DRAFT RESOURCE MANAGEMENT PLAN/ ENVIRONMENTAL IMPACT STATEMENT

Western Oregon

Volume 1

U.S. Department of the Interior
Bureau of Land Management

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation.

The BLM's mission is to manage and conserve the public lands for the use and enjoyment of present and future generations under our mandate of multiple-use and sustained yield. In fiscal year 2013, the BLM generated $4.7 billion in receipts from public lands.

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NATIONAL SYSTEM OF PUBLIC LANDS

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965, Portland, Oregon 97208
http://www.blm.gov/or

Dear Reader:

The 2.5 million acres of lands administered by the Bureau of Land Management (BLM) in western Oregon play an important role in the region's social, ecological, and economic well-being. As stewards of these lands, the BLM has a responsibility to ensure that our management is effectively meeting our legal mandates and the needs of the communities in western Oregon.

Enclosed you will find our Draft Resource Management Plan (RMP)/Environmental Impact Statement (EIS) for six BLM districts in western Oregon. This document integrates the requirements for land use planning from the Federal Land Policy and Management Act and the requirements for analysis of federal actions from the National Environmental Policy Act.

This Draft RMP/EIS explains why we are proposing a plan revision, presents a full spectrum of different management alternatives, and analyzes the environmental effects of the alternatives. These alternatives respond to the Purpose and Need for action, described in Chapter 1, which outlines the goals that we seek to achieve. Based on this analysis and comments that we receive on this Draft RMP/EIS, we will prepare a Proposed RMP/Final EIS with the assistance of cooperating agencies.

Public engagement has always been a foundational principle for our planning team. Since the inception of this planning effort in 2012, we have held more than three dozen public meetings to solicit feedback and share our thinking. We have also worked closely with our state, federal, and county partners to ensure that the analysis is rigorous, thorough, and reflects our 20 years of experience of implementing our current plans. We will use the results of this analysis, along with your feedback, to begin developing the Proposed RMP/Final EIS.

Following publication of this Draft RMP/EIS, you will have 90 days to provide written comments. We would appreciate your feedback; please see the "Readers Guide" section for more specific information on the many ways you can comment on this document. Please join us by submitting your comments and participating in the upcoming public open houses and workshops in your community.

The people of western Oregon are in need of a lasting solution that will provide predictable outcomes and sustainable management of the BLM-administered lands. With your help, we can utilize your insight and comments to build an RMP that will provide sustainable solutions for the public lands that we are privileged to manage.

Thank you for your interest and participation in this planning process.

Jerome E. Perez
State Director
Bureau of Land Management
Oregon/Washington

United States Department of the Interior
Bureau of Land Management

Draft Resource Management Plan/Environmental Impact Statement for the Resource Management Plans for Western Oregon

Coos Bay, Eugene, Medford, Roseburg, and Salem Districts
and the Lakeview District's Klamath Falls Field Office

Cooperating agencies:

Benton County	State of Oregon
Clackamas County	Environmental Protection Agency
Columbia County	National Marine Fisheries Service
Coos County	U.S. Fish and Wildlife Service
Curry County	U.S. Forest Service
Douglas County	Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians
Klamath County	Confederated Tribes of Grand Ronde
Lane County	Confederated Tribes of Siletz Indians
Lincoln County	Coquille Indian Tribe
Linn County	Cow Creek Band of Umpqua Tribe of Indians
Marion County	Klamath Tribes
Multnomah County	
Polk County	
Tillamook County	
Washington County	
Yamhill County	

Abstract: This Draft Resource Management Plan/Environmental Impact Statement addresses revision of the 1995 Resource Management Plans for the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. The purpose of this Resource Management Plan revision is to provide a sustained yield of timber, contribute to the conservation and recovery of threatened and endangered species, provide clean water in watersheds, restore fire-adapted ecosystems, provide recreation opportunities, and coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe. The BLM analyzed the No Action alternative of continued implementation of the 1995 Resource Management Plans, four alternatives, and two sub-alternatives.

Comments on this Draft Resource Management Plan/Environmental Impact Statement must be submitted by July 23, 2015.

For further information contact:

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Reader's Guide

The Bureau of Land Management (BLM) is revising the resource management plans (RMPs) for its Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. The planning area for this RMP revision encompasses western Oregon and includes approximately 2.5 million acres of public land managed by the BLM. When approved, these RMPs will replace the existing RMPs and guide the management of public lands in the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office into the future.

The BLM has prepared this Draft Resource Management Plan/Environmental Impact Statement (Draft RMP/EIS) in accordance with the National Environmental Policy Act of 1969, as amended, the Federal Land Policy and Management Act of 1976, as amended, the BLM NEPA Handbook (H-1790-1), the BLM Land Use Planning Handbook (H-1601-1), and other applicable law and policy.

Organization of the Draft Resource Management Plan/Environmental Impact Statement

This Draft RMP/EIS provides a progression of information to the reviewer.

The Summary presents a brief description of the major elements of this document. The summary is necessarily neither comprehensive nor complete. Therefore, the details in the four chapters of this document are essential to fully understanding the planning process, the alternatives, and their effects.

Chapter 1 presents the purpose and need for this RMP revision and the guidance for the development of the action alternatives. Chapter 1 presents a discussion of the major authorizing laws and regulations that affect management of the BLM-administered lands in the planning area.

Chapter 2 describes the No Action alternative and the action alternatives that are analyzed in detail, including identification of the preferred alternative. This chapter also discusses alternatives that the BLM considered but did not analyze in detail. Finally, this chapter presents a comparison of the alternatives, including summaries of key features of the alternatives and key impacts of the alternatives.

Chapter 3 describes the environment that the RMPs are likely to affect and the environmental consequences of the alternatives. Although many EISs present the affected environment and environmental consequences in separate chapters, the BLM has combined these two topics into this single chapter to provide all of the relevant information on a resource in a single discussion. This chapter is includes sections for each resource that the RMPs are likely to affect. Each section begins with a summary of the methods used to analyze the impacts of the alternatives on this resource. The BLM has then divided each section into subsections that address a particular question about how the BLM's draft alternatives may affect the resource (the BLM refers to these questions as "issues"). Under each issue, the BLM describes the status and trends of the pertinent resource and the environmental consequences to the resource of the alternatives analyzed in detail, including the No Action alternative.

Chapter 4 describes the public involvement and collaboration that occurred during the preparation of this Draft RMP/EIS. That collaboration includes government-to-government relationships with tribes, formal cooperators in the planning process, and consultation with other agencies. This chapter also includes a list of staff involved in the RMPs for Western Oregon.

Following Chapter 4 is a list of acronyms, a glossary of words and terms that are not in common usage, and references cited in the document.

The appendices provide technical discussions and background information supporting the text of the Draft RMP/EIS.

Commenting

The BLM encourages the public to review this Draft RMP/EIS and provide comments pertaining to the alternatives and analysis. Comments will be most useful to the BLM to the extent that they

- present new information relevant to the analysis;
- present reasonable alternatives other than those analyzed in the Draft RMP/EIS;
- make suggestions, with a reasoned basis, for the development of a proposed RMP;
- question, with a reasoned basis, the adequacy of, methodology for, or assumptions used for the analysis; or
- question, with a reasoned basis, the accuracy of information in the Draft RMP/EIS

Comments that are simply votes in support of or opposition to a particular alternative, or position statements in support of or opposition to particular BLM policies or proposals, without providing reasons, are less useful to the BLM in the planning process.

To be considered timely, comments on this Draft RMP/ EIS must be submitted within 90 days of the publication in the Federal Register of the Notice of Availability for this Draft RMP/EIS. You can submit comments by mail to

RMPs for Western Oregon
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

or by electronic mail (email) to

BLM_OR_RMPs_WesternOregon@blm.gov

Comments by mail must be postmarked by July 23, 2015. Comments by email must be received by July 23, 2015. If you have questions, please contact Sarah Levy, BLM Public Affairs Specialist, at (503) 808-6217.

Persons who use a telecommunications device for the deaf may call the Federal Information Relay Service at 1-800-877-8339 to contact the above individual during normal business hours. The FIRS is available 24 hours a day, 7 days a week, to leave a message or question with the above individual. You will receive a reply during normal business hours.

All information in your comments including your address, phone number, email address, or other personal identifying information (PII) is maintained as a BLM record. Although your information is sensitive and protected from public access, it may be made available under a Freedom of Information Act request. You may request in your comment that your PII information be withheld from public review although the agency is unable to guarantee full protection of such information. Please consider all information you may want to include in your comments.

Next Steps in the Planning Process

The BLM is planning a series of public meetings after the release of the Draft RMP/EIS. The purpose of these meetings is to help members of the public understand the content of the Draft RMP/EIS and provide meaningful and constructive comments. There will likely be six "open-house" public meetings (one meeting per District) where people can engage with BLM employees on all resources addressed in the Draft RMP/EIS. The BLM will likely also be organizing issue-specific meetings on topics such as socio-economics, forestry, aquatics, and wildlife. Information on meeting locations and dates will be available at
http://www.blm.gov/or/plans/rmpswesternoregon/

Following the 90-day comment period for this Draft RMP/EIS, the BLM will review the comments and work with cooperating agencies to develop a Proposed RMP/Final EIS. In that document, the BLM will present the Proposed RMP, which will be either one of the alternatives analyzed in this Draft RMP/EIS or a newly developed alternative that is within the spectrum of the alternatives analyzed in this Draft RMP/EIS. In the Proposed RMP/Final EIS, the BLM will also provide copies or summaries of substantive comments on the Draft RMP/EIS, the BLM responses to those comments, and changes or additions to the text of the Draft RMP/EIS in response to comments.

Following publication of the Proposed RMP/Final EIS, any person who participated in the planning process and has an interest that may be adversely affected by the approval of the Proposed RMP may protest to the Director of the BLM within 30 days of the publication of the Proposed RMP/Final EIS. The BLM will submit the Proposed RMP to the Governor of Oregon to identify any known inconsistencies with State or local plans, policies, or programs.

Following resolution of any protests and the completion of the consistency review by the Governor of Oregon, the BLM will prepare a Record of Decision/RMP (ROD/RMP) to approve the RMP revision. The ROD/RMP will identify the decision by the State Director on the RMP revision and the rationale for the decision. The ROD/RMP will also contain the RMP itself, including the land use allocations, management objectives, and management direction.

The publication of the ROD/RMP will represent the completion of the RMP revision process. Following publication of the ROD/RMP, the BLM will take only those management actions that are specifically provided for in the approved RMP, or, if not specifically mentioned, actions that are clearly consistent with the goals, objectives, or management direction of the approved RMP.

Summary

This summary presents a brief description of the major elements of this document. This summary is necessarily neither comprehensive nor complete. Furthermore, this summary omits the citations, definitions, and explanations provided in the document. Therefore, the details in the four chapters of this document are essential to fully understanding the planning process, the alternatives, and their effects.

Introduction

The Bureau of Land Management (BLM) is revising the resource management plans (RMPs) for its Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. This Draft RMP/Environmental Impact Statement (EIS) provides a description of the various alternative management approaches the BLM is considering for the management of these lands along with an analysis of the potential impacts of these alternatives.

The 1995 RMPs are consistent with the 1994 Northwest Forest Plan, which the Department of the Interior and the Department of Agriculture adopted for Federal forests within the range of the northern spotted owl. This RMP revision would replace the 1995 RMPs and thereby replace the Northwest Forest Plan for the management of BLM-administered lands in western Oregon. The purpose and need for this RMP revision are different from the purpose and need for the Northwest Forest Plan. As such, the action alternatives in this Draft RMP/EIS do not contain all elements of the Northwest Forest Plan.

The BLM conducted plan evaluations, which concluded that a plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs. Moreover, the BLM needs to revise existing plans to replace the 1995 RMPs' land use allocations and management direction because of new scientific information and policies related to the northern spotted owl.

The purpose of the RMP revision is to

- Provide a sustained yield of timber
- Contribute to the conservation and recovery of threatened and endangered species, including
    - maintaining a network of large blocks of forest to be managed for late-successional forests
    - maintaining older and more structurally complex multi-layered conifer forests
- Provide clean water in watersheds
- Restore fire-adapted ecosystems
- Provide recreation opportunities
- Coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe

Alternatives

The BLM has designed the range of alternatives in this Draft RMP/EIS to span the full spectrum of alternatives that would respond to the purpose and need for the action. The BLM has developed the alternatives to represent a range of overall management approaches, rather than exemplify gradations in design features. In this Draft RMP/EIS, the BLM analyzed in detail the No Action alternative and four action alternatives. In addition, the BLM analyzed how two sub-alternatives, which modify an individual component of northern spotted owl conservation in an alternative, would alter effects on timber production and northern spotted owls. Table 1 summarizes key features of the alternatives that vary substantially among the alternatives and are easily quantified and summarized.

The No Action alternative in this Draft RMP/EIS is implementation of the 1995 RMPs as written (in contrast to the BLM's current implementation practices under the 1995 RMPs). Implementation of the timber management program has departed substantially from the outcomes predicted in the 1995 RMPs, and continuing to harvest timber at the declared annual productive capacity level for multiple decades into the future would not be possible using the current practices.

All action alternatives include the following land use allocations: Congressionally Reserved, District-Designated Reserves, Late-Successional Reserve, Riparian Reserve, Harvest Land Base, and Eastside Management Area (Figure 1). The location and acreage of these allocations, with the exception of Congressionally Reserved, vary by alternative. Within each action alternative, the Harvest Land Base, Late-Successional Reserve, and Riparian Reserve have specific, mapped sub-allocations with differing management direction.

Alternative A has a Late-Successional Reserve larger than the No Action alternative. The Harvest Land Base is comprised of the Uneven-Aged Timber Area and the High Intensity Timber Area. The High Intensity Timber Area includes regeneration harvest with no retention (clear cuts).

Alternative B has a Late-Successional Reserve similar in size to Alternative A, though of a different spatial design. The Harvest Land Base is comprised of the Uneven-Aged Timber Area, Low Intensity Timber Area, and Moderate Intensity Timber Area. The portion of the Harvest Land Base in Uneven-Aged Timber Area is the largest of all action alternatives. The Low Intensity Timber Area and Moderate Intensity Timber Area include regeneration harvest with varying levels of retention.

Sub-alternative B is identical to Alternative B, except that it includes protection of habitat within the home ranges of all northern spotted owl known and historic sites.

Alternative C has the largest Harvest Land Base of any of the alternatives. The Harvest Land Base is comprised of the Uneven-Aged Timber Area and the High Intensity Timber Area. The High Intensity Timber Area includes regeneration harvest with no retention (clear cuts). Alternative C has the smallest acreage in the Riparian Reserve of all of the alternatives.

Sub-alternative C is identical to Alternative C, except that the Late-Successional Reserve includes all stands 80 years old and older.

Alternative D has the smallest Late-Successional Reserve of any of the alternatives. The Harvest Land Base is comprised of the Uneven-Aged Timber Area, Owl Habitat Timber Area, and Moderate Intensity Timber Area. The Owl Habitat Timber Area includes timber harvest applied in a manner that would maintain northern spotted owl habitat. The Moderate Intensity Timber Area includes regeneration harvest with retention. Alternative D has the largest acreage in the Riparian Reserve of all of the action alternatives.

Table I. Key features of the alternatives.

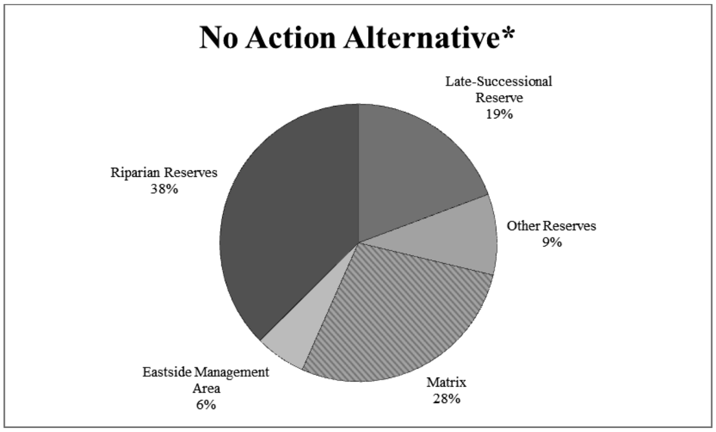
Alt.	Total Late-Successional Reserve (Acres)	Protection of Structurally-Complex Forest	Riparian Reserve Total Width	Riparian Reserve Inner Zone Width	Marbled Murrelet Survey and Protection
No Action	478,860	None specified	2 SPTH[21] on fish-bearing streams; 1 SPTH on non-fish-bearing streams	None specified	Survey in Zones 1 and 2; protect contiguous recruitment and existing habitat within ½ mile of sites
Alt. A	1,147,527	≥120 years	1 SPTH on all streams	120' on fish-bearing and perennial streams; 50' on non-fish-bearing intermittent streams	None
Alt. B	1,127,320	District-defined map based on existing, district-specific information	1 SPTH on perennial and fish-bearing streams; 100' on debris-flow-prone non-fish-bearing intermittent streams; 50' on other non-fish-bearing intermittent streams	60' on fish-bearing and perennial streams; 50' on non-fish-bearing intermittent streams	Survey in Zone 1; protect contiguous habitat within 300' of sites
Sub. B	1,422,933				
Alt. C	949,279	≥160 years	150' on fish-bearing streams; 50' on non-fish-bearing streams	60' on fish-bearing and perennial streams; 50' on non-fish-bearing intermittent streams	Survey stands >120 years; protect contiguous habitat within 300' of sites
Sub. C	1,373,206	≥80 years			None
Alt. D	714,292	≥120/140/160 years on high/moderate/low productivity sites	1 SPTH on all streams	120' on all streams	Survey in Zones 1 and 2; protect habitat within ½ mile of sites

