project. Intermittent channels only flow seasonally and would likely not be flowing when haul is occurring. In the rare circumstances that the road network has dried enough to reinitiate haul and the intermittent channels are still running, there would not be a mechanism for sediment from the road to be transported into the stream channel because the roads would be dry. However, fine sediment generated from haul could be transported off site during high flow events when intermittent channels are flowing.

Direct and indirect sediment inputs to aquatic habitat may result from haul-related surface erosion. Surface erosion would be minimized because project design features would allow log hauling during dry conditions and it would be restricted whenever soil moisture conditions or rainstorms could result in the transport of sediment to ditch lines and nearby stream channels. Most of the haul roads are rocked (74 of 77 miles) or paved, rather than native or natural surface. This reduces the probability of road surface erosion and subsequent sedimentation of aquatic habitat, as the hardened surfaces can withstand more wear and tear.

After the dry season, during the fall and winter rains, sediment from the road prism could be transported into the ditch system. However, this would occur at a time when stream levels are elevated and transporting sediment naturally. Under these conditions, the small amount of sediment indirectly contributed from hauling would not be measureable or detectable above background levels. The amount of sediment entering stream channels from timber hauling as part of this project would be greatly reduced because hauling would be seasonally restricted, most haul routes would be located high in the watershed, haul routes cross intermittent channels, and roads are well-maintained (mostly rocked). Any haul dust or sediment from wear and tear on rocked roads would only be moved during intense rain events when it would not be measurable or detectable above background levels.

It is not possible to accurately quantify how much dry season haul may increase erosion rates or sediment input into aquatic habitat because too many interacting variables exist (MacDonald and Coe 2008) and studies have largely focused on wet season hauling. Because dry season hauling would yield substantially less initial erosion of the road surface and less subsequent transport of eroded sediment, amounts contributed to aquatic habitat are anticipated to be minimal. Given that these inputs would occur only during a precipitation event following a season of hauling, would be spatially spread over many input locations, and would occur in the nature of increased turbidity, it is extremely unlikely that sediment input by hauling would be detectable beyond background levels at the site level.

Although timber hauling would likely result in some sediment entering aquatic habitats, the magnitude of the inputs would be small because hauling would occur in the dry season, spatial scale of activity is large, project design features would be implemented, and most of the crossings are on intermittent channels. The amount of sediment to reach and settle out in any one pool would be insufficient to adversely modify aquatic habitats or meaningfully affect aquatic organisms. Additionally, in most cases there is at least 0.25 mile between the hydrologically connected action and CCH, allowing adequate stream length to filter, sort, and store sediment. Suspended sediment inputs would only occur during a precipitation event following a season of hauling. It would be spatially spread over many input locations at a time when stream levels are elevated and naturally turbid and would not be detectable above background levels. No effects to CCH are anticipated.

Approximately 80 miles of road renovation is proposed. This road work would include blading, brush removal, and improving drainage features on existing roads. These roads are located at least 0.25 miles upstream of CCH. Project design features are designed to limit the amount of road work (blading and ditching) that occurs near stream crossings and requires seeding and mulching where these actions are deemed necessary for road stability and drainage improvement. Additionally, roads would be disconnected from the stream network by adding cross drains where necessary. In this case, seeding and mulching would occur within the same season as the road work to stabilize the surfaces.

As the proposed road renovation would be located outside of riparian areas, there is little probability that it would intercept ground water. The roads would be able to intercept precipitation directly, which could potentially become concentrated flow capable of rutting the road surface and transporting eroded material downslope. However, drainage relief would be incorporated into the renovation, which would ensure the road surfaces would shed intercepted water and any mobilized sediment off of their prisms and into downslope vegetation, minimizing the potential for rutting and disruption of natural flow paths. This, coupled with the absence of hydrological connectivity, minimizes the potential for road renovation proposed in the Trail Project to affect aquatic habitat.

Road Decommissioning

Two types of road decommissioning are proposed as part of this project: full and partial. Full decommissioning includes ripping, adding water bars, barricading, removing culverts, mulching, and seeding. Roads would not be ripped during partial decommissioning but all of the other actions would occur. Approximately 4.3 miles are proposed for full decommissioning and 6.0 miles for partial decommissioning. Some of these road segments are not hydrologically connected to the stream network due to ridge top locations. Others are hydrologically connected through culverts and cross drains. All of these actions would occur more than 0.5 mile from CCH and project design features would be followed to minimize sediment entering the stream network.

Road decommissioning would reduce the overall road densities in the watershed and would reduce the amount of compacted ground. Compaction and terrestrial connectivity would improve at the site level. Where stream crossings and culverts are removed, sediment could enter the stream system at the site. The amount of sediment would be minimized by following the project design features and by working during the instream work period when flows are lowest.

Temporary Route Construction and Reconstruction

In the Trail Creek Project, 1.1 miles of temporary route construction and reconstruction are proposed in Alternatives 2, and 3 to facilitate access to treatment units. No temporary routes would be constructed in Alternative 4 and 0.5 mile would be reconstructed. These temporary routes are either extensions of existing roads or short spur routes off existing roads; they are located outside riparian reserves. Temporary route construction and reconstruction would occur during the dry season. This is not expected to affect aquatic resources because they are located outside CCH and are not hydrologically connected to the stream network. Additionally, the temporary roads would be decommissioned by ripping, water barring, seeding, mulching, and blocking once the project is completed.

Hazardous Fuels Reduction

Fuels treatments would leave riparian buffers, require minimal ground disturbance, and would not treat large trees. All fire lines would be water barred and rehabilitated after ignition operations were completed. Treatments would not lead to increases in water temperature or sediment inputs to channels because

streamside shade-producing vegetation would be buffered. Canopy levels would not be reduced and ground compaction would not be increased by treatments; therefore, peak flows would not be affected. The only effect fuels treatments may have to fisheries resources is a possible increase in ground water storage and subsequent release to streams throughout the dry season. However, any extra water available is likely to be used by remaining vegetation before entering stream channels. For these reasons, fuels treatments are not expected to impact fisheries resources and, therefore, would not contribute to cumulative impacts.

Public Roadside Firewood Cutting

Vegetation would not be removed from within riparian reserves and, therefore, would not affect stream shade or large wood.

Off-Highway Vehicle Trail Closure and Restoration

Trail closure and restoration is proposed throughout the Project Area. Most of the proposed segments are located along ridge tops and, as such, are not hydrologically connected to the stream network and would not impact fish or aquatic habitat. Three segments are located within the riparian reserves. One segment is located in the riparian reserve of an intermittent tributary to Wall Creek approximately 1 mile from CCH. The second segment is located along the main stem of Trail Creek within 500 feet of CCH. The third segment is located in the riparian reserve of a perennial tributary to Chicago Creek approximately 1.5 miles upstream of CCH. Project design features would reduce impacts to aquatic habitat.

Stream Habitat Enhancement and Riparian Restoration

Stream habitat restoration proposed in this project would improve aquatic habitat by increasing the amount of large wood and boulder habitat and decommissioning user-created roads in the riparian reserves. These actions would be beneficial to fish and aquatic systems.

Cumulative Effects

Proposed activities that would be hydrologically connected to the stream network include timber hauling, road renovation, and road decommissioning. Short term (one to five years), small inputs of sediment at stream crossings in the Project Area could result from these actions. Given the dry season haul restriction, inputs would occur only during a precipitation event following a season of hauling and would be spatially spread over many input locations. It is extremely unlikely that sediment input from these activities would be detectable above background levels and would have an effect on aquatic habitat. Sediment increases would be minor and undetectable relative to existing sediment levels and would not contribute measurable or detectable effects above already elevated background levels. Over the long term, road renovation would improve drainage and reduce road-related sediment inputs.