[21] Site-potential tree height

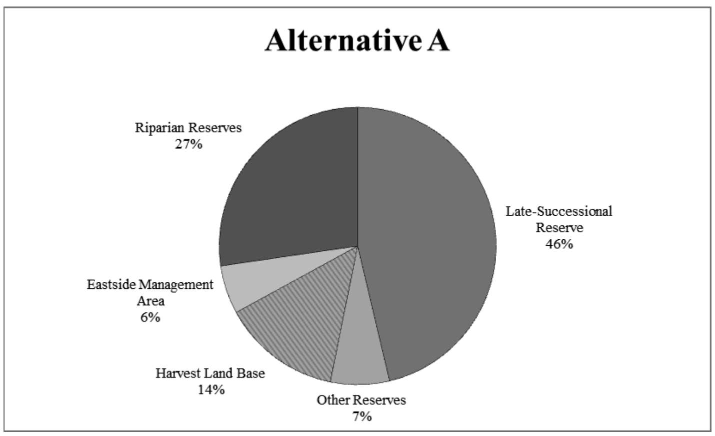
Alt.	Total Harvest Land Base (Acres)	Green tree retention	Areas of Critical Environmental Concern (# Designated)	Recreation Management Areas (SRMA[22] Acres ERMA[23] Acres)	Protection of Lands with Wilderness Characteristics (Acres)	Suitable Wild and Scenic Rivers (# of River Segments)
No Action	691,998	GFMA[24]: 6-8 trees per acre Connectivity/Diversity: 12-18 trees per acre Southern GFMA: 16-25 trees per acre	89 (and 53 potential)	168,968 2,397,460	None	9 (and 51 eligible)
Alt. A	343,900	No retention	119	20,065 0	88,070	0
Alt. B	556,335	Low Intensity Timber Area: 15-30% retention Moderate Intensity Timber Area: 5-15% retention	114	24,972 139,320	50,727	6
Sub. B	298,121					
Alt. C	741,332	No retention	111	59,046 357,771	50,727	6
Sub. C	495,507					
Alt. D	650,382	Owl Habitat Timber Area: maintain owl habitat Moderate Intensity Timber Area: 5-15% retention	118	86,693 580,458	None	59

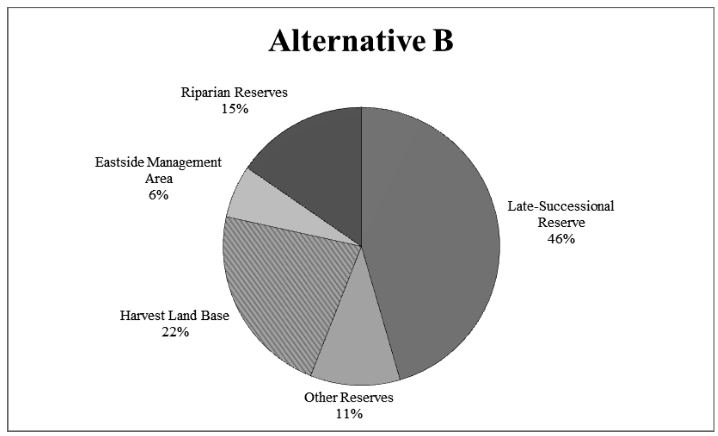
[22] Special Recreation Management Area
[23] Extensive Recreation Management Area
[24] General Forest Management Area

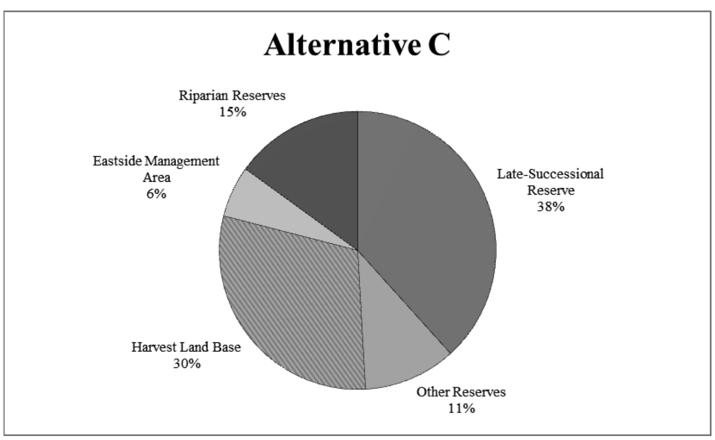
Figure i. Land use allocations under the alternatives.

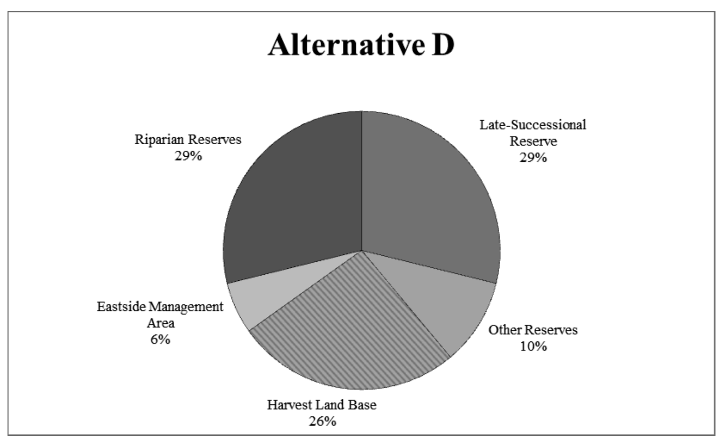


No Action alternative displays modified hierarchy (see Chapter 2).









Affected Environment and Environmental Consequences

This section summarizes the existing conditions and environmental consequences for each resource that the RMPs are likely to affect. Throughout this document, the BLM uses the term 'planning area' to refer to the 22 million acres of land within the geographic boundary of this planning effort regardless of jurisdiction, and uses the term 'decision area' to refer to the 2.5 million acres of BLM-administered land within the planning area.

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Air Quality

All action alternatives would produce more particulate emissions than the No Action alternative and current conditions. However, adherence to the requirements of the Oregon Smoke Management Plan would continue to limit impacts to human health and visibility from prescribed fires.

Areas of Critical Environmental Concern

The alternatives consider the designation of 121 potential Areas of Critical Environmental Concern. Alternative A would designate the most and Alternative C the fewest areas as Areas of Critical Environmental Concern at 119 and 111, respectively.

Climate Change

Carbon storage would increase under all alternatives. Greenhouse gas emissions associated with BLM-administered lands would increase under all alternatives, but would remain less than one percent of the 2010 statewide greenhouse gas emissions. Climate change provides uncertainty that reserves will function as intended and that planned timber harvest levels can be attained, with the uncertainty increasing over time.

Cultural and Paleontological Resources

The BLM can reduce or eliminate effects to cultural and paleontological resources through systematic and thorough cultural and paleontological resource inventories. Implementation of Alternatives A and D would be the least likely to result in potential adverse impacts to cultural and paleontological resources.

Fire and Fuels

All alternatives would increase stand-level fire resistance and reduce wildfire hazard on BLM-administered lands compared to current conditions. The BLM-administered lands constitute only a small portion of the entire interior/south dry forest landscape. Consequently, the modest shifts under any alternative would not result in any substantial change in the overall landscape fire resilience. The dry forest landscape would continue to have an overabundance of mid-seral closed forest and a deficit of late-seral open forest.

Fisheries

All of the alternatives would increase the potential large wood and small functional wood contribution to streams from the current conditions over time. Sediment production from road construction and operation would increase by less than one percent under all alternatives, and the effects to fish would not differ by alternative. These effects to fish would be short-term and localized and could result from increases in turbidity or deposition of fines in the stream channel substrates affecting habitat in the short term.

Forest Management

Even-aged systems with clear-cutting would produce more uniform stands in a mix of age classes without structural legacies. Two-aged systems with variable-retention regeneration harvesting would produce stands in a mix of age classes with legacy structures and multiple canopy layers. Uneven-aged management systems with selection harvesting regimes would produce mostly older, structurally complex stands and mature forests with multiple canopy layers.

The allowable sale quantity (ASQ) under the alternatives would range from 120 million board feet per year under Sub-alternative B to 486 million board feet per year under Alternative C. Non-ASQ timber harvest volumes in the first decade would range from 4 million board feet per year under Alternative D to 122 million board feet per year under the No Action alternative.

Hydrology

Under the No Action alternative, and Alternatives A and D, less than 0.5 percent of all perennial and fish-bearing reaches in the decision area would currently be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves. Under Alternative B and C, approximately 5 percent of all perennial and fish-bearing reaches in the decision area would currently be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves.

Under all alternatives, potential sediment delivery to streams from new road construction would constitute less than a one percent increase above current levels of fine sediment delivery from existing roads. Less than 2 percent of the decision area would be susceptible to peak flow increases over time under any alternative. Less than 1 percent of the Harvest Land Base would be susceptible to landsliding with the potential to deliver sediment to streams over time under any alternative.

Invasive Species

The risk of introducing and spreading invasive plant species over the next 10 years, and in the long term, would be lowest under Alternative D, and highest under Alternatives B and C. Sudden oak death infestations would occupy 100 percent of the Riparian Reserves in Infestation Zone 2 and almost 90 percent in Infestation Zone 3 by 2033 under Alternatives A and B.

Lands and Realty

Under all alternatives, BLM-administered lands would generally be available for rights-of-way. Alternative D would most constrain the BLM's ability to grant right-of-ways from the current conditions.

Lands with Wilderness Characteristics

Alternative A provides the greatest protection of identified lands with wilderness characteristics within the planning area. Alternatives B and C provide intermediate protection of lands with wilderness characteristics within the planning area. Alternative D provides no protection of lands with wilderness characteristics with the planning area.

Livestock Grazing

Under Alternatives A, B, and C, public land available for livestock grazing would decrease from 495,190 acres to 359,049 acres. This change would occur through the BLM making currently vacant allotments unavailable for grazing. Under Alternative D, the BLM would no longer authorize livestock grazing within the decision area, a change that would affect 495,190 acres.

Minerals

Under the action alternatives, the BLM would petition for the withdrawal of an additional six to eight percent of the decision area. Approximately 90 percent of the decision area would remain open to locatable and salable mineral entry. All of the decision area would remain open to leasable mineral development.

National Trails System

Alternative D would provide the largest National Trail Corridor and protect the greatest number of acres within the viewshed. However, these acres only account for nine percent of all viewable acres.

Rare Plants and Fungi

Only two Federally-listed plant species occur within forest and woodland habitat in the decision area: Kincaid's lupine and Gentner's fritillary. Under all alternatives, the BLM would conduct pre-disturbance survey and apply conservation measures for these Federally-listed plant species. The BLM would manage Bureau Sensitive plant and fungi species under the BLM's sensitive species program under all alternatives. Under all action alternatives, species that are currently Survey & Manage and not included on the Bureau Sensitive species list would receive no specific protections.

Recreation and Visitor Services

Alternative A would provide a reduction in recreation opportunities when compared to the existing management situation. Alternative D would provide the greatest number and acres of recreation management areas in closest proximity to the twelve most populated communities in the planning area.

Soil Resources

All alternatives would increase the acreage of detrimental soil disturbance from timber harvest, road construction, and fuels treatments by 13 to 30 percent of current amounts during the first decade. The BLM would be able to reduce the acreage of detrimental soil conditions from timber harvest, road construction, and fuels treatments through sound management practices that would limit initial compaction levels, remove existing or created compacted surfaces, and improve soil water and organic matter levels.

Socioeconomics

BLM-administered lands provide a wide variety of market and non-market goods and services to the planning area such as timber, recreation, carbon storage, minerals, and source water protection. The annual harvest value of timber, compared to $23 million in 2012, would increase under all alternatives; from $37 million under Alternative D to $135 million under Alternative C. Using non-market valuation techniques the analysis estimates the 2012 value of recreation on BLM-administered lands at $223 million and the annual value of carbon storage at $99 million. Under all alternatives, the annual value of recreation would increase to $250 million. The annual value of net carbon storage would increase under all alternatives except Alternative C, under which it would fall to $55 million.

In 2012, BLM management contributed 7,900 jobs and $355 million in earnings to the planning area, which is about 0.4 percent of the total jobs and earnings. Under the alternatives, these contributions would range from a low of 6,900 jobs and $304 million in earnings (Alternative D) to a high of 12,419 jobs and $584 million in earnings (Alternative C). Employment effects to low-income populations in Coos, Curry, Douglas, and Klamath Counties would be disproportionately negative under Alternatives A and D. Low-income communities and tribes in these counties would also be vulnerable to these disproportionately negatively effects. Under Alternative B, employment effects would be disproportionately negative for Coos and Curry Counties.

There is uncertainty regarding the source and amounts of future payments to counties from activities on BLM-administered lands. Secure Rural Schools and Community Self-Determination Act payments to counties totaled $38 million in 2012. Had payments in 2012 been based on the O&C Act formula, they would have been $12 million. Under the alternatives, payments in 2018 would range from a low of $19 million under Alternative D to a high of $67 million under Alternative C.

Sustainable Energy

Under all alternatives, the majority of the land in the decision area would be available for the potential development of sustainable energy resources. While there is no current geothermal development and limited potential in the decision area, all action alternatives would be less constraining to geothermal development than the current condition.

Trails and Travel Management

All action alternatives would increase the acreage closed to off-highway vehicle use and decrease the acreage open to off-highway vehicle use when compared to the No Action alternative.

Tribal Interests

An ongoing dialogue between BLM representatives and designated tribal representatives and their leadership produced the issues addressed in the Tribal Interests section. A large portion of the tribally identified issues are covered under specific resource sections (e.g., fish, water, socio-economics, cultural resources), though the effects specific to tribal communities may differ due to the unique relationships that tribes have with the landscape and resources on it.

Visual Resources Management

Under all alternatives, visual resource quality would decline to some extent over time, because the BLM would manage a substantial acreage of land at a higher Visual Resource Management class than the Visual Resource Inventory class at which it inventoried. Alternative D would provide the greatest protection, and Alternatives A, B, and C would provide the least protection of visual resources.

Wildlife

Northern spotted owl

The northern spotted owl population is under severe biological stress in much of western Oregon and has an even chance of being extirpated from the Coast Range within 35 years. This population risk is predominately due to competitive interactions between northern spotted owls and barred owls. Under current barred owl encounter rates, the BLM has no opportunity through habitat management in the Coast

Range to reduce risks to the northern spotted owl during the next 50 years, and there are no substantive differences among the alternatives in their potential effects on those risks. However, in the western Cascades and Klamath Basin, the BLM would contribute to self-sustaining northern spotted owl populations during the next 50 years under all alternatives.

Marbled Murrelet

All alternatives would result in an increase in the amount of marbled murrelet high-quality nesting habitat and total nesting habitat in 50 years. Alternatives A, B, and C would result in the loss of 96, 12, and 210 future marbled murrelet sites, respectively, as a result of timber harvest in the Harvest Land Base in the absence of surveys.

Wild Horses

The Pokegama herd is the only wild horse herd in the decision area and is currently within the appropriate management level of 30 to 50 horses. Alternative D, which would eliminate livestock grazing, would reduce competition for forage and provide the potential for increased growth of the Pokegema herd. Otherwise, the alternatives would not differ in their effects on the Pokegama herd.

Wild and Scenic Rivers

Under Alternative A, the BLM would not designate any of the 51 eligible Wild and Scenic River segments as suitable, resulting in impacts to all eligible river segments and their associated values. Under Alternatives B and C, the BLM would designate six eligible Wild and Scenic River segments as suitable. Under Alternative D, the BLM would designate all 51 eligible Wild and Scenic River segments as suitable, resulting in the greatest protection for all segments and their associated river values.

Consultation and Coordination

The preparation of this Draft RMP/EIS has included 38 public involvement efforts, including formal scoping, regional workshops on recreation management, community listening sessions, and public meetings about the Planning Criteria and preliminary alternatives.

The BLM is planning a series of public meetings after the release of the Draft RMP/EIS. The purpose of these meetings is to help members of the public understand the content of the Draft RMP/EIS and provide meaningful and constructive comments. There will likely be six "open-house" public meetings (one meeting per District) where people can engage with BLM employees on all resources addressed in the Draft RMP/EIS. The BLM will likely also be organizing issue-specific meetings on topics such as socio-economics, forestry, aquatics, and wildlife. Information on meeting locations and dates will be available at http://www.blm.gov/or/plans/rmpswesternoregon/

The BLM is consulting on a government-to-government level with the nine federally recognized tribes located within, or that have interests within, the planning area. The Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, the Coquille Indian Tribe, the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, the Cow Creek Band of Umpqua Tribe of Indians, and the Klamath Tribes are formal cooperators in the RMP revisions, in addition to their government-to-government status.

The BLM has been assisted in the preparation of this Draft RMP/EIS by a Cooperating Agency Advisory Group, including representatives of Federal and State agencies, counties, and Tribes. In addition to meeting as a full group periodically throughout the development of the Draft RMP/EIS, the Cooperating

Agency Advisory Group also created five working groups in order to facilitate a more detailed level of engagement with the BLM on the following topics: aquatics, outreach, terrestrial, socio-economics, and tribal issues.

Working through a robust engagement process with neutral facilitation, the cooperators have provided expertise on much of the subject matter the BLM is addressing in the Draft RMP/EIS, as well as advice based on experience with similar planning efforts. The cooperators have provided feedback on public outreach sessions, data sources and analytical methods, and components of the draft alternatives. They have provided oral and written feedback and ideas throughout the process of developing the Draft RMP/EIS. Nearly all cooperators have been positive about the level of engagement and the general direction of the planning process. However, the Association of O&C Counties (which is the designated representative of 15 counties) has continued to express a high level of concern about the BLM's planning process. Specifically, the Association of O&C Counties continues to assert that the BLM's Purpose and Need statement was fatally flawed by failing to place sustained sustained-yield timber production as the primary purpose of the planning effort.

The BLM district managers and planning personnel have met with individual county commissioners on an ongoing basis to provide updates on progress and key milestones. As noted above, several county governments are formal cooperators in the planning process. While the Association of O&C Counties represents most of the counties at the Cooperating Agency Advisory Group meetings, BLM district managers also maintain relationships with local county representatives.

Before signing a Record of Decision on the RMP revisions, the BLM will consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under Section 7(a)(2) of the Endangered Species Act (ESA). The BLM, U.S. Fish and Wildlife Service, and National Marine Fisheries Service signed an ESA Consultation Agreement, which identifies responsibilities for each agency and defines the processes, products, actions, timeframe, and expectations for the consultation process.

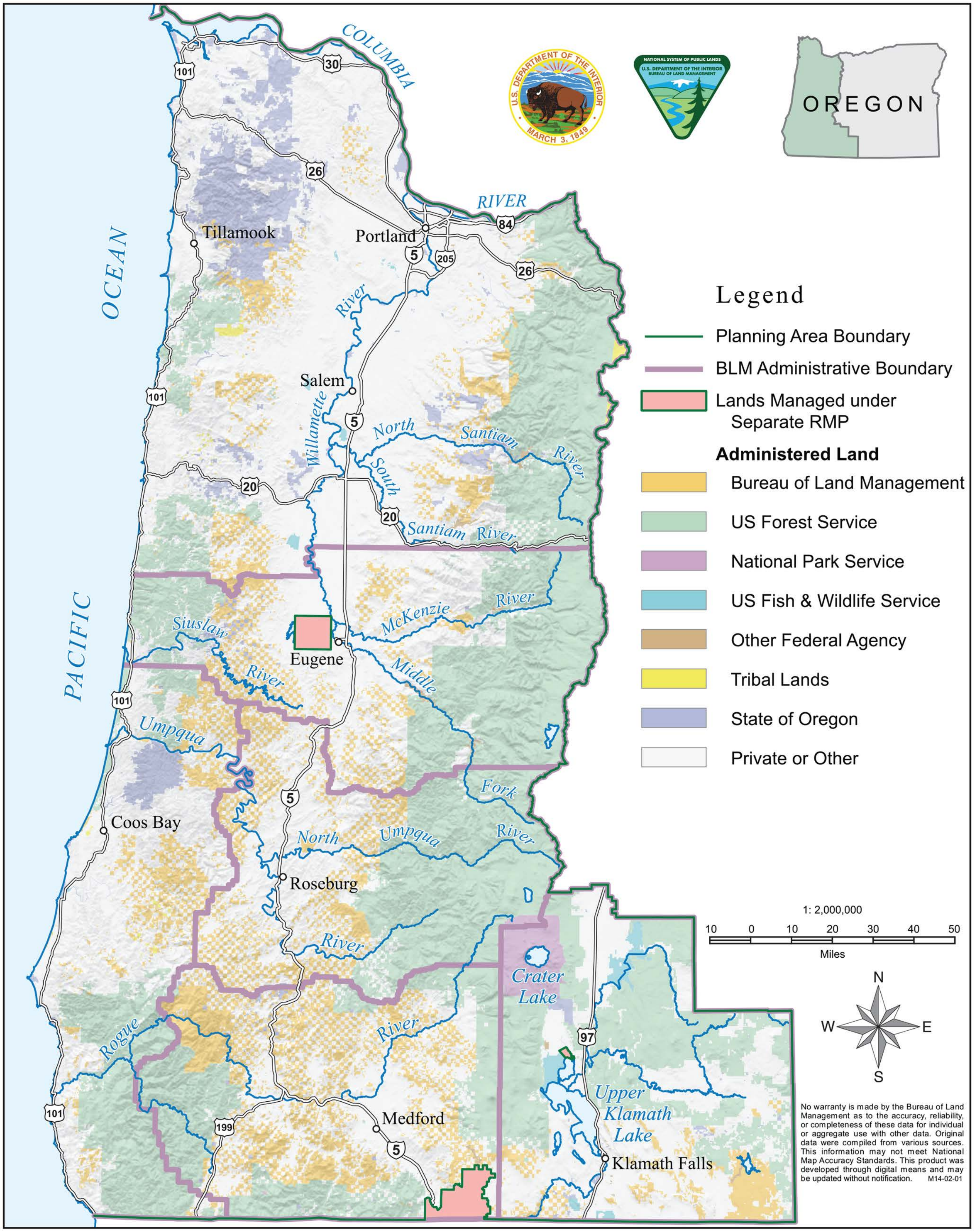
Chapter 1 – Introduction

The Bureau of Land Management (BLM) is revising the resource management plans (RMPs) for its Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office (1995 RMPs; USDI BLM 1995 a, b, c, d, e, f). This Draft RMP/Environmental Impact Statement (EIS) provides a description of the various alternative management approaches the BLM is considering for the management of these lands along with an analysis of the potential effects of these alternatives. The BLM will consider public comments on the alternatives and analysis as it develops a Proposed RMP/Final EIS.

In 2012, the BLM conducted an evaluation of the 1995 RMPs in accordance with its planning regulations, which require that RMPs "shall be revised as necessary based on monitoring and evaluation findings, new data, new or revised policy and changes in circumstances affecting the entire plan or major portions of the plan" (43 CFR 1610.5-6). This evaluation contains the conclusion that "[a] plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs" (USDI BLM 2012a, p. 12). Included in this evaluation was the identification of new information related to northern spotted owls, (including new demographic studies, the Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina)*(owl recovery plan; USDI FWS 2011), and revision of critical habitat by the U.S. Fish and Wildlife Service (77 FR 71875)), and the BLM concluded that the EIS supporting the 1995 RMPs contains outdated analysis relative to the development of suitable habitat for the northern spotted owl (USDI BLM 2012, p. 14). From this evaluation, the BLM identified a need to modify or update management direction for most of the other resource management programs due to changed circumstances and new information.

The Planning Area

The planning area includes approximately 2.5 million acres of BLM-administered land in western Oregon managed by the BLM's Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office (**Map 1-1**).



Map 1-1: Major Ownership within the Planning Area

Throughout this document, the BLM will use the term 'planning area' to refer to all lands within the geographic boundary of this planning effort regardless of jurisdiction. However, the BLM will only make decisions on lands that fall under BLM jurisdiction (including subsurface minerals). The BLM will use the term 'decision area' to refer to the lands within the planning area for which the BLM has authority to make land use and management decisions. In general, the BLM has jurisdiction over all BLM-administered lands (surface and subsurface) and over subsurface minerals in areas of split estate (i.e., areas where the BLM administers Federal subsurface minerals, but the surface is not administered by the BLM).

Within the western Oregon offices, three BLM-administered areas are not included in the decision area: the Cascade Siskiyou National Monument (Medford District), the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District). The first two areas have independent RMPs, while the BLM is currently developing an RMP for the West Eugene Wetlands. This revision process will not alter these independent RMPs.

Planning Process

The BLM integrates its planning process with its compliance with the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 et seq.), which requires that Federal agencies prepare an environmental impact statement (EIS) for all actions that significantly affect the quality of the human environment. The BLM planning regulations direct: "Approval of a resource management plan is considered a major Federal action significantly affecting the quality of the human environment. The environmental analysis of alternatives and the proposed plan shall be accomplished as part of the resource management planning process and, wherever possible, the proposed plan and related environmental impact statement shall be published in a single document" (43 CFR 1601.0-6). Therefore, the BLM presents this Draft RMP integrated with the Draft Environmental Impact Statement as a single document (Draft RMP/EIS).

Preparing a RMP involves the following nine interrelated actions or steps:

1. Conduct scoping and identify issues.
2. Collect inventory data.
3. Analyze management situation.
4. Develop planning criteria.
5. Formulate alternatives.
6. Analyze effects of alternatives.
7. Select the preferred alternative; issue Draft RMP/EIS.
8. Issue Proposed RMP/Final EIS.
9. Sign Record of Decision.

The BLM is preparing a single Draft RMP/EIS and a single Proposed RMP/Final EIS for the revision of the RMPs for the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. At this time, the BLM anticipates eventually issuing two Records of Decision/Approved RMPs: a Northwest Oregon Record of Decision/Approved RMP that would apply to the Salem District, the Eugene District, the Coos Bay District, and the Swiftwater Field Office of the Roseburg District, and a Southwest Oregon Record of Decision/Approved RMP that would apply to the South River Field Office of the Roseburg District, the Medford District, and the Klamath Falls Field Office of the Lakeview District. The Proposed RMP/Final EIS will more fully address the structure of the eventual Records of Decision/RMPs.

Decision to be Made

Through this effort, the BLM will decide on an approach to managing the public land it administers in western Oregon. As described in the Federal Land Policy and Management Act (FLPMA; 43 U.S.C, 1701(a)(2)), RMPs are tools by which "present and future use is projected." The BLM's planning regulations make clear that RMPs are a preliminary step in the overall process of managing public lands, and are "designed to guide and control future management actions and the development of subsequent, more detailed and limited scope plans for resources and uses" (43 CFR 1601.0-2).

The major provisions of the RMPs will include the following land use plan decisions–

- Objectives for the management of BLM-administered lands and resources;
- Land use allocations relative to future uses for the purposes of achieving the various objectives; and
- Management direction that identifies where future actions may or may not be allowed and what restrictions or requirements may be placed on those future actions to achieve the objectives set for the BLM-administered lands and resources.

Through the RMPs, the BLM will determine and declare the annual productive capacity for sustained-yield timber production.[1] The annual productive capacity is the timber volume that a forest can produce continuously under the intensity of management described in the RMPs for those lands allocated for sustained-yield timber production. The BLM will make the determination and declaration of the annual productive capacity for each of the six sustained yield units, which match the five western Oregon BLM district boundaries and the western portion of the Klamath Falls Field Office in the Lakeview District. The determination of the annual productive capacity includes compliance with other laws and consideration of the objectives, land use allocations, and management direction of the RMPs, which affect the amount of timber that each of the sustained yield units can produce. Chapter 3 contains additional discussion of the determination of the annual productive capacity under Vegetation Modeling Products.

In both the 1995 RMPs and in the 2008 RMPs, the BLM identified that there would be some level of variation in the annual amount of timber offered for sale. In this plan revision process, the BLM will consider whether the plan will include some level of variation in the amount of sustained-yield timber volume that the BLM will offer on an annual basis or over a longer period of time. In making a decision about the extent to which the plan will identify such variation in the amount of sustained-yield timber volume to be offered, the BLM will take into account a number of factors, including the availability of resources and compliance with applicable law, among other agency considerations. The BLM would identify the level of variation in the amount of sustained-yield timber volume that may be offered as part of the declaration of the annual productive capacity in this RMP.

At this time, the BLM does not anticipate including any implementation decisions in the eventual Records of Decision/RMPs.[2] That is, the BLM anticipates that all of the decisions in the Records of Decision/RMPs will be land use plan decisions. If the BLM elects to include some implementation decisions later in the planning process, any implementation decisions will be clearly distinguished from

[1] The terms "annual productive capacity," "annual sustained yield capacity," and "allowable sale quantity" are synonymous.

[2] Implementation decisions authorize implementation of on-the-ground projects. Land use plan decisions (land use allocations, management objectives, and management direction) do not directly authorize implementation of on-the-ground projects. Land use plan decisions guide and control future implementation decisions, which can be carried out only after completion of further appropriate NEPA analysis or documentation, consultation, and decision-making processes.

the land use plan decisions in the Proposed RMP/Final EIS, and the Proposed RMP/Final EIS will describe the administrative remedies for both.

Purpose and Need for Action

The purpose and need statement describes why the BLM is revising the 1995 RMPs and what outcomes the BLM intends the RMPs to achieve. The purpose and need statement defines the range of alternatives that will be analyzed in the planning process, because alternatives must respond to the purpose and need for action to be considered reasonable.

The proposed action is to revise the 1995 RMPs with land use allocations, management objectives, and management direction that best meet the purpose and need.

This plan revision process takes place against the backdrop of past planning efforts. These previous planning efforts and their supporting analyses, including the Record of Decision for the Northwest Forest Plan (USDA/USDI 1994a), the 1995 RMPs (the plans currently in effect; USDI BLM 1995 a, b, c, d, e, f), and the 2008 RMPs (which are no longer in effect; USDI BLM 2008 a, b, c, d, e, f), together with the results of the scoping process for this planning effort help to inform the BLM's discretion in determining the purpose and need for this action and to identify the scope of alternatives and impacts that need to be explored in this planning effort.

Need for the Action

The BLM conducted plan evaluations in accordance with its planning regulations, which require that RMPs "shall be revised as necessary based on monitoring and evaluation findings, new data, new or revised policy and changes in circumstances affecting the entire plan or major portions of the plan" (43 CFR 1610.5-6). These evaluations concluded that "[a] plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs" (USDI BLM 2012a, p. 12). These evaluations also concluded that the management direction for most of the other resource management programs need to be modified or updated because of changed circumstances and new information. These evaluations concluded that changes are particularly indicated for the fisheries, aquatics, recreation, off-highway vehicle, and fire and fuels programs.

Moreover, the BLM needs to revise existing plans to replace the 1995 RMPs' land use allocations and management direction because of new scientific information and policies related to the northern spotted owl. Since the 1995 RMPs were approved, there have been analyses on the effects of land management on northern spotted owl habitat, demographic studies, and analyses of the effects of barred owls on northern spotted owls. In addition, since that time, new policies for northern spotted owls have been put in place, including a revised recovery plan and a new designation of critical habitat.

Purpose of the Action

The purpose of this proposed action is to make land use plan decisions to guide the management of BLM-administered lands.

Several of the purposes of the action are necessary for the BLM to be able to deliver a predictable supply of timber from the BLM-administered lands, based on the BLM's almost two decades of experience implementing the Northwest Forest Plan, new scientific information, and the advice of other Federal agencies, as discussed below. Harvesting timber on a sustained-yield basis for the Oregon and California

Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act; 43 U.S.C. 1181a *et seq*.) purposes is required under the O&C Act. Harvesting timber on a sustained-yield-basis ensures that the BLM will achieve the purposes of the O&C Act, which include continuing to be able to provide, over the long-term, a sustained volume of timber within the management direction in the RMP. Declining populations of species now listed under the Endangered Species Act (16 U.S.C. 1531 *et seq*.) have caused the greatest reductions and instability in the BLM's supply of timber in the past. Any further population declines of listed species or new species listings would likely lead to additional reductions in timber harvest. Contributing to the conservation and recovery of listed species is essential to delivering a predictable supply of timber. Specifically, the BLM recognizes that providing large, contiguous blocks of late-successional forest and maintaining older and more structurally-complex multi-layered conifer forests are necessary components of the conservation and recovery of the northern spotted owl. Providing clean water is essential to the conservation and recovery of listed fish, and a failure to protect water quality would lead to restrictions that would further limit the BLM's ability to provide a predictable supply of timber. Furthermore, the O&C Act recognizes the importance of water quality; the purposes of sustained yield include, among others, "protecting watersheds and regulating stream flow." Finally, in fire-prone ecosystems in southern Oregon, the BLM must manage forests to reduce the likelihood of catastrophic fires and the attendant loss of timber. These purposes require the BLM to exercise its discretion to determine how best to achieve sustained-yield timber production over the long term and avoid future limitations on timber production.

Provide a Sustained Yield of Timber

The purpose of the action includes providing a sustained yield of timber. The O&C Act requires that the revested Oregon and California Railroad Grant lands and reconveyed Coos Bay Wagon Road Grant lands (O&C lands) be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities" (43 U.S.C. 1181a). The O&C Act goes on to state that "[t]he annual productive capacity for such lands shall be determined and declared … [p]rovided, [t]hat timber from said lands … not less than the annual sustained yield capacity … shall be sold annually, or so much thereof as can be sold at reasonable prices on a normal market." In meeting the various requirements for managing the O&C lands, the Secretary of the Interior has discretion under the O&C Act to determine how to manage the forest to provide for permanent forest production on a sustained yield basis, including harvest methods, rotation length, silvicultural regimes under which these forests would be managed, or minimum level of harvest. In addition, the FLPMA specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands and resources, the O&C Act prevails (i.e., takes precedence) (43 U.S.C. 1701 note (b)). Thus, the multiple-use management direction of the FLPMA does not apply to the O&C lands that are suitable for timber production. The planning process established by the FLPMA is applicable to the O&C lands, because it is not in conflict with the O&C Act's management direction for those lands.

For the public domain lands, the FLPMA requires that public lands be managed "on the basis of multiple use and sustained yield unless otherwise specified by law" (43 U.S.C. 1701 [Sec. 102.a.7]). The FLPMA also requires that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands" (43 U.S.C. 1701 [Sec. 102.a.12]).

Conservation and Recovery of Threatened and Endangered Species

The purpose of the action includes contributing to the conservation and recovery of threatened and endangered species within the planning area, including the northern spotted owl, marbled murrelet, and threatened and endangered anadromous fish. The Endangered Species Act requires agencies to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in the adverse modification or destruction of critical habitat. Since the adoption of the Northwest Forest Plan, BLM has recognized that additional species listings could have the effect of further limiting the BLM's ability to provide a sustained yield of timber under the O&C Act (USDA FS/USDI BLM 1994a, pp. 49-50). Using its discretion and authority under the O&C Act and the FLPMA, the BLM can direct sustained-yield management of the O&C lands and public domain lands in western Oregon in a manner that contributes to the conservation and recovery of listed species and helps limit or avoid future listings, and thereby best ensures a permanency of timber production over the long-term, while, among other benefits of sustained yield, contributing to the economic stability of local communities.

The purpose of contributing to the conservation and recovery of the northern spotted owl necessarily includes maintaining a network of large blocks of forest to be managed for late-successional forests and maintaining older and more structurally-complex multi-layered conifer forests, based on the existing scientific information on the conservation needs of the northern spotted owl and the results of previous analyses as described below.

Large, Contiguous Blocks of Late-Successional Forest

Large, contiguous blocks of late-successional forest have been an element of northern spotted owl conservation strategies for over two decades. Thomas *et al*. (1990, pp. 23-27) described that a conservation strategy for the northern spotted owl requires large blocks of nesting, roosting, and foraging habitat (i.e., suitable habitat) that support clusters of reproducing owls, distributed across a variety of ecological conditions and spaced so as to facilitate owl movement between the blocks. Courtney *et al*. (2004, pp. 9-11; 9-15), in the status review for the northern spotted owl, evaluated the conservation needs of the northern spotted owl and concluded that, based on existing knowledge, large contiguous blocks of suitable habitat are still necessary for northern spotted owl conservation. Culminating this confirmation of the scientific information on the conservation needs of the northern spotted owl, the owl recovery plan recommends managing for large, contiguous blocks of late-successional forest (USDI FWS 2011, p. III-19).

Based on the results of previous analyses, large contiguous blocks of late-successional forest would not develop in the absence of a land use allocation reserving a network of large blocks of forest. The Supplemental EIS for the Northwest Forest Plan (USDA FS/USDI BLM 1994b, p. 2-22) explicitly required that all alternatives analyzed in detail include the allocation of a network of Late-Successional Reserves. Other previous planning efforts have considered alternatives that would not allocate such a network, including:

- Alternative A in the 1994 RMP/EIS, which would have reserved no late-successional forest outside of special areas and sites occupied by listed species
- Alternative B in the 1994 RMP/EIS, which would have reserved small blocks of late-successional forest
- Alternative 3 in the 2008 RMP/EIS, which would have allocated the majority of the landscape to a General Landscape Area that directed timber harvest on long rotations

For each of those alternatives, the analyses concluded that these alternatives would have resulted in less contribution to northern spotted owl conservation than alternatives that allocated a network of large blocks of forest. Notably, Alternative 3 in the 2008 RMP/EIS would have resulted in a total acreage of northern spotted owl habitat comparable to most other action alternatives, but would have failed to meet the conservation needs of the spotted owl because of the arrangement of that habitat. Overall, these previous analyses demonstrated that large, contiguous blocks of late-successional forest would not have developed under these alternatives, further demonstrating that reserving a network of large blocks of forest from programmed timber harvest is a necessary part of the purpose of contributing to the conservation and recovery of the northern spotted owl.