Upland work, including timber harvest and follow-up fuels treatments, would have no effect on fine sediment levels due to the filtering action of riparian reserve buffers, project design features designed to prevent overland sediment movement, and best management practices. Stream temperatures would not be affected as no riparian vegetation adjacent to perennial streams would be removed.

Timber harvest and development on private land is expected to continue existing trends in fine sediment potential and health of riparian areas currently present in the Project Area. The Trail Creek project would, in the short term, contribute a small amount of sediment to streams within the Project Area, in addition to the large amounts contributed annually from all other sources. Direct inputs of fine sediment resulting from timber hauling would be of insufficient magnitude to meaningfully affect fish or fish habitat and would not be detectable above background levels. No measurable changes in the aquatic habitat conditions are

anticipated to result from implementation of this alternative and, as such, there would not be a cumulative effect to aquatic habitats.

Appendix J: Harvest Units Deferred from Entry

J.1 Units Considered for Timber Harvest but Deferred

Table J-1 contains a list of the operational inventory units that were considered for harvest in the Trail Creek Project and deferred from entry at this time. These units may be considered in future projects.

Total acres deferred from harvest entry in the Trial Creek fifth field watershed: 2,443 acres.

Table J-1. Operational Inventory Units Deferred from Timber Harvest in the Trail Creek Project

Legal Description	Operational Inventory Unit	Acres	Remarks
T32S, R1W, sec 21	003	28	East portion of stand classified as RA32 habitat.
	009	95	Variable stand with large portions in riparian reserve, some RA32 habitat, and some areas that are at appropriate stocking levels.
	020	16	South portion of stand classified as RA32 habitat.
	022	8	West portion of stand classified as RA32 habitat.
T32S, R1W, sec 28	008	7	Low basal area.
	009	10	Low basal area, with portions of stand needing understory treatment.
	014	2	Riparian reserve and RA32 habitat.
T32S, R1W, sec 29	001	25	Stocking levels at target Rx for NRF habitat.
	005	13	Stand classified as RA32 habitat.
	010	108	Stocking levels at target Rx for portions of this stand. Riparian reserves and slump areas also removed from consideration.
T32S, R1W, sec 30	002	10	West portion of stand classified as RA32 habitat.
T32S, R1W, sec 31	003	27	Stocking levels at target for rest of stand.
	007	7	Majority of stand in riparian reserve.
	010	30	Southeast portion of stand classified as RA32 habitat.
	011	39	Stand classified as RA32 habitat.
T32S, R1W, sec 32	001	27	East portion of stand classified as RA32 habitat.
	002	18	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand.
	014	3	North portion of stand classified as RA32 habitat.

Table J-1. Operational Inventory Units Deferred from Timber Harvest in the Trail Creek Project

Legal Description	Operational Inventory Unit	Acres	Remarks
T32S, R1W, sec 33	002	80	Variable stand with large portions in riparian reserve, some RA32 habitat, oak woodlands, and some areas at target for appropriate stocking levels.
	003	36	Stand classified as RA32 habitat with multiple riparian reserves.
	006	35	Low basal area.
	007	65	Low basal area with multiple riparian reserves. Would benefit from potential stewardship or understory treatment.
	011	16	Unstable soils with multiple riparian reserves.
	014	56	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand.
	015	15	East portion of stand classified as RA32 habitat.
	017	4	Stocking levels at target Rx for stand.
T32S, R1W, sec 34	009	12	Stand classified as RA32 habitat with multiple riparian reserves.
T33S, R1W, sec 3	005	52	North portion mostly riparian reserve and east portion is understocked with low basal area.
T33S, R1W, sec 5	004	30	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand.
	005	85	Previous hazardous fuels treatment. Stocking levels at target Rx.
	009	70	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand. Previous hazardous fuels treatment.
T33S, R1W, sec 7	002	204	Previous hazardous fuels treatment. Stocking levels at target Rx.
	003	74	Previous hazardous fuels treatment. Stocking levels at target Rx.
	011	60	North, south, and west portions of stand have stocking levels at target Rx.
T33S, R1W, sec 9	008	5	East portion of stand classified as RA32 habitat.
	009	13	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand.
	011	17	Multiple riparian reserves with stocking levels at target Rx for the remaining portions of stand.

Table J-1. Operational Inventory Units Deferred from Timber Harvest in the Trail Creek Project

Legal Description	Operational Inventory Unit	Acres	Remarks
T33S, R1W, sec 10	005	21	Stand classified as RA32 habitat.
	006	4	Riparian reserve, partially located in previous timber sale unit leaving only a couple acres to treat.
	006	7	Portion of stand along south section line classified as RA3 habitat.
	506	4	75% of stand at target Rx.
T33S, R1W, sec 15	007	5	Stocking level at Rx for west portion of unit.
T33S, R1W, sec 17	002	32	North portion of unit classified as RA32 habitat.
	004	66	Entire stand classified as RA32 habitat.
	009	21	North portion of stand classified as RA32 habitat.
T33S, R1W, sec 18	001	26	Low basal area; needs fuels reduction treatment.
	002	36	Low basal area; needs fuels reduction treatment. 5 acres within spotted owl nest patch.
	003	10	Low basal area; needs fuels reduction treatment.
	008	18	Nest patch. Recent finding of spotted owl pair.
T33S, R1W, sec 19	001	34	Precommercially thinned in the last 15 years with stocking levels currently at target Rx.
	004	6	Mostly riparian reserve.
	006	6	Stocking levels are currently at 80 basal area average.
	010	50	Mostly riparian reserve.
T33S, R1W, sec 20	002	8	Stand classified as RA32.
T33S, R1W, sec 21	011	23	Low basal area; needs understory density reduction.
	013	11	Low basal area; hardwood-dominated stand.
	014	10	Low basal area; hardwood-dominated stand.
	019	75	Not economical for harvest. Portion of unit is classified as RA32 habitat, some portions need understory treatment, and other portions are in riparian reserve.
T33S, R1W, sec 29	001	18	Variable stand with portions in riparian reserve, some oak woodlands, and other areas at target for appropriate stocking levels.
	003	22	Variable stand with portions in riparian reserve, some hardwoods, and other areas at target for appropriate stocking levels.
T33S, R1W, sec 31	003	41	Stand currently at Rx for appropriate stocking levels.

Table J-1. Operational Inventory Units Deferred from Timber Harvest in the Trail Creek Project

Legal Description	Operational Inventory Unit	Acres	Remarks
T33S, R2W, sec 1	004	26	Unstable soils with slumped areas. At Rx with appropriate stocking levels for stands with pyroclastic soils.
	005	5	Low basal area with understory treatment recommended.
	006	18	Needs understory treatment, with overstory basal area at 75.
	010	20	Needs understory treatment, with overstory basal area at 65.
	014	8	Low basal area with varying amounts of rock and cliffy areas.
T33S, R1W, sec 3	001	94	RA32 habitat and riparian reserve acres dropped.
	005	13	Multiple riparian reserves.
	006	8	Multiple riparian reserves.
T33S, R1W, sec 9	025	5	Stand classified as RA32 habitat.
T33S, R1W, sec 15	001	53	Low basal area. Needs understory treatment.
T33S, R1W, sec 23	001S	28	Previous hazardous fuels treatment; currently at target stocking level.
	003	7	Previous hazardous fuels treatment; currently at target Rx for stocking levels. Riparian reserves and springs within stand.
T33S, R1W, sec 25	004	154	65% of unit dropped. Previous hazardous fuels treatment; currently at target stocking levels. 12 acres RA32 habitat.
T34S, R2W, sec 1	001	28	Low basal area except for 4 acres RA32 habitat.
	013	14	Stand classified as RA32 habitat.
	014	6	Stand classified as RA32 habitat.
Total		**2,443**	

J-2. Units Considered for Small Diameter Thinning but Deferred

Approximately 648 acres were originally considered for small diameter thinning but were eliminated from consideration due to the lack of access, lack of treatments need, habitat buffers, or different treatment proposed. Some of the dropped units would require skyline-cable yarding systems and the development of road access. All or portions of the following operational inventory units were deferred from entry at this time (Table J-2).