Older and More Structurally-Complex Multi-Layered Conifer Forests

The scientific foundation for the importance of older, more structurally-complex multi-layered conifer forests as habitat for the northern spotted owl has been clearly established. Thomas *et al*. (1990) described high-quality northern spotted owl habitat as older, multilayered, structurally-complex forests characterized by large-diameter trees, high amounts of canopy cover, numerous large snags, and lots of downed wood and debris. Courtney *et al*. (2004, pp. 5-18), in the status review for the northern spotted owl, evaluated the existing scientific information on spotted owl habitat and confirmed that nesting, foraging and roosting habitat is associated with older, more structurally-complex multi-layered conifer forests in the Pacific Northwest. The 15-year spotted owl monitoring report concluded that the highest stand-level habitat suitability for spotted owls is provided by older, more structurally-complex forests (Davis *et al*. 2011, p. 38).

The owl recovery plan recommends maintaining older and more structurally complex multi-layered conifer forests. As noted in the owl recovery plan, the maintenance of older, more structurally-complex multi-layered conifer forests has scientific support at several scales: "At the scale of a spotted owl territory, Dugger *et al*. (in press) found an inverse relationship between the amount of old forest within the core area and northern spotted owl extinction rates from territories. At the population scale, Forsman *et al*. (2011) found a positive relationship between recruitment of spotted owls into the overall population and the percent cover of spotted owl NRF [nesting, roosting, and foraging] habitat within study areas" (USDI FWS 2011, p. III-67). The U.S. Fish and Wildlife Service noted that, in dry forest areas, maintaining these older and more structurally-complex multi-layered conifer forests may require active management to meet the overlapping goals of spotted owl recovery and restoration of dry forest structure, composition, and processes including fire, insects, and disease.

Previous planning efforts have considered a wide variety of approaches to the management of older, more structurally-complex multi-layered conifer forests, including—

- Alternative A in the 1994 RMP/EIS, which would have reserved no late-successional forest outside of special areas and sites occupied by listed species;
- The 1995 RMP, which reserved approximately 83 percent of old-growth forest;
- The Proposed RMP in the 2008 RMP/EIS, which would have reserved 81 percent of old-growth forest and would have deferred harvest of any forest older than 160-years-old for 15 years;
- Alternative E in the 1994 RMP/EIS, which would have reserved all old-growth forest;
- A sub-alternative for Alternative 1 in the 2008 RMP/EIS, which would have reserved all forests older than 200 years old; and
- A sub-alternative for Alternative 1 in the 2008 RMP/EIS, which would have reserved all forests older than 80 years old.

None of these alternative approaches defined management direction explicitly in terms of older, more structurally-complex, multi-layered conifer forests, but used a variety of different terms, such as older forest, old-growth forest, late-successional forests, or a specific stand age. Nevertheless, these different management approaches would have resulted in the maintenance of differing amount of older and more structurally-complex multi-layered conifer forests. Those analyses demonstrated that alternatives that would have maintained more older and more structurally-complex multi-layered conifer forests would have maintained more northern spotted owl habitat and would have provided better conditions for northern spotted owl movement between large blocks of habitat than alternatives that would have maintained less older and more structurally-complex multi-layered conifer forests.

The existing science clearly establishes the importance of older and more structurally-complex multi-layered conifer forests as northern spotted owl habitat; the owl recovery plan recommends the maintenance of older and more structurally-complex multi-layered conifer forests; and the results of previous analyses demonstrate that maintaining older and more structurally-complex multi-layered conifer forests would contribute to meeting conservation needs of the northern spotted owl. Therefore, maintaining older and more structurally-complex multi-layered conifer forest is a necessary part of the purpose of contributing to the conservation and recovery of the northern spotted owl.

To respond to this purpose for the action, alternatives would explore differing approaches to defining older and more structurally-complex multi-layered conifer forest, by such criteria as stand age, structure, size, or landscape context. In addition, alternatives would explore differing management approaches to maintaining older and more structurally-complex multi-layered conifer forest, such as active management in dry forest areas to reduce fire risk and restore fire resiliency.

The purpose of this action includes maintaining marbled murrelet habitat. The status review of the marbled murrelet prepared for the U.S. Fish and Wildlife Service reviewed the existing scientific information and confirmed the importance of maintaining suitable nesting habitat to the conservation and recovery of the marbled murrelet (McShane *et al*. 2004, pp. 4-61–4-63). Additionally, the recovery plan for the marbled murrelet (USDI FWS 1997) recommends protecting adequate nesting habitat for marbled murrelets.

The purpose of this action includes protecting existing habitat and restoring degraded habitat for threatened and endangered anadromous fish. The status review of threatened and endangered anadromous fish prepared by the National Marine Fisheries Service reviewed the existing scientific information and confirmed the importance of maintaining existing habitat and restoring degraded habitat to the conservation and recovery of threatened and endangered fish (Good *et al*. 2005). The National Marine Fisheries Service has prepared several final and draft recovery plans for listed salmonid fish within the planning area, including the Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead (ODFW/USDC NMFS 2011), which recommend maintaining existing habitat and restoring degraded habitat.

Provide Clean Water in Watersheds

The purpose of the action includes continuing to comply with the Clean Water Act (33 U.S.C. 1251 *et seq*.), which directs the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The policy declaration in the FLPMA states that the BLM should manage the public lands in a manner that protects many resources and their values, including the water resource (43 U.S.C. 1701[a][8]). The FLPMA directs that land use plans provide for compliance with applicable State and Federal air, water, noise, or other pollution control laws, standards, or implementation plans (43 U.S.C. 1712[c][8]).

In addition, the O&C Act includes reference to protecting watersheds and regulating stream flows, requiring that the O&C lands be managed “for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of … protecting watersheds, regulating stream flow, …” (43 U.S.C. 1181a).

Restore Fire-Adapted Ecosystems

The purpose of the action includes restoring fire-adapted ecosystems to increase fire resiliency. Previous analyses have shown that active management in the dry forest landscape of southern Oregon can positively influence fire risk and fire resiliency, thereby restoring fire-adapted ecosystems (2008 RMP/EIS). Further, as noted in the owl recovery plan, natural landscape resilience mechanisms in the dry forest landscape of southern Oregon have been decoupled by fire exclusion and wildfire suppression activities. The owl recovery plan recommends active management within the dry forest landscape to restore ecosystem resiliency. Additionally, in order to provide for sustained yield of timber from public lands under the O&C Act, BLM management must account for potential loss of this timber to fire. Based on the BLM’s authority under the O&C Act, the results of previous analyses showing the benefits of active management in restoring fire-adapted ecosystems, and in light of the recommendations in the owl recovery plan, the purpose of this action includes restoring fire-adapted ecosystems to increase fire resiliency.

Provide for Recreation Opportunities

The purpose of the action includes providing for recreation opportunities. The FLPMA requires that, among other uses, “the public lands be managed in a manner that will … provide for outdoor recreation” 43 U.S.C. 1701 [Sec. 102.a.8]. In addition, the O&C Act states that O&C lands shall be managed “… for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of … providing recreational facilities” (43 U.S.C. 1181a). Finally, changes in BLM policy since the 1995 RMPs for recreation land use allocations and management objectives necessitate plan revision, as concluded in the BLM plan evaluations (USDI BLM 2012, pp. 28-29).

Coordinate Management of Lands Surrounding the Coquille Forest with the Coquille Tribe

The management of the Coquille Forest is subject by law (25 U.S.C. 715c (d)) to the standards and guidelines of forest plans for adjacent or nearby Federal forest lands. Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208) created the Coquille Forest to be held in trust for the benefit of the Coquille Tribe. This Act states that the Coquille Forest shall be managed “under applicable State and Federal forestry and environmental protection laws, and subject to critical habitat designations under the Endangered Species Act and subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future.” This Act also requires the Secretary of the Interior to take the Coquille Forest lands into trust for the benefit of the Coquille Tribe. As such, the purpose of the action includes coordinating the management of BLM-administered lands “adjacent or nearby” the Coquille Forest with the Coquille Tribe.

Guidance for Development of All Action Alternatives

The BLM will develop all action alternatives to meet the purposes for the action, described above under ‘Purpose and Need for Action.’ To be considered reasonable, action alternatives would have to make a substantial and meaningful contribution to meeting each of the purposes, rather than a minimal contribution. The alternatives will explore various ways of contributing to these purposes and meeting the requirements of the management guidance provided in this document.

In developing all action alternatives, the BLM will:

- Review existing Areas of Critical Environmental Concern (ACECs) and nominations for new ACECs. In this review, the BLM will do the following:
    - Determine if they meet the Relevance and Importance criteria.
    - Determine, for those on O&C lands that meet Relevance and Importance criteria, if designation would be in conflict with the O&C Act, as detailed below under The O&C Act and the FLPMA.
    - Eliminate from further consideration those areas that do not meet criteria for designation as ACECs.
    - Determine if the relevant and important resource values of the remaining nominations can be protected and maintained through other features of the alternatives or if special management attention is needed.
    - Include in development of alternatives those nominations that meet criteria for designation as ACECs.

- Designate areas as Special Recreation Management Areas or Extensive Recreation Management Areas; lands not designated under one of these two categories are Public Lands not Designated for Recreation. Develop a range of recreation management area scenarios in relationship to various land use allocations and management objectives among the alternatives, consistent with the discussion of recreation management areas below under The O&C Act and the FLPMA.

- Designate Visual Resource Management classifications for areas. Develop a range of Visual Resource Management classification scenarios in relationship to various land use allocations and management objectives among the alternatives, consistent with the discussion of visual resources below under The O&C Act and the FLPMA.

- Evaluate all eligible Wild and Scenic River segments and determine which are suitable or non-suitable per Section 5(d)(1) of the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 *et seq*.) and consistent with BLM Manual 6400 – Wild and Scenic Rivers (USDI BLM 2012b).

- Designate areas as open, limited, or closed to off-highway vehicle use in accordance with 43 CFR 8342.1. Develop a range of travel management area scenarios in relationship to various land use allocations and management objectives among the alternatives. Defer implementation level travel and transportation management planning until after completion of the RMP revision process. For those areas designated as limited in the RMP, define interim management objectives and clearly identify the process leading from the interim area designation of 'limited to existing roads, primitive roads and trails' to the development of a designated network of roads, primitive roads and trails, consistent with BLM Handbook 8342 – Travel and Transportation Handbook (USDI BLM 2012c).

- Consider a range of management alternatives for addressing lands with wilderness characteristics, consistent with the discussion of lands will wilderness characteristics below under The O&C Act and the FLPMA.

- Designate areas that are available and have the capacity for planned, sustained-yield timber harvest, and declare an Allowable Sale Quantity of timber that represents the annual productive capacity for sustained-yield timber production.

- Designate lands that are available or not available for livestock grazing. For lands available for livestock grazing, identify the amount of forage available for livestock.

- Designate land tenure zones identifying lands for retention, disposal, or acquisition.

- Designate lands as open or closed to the several forms of mineral entry location, leasing, or sale as appropriate to the type of commodity and land status. Identify areas, if any, recommended for closure to the mining laws for locatable exploration or development (and which the BLM would recommend for withdrawal).

In developing the action alternatives, the BLM will consider the concepts contained in the Framework to Guide Forest Service and Bureau of Land Management Land Use Plan Revisions and Amendments, dated April 11, 2011 (RIEC 2011).

The BLM will not constrain the development of alternatives by current or projected BLM budget or staff levels. As long as alternatives are economically feasible, the analysis of the alternatives will assume that BLM budget and staff will be sufficient to implement all alternatives. The analysis of alternatives will include an evaluation of the cost of implementation.

In accordance with national BLM planning policy (USDI BLM 2005, pp. 11-13), the RMP will emphasize management direction for allowable uses and management actions needed to achieve desired resource goals and objectives, rather than administrative process, reviews, or analysis requirements. The BLM will use program guidance issued outside the land use planning process to provide direction on administrative process, reviews, and analysis. Ongoing program guidance provides more flexibility to respond to changing national or state-level BLM administrative process or analysis requirements. Of course, the RMP process itself will be conducted consistent with procedural, review, and analysis requirements necessary to comply with Federal law and regulations applicable to planning for BLM-administered lands.

The BLM will develop action alternatives to provide a high degree of predictability and consistency about implementing land management actions and a high degree of certainty of achieving management objectives (desired outcomes), especially those outcomes related to discrete statutory mandates.

The BLM will develop action alternatives and provide cumulative effects analysis to provide a framework to simplify and facilitate project-level NEPA analysis for management actions implementing the RMP.

The BLM will develop action alternatives to simplify implementation of management actions and reduce the costs of implementation.

Working closely with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, the BLM will develop the action alternatives to provide sufficient detail in the analysis to facilitate RMP-level Endangered Species Act consultation, as well as eventual project-level consultation for management actions implementing the RMP.

Working closely with the Oregon Department of Environmental Quality, in coordination with the Environmental Protection Agency, the BLM will develop the action alternatives to satisfy State and Federal water quality rules and regulations at the RMP level.

Major Authorizing Laws and Regulations

This section discusses how various laws affect management of the BLM-administered lands in the planning area. The planning area includes lands of different status: O&C lands, public domain lands, and acquired lands. In addition to the laws presented here, many other legal authorities affect management of BLM-administered lands (*Appendix A*).

The O&C Act has been the statutory authority for the management of the O&C lands since 1937. Subsequent laws affect the management of the O&C lands to varying degrees. Laws, such as the Endangered Species Act and Clean Water Act, are directly applicable to how the BLM exercises its statutory authorities in managing the O&C lands, but none of these laws repealed the underlying primary direction and authority for the O&C lands. Thus, the BLM has a duty to find a way to concurrently implement all these laws, in a manner that harmonizes any seeming conflict between them, unless Congress has provided that one law would override another law, such as with the O&C Act and the FLPMA, as described below.

Endangered Species Act

Section 7 of the Endangered Species Act requires Federal agencies to use their legal authorities to promote the conservation purposes of the act. This section also requires Federal agencies to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service to ensure that actions these agencies authorize, fund, or carry out will not jeopardize species listed as threatened or endangered under the Endangered Species Act or cause destruction or adverse modification to designated critical habitat for such species. Critical habitat is defined, in part, as geographic areas occupied by the species that contain the physical or biological features essential to the conservation of a species listed under the Act and that may need special management or protection. The BLM will complete Section 7 consultation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service prior to signing Records of Decision/RMPs for this RMP revision.

Clean Water Act

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation’s waters. To accomplish this objective, the statute requires that: water quality standards consistent with the statutory goals of the Clean Water Act be established; water bodies be monitored to determine whether the water quality standards are being met; and, if all of the water quality standards are being met, then anti-degradation policies and programs, including ambient monitoring, be employed to keep the water quality at acceptable levels. In accord with this statute, the responsibility for establishing these standards, developing a strategy for meeting these standards, and monitoring their attainment in Oregon has been delegated to the Oregon Department of Environmental Quality.

Sections 303(d), 313(a), and 319 of the Clean Water Act are relevant to management of water resources on BLM-administered lands. Section 303(d) (codified as 33 U.S.C. 1313[d]) directs the states and tribes to develop a list of waters that fail to meet water quality standards for various constituents including, among others, sediment, temperature, and bacteria. Section 303(d) requires states and tribes to develop total maximum daily loads that apportion a load of pollutants that can be discharged into the waters of a state. The total maximum daily loads determine what level of pollutant load would be consistent with meeting the water quality standards and allocate acceptable loads among sources of the relevant pollutants. Necessary reductions in pollutant loading are achieved by implementing strategies authorized by the Clean Water Act, along with other tools available from Federal, State, and local governments and nongovernmental organizations. Section 313(a) (codified as 33 U.S.C. 1323[a]) directs that the Federal Government, "(1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants," shall comply with requirements for the control and abatement of water pollution. Section 319 (codified as 33 U.S.C. 1329) established management programs to control water pollution from nonpoint sources, such as sediment.

Federal Land Policy and Management Act

The FLPMA provides the legal authority to the Secretary of the Interior for the management of public lands. The FLPMA requires, in part, that "the public lands scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use" (43 U.S.C. 1701 [Sec. 102.a.8]). In addition, the FLPMA requires that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands" (43 U.S.C. 1701 [Sec. 102.a.12]). The FLPMA directs that acquired lands "… shall, upon acceptance of title, become public lands, and, for the administration of public land laws not repealed by this Act, shall remain public lands" (43 U.S.C. 1701 [Sec. 205.c]).

Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act

The O&C Act provides the legal authority to the Secretary of the Interior for management of the O&C lands. The O&C Act requires that the O&C lands "classified as timberlands … shall be managed … for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities" (43 U.S.C. 1181a). Section 701(b) of the FLPMA states, "Notwithstanding any provision of this Act, in the event of conflict with or inconsistency between this Act and [the O&C Act] …, insofar as they relate to management of timber resources, and disposition of revenues from lands and resources, the latter Acts shall prevail." In this case, the "latter Acts" refers to the O&C Act.