Table J-2. Operational Inventory Units Deferred from Small Diameter Thinning

Legal Description	Operational Inventory Unit	Acres	Remarks
T32S, R1W, sec 29	004	20	No access.
T32S, R1W, sec 30	004	74	Low volume; needs hazardous fuels reduction.

Table J-2. Operational Inventory Units Deferred from Small Diameter Thinning

Legal Description	Operational Inventory Unit	Acres	Remarks
T32S, R1W, sec 32	005	17	Low volume; needs hazardous fuels reduction.
	012	6	Low volume; needs hazardous fuels reduction.
T32S, R1W, sec 33	007	10	Red tree vole buffer.
T33S, R1W, sec 9	002	30	Low volume; needs hazardous fuels reduction.
	003	30	Low volume; needs hazardous fuels reduction.
	005	10	Low volume; needs hazardous fuels reduction.
	013	29	Cable yarding. Low volume; needs hazardous fuels reduction.
T33S, R2W, sec 1	007	10	Low volume; needs hazardous fuels reduction.
	008	28	Low volume; needs hazardous fuels reduction.
	009	24	Low volume; needs hazardous fuels reduction.
	015	7	Low volume; needs hazardous fuels reduction.
T33S, R2W, sec 3	002	185	Low treatment need/precommercial thinning recommended.
T33S, R2W, sec 15	003	47	Timber; sensitive soils
T34S, R2W, sec 1	010	29	Previous hazardous fuels reduction; low volume; riparian reserve.
	006	16	Low volume; riparian reserve
	013	36	RA32 habitat.
Total		**648**	

Appendix K: Lands With Wilderness Characteristics—Berry Creek Unit

An ongoing inventory of wilderness resources was updated in 2012 in preparation for a Medford District RMP plan revision, as required under Section 201 of FLPMA. In order for an area to qualify as lands with wilderness characteristics, it must possess sufficient size, naturalness, and outstanding opportunities for either solitude or primitive and unconfined recreation (BLM Manual 6310 — Conducting Wilderness Characteristics Inventory on BLM Lands). The inventory found 6,254 acres with all of these wilderness characteristics in the Berry Creek unit; 1,322 acres of this unit are within the Trail Creek Project Area.

The portion of the Berry Creek unit within the Trail Creek project area is the west-facing side of a 4-mile long north-south ridgeline generally located east of the Tiller Highway, from Highway 62 north to a ridgeline running east from Buck Rock. The area rises in elevation from 1,700 feet to 3,900 feet, with moderately steep to steep slopes. Areas of open grassland are scattered through mixed conifer/hardwood forest and shrubs. Resistant, layered rock creates cliffs and slopes of variegated forest/grass/brush/rock outcrops. Dominant human uses of this part of the unit have been timber harvest and silviculture activities, grazing, hunting, and off-highway vehicle use. Between 2004 and 2006, 65 acres of density management and regeneration harvest via helicopter occurred in Sections 15, 21, and 22. Stumps and tree markings are visible in the immediate vicinity of the harvested areas, and more light reaches the forest floor, but this does not impact the area as a whole; the harvested areas are not visible from the top of Buck Rock or on Google Earth imagery.

A 20-foot tall communication tower with solar panels is located on top of Buck Rock at the site of a previous fire lookout; access to the site is via a steep all-terrain vehicle trail from BLM road 33-1-10.2. The tower is not visible from the surrounding area below. A user-created all-terrain vehicle trail runs from the end of BLM road 33-1-15 in Section 15, past the previously harvested units, southwest to a route in Section 27. This second route is visible on Google Earth imagery but its width or condition is unknown due to the inability to access the area; GIS records show it as an unnumbered, natural-surface, unmaintained route. Several vehicle routes are visible on Google Earth imagery that enter this part of the unit from private lands; the size and condition of these routes are unknown, but are assumed to be natural surfaced and unmaintained. A review of fire records shows the possibility of two water sources of unknown condition just within the unit's west boundary—a spring development in Section 28 and a water tank in Section 21.

Vegetative and topographic screening allows opportunities for solitude throughout most of the unit; roads around the periphery are native or gravel surface, low to medium use, and screened from the interior of the unit by vegetation and topography. Because of private property along the west, south, and east sides, the area is difficult to access by the public from those directions. The only legal access for the public into the area is from BLM roads along the north boundary.

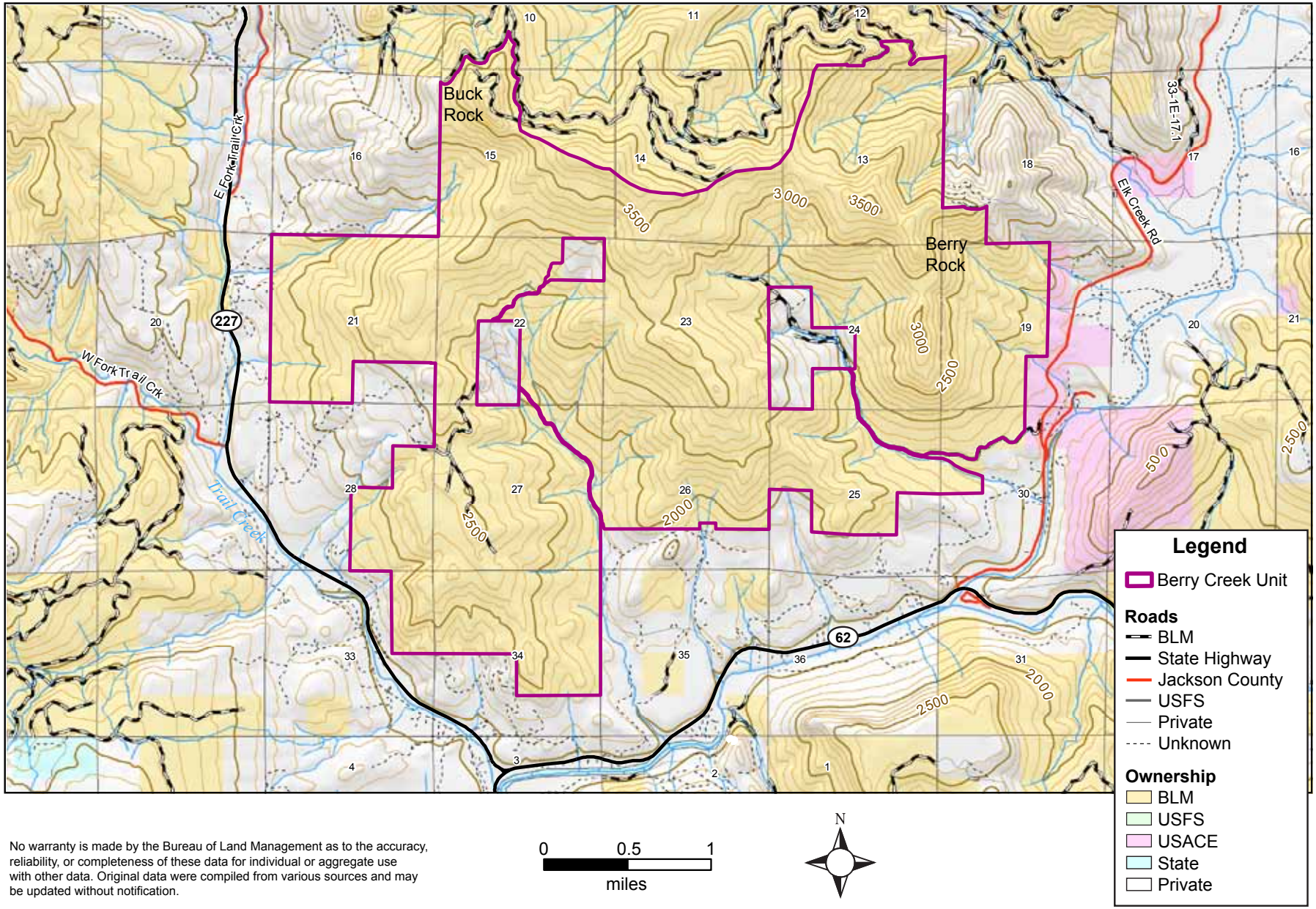
Because of limited roads and developments in the unit, there are opportunities for cross-country hiking and backpacking. A trail system in the area was proposed 15 years ago, but was never built. Vegetation and topography screen and isolate the area from developed areas along the Tiller-Trail Highway and Highway 62.

The 35 acres of proposed harvest within the Berry Creek unit are located adjacent to 65 acres of density management and regeneration harvest completed in 2006. The proposed harvest is similar to the previous harvest and is expected to have similar impacts. Stumps and slash would be evident in the immediate vicinity of each unit, and would be most evident in the first 5 years after treatment. Because the canopy would be

thinned, more light would enter the treated areas. The impacts from Alternative 2 will be more visible and apparent to the casual viewer than those under Alternatives 3 and 4. However, impacts under all alternatives are anticipated to be visible only from the immediate vicinity of each unit, not from any distance. Harvest activity in the 4-acre helicopter unit located at the end of BLM road 33-1-10.2 would be the most visible unit in all of the action alternatives. Because of its flatter topography, this unit would also have more potential for later off-highway vehicle intrusions after harvest. This would be mitigated when the road is barricaded at its junction with BLM road 33-1-8 after harvest.

Berry Rock

Berry Creek Lands with Wilderness Characteristics—Unit #OR11-9



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

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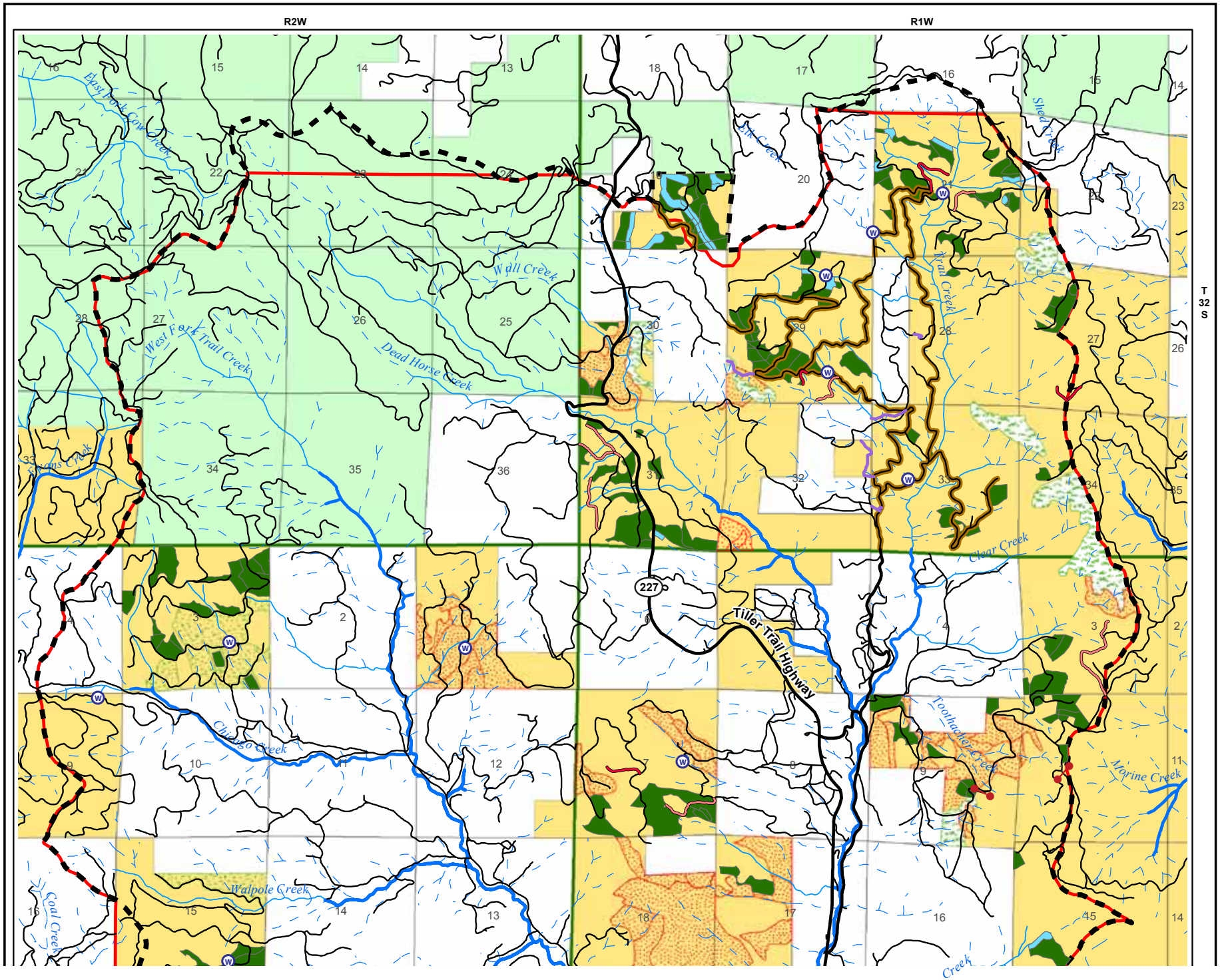
R2W
R1W
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East Fork Cow Creek
Wall Creek
West Fork Trail Creek
Dead Horse Creek
Trail Creek
Shed Creek
Clear Creek
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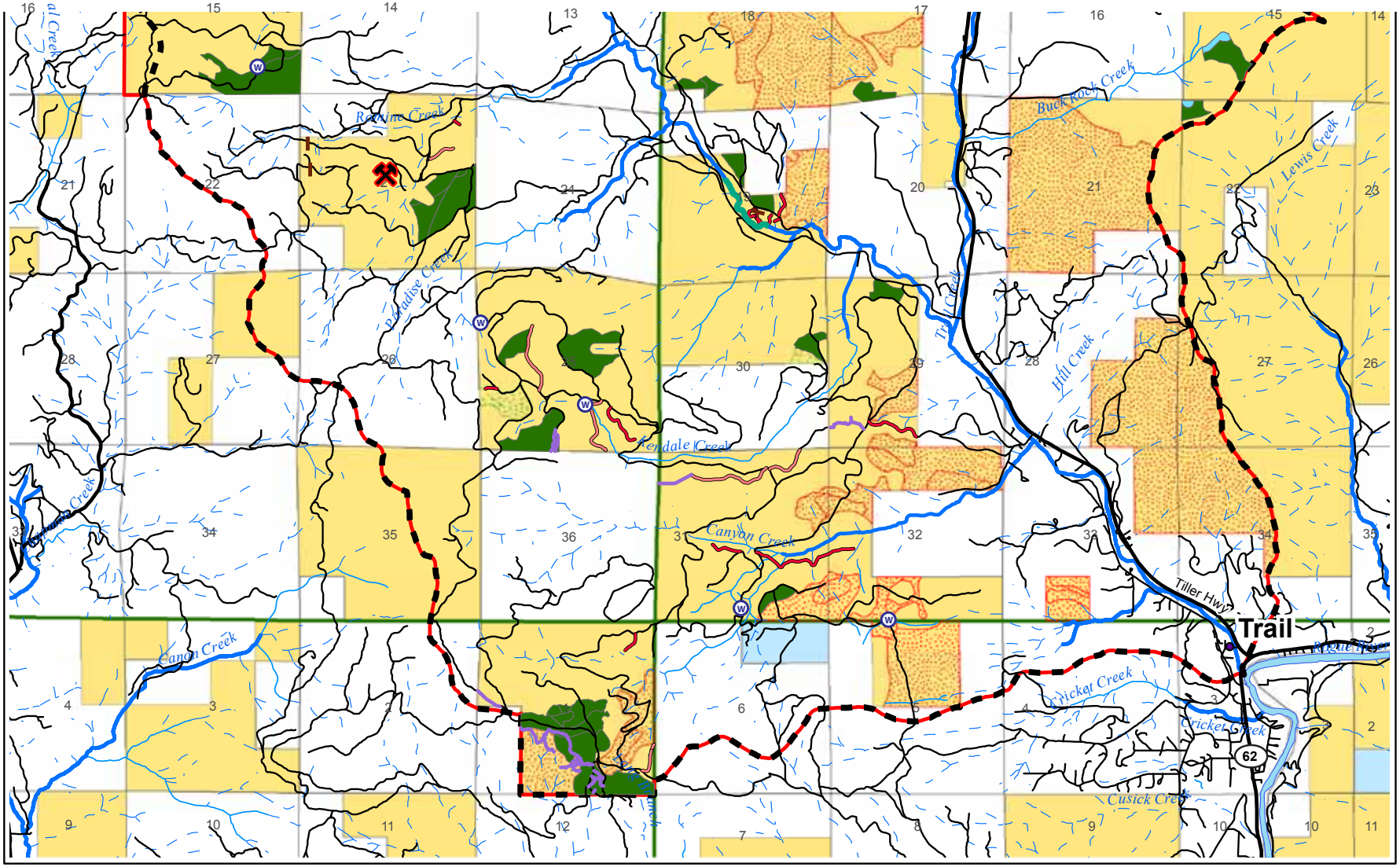
227
Toothacher Creek
Moraine Creek
Walpole Creek
Coal Creek
Creek