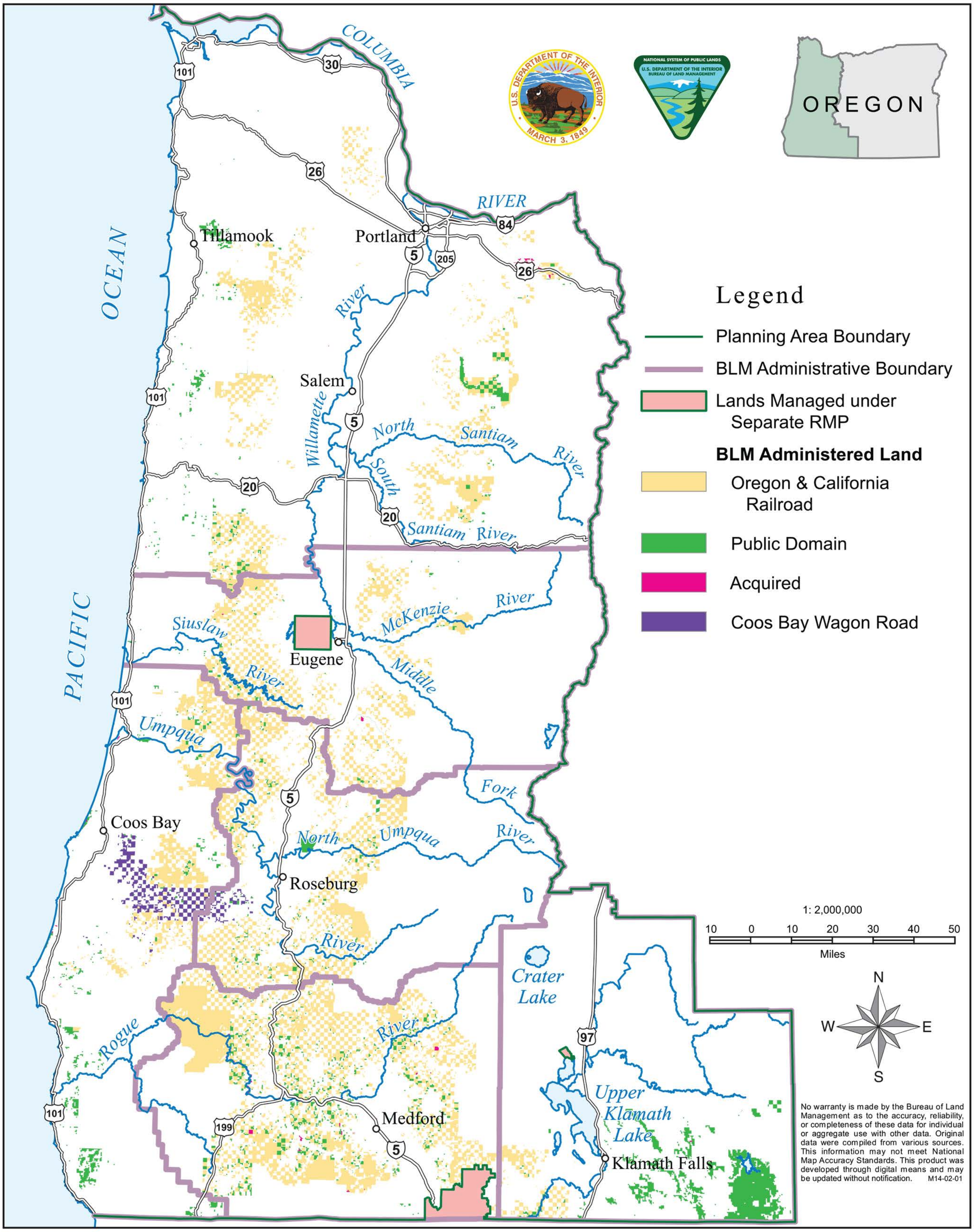
The O&C Act and the FLPMA

On August 28, 1937, Congress enacted the O&C Act, which provides the legal authority for the management of O&C lands and Coos Bay Wagon Road lands. Approximately 81 percent of the BLM-administered lands in the planning area are O&C lands, and approximately 3 percent are Coos Bay Wagon Road lands (**Map 1-2**). The provision of the O&C Act that provides the management direction for the O&C lands states, in part, that these lands:

> "shall be managed except as provided in section 3 hereof, for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the [principle] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities …"

Based on the language of the O&C Act, the O&C Act's legislative history, and case law, it is clear that sustained-yield timber production is the primary or dominant use of the O&C lands in western Oregon. In managing the O&C lands for that primary or dominant use, the BLM must exercise its discretion to determine how to manage the forest to provide for sustained-yield timber production, including harvest methods, rotation length, silvicultural regimes under which these forests would be managed, or minimum level of harvest. In addition, the BLM must conduct this management "for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities." Finally, when implementing the O&C Act, BLM must do so in full compliance with a number of subsequent laws that direct how the BLM accomplishes the statutory direction.

The FLPMA provides the legal authority for the management of public domain lands and acquired lands. These lands and resources are to be managed under the principles of multiple use and sustained yield. Approximately 15 percent of the BLM-administered lands in the planning area are public domain lands, and less than 1 percent is acquired lands (**Map 1-2**). The FLPMA specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands and resources, the O&C Act prevails (i.e., takes precedence) (43 U.S.C. 1701 note (b)). However, provisions of the FLPMA that do not conflict with the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands are applicable to the O&C lands. Preparation of the RMPs and EIS will conform to these land laws as described in this section and will comply with other Federal laws, including, but not limited to, the Endangered Species Act, the Clean Water Act, and the National Environmental Policy Act.



Map 1-2: Land Status within the Planning Area

In developing the range of alternatives in this planning process, the BLM will need to apply the direction set forth in the O&C Act to key issues associated with the management of areas or resources that typically arise during land use planning. These areas or resources include:

- Areas of Critical Environmental Concern
- Lands with wilderness characteristics
- Visual resources
- Recreation management areas
- Sensitive species

Areas of Critical Environmental Concern (ACECs)

The FLPMA provides authority for designation of Areas of Critical Environmental Concern (43 U.S.C. 1712 [Sec. 202.c.3]). In this planning process, the BLM will evaluate nominated and existing ACECs to determine whether relevant and important values are present and if special management is needed to maintain those values.

For areas that have relevant and important values and need special management to maintain those values, the BLM will designate and manage ACECs on public domain lands and acquired lands. The BLM will also designate and manage ACECs on O&C lands where the special management needed to maintain relevant and important values would not conflict with the planning for sustained-yield timber production for the purposes of the O&C Act. For example, designating and managing ACECs on O&C lands would not conflict with sustained-yield timber production in the following circumstances: on non-forested lands; on O&C lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on lands for which the Timber Productivity Capability Classification[3] category is ‘not included in the harvest land base.’ In addition, designating and managing ACECs on O&C lands would not conflict with sustained-yield timber production, if the special management needed to maintain relevant and important values were compatible with sustained-yield timber production, even if that special management might condition how sustained-yield timber production would be conducted. Finally, designation and management of Research Natural Areas, which are a type of ACEC, on O&C lands would not conflict with sustained-yield timber production when the scientific value of the research is relevant to sustained-yield timber production.

Lands with Wilderness Characteristics

Designated Wilderness Areas will be managed pursuant to the Wilderness Act of 1964 (16 U.S.C. 1131 *et seq*.), the area’s designating statute, the BLM’s wilderness regulations at 43 CFR 6300, and BLM Manual 6340 – Management of Designated Wilderness Areas (USDI BLM 2012d). In this planning process, the BLM will consider whether to manage lands outside of designated Wilderness Areas for wilderness characteristics on public domain lands and acquired lands. The BLM will also consider whether to manage lands outside of designated Wilderness Areas for wilderness characteristics on O&C lands where management for wilderness characteristics would not conflict with the planning for sustained-yield timber production for the purposes of the O&C Act. For example, management for wilderness characteristics on O&C lands would not conflict with sustained-yield timber production in the following circumstances: on non-forested lands; on lands that would otherwise be allocated to a land use allocation that would

[3] Timber Productivity Capability Classification is the process of partitioning forest land into major classes indicating relative suitability to produce timber. See Chapter 2.

preclude sustained-yield timber production; or on lands for which the Timber Productivity Capability Classification category is ‘not included in the harvest land base.’

However, management for wilderness characteristics cannot be compatible with sustained-yield timber production, because the selling, cutting, and removing timber in conformance with the principles of sustained yield would alter such areas to the point of reducing or eliminating their wilderness characteristics. Thus, in developing the range of alternatives for this planning effort, alternatives should not include managing O&C lands outside of designated Wilderness Areas for wilderness characteristics in areas dedicated to sustained-yield timber production.

Visual Resources

The FLPMA provides authority for protection of scenic values (43 U.S.C. 1701 [Sec. 102.a.8]). Through this planning process, the BLM will designate Visual Resource Management classes for all BLM-administered lands, based on an inventory of visual resources and management considerations for other land uses.

In this planning process, the BLM will designate Visual Resource Management classes that would protect scenic values as identified through a visual resource management inventory where the protection is required as part of the management specified by Congress in legislation, such as the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et seq.). In this planning process, the BLM will consider designating Visual Resource Management classes that would conflict with sustained-yield timber production to protect scenic values as identified through a visual resource management inventory on public domain lands and acquired lands; on non-forested O&C lands; on O&C lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on O&C lands for which the Timber Productivity Capability Classification category is ‘not included in the harvest land base.’ Finally, in this planning process, the BLM will consider designating Visual Resource Management classes to protect scenic values as identified through a visual resource management inventory on O&C lands to the extent that the protection of scenic values is compatible with sustained-yield timber production, even if that protection might condition how sustained-yield timber production would be conducted. The O&C Act contemplates that sustained yield forest management can be conducted in a manner to provide for purposes including recreation, and the BLM recognizes that scenery can be an important component of recreation.

Recreation Management Areas

The FLPMA provides authority for management for outdoor recreation (43 U.S.C. 1701 [Sec. 102.a.8]). The O&C Act contemplates that sustained-yield timber production can be conducted in a manner to provide for purposes including recreation. A Special Recreation Management Area is an administrative unit where the existing recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and distinctiveness, as compared to other areas used for recreation. Consistent with BLM Manual 8320 – Planning for Recreation and Visitor Services (USDI BLM 2011), within a Special Recreation Management Area, recreation and visitor services management is recognized as the predominant land use plan focus, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis.

In this planning process, the BLM will consider designating Special Recreation Management Areas on public domain lands and acquired lands; on non-forested O&C lands; on O&C lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on O&C lands for which the Timber Productivity Capability Classification category is not included in the harvest land base. Finally, in this planning process, the BLM will consider designating Special Recreation

Management Areas on O&C lands to the extent that the management for recreation and visitor services would be compatible with planning for sustained-yield timber production for the purposes of the O&C Act, even if that management might condition how sustained-yield timber production would be conducted. However, in developing the range of alternatives for this planning effort, alternatives should not include Special Recreation Management Areas on O&C lands if the management for recreation and visitor services would conflict with planning for sustained-yield timber production for the purposes of the O&C Act.

An Extensive Recreation Management Area is an administrative unit that requires specific management consideration in order to address recreation use, demand, or recreation and visitor services program investments. Extensive Recreation Management Areas do not necessarily conflict with sustained-yield timber production. Consistent with BLM Manual 8320, management of Extensive Recreation Management Areas "… is commensurate with the management of other resources and resource uses." Furthermore, this manual explains that land use plan decisions for management of Extensive Recreation Management Areas will be "… compatible with other resource objectives." Because management for recreation values in Extensive Recreation Management Areas is intended to be done in a manner that is compatible with other resource uses, such as sustained-yield timber production, designation of Extensive Recreation Management Areas would not necessarily conflict with sustained-yield timber production. Therefore, the BLM will consider designating Extensive Recreation Management Areas on all lands in the planning area, including O&C lands.

Sensitive Species

The FLPMA provides authority for management for ecological and environmental values and to provide food and habitat for fish and wildlife (43 U.S.C. 1701 [Sec. 102.a.8]). Consistent with BLM Manual 6840 – Special Status Species (USDI BLM 2008g), the BLM shall designate Bureau sensitive species and implement measures to conserve these species and their habitats. It is in the interest of the BLM to undertake conservation actions for such species before listing under the Endangered Species Act is warranted. By doing so, the BLM will have greater flexibility in managing the public lands to accomplish native species conservation objectives and other legal mandates. BLM Manual 6840 also directs that specific protection to species that are listed by the BLM as sensitive on lands governed by the O&C Act must be consistent with timber production as the dominant use of those lands.

In developing the range of alternatives to be considered in this planning process, the BLM will consider providing measures to conserve Bureau sensitive species and their habitats on O&C lands to the extent that the conservation measures are compatible with planning for sustained-yield timber production for the O&C Act purposes. The BLM will consider providing these measures even if the conservation measures might condition how sustained-yield timber production would be conducted. Furthermore, the BLM will consider providing measures to conserve Bureau sensitive species and their habitats on O&C lands to the extent that the conservation measures are necessary to prevent the need to list Bureau sensitive species under the Endangered Species Act. Future listings under the Endangered Species Act could have the effect of limiting the BLM's ability to provide a sustained yield of timber under O&C Act; limiting or avoiding future listings could best ensure a permanency of timber production over the long-term.

Management of the Public Domain Lands in Relation to the O&C Lands

Out of the approximately 2.5 million acres of BLM-administered lands in the planning area, 384,273 acres are public domain lands. About half of those public domain lands are small parcels that are widely scattered and intermingled with the O&C lands. While the FLPMA requires that the public domain lands be managed for a multitude of values, the Act does not require that every parcel be managed for every value. As in previous RMPs, these public domain parcels will be managed in accordance with the 1975 Public Land Order No. 5490 (40 FR 7450), which reserves these intermingled public domain lands for multiple-use management, including the sustained yield of forest resources in connection with the intermingled O&C lands.

Relationship of the RMPs to Other Plans and Programs

The 1995 RMPs are consistent with the 1994 Northwest Forest Plan, which was adopted by the Department of the Interior and the Department of Agriculture for Federal forests within the range of the northern spotted owl as an "ecosystem management plan for managing habitat for late-successional and old-growth forest related species." The April 1994 Record of Decision for the Northwest Forest Plan, signed jointly by the Secretary of the Interior and the Secretary of Agriculture, required the BLM to incorporate the Northwest Forest Plan's land use allocations and its standards and guidelines into the district RMPs for western Oregon. The Northwest Forest Plan was implemented on the BLM-administered lands in western Oregon in 1995 through the completion of its RMPs in the six western Oregon Districts.

The Northwest Forest Plan is not a statute or regulation. It was a coordinated, multi-agency amendment to the then-current RMPs of the BLM and forest plans of the U.S. Forest Service. The Secretaries and the agencies retained authority provided by statutes and regulations to revise these plans in the future. The only provision the Northwest Forest Plan made concerning future amendments or modifications to these plans was that they would be "coordinated" through the "Regional Interagency Executive Committee and the Regional Ecosystem Office" (USDA FS/USDI BLM 1994a, p. 58). In keeping with the intention of the Northwest Forest Plan to encourage cooperation and coordination of programs among the Federal agencies, the BLM has coordinated with the Regional Interagency Executive Committee on this RMP revision. Furthermore, many of the agencies that are represented on the Regional Interagency Executive Committee are cooperating agencies in this RMP Revision. Those cooperating agencies include the U.S. Forest Service, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the Environmental Protection Agency.

The Northwest Forest Plan did not change the authority of the BLM, provided under the FLPMA and its promulgating regulations, for amending or revising RMPs. The 1995 RMPs, consistent with FLPMA planning regulations, anticipated the possibility that periodic plan evaluations could lead to RMP amendments and revisions. The BLM has subsequently amended the 1995 RMPs, as described below.

The interagency Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA FS/USDI BLM 2001) amended all of the 1995 RMPs.[4]

The BLM has also amended the Coos Bay, Medford, and Roseburg District RMPs with the Record of Decision and Resource Management Plan Amendment for Management of Port-Orford-Cedar in

[4] The Survey and Manage categorizations for the red tree vole were established in this record of decision. The Ninth Circuit Court decision in *Klamath-Siskiyou Wildlands Center v. Boody*, 468 F.3d 549 (2006), found that the changes to those survey and manage categorizations for the red tree vole would constitute plan amendments that need to be analyzed with NEPA procedures. The court then invalidated the re-categorizations regarding the red tree vole, because the BLM had not prepared a plan amendment and appropriate environmental analysis consistent with the FLPMA and NEPA.

Southwest Oregon, Coos Bay, Medford, and Roseburg District (USDI BLM 2004), which was based on an interagency supplemental EIS. Under all alternatives in this RMP revision, the BLM would continue to manage Port-Orford-Cedar in accordance with this 2004 Record of Decision.

In addition, the BLM has amended individual RMPs with amendments of more limited scope than the above amendments, and has periodically maintained individual RMPs.[5] Individual District Annual Program Summaries have documented these RMP amendments and RMP maintenance actions.

In contrast to these amendments of the 1995 RMPs, this RMP revision would replace the 1995 RMPs and thereby replace the Northwest Forest Plan for the management of BLM-administered lands in western Oregon. The purpose and need for this RMP revision, as described earlier in this chapter, is different from the purpose and need for the Northwest Forest Plan. As such, the action alternatives in this Draft RMP/EIS do not contain all elements of the Northwest Forest Plan.

Survey and Manage

The BLM adopted a purpose and need for this RMP revision that is consistent with the agency's discretion and obligations under FLPMA and the O&C Act. Under the O&C Act, the BLM has no specific wildlife conservation mandate, but has a range of discretion on how to manage the O&C timberlands for permanent, sustained-yield timber production. The purpose and need differs from the purpose and need for the Northwest Forest Plan and reflects the BLM's determination that it can achieve the goals of the O&C Act without the Survey and Manage measures. While none of the action alternatives in this Draft RMP/EIS therefore includes the Survey and Manage measures, Survey and Manage is reflected in the Draft RMP/EIS's No Action alternative described in Chapter 2.[6] As such, the BLM retains the discretion to consider this component in whole or part for inclusion in the eventual development of the Proposed RMP, along with any of the components of the alternatives and sub-alternatives, which are described in Chapter 2.

The purpose and need for the Northwest Forest Plan was guided by the policy pronouncements of President Clinton at the 1993 Forest Conference directing the BLM and U.S. Forest Service to adopt a "comprehensive…common management approach to the [federal] lands administered throughout an entire ecological region" (USDA FS and USDI BLM 1994a, p. 1). To achieve this comprehensive approach, the Northwest Forest Plan included a goal of supporting "viable populations, well-distributed across their current range, of species known (or reasonably expected) to be associated with old-growth forest conditions" (USDA *et al.* 1993, p. II-5; USDA FS and USDI BLM 1994b, p. 3&4-113). This goal was founded on the Forest Service planning regulation issued under the National Forest Management Act (NFMA) "to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area" (36 CFR 219.19).[7] In carrying out this goal, the Secretaries for the respective departments included what is known as "Survey and Manage" as mitigation in the Northwest Forest Plan to provide benefits to these species and increase the likelihood of viable, well-distributed populations across all

[5] RMP maintenance actions respond to minor data changes and incorporation of activity plans and are limited to further refining or documenting a previously approved decision incorporated in the plan. Plan maintenance does not result in expansion of the scope of resource uses or restrictions or change the terms, conditions, and decisions of the approved RMP.
[6] As further explained in Chapter 2, the No Action alternative in this Draft RMP/EIS is implementation of the 1995 RMPs as written (in contrast to the BLM's current implementation practices under the 1995 RMPs).
[7] Since the adoption of the Northwest Forest Plan, the Forest Service adopted new planning regulations at 36 CFR 219 in 2000 and in 2012, which replaced the cited regulation.

federal lands in the planning area, including BLM-administered lands (USDA FS and USDI BLM 1994b, p. 3&4-129).