Timber Harvest Units
Riparian Thinning
Fuel Hazard Reduction
Meadow Restoration
Precommercial Thinning
Roadside Firewood Area
Quarry Reclamation
Water Source Restoration

OHV Trail Closure and Restoration
Full Decommission
Partial Decommision
Barricade
Gate

Stream Habitat Enhancement

Exclosure
Road Decommissioning
Stream Restoration

Paved Road
Forest Road
Trail Creek Project Boundary
Wildland Urban Interface
Fish Bearing Stream
Perennial Stream
Intermittent Stream

Private
Forest Service
BLM-Administered
State

N

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miles

Trail Creek Forest Management Project Environmental Assessment

Butte Falls Resource Area
January 2014

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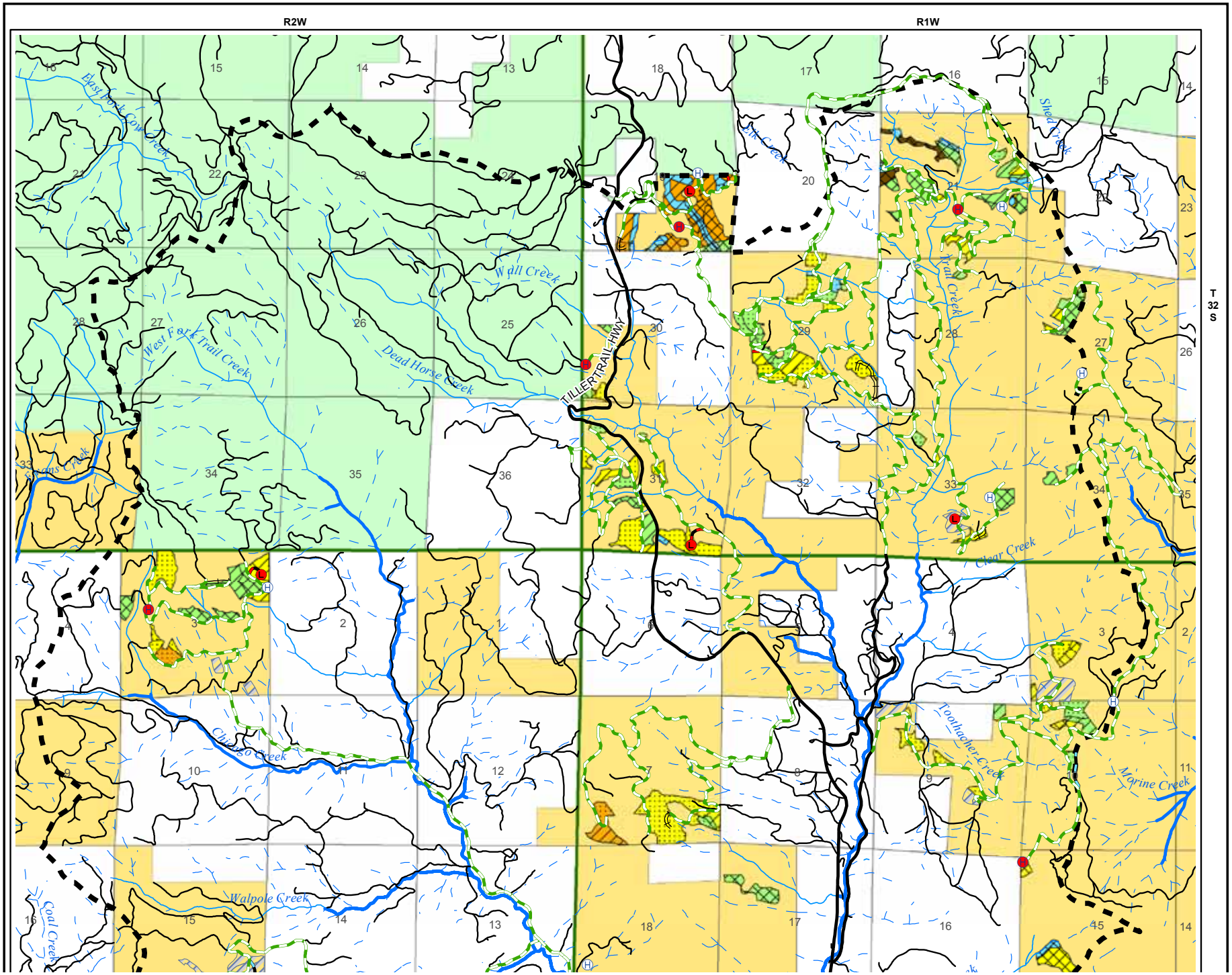
Map 2. Trail Creek Projects Common to All Action Alternatives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East Fork Cow Creek
West Fork Trail Creek
Dead Horse Creek
Wall Creek
Jim Creek
Shed Creek