The Northwest Forest Plan species viability objective is not part of this RMP revision. However, the purpose of this revision does include contributing to the conservation and recovery of threatened and endangered species, consistent with the BLM's mandate under the Endangered Species Act. Furthermore, all of the action alternatives would implement the BLM's special status species policy, which is described in detail in the Final Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines, which is incorporated here by reference (USDA FS and USDI BLM 2004, pp. 45-54), and include conservation measures to the extent necessary to prevent the need to list Bureau sensitive species under the Endangered Species Act (BLM Manual 6840 - Special Status Species Management).

In addition, in developing a plan consistent with the purpose and need for this RMP revision the BLM will not need the Survey and Manage measures to protect species associated with older and more structurally-complex forests. This is because the purpose of this RMP revision includes maintaining a network of large blocks of forest to be managed for late-successional forests and maintaining older and more structurally-complex multi-layered conifer forests, as necessary components of contributing to the conservation and recovery of the northern spotted owl. All action alternatives therefore allocate a Late-Successional Reserve network, where sustained-yield timber harvest would not occur, that is larger than what is provided in the Northwest Forest Plan and broadly encompasses "old-growth forests." Each alternative would more than sufficiently address maintenance of older and more structurally-complex forests, without the need for additional mitigation like that provided by Survey and Manage. Further, even if the larger Late-Successional Reserve and protection of older and more structurally-complex forest were not sufficient to provide adequate habitat for Survey and Manage species, before such species could need listing under the Endangered Species Act, the BLM would be able to include such species on the BLM Sensitive species list and provide necessary management to avoid the need for listing.

Aquatic Conservation Strategy

As described earlier in this chapter, this RMP revision would replace the 1995 RMP's and thereby replace the Northwest Forest Plan for the management of BLM-administered lands in western Oregon. The BLM adopted a purpose and need for this RMP revision that is consistent with the agency's discretion and obligations under FLPMA and the O&C Act. The purpose and need differs from the purpose and need for the Northwest Forest Plan and reflects BLM's determination that it can achieve the goals of the O&C Act without the Aquatic Conservation Strategy in its entirety as constituted in the Northwest Forest Plan. Because of these differences, none of the action alternatives in this Draft RMP/EIS includes the Aquatic Conservation Strategy in its entirety as constituted in the Northwest Forest Plan. The Aquatic Conservation Strategy in its entirety as constituted in the Northwest Forest Plan is reflected in the Draft RMP/EIS's No Action alternative described in Chapter 2. As such, the BLM retains the discretion to consider this component in whole or part for inclusion in the Proposed RMP, along with any of the components of the alternatives and sub-alternatives, which are described in Chapter 2.

As previously discussed, the purpose and need for the Northwest Forest Plan was guided by the policy pronouncements of President Clinton at the 1993 Forest Conference directing the BLM and U.S. Forest Service to adopt a "comprehensive… common management approach to the [federal lands administered throughout an entire ecological region" (USDA FS and USDI BLM 1994a, p.1). To achieve this comprehensive approach, the Northwest Forest Plan includes the Aquatic Conservation Strategy (ACS), which was intended to fulfill nine broad objectives, including restoring and maintaining the ecological health of watersheds and aquatic ecosystems and supporting well-distributed populations of riparian-dependent species. These objectives were based on the Forest Service organic statute and implementing regulations. The Aquatic Conservation Strategy consists of four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration.

Consistent with the purpose and need for this revision, all of the action alternatives include some, but not all, components of the Aquatic Conservation Strategy of the Northwest Forest Plan. For example, all of the action alternatives in the Draft RMP/EIS include Riparian Reserves, with widths and management direction that vary among the alternatives and differ from the No Action alternative. In addition, all of the action alternatives include management direction for watershed restoration similar to the watershed restoration described in the Northwest Forest Plan and included in the No Action alternative. Although none of the action alternatives delineates a network of key watersheds as did the Northwest Forest Plan, the range of Riparian Reserve designs and management direction among the action alternatives would allow the BLM to protect watersheds in the development of the Proposed RMP. Further, while none of the action alternatives includes a watershed analysis process as that included in the Northwest Forest Plan, under all of the action alternatives the BLM will generate the equivalent of watershed analysis by providing watershed scale information, including identifying resource conditions, watershed processes, risks to resources, and restoration opportunities, as needed for NEPA analysis or ESA consultation for implementation actions taken in the future consistent with the plan.

Existing Decisions

The following existing decisions, which are valid for continued implementation and are supported by an EIS, will be carried forward into the RMPs. The BLM will restate or summarize these decisions to incorporate them into the RMPs without additional analysis. These decisions will be common to all alternatives and include the following:

- Management plans for congressionally-designated areas such as Wilderness Areas, Wilderness Study Areas, and Wild and Scenic Rivers
- Pokegama Wild Horse Herd Management Area Plan (Klamath Falls Field Office, USDI BLM 2002)
- Record of Decision for Management of Port-Orford-cedar in Southwest Oregon (Coos Bay, Medford, and Roseburg Districts; USDI BLM 2004)
- Record of Decision for Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments (USDI BLM 2005b)
- Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States (USDA FS/USDI BLM 2008)
- Approved Resource Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-administered lands in the 11 Western States (USDI BLM 2009)
- Vegetation Treatments Using Herbicides on BLM Lands in Oregon Record of Decision (USDI BLM 2010)
- Seed Orchard Records of Decision for Integrated Pest Management (Salem, Eugene, Medford Districts; USDI BLM 2005c, 2005d, 2006)
- Jordan Cove Energy and Pacific Connector Pipeline Project (in process)
- Greater Sage Grouse Plan Amendments (in process)

The Cascade Siskiyou National Monument (Medford District), and the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District) are not included in the decision area for this RMP revision. This RMP revision will not alter these independent RMP decisions.

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Chapter 2 – Alternatives

Introduction

This chapter describes the alternatives considered in this Draft RMP/EIS. The Council on Environmental Quality regulations direct that an EIS shall "... rigorously explore and objectively evaluate all reasonable alternatives ..." 40 CFR 1502.14. Guidance from the Council on Environmental Quality further explains, "When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS" ("Forty Most Asked Questions ..." 46 FR 18027). The purpose and need for action dictates the range of alternatives that must be analyzed, because action alternatives are not reasonable if they do not respond to the purpose and need for the action (USDI BLM 2008, pp. 35-36, 49-50).

For an RMP, there are potentially endless variations in design features or combinations of different plan components. The BLM has designed the range of alternatives in this Draft RMP/EIS to span the full spectrum of alternatives that would respond to the purpose and need for the action. The BLM has developed the alternatives to represent a range of overall management approaches, rather than exemplify gradations in design features. Nevertheless, the alternatives do not provide all possible combinations of plan components. There are components of the alternatives that are somewhat separable, and the BLM may combine management objectives and management direction from several of these alternatives in developing the eventual Proposed RMP. In addition, the BLM could consider components of the No Action alternative, which is analyzed in detail in this Draft RMP/EIS, for inclusion in the eventual Proposed RMP, along with any of the components of the alternatives and sub-alternatives.

This chapter describes the No Action alternative and the action alternatives that are analyzed in detail in this RMP/EIS, including identification of the preferred alternative. This chapter also discusses alternatives that the BLM considered but did not analyze in detail. Finally, this chapter presents a comparison of the alternatives, including a summary of the environmental effects of the alternatives.

No Action Alternative

The Council on Environmental Quality NEPA regulations require that an EIS analyzes a No Action alternative (40 CFR 1502.14(d)). The Council on Environmental Quality guidance explains that, for plans such as this RMP revision, No Action means there is no change from current management direction or level of management intensity (CEQ 1981). The No Action alternative in this Draft RMP/EIS is implementation of the 1995 RMPs as written (in contrast to the BLM's current implementation practices under the 1995 RMPs). A section later in this chapter, titled Alternatives Considered but not Analyzed in Detail, includes further discussion of an alternative that would seek to continue the current practices.

The land use allocations and management actions/direction in the 1995 RMPs for the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Klamath Falls Field Office of the Lakeview District, as amended and modified by court order, describe the No Action alternative (**Figure 2-1**, **Table 2-1**, and

Map 2-1) and are incorporated here by reference. The No Action alternative, as analyzed in this Draft EIS/RMP, includes Survey and Manage standards and guidelines, consistent with—

- The January 2001, Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl;
- The 2001, 2002, and 2003 Annual Species Review modifications to the Survey and Manage species list, except for the changes made for the red tree vole; and
- The Pechman exemptions.[8]

The BLM has documented all amendments and plan maintenance of the 1995 RMPs in the district annual program summaries and monitoring reports from 1996 through 2014.

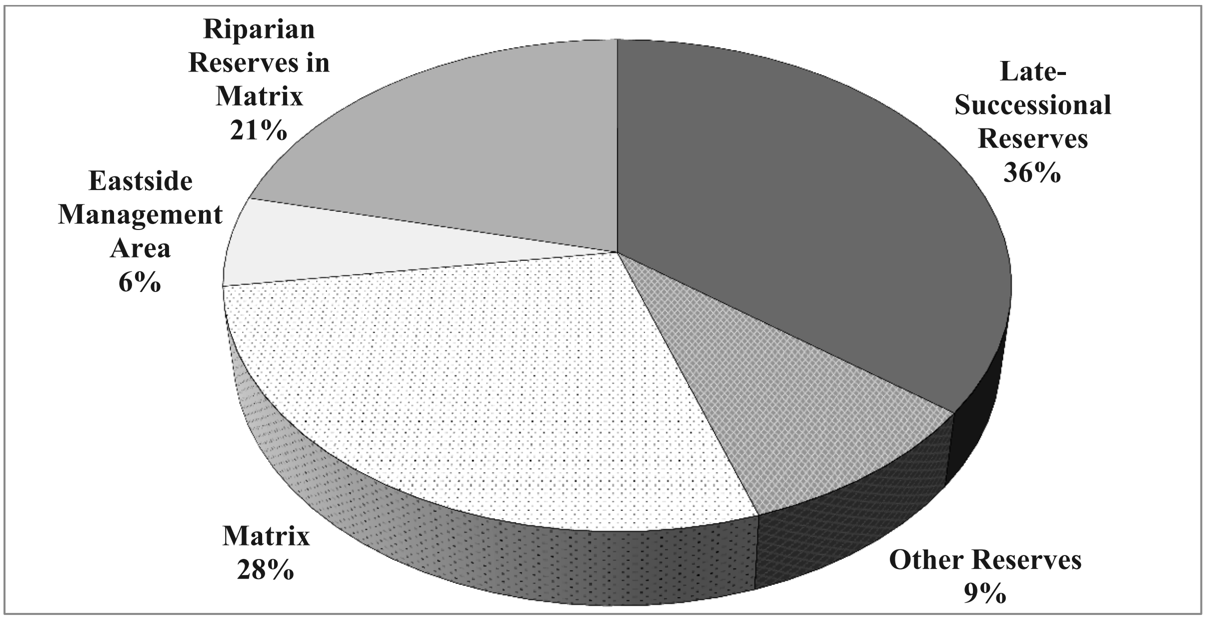


Figure 2-1. No Action alternative land use allocations.

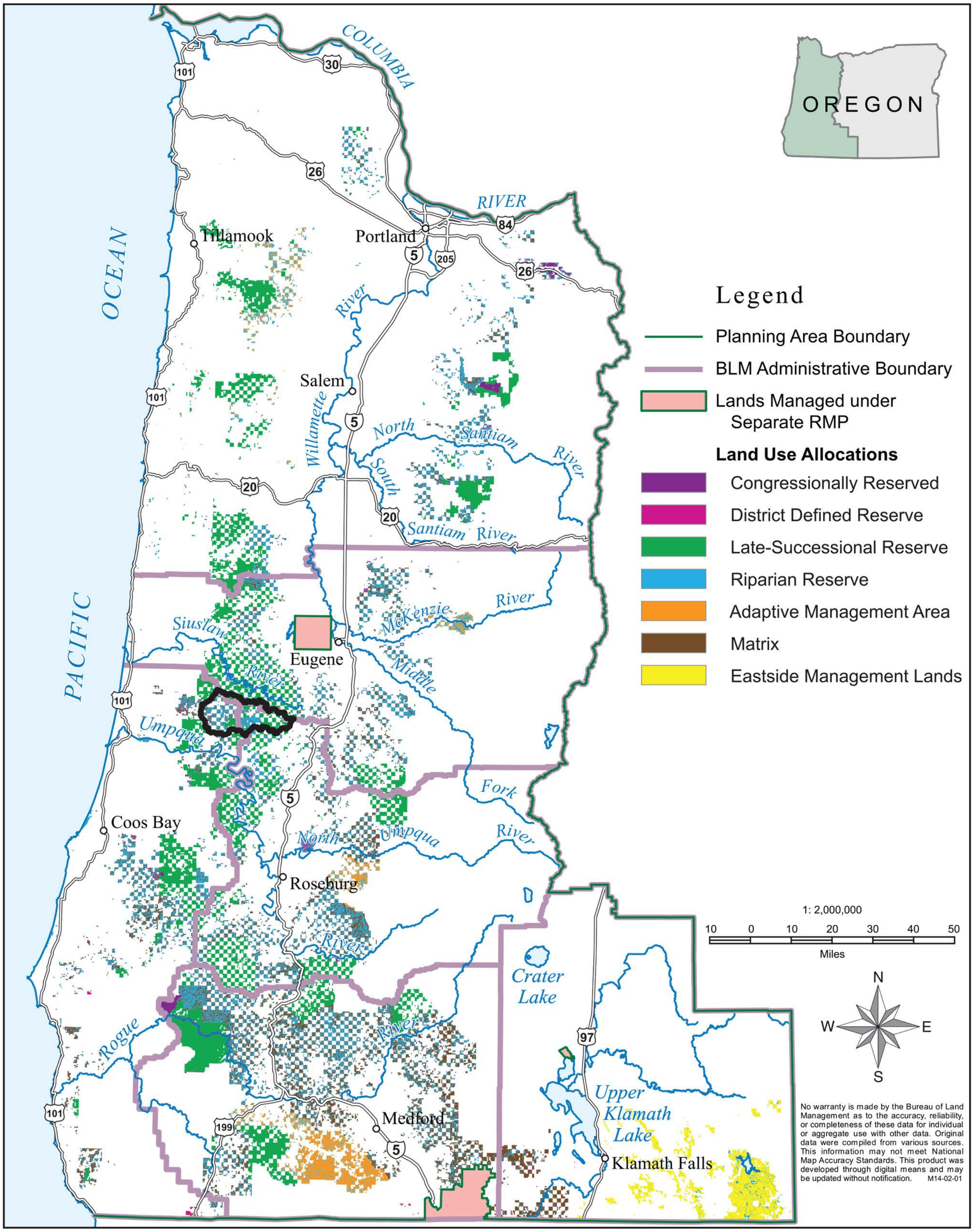
[8] The District Court for the Western District of Washington issued a remedy order on Feb. 18, 2014, in the case of *Conservation Northwest et al.* v. *Boonie et al.*, No. 08-1067-JCC (W.D. Wash.)/No.11-35729 (9th Cir.) that vacated the 2007 Records of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines. Vacatur of the 2007 RODs has the effect of returning the BLM to the status quo in existence prior to the 2007 RODs, which was defined by three previous legal rulings, as follows:

- Judge Pechman reinstated the 2001 ROD, including any amendments or modifications to the 2001 ROD that were in effect as of March 21, 2004 (CV-04-00844-MJP, Jan. 9, 2006), and this ruling incorporated the 2001, 2002, and 2003 Annual Species Reviews;
- The Ninth Circuit Court of Appeals in *KSWC et al.* v. *Boody et al.*, 468 F3d 549 (2006) vacated the 2001 Annual Species Review category change and 2003 Annual Species Review removal for the red tree vole in the mesic zone; and
- Judge Pechman ordered four categories of projects exempt from compliance with the Survey and Manage standards and guidelines (CV-04-00844-MJP, Oct. 11, 2006, “Pechman exemptions”): thinnings in forest stands younger than 80 years of age, culvert replacement/removal, riparian and stream improvement projects, and hazardous fuel treatments applying prescribed fire for noncommercial projects.

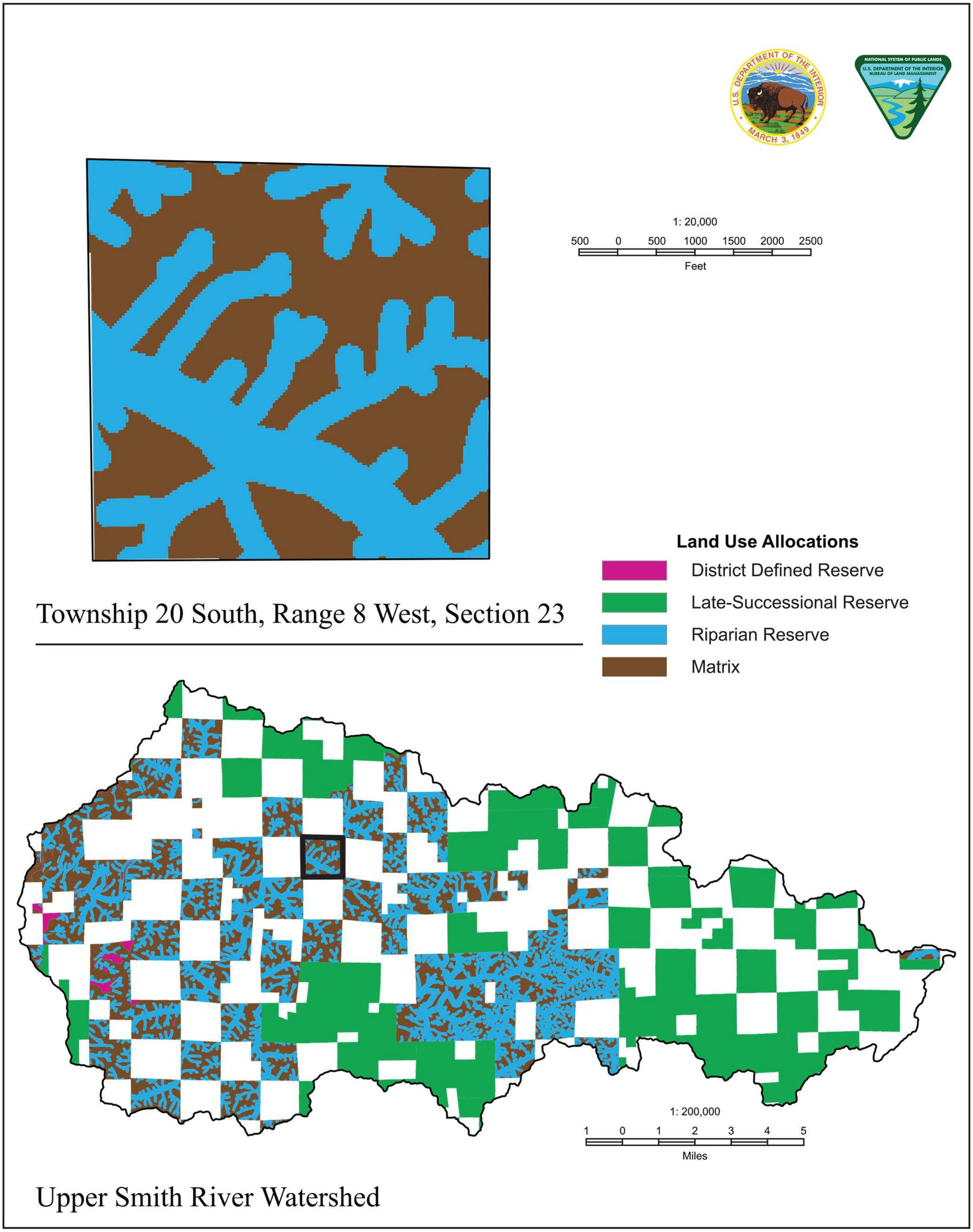
Table 2-1. No Action alternative land use allocations.

Allocation	Acres	Percentage of Total Acres
Late-Successional Reserves[9]	879,031	36%
Riparian Reserves in Matrix	527,550	21%
Other Reserves[10]	233,410	9%
Matrix[11]	691,998	28%
Eastside Management Area	146,867	6%

[9] Late-Successional Reserves include Adaptive Management Areas within the Late-Successional Reserves and predictions of the acreage of newly discovered marbled murrelet sites.
[10] Other Reserves in the No Action alternative include Congressionally Reserved lands, District-Designated Reserves, and lands reserved within the Matrix.
[11] Matrix includes Adaptive Management Areas.



Map 2-1: The No Action Alternative Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Land Use Allocations
District Defined Reserve
Late-Successional Reserve
Riparian Reserve
Matrix
Township 20 South, Range 8 West, Section 23
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

For comparing the acreage by land use allocation for the No Action alternative to the action alternatives, the Matrix land use allocation in the No Action alternative is comparable to the Harvest Land Base land use allocation in the action alternatives.

The Eastside Management Area in the No Action alternative comprises those BLM-administered lands in the Klamath Falls Field Office outside the range of the northern spotted owl. In the action alternatives, the Eastside Management Area comprises those BLM-administered lands in the Klamath Falls Field Office east of Highway 97. Because of these different boundaries, the acreage for the Eastside Management Area is slightly higher in the No Action alternative than in the action alternatives.

The Riparian Reserves acreage for the No Action alternative in **Figure 2-1** and **Table 2-1**, presents only the Riparian Reserves within the Matrix, which is how the 1995 RMPs presented the hierarchy of land use allocations. The Late-Successional Reserves acreage for the No Action alternative do not account for Riparian Reserves within the Late-Successional Reserves. In the No Action alternative, the Riparian Reserves would overlay the Late-Successional Reserves, and implementation in those overlapping areas would apply the management objectives and management direction for both land use allocations (USDA/USDI 1994, pp. A-5–A-6). As a result, the 1995 RMPs only accounted for the Riparian Reserves acreage in the Late-Successional Reserves as Late-Successional Reserves; the only Riparian Reserve acreage calculated were those in the Matrix. Thus, the acreage of Riparian Reserves and Late-Successional Reserves presented in the 1995 RMPs cannot be directly compared to the acreages presented in this analysis.

To facilitate more direct comparison of these acreages by land use allocation for the No Action alternative to the action alternatives, **Figure 2-2**, and **Table 2-2**, present a modified hierarchy of land use allocations in the No Action alternative to display the Riparian Reserves acreage regardless of the underlying land use allocation (**Figure 2-1** and **Table 2-1**). The results are a reduction in acreage identified as Late-Successional Reserves and a corresponding increase in acreage identified as Riparian Reserves that allows for direct comparative analysis in this Draft EIS/RMP.

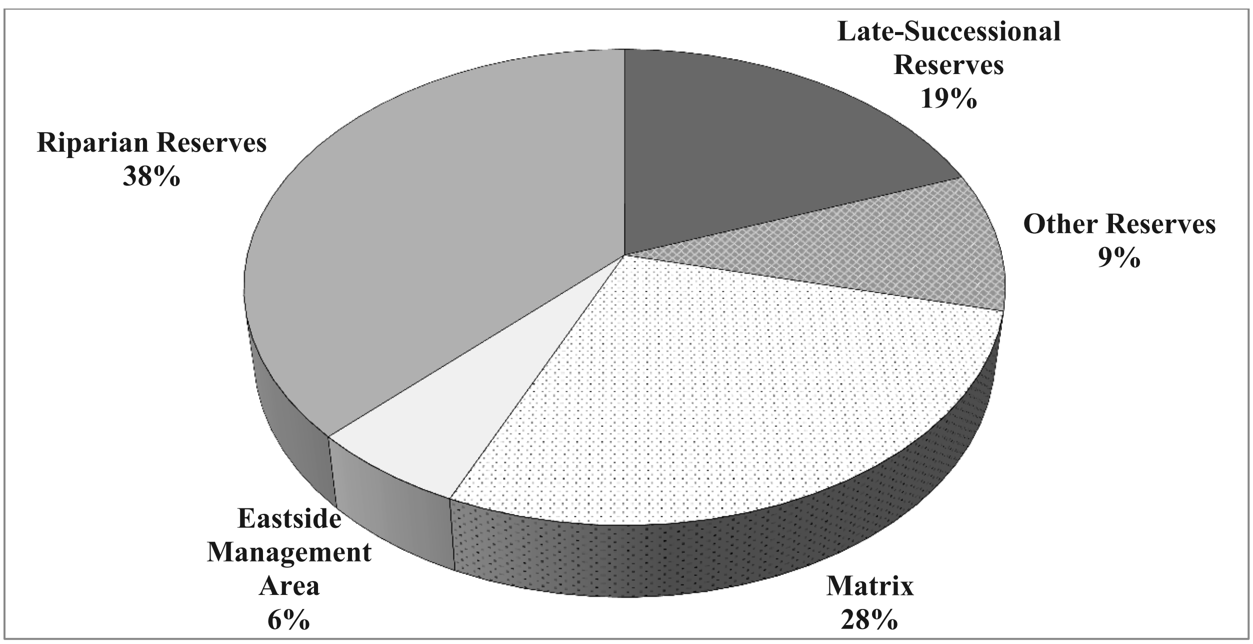


Figure 2-2. No Action alternative land use allocations with modified hierarchy.

Table 2-2. No Action alternative land use allocations with modified hierarchy.

Allocation	Acres	Percentage of Total Acres
Late-Successional Reserves	478,860	19%
Riparian Reserves	927,721	38%
Other Reserves[12]	233,410	9%
Matrix	691,998	28%
Eastside Management Area	146,867	6%

[12] Other Reserves in the No Action alternative include Congressionally Reserved lands, District-Designated Reserves, and lands reserved within the Matrix.

Action Alternatives

The four action alternatives with two sub-alternatives comprise a range of management strategies that the BLM has designed to meet the purpose and need discussed in Chapter 1. In addition, the BLM has developed the action alternatives to be consistent with the guidance for the formulation of alternatives discussed in Chapter 1. These action alternatives examine potential management strategies through land use allocations, management objectives, and management direction. Some land use allocations, management objectives, and management direction are common to all action alternatives, and some vary by action alternative, as described below.

The BLM has developed the action alternatives in response to input received during external and internal scoping. Each of the action alternatives described below include land use allocations designed to respond to the purpose and need for action, including areas managed for sustained-yield timber production that would provide the annual productive capacity of timber and areas reserved from sustained-yield timber production for purposes such as the protection of clean water and the conservation and recovery of threatened and endangered species.

Sub-Alternatives

Sub-alternatives are variations of an action alternative that modify an individual component of the alternative to explore how these changes would alter certain outcomes. These examinations provide the responsible official with information that is useful for both fully understanding the alternatives and for informing the eventual development of the Proposed RMP.

The BLM focuses and limits the analysis of the sub-alternatives to the specific analytical question that is associated with a sub-alternative: that is, how modifying a single component would alter the effects on the resources associated with that component. This is in contrast to the broader analysis that is associated with the No Action alternative and the four action alternatives, which explores the effects of the alternatives on all resources. The sub-alternatives are variations on the action alternatives and, as such, could be carried forward as the eventual Proposed RMP; their individual components could also be incorporated into the eventual Proposed RMP.

The BLM has developed two sub-alternatives in this Draft RMP/EIS, which vary individual components to test specific questions about alternative design based on input received during external and internal scoping. For both sub-alternatives, the BLM focuses analysis on how the changes in the sub-alternative would alter effects on timber production and northern spotted owls. The BLM focused the analysis of these sub-alternatives on these two resources, because the modification of the alternative component would vary the approach to an element of northern spotted owl conservation, and the change in the sub-alternatives would directly and explicitly alter the approach to timber production. The specific features of these sub-alternatives are described under the pertinent action alternatives.

Features Common to All Action Alternatives

This section contains a summary of those features that are common to all action alternatives. The subsequent section contains a description of the features that differ among the action alternatives.

All action alternatives include the following land use allocations: Congressionally Reserved, District-Designated Reserves, Late-Successional Reserve, Riparian Reserve, Harvest Land Base, and Eastside Management Area. The location and acreage of these allocations, with the exception of Congressionally Reserved, vary by alternative. Within each action alternative, the Harvest Land Base, Late-Successional Reserve, and Riparian Reserve have specific, mapped sub-allocations with differing management direction. The Harvest Land Base has multiple sub-allocations with differing management direction for forest management summarized in **Table 2-3**. Appendix B contains detailed descriptions of the management direction for the sub-allocations of the Harvest Land Base.

Table 2-3. Forest management practices by Harvest Land Base sub-allocation.

Sub-allocation	Alternatives That Include Sub-Allocation	Forest Management Practices
High Intensity Timber Area (HITA)	Alt. A Alt. C	Thinning and regeneration harvest with no retention
Moderate Intensity Timber Area (MITA)	Alt. B Alt. D	Thinning and regeneration harvest with retention of 5-15 percent of the pre-harvest basal area of the stand
Low Intensity Timber Area (LITA)	Alt. B	Thinning and regeneration harvest with retention of 15-30 percent of the pre-harvest basal area of the stand
Uneven-aged Timber Area (UTA)	All action alternatives	Prescribed fire, thinning, single tree selection harvest, and group selection harvest
Owl Habitat Timber Area (OHTA)	Alt. D	Thinning and uneven-aged timber harvest applied in a manner that would maintain and promote the development of northern spotted owl habitat

In the context of these land use allocations, the term “reserve” indicates that the BLM or Congress have reserved lands within the allocation from sustained-yield timber production. These reserve land use allocations—Congressionally Reserved, District-Designated Reserves, Late-Successional Reserve, and Riparian Reserve—are in contrast to the Harvest Land Base, which includes management objectives for sustained-yield timber production. This does not mean that the BLM is necessarily prohibiting active management in these reserve allocations. On the contrary, each action alternative includes management direction to conduct the management actions necessary to achieve the management objectives for these allocations.

Congressionally Reserved Lands

Congressionally Reserved lands are those lands that Congress has designated and defined management through law, such as designated Wilderness and Wild and Scenic Rivers. The mandated management of these lands requires that the BLM reserve these lands from sustained-yield timber production. The location and acreage of Congressionally Reserved lands does not vary among the alternatives, including the No Action alternative.

District-Designated Reserves

District-Designated Reserves[13] include lands that are reserved from sustained-yield timber production for a variety of reasons, including—

- Areas that the BLM has constructed for specific purposes (such as roads, buildings, maintenance yards, and other facilities and infrastructure);

[13] These areas have been termed Administratively Withdrawn in previous planning efforts. This RMP/EIS does not use the term withdrawn in this context to avoid confusion with the withdrawal of areas from operation of public land laws, location, and entry under mining laws, or application and offers under mineral leasing laws.

- Areas that the BLM has identified through the Timber Production Capability Classification[14] system as unsuitable for sustained-yield timber production (e.g., rock outcrops);
- Areas of Critical Environmental Concern, including Research Natural Areas; and
- Other reserves (e.g., special recreation management areas and areas protected for Bureau sensitive species).

Under all alternatives, the BLM would manage roads, maintenance yards, buildings, and other facilities for the purpose for which they were constructed. The BLM may manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system for other uses, if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the timber production capability classification codes). The BLM will periodically add additional areas to those areas reserved through updates to the timber production capability classification system, when examinations indicate that an area meets the criteria for reservation. The BLM may also delete areas from those areas reserved and return the area to sustain-yield timber production through updates to the timber production capability classification system, when examinations indicate that an area does not meet the criteria for reservation. The BLM would reserve Areas of Critical Environmental Concern and other District-Designated Reserves on O&C lands consistent with the discussion in Chapter 1 under The O&C Act and the FLPMA.

Land Use Allocation Objectives that are Common to All Action Alternatives

Late-Successional Reserve

The Late-Successional Reserve in all action alternatives has management objectives to—

- Protect stands of older, structurally-complex, conifer forest;
- Maintain habitat for the northern spotted owl and marbled murrelet;
- Promote development of habitat for the northern spotted owl in stands that do not currently meet suitable habitat criteria; and
- Promote development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.

Riparian Reserve

The Riparian Reserve in all action alternatives has management objectives to—

- Contribute to the conservation and recovery of listed fish species and their habitats and provide for conservation of special status fish and other special status riparian associated species;
- Maintain and restore riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates;

[14] The Timber Production Capability Classification is an analytical classification system by which the BLM inventories and identifies sites as capable of supporting sustained-yield timber production without degrading the site's productive capacity. This classification considers factors such as soil depth, available moisture, slope, drainage, and stability. Sites that are not capable of supporting sustained-yield timber production are not included in the Harvest Land Base.

- Maintain water quality and stream flows within the range of natural variability, to protect aquatic biodiversity, and provide quality water for contact recreation and drinking water sources;
- Meet ODEQ water quality targets for 303(d) water bodies with approved Total Maximum Daily Loads (TMDLs);
- Maintain high quality water and contribute to the restoration of degraded water quality downstream of BLM-administered lands; and
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.

Harvest Land Base

The Harvest Land Base in all action alternatives has management objectives to—

- Manage forests to achieve continual timber production that can be sustained through a balance of growth and harvest;
- Offer for sale the declared annual productive capacity of timber;
- Recover economic value from timber harvested after a stand-replacement disturbance, such as a fire, windstorm, disease, or insect infestation;
- Ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth in harvested or disturbed areas; and
- Enhance the economic value of timber in forest stands.

Eastside Management Area

All action alternatives include an Eastside Management Area land use allocation, which applies to BLM-administered lands in the Klamath Falls Field Office east of Highway 97. This allocation includes management objectives to—

- Manage forest and non-forest lands with the intent of maintaining or improving wildlife habitat and rangeland conditions based on ecological site parameters;
- Manage forest and non-forest lands for multiple uses in addition to those listed above including: recreational needs, community stability, and commodity production;
- Promote development of fire-resilient forests;
- Provide for the conservation of BLM Special Status Species; and
- Meet Oregon Department of Fish and Wildlife management goals for wildlife on public domain lands.

In addition, the design, management objectives, and management direction for the Riparian Reserve on BLM-administered lands in the Klamath Falls Field Office east of Highway 97 do not vary among action alternatives (*Appendix B*).

Resource-Specific Objectives that are Common to All Action Alternatives

For many programs or resources, the management objectives and management direction differ from the No Action alternative, but do not vary among the action alternatives. For some of these resources or programs, the management objectives and management direction do not vary among the action alternatives, but the management of the resource is tied to allocations that do vary among action alternatives. For example, the management objectives and management direction for designated Areas of Critical Environmental Concern do not vary among action alternatives, but which specific areas the BLM would designate as Areas of Critical Environmental Concern would vary with the land use allocations of each alternative. The following section summarizes the resource-specific management objectives that are common to all action alternatives. Appendix B contains detailed descriptions of the management objectives and management direction that are common to all action alternatives.

Air Quality: The BLM would follow the Clean Air Act by protecting air quality in Class 1 areas, such as wilderness areas, and preventing exceedances of National, State, or local ambient air quality standards.

Areas of Critical Environmental Concern (ACECs): The BLM would manage designated ACECs to maintain and restore their relevant and important values (though the array of ACECs that the BLM would designate varies by alternative).

Cultural/Paleontological Resources: The BLM would protect significant cultural resources and ensure that all land and resource uses comply with the National Historic Preservation Act. The BLM would protect and preserve significant localities from natural or human-caused deterioration or potential conflict with other resources.

Fire and Fuels: In responding to wildfires, the BLM would provide for public and firefighter safety while meeting land management objectives. The BLM would also manage the land to restore and maintain resilience to wildfires and to decrease the risk of catastrophic wildfires.

Fisheries: The BLM would manage riparian areas to maintain and improve the aquatic habitat across the landscape.

Forest Management: The BLM would enhance the health, stability, growth, and vigor of forest stands. The BLM would not allow management activities that would disrupt the Density Management study sites until data collection is complete.

Hydrology: The BLM would manage to provide water that meets Oregon Department of Environmental Quality water quality standards for drinking water, contact recreation, and aquatic biodiversity.

Invasive Species: The BLM would prevent the introduction and spread of non-native invasive species.

Lands, Realty, and Roads: The BLM would adjust land tenure zones to facilitate potential changes in ownership to improve the management of resources and enhance public resource values. It would also provide legal access to BLM-administered lands and facilities and rights-of-way, permits, leases, and easements in a manner that is consistent with Federal and State laws.

Minerals: The BLM would manage mineral resources in a manner that allows for their orderly and efficient development.

Rare Plants and Fungi: The BLM would manage to contribute toward the recovery of Federally-listed plant and fungi species. It would also manage for an array of natural communities including oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands, and would support ecological processes and disturbance mechanisms to allow for a range of seral conditions.