Trail Creek
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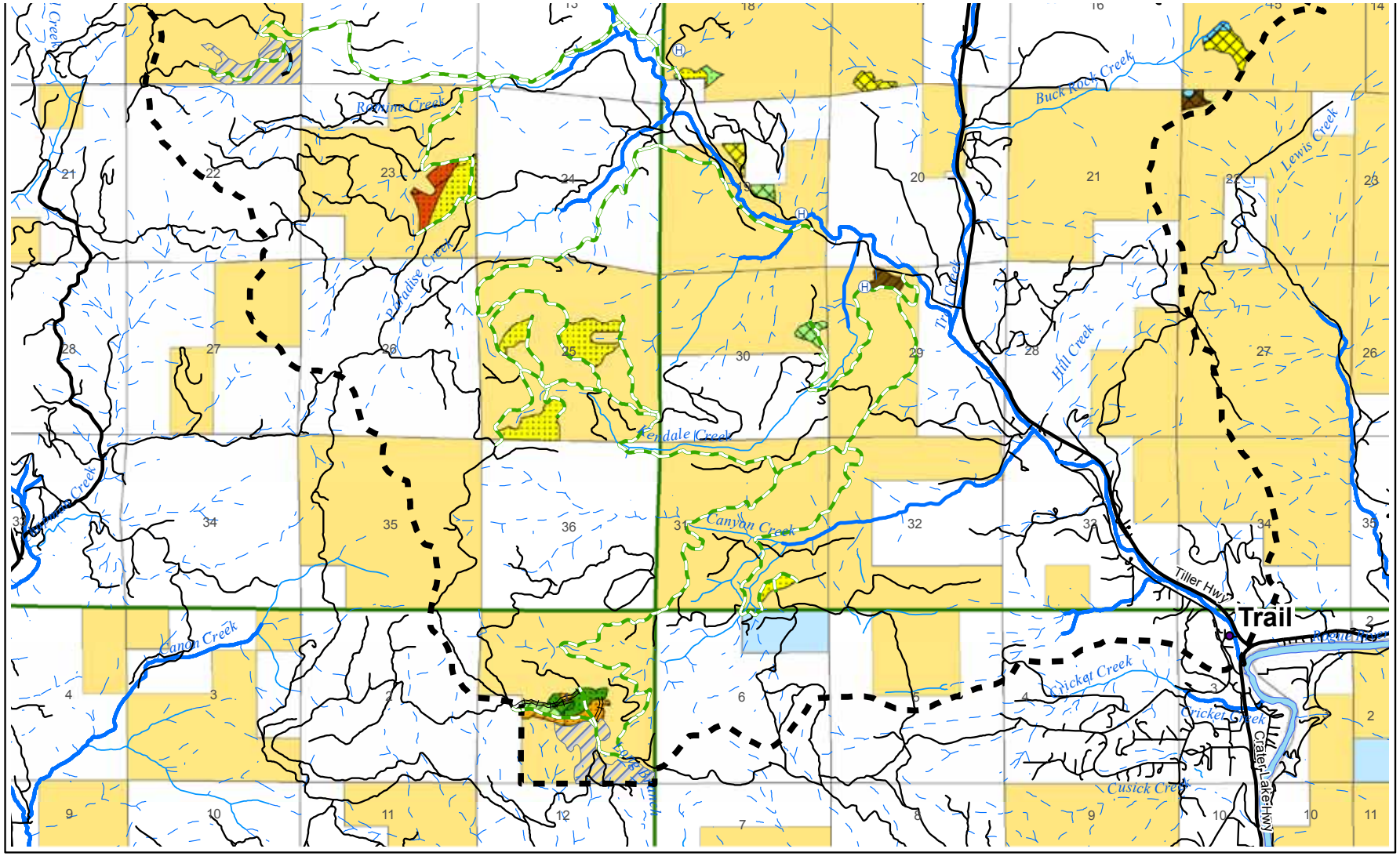
Clear Creek
Toothacher Creek
Marine Creek
Chicago Creek
Walpole Creek
Coal Creek
Stevens Creek



Commercial Thinning
Density Management 40%
Density Management 60%
Riparian Thinning
NGFMA Regeneration
SGFMA Regeneration
Shelterwood
Small Diameter Thinning
Helicopter
Skyline
Tractor

Trail Creek Project Boundary
Existing Helicopter Landing
New Helicopter Landing
New Log Landing
Paved Road
Forest Road
Predesignated Skid Trail
Temporary Route Construction
Temporary Route Reconstruction
Road Renovation

Fish-Bearing Stream
Perennial Stream
Intermittent Stream
Private
Forest Service
BLM
State

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Trail Creek Forest Management Project Environmental Assessment

Butte Falls Resource Area
January 2014

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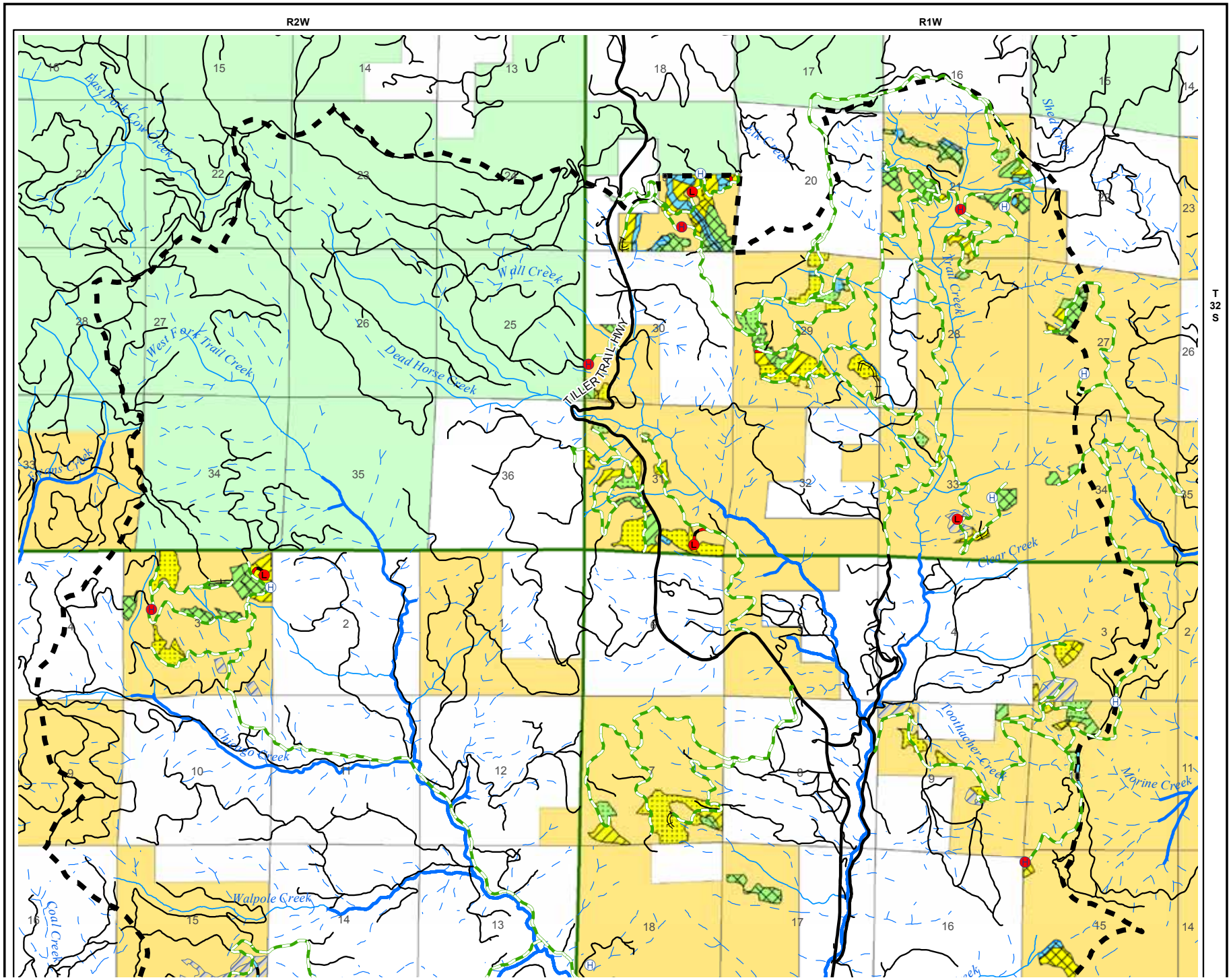
Map 3. Trail Creek Alternative 2


R2W
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T 32 S
East Fork Cow Creek
Wall Creek
West Fork Trail Creek
Dead Horse Creek
TILLER TRAIL HWY
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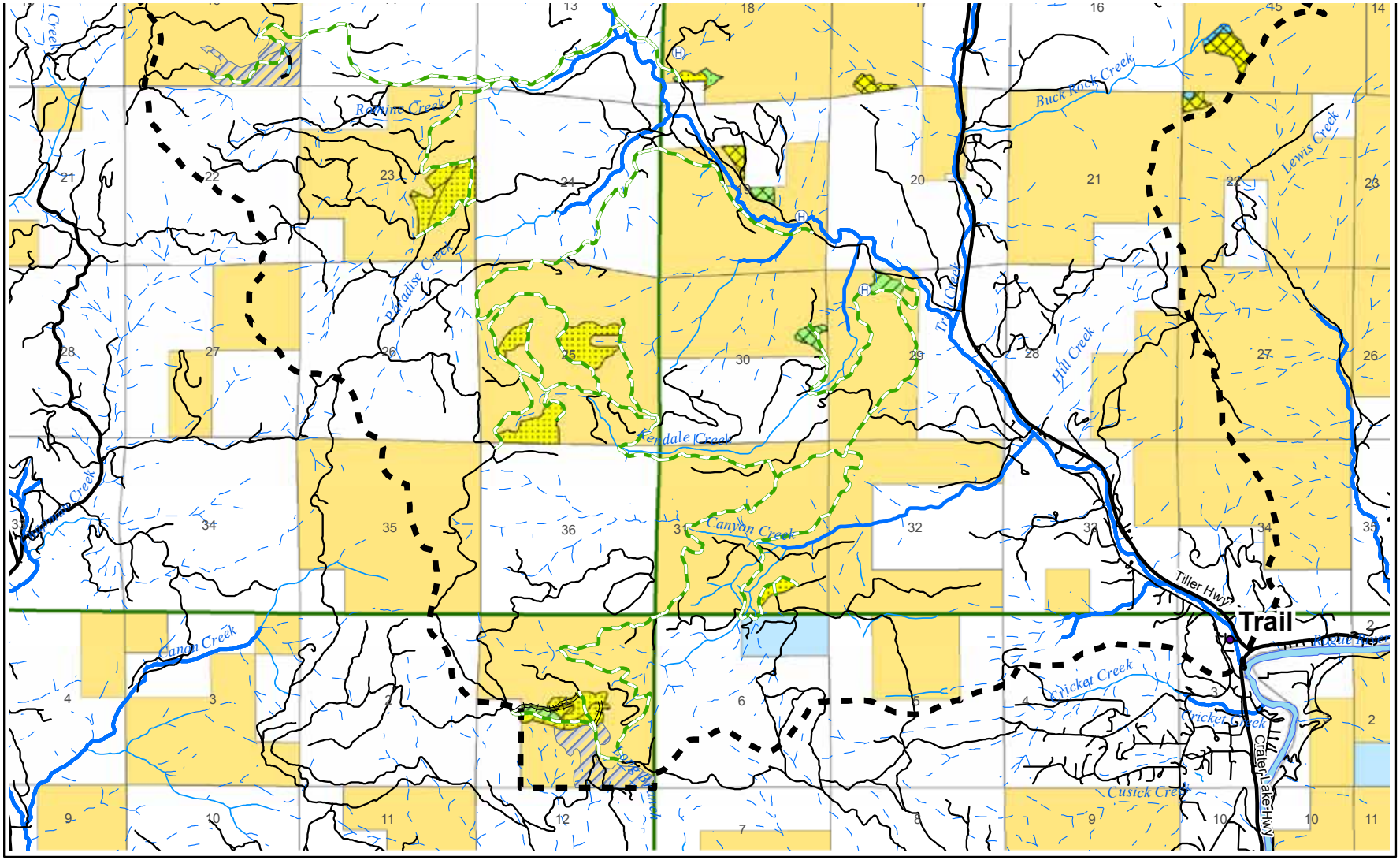
Morine Creek
Chicago Creek
Walpole Creek
Coal Creek



Restoration Thinning 40%
Restoration Thinning 60%
Riparian Thinning
Small Diameter Thinning
Helicopter
Skyline
Tractor
Trail Creek Project Boundary

Existing Helicopter Landing
New Helicopter Landing
New Log Landing
Paved Road
Forest Road
Predesignated Skid Trail
Temporary Route Construction
Temporary Route Reconstruction
Road Renovation

Fish-Bearing Stream
Perennial Stream
Intermittent Stream
Private
Forest Service
BLM
State

Trail Creek Forest Management Project Environmental Assessment

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Miles

Butte Falls Resource Area
January 2014

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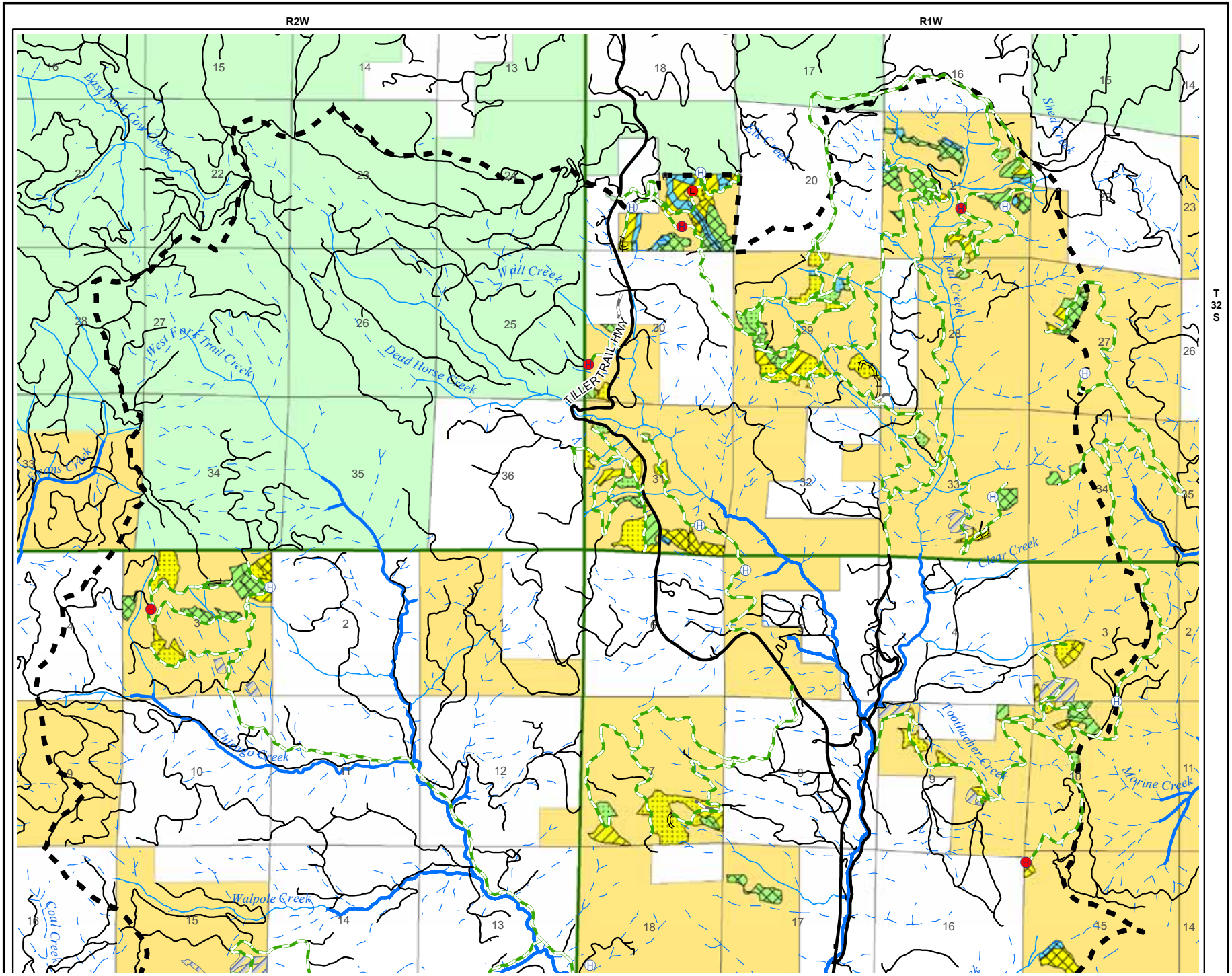
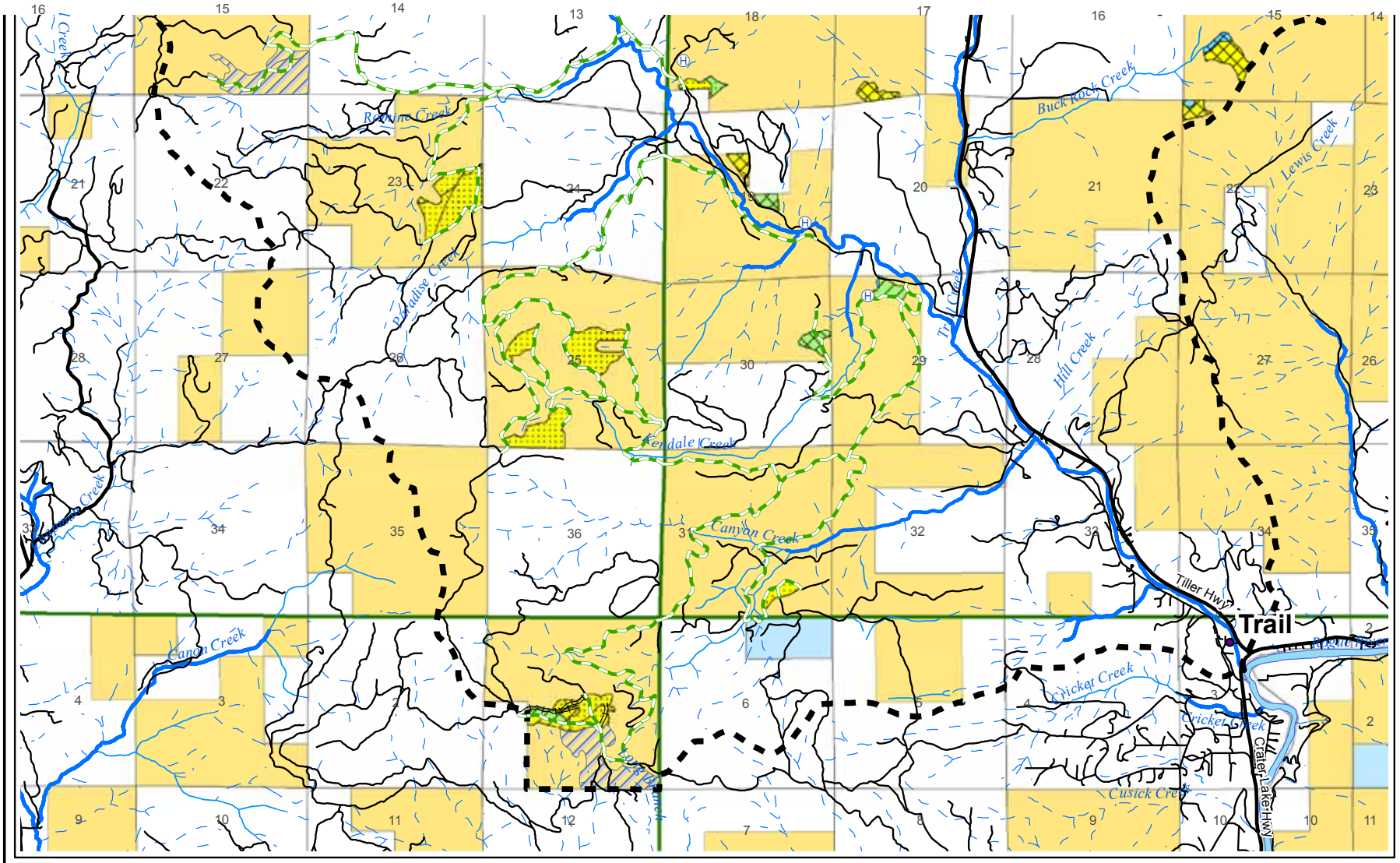
Map 4. Trail Creek Alternative 3


R2W
R1W
T 32 S
East Fork Cow Creek
West Fork Trail Creek
Dead Horse Creek
Wall Creek
Dry Creek
Shed Creek
Trail Creek
TILLER-TRAIL HWY
Clear Creek
Toothacher Creek
Morine Creek
Chicago Creek
Walpole Creek
Coal Creek



Restoration Thinning 40%
Restoration Thinning 60%
Riparian Thinning
Small Diameter Thinning
Helicopter
Skyline
Tractor
Trail Creek Project Boundary

Existing Helicopter Landing
New Helicopter Landing
New Log Landing
Pre-Designated Skid Trail
Existing Non-System Road
Road Renovation

Paved Road
Forest Road
Fish-Bearing Stream
Perennial Stream
Intermittent Stream
Private
Forest Service
BLM-Administered
State

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Trail Creek Forest Management Project Environmental Assessment

Butte Falls Resource Area
January 2014

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Map 5. Trail Creek Alternative 4