Recreation: The BLM would provide diverse recreational opportunities.

National Landscape Conservation System: The BLM would conserve, protect, and restore areas that Congress has designated for their outstanding values.

Travel and Transportation: The BLM would maintain a travel network that best meets the full range of public, resource management, and administrative access needs.

Visual Resource Management: The BLM would protect the quality of the scenic values on public lands where visual resource management is an issue or where high value visual resources exist, and protect areas having high scenic quality, visual sensitivity, and public visibility.

Soils: The BLM would manage to maintain the overall soil capacity of BLM-administered lands.

Sustainable Energy: The BLM would allow for the development of sustainable energy resources to the maximum extent possible without precluding other land uses.

Wild Horses: The BLM would maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area.

Wildlife: The BLM would manage to contribute to the conservation and recovery of Federally-listed wildlife species. It would also implement proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the Endangered Species Act.

Under all action alternatives, the BLM would implement administrative actions at approximately the same levels as during the past decade. Administrative actions are routine transactions and activities that are required to serve the public and to provide optimum management of resources, including:

- Competitive and commercial recreation activities
- Special forest product collection permit issuance
- Lands and realty actions (including the issuance of grants, leases, and permits)
- Trespass resolution
- Facility maintenance
- Facility improvements
- Road maintenance
- Hauling permit issuance
- Recreation site maintenance
- Recreation site improvement
- Hazardous materials removal
- Law enforcement
- Legal land or mineral estate ownership surveys
- Engineering support assistance in mapping
- Field visits for the design of projects, include clearance inventories
- Tree sampling (including using the 3P fall, buck, and scale sampling method)
- Project implementation and plan effectiveness monitoring
- Incidental live or dead tree removal for safety or operational reasons
- Wildlife, fisheries, or plant population monitoring

Potential Mitigation Measures that are Common to All Action Alternatives

BLM Participation in Barred Owl Management

The U.S. Fish and Wildlife Service is currently authorizing the removal of barred owls from four study areas in California, Oregon, and Washington to evaluate the feasibility, cost, and effectiveness of barred owl removal and the resulting effects to northern spotted owl populations (USDI FWS 2013). In the Revised Recovery Plan for the Northern Spotted Owl, Recovery Action 29 describes the design and implementation of large-scale barred owl control experiments to assess the effects on spotted owl site occupancy, reproduction, and survival (USDI FWS, 2011, p. III-65). Recovery Action 30 calls for management to reduce the negative effects of barred owls on spotted owls so that the recovery criterion for a stable population trend can be achieved. In the Revised Recovery Plan for the Northern Spotted Owl, the U.S. Fish and Wildlife Service acknowledges the need for aggressive strategies to address the threat from barred owls in the face of scientific uncertainty, and will employ an active program of adaptive management in order to deal with uncertainty and risk (USDI FWS 2011, p. II-6–II-10).

Based on information in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011), the analysis in the U.S. Fish and Wildlife Service EIS for Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls (USDI FWS 2013), and preliminary results from experimental removals (Diller 2013, Diller *et al.* 2014), barred owl management may result in decreased competition between barred owls and northern spotted owls, increased site occupancy by northern spotted owls, and increased northern spotted owl survival and reproduction. These outcomes may increase the likelihood of recovery of the northern spotted owl. As such, the experimental removals represent an inquiry into the best manner in which barred owl management can contribute to the recovery of the northern spotted owl.

As a potential mitigation measure, the BLM would cooperate with the U.S. Fish and Wildlife Service and provide financial support for this experimental removal of barred owls. Further, when the U.S. Fish and Wildlife Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl, the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30. Barred owl management actions on BLM-administered lands within the range of the northern spotted owl could include BLM participation in scheduling, funding, and implementing such actions. These actions would be implemented pursuant to appropriate NEPA analysis and decision-making. To the extent the BLM funds implementation of the Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls (USDI FWS 2013), the NEPA analysis for that action is already completed. The EIS prepared by the U.S. Fish and Wildlife Service describes and evaluates nine alternatives for an experimental removal of northern barred owls on a scale sufficient to determine if the removal would increase northern spotted site occupancy and improve population trends. Results from these experiments would be used by the U.S. Fish and Wildlife Service to inform future decisions on potential long-term management strategies for barred owls (USDI FWS 2013). That analysis is hereby incorporated by reference.

Action Alternative Descriptions

This section includes a summary of those features that differ among the action alternatives. Appendix B contains detailed descriptions by alternative of the management objectives and management direction that differ among the action alternatives.

Alternative A

Alternative A has a Late-Successional Reserve larger than the No Action alternative (**Figure 2-3**, **Table 2-4**, and **Map 2-2**; compare to **Figure 2-2**, **Table 2-2**). The Harvest Land Base is comprised of the Uneven-Aged Timber Area and the High Intensity Timber Area. The High Intensity Timber Area includes regeneration harvest with no retention (clear cuts).

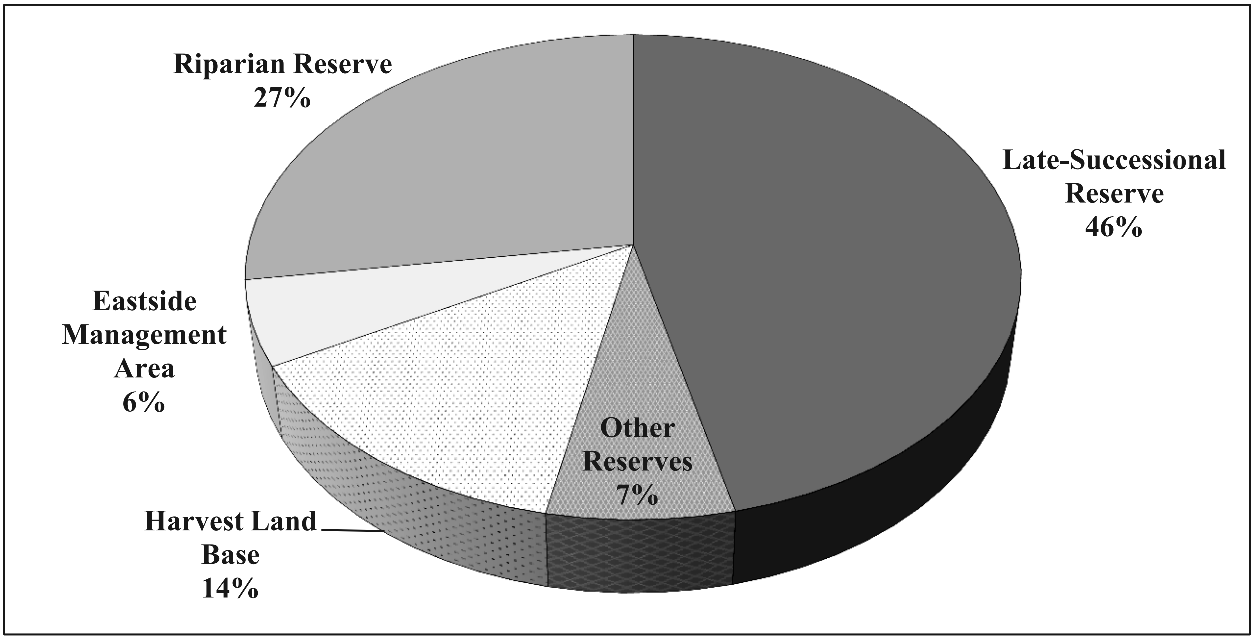
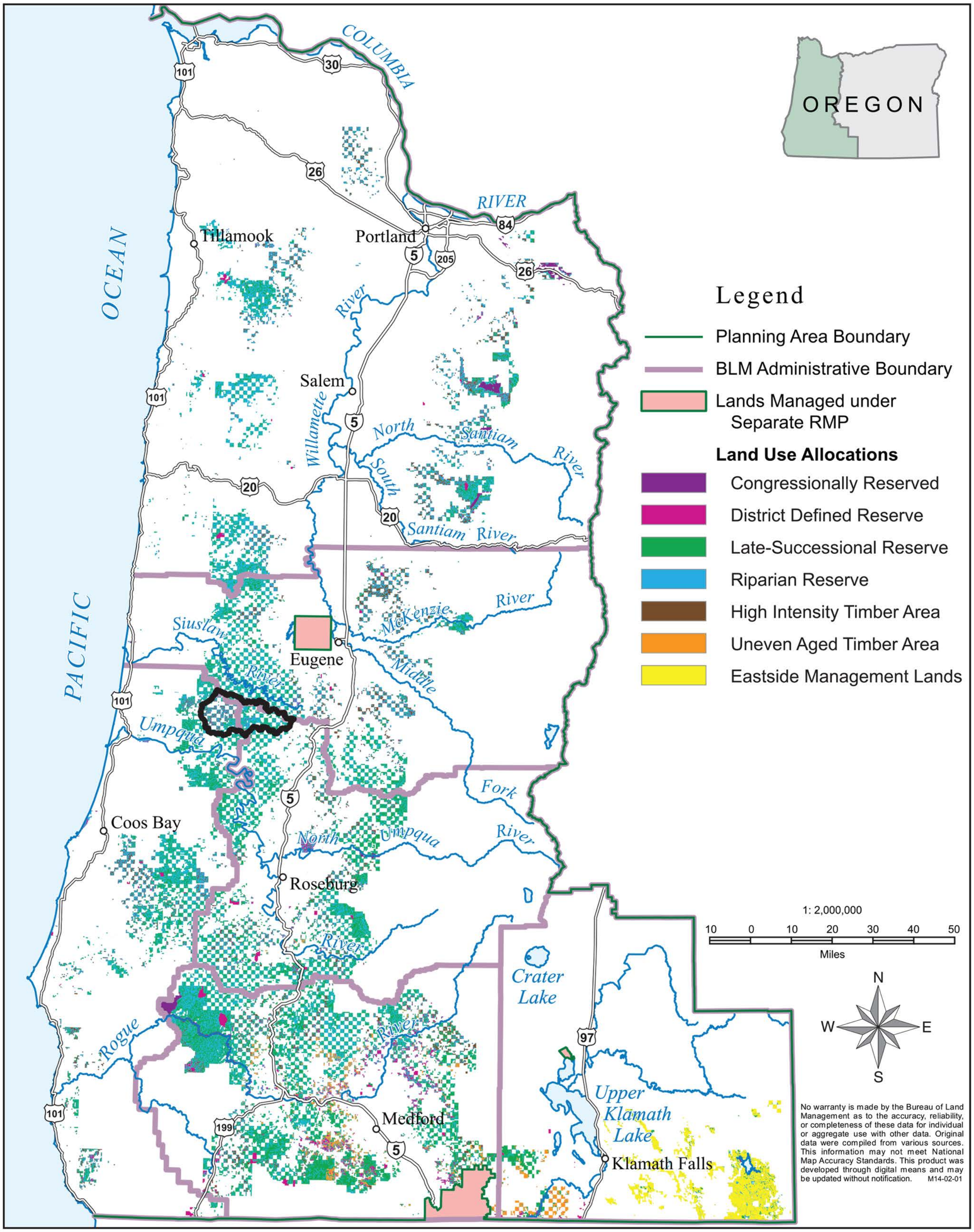


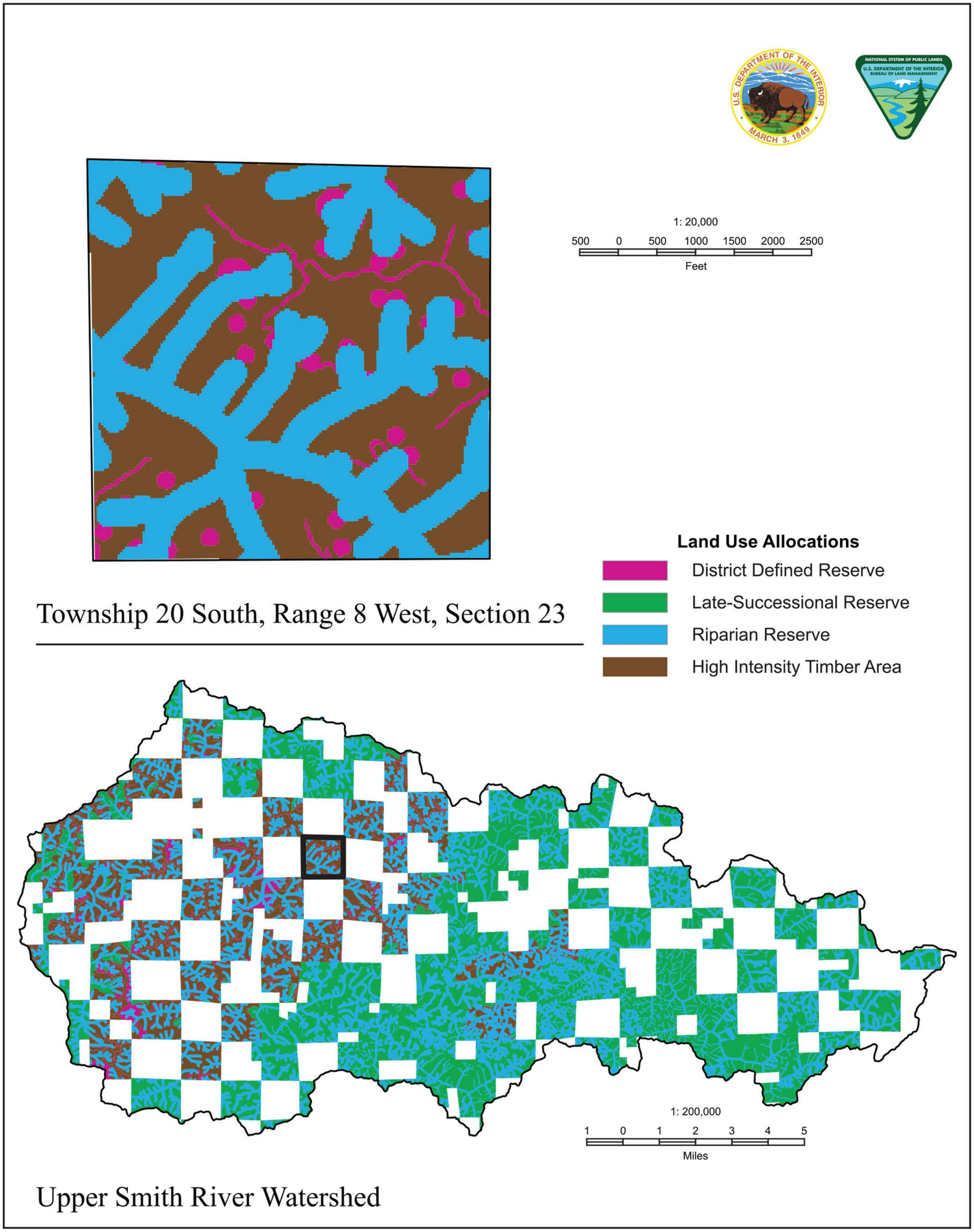
Figure 2-3. Alternative A land use allocations.

Table 2-4. Alternative A land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	1,147,527	46%	Structurally-Complex Forest	655,125	26%
			Late-Successional Reserve (Moist)	265,376	11%
			Late-Successional Reserve (Dry)	188,440	8%
			Existing Marbled Murrelet Sites	38,312	2%
			Existing Red Tree Vole Sites	274	<1%
Riparian Reserve	676,917	27%	Riparian Reserve (Moist)	441,603	18%
			Riparian Reserve (Dry)	235,313	9%
Other Reserves	170,540	7%	Congressionally Reserved	40,537	2%
			District Designated Reserves	130,003	5%
Harvest Land Base	343,900	14%	High Intensity Timber Area	289,060	12%
			Uneven-Aged Timber Area	54,840	2%
Eastside Management Area	139,972	6%	-	139,972	6%
			Totals	**2,478,856**	**-**



Map 2-2: Alternative A Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Township 20 South, Range 8 West, Section 23
Land Use Allocations
District Defined Reserve
Late-Successional Reserve
Riparian Reserve
High Intensity Timber Area
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

Late-Successional Reserve
The Late-Successional Reserve includes, primarily, Structurally-Complex Forest, Large Block Forest Reserves (Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)), and much smaller acreages from existing occupied marbled murrelet sites and existing sites of the North Oregon Coast Distinct Population Segment of the red tree vole. Within the Late-Successional Reserve, the BLM would not conduct timber salvage after disturbance, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Structurally-Complex Forest
Alternative A includes within the Late-Successional Reserve all stands120-years old and older, based on the current age of stands in the BLM forest operations inventory.

Large Block Forest Reserves: Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)[15]
Alternative A includes within the Late-Successional Reserve all northern spotted owl critical habitat designated in 2013 and marbled murrelet critical habitat designated in 2011. In moist forests, the BLM would conduct restoration thinning to promote the development of structurally-complex forest, but without commercial removal of timber (i.e., coarse woody debris and snag creation only). In dry forests, the BLM would conduct restoration activities including thinning and prescribed burning to promote the development of structurally-complex forest and to improve resilience to disturbance. In dry forests, restoration thinning would include removing cut trees, including commercial removal, as needed to reduce the risk of uncharacteristic high-severity or high-intensity fire.

Riparian Reserve
In Alternative A, the Riparian Reserve encompasses lands within one site-potential tree height[16] on either side of all streams.

The Riparian Reserve includes an inner zone in which thinning is not permitted. Inner zone widths are—

- 120 feet on either side of perennial and fish-bearing intermittent streams; and
- 50 feet on either side of non-fish-bearing, intermittent streams.

Outside of the inner zone, the BLM would conduct restoration thinning as needed to ensure that stands are able to provide trees to form stable instream structures. In moist forests, the BLM would conduct restoration thinning without commercial removal of timber (i.e., coarse woody debris and snag creation only). In dry forests, restoration activities would include prescribed burning and thinning that would include removal of cut trees, including commercial removal, as needed to reduce the risk of uncharacteristic high-severity or high-intensity fire.

Harvest Land Base
The Harvest Land Base is comprised of the Uneven-Aged Timber Area and the High Intensity Timber Area. The allocation of the Uneven-Aged Timber Area in Alternative A is based on areas below an average annual precipitation threshold. Timber management in the High Intensity Timber Area includes

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[15] For the purpose of Late-Successional Reserve and Riparian Reserve management in Alternative A, dry forests are defined by dry and very dry forest types identified by potential vegetation types.
[16] Site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class. Site-potential tree heights generally range from 140 feet to 240 feet across the decision area, depending on site productivity.

thinning and regeneration harvest with no retention (clear cuts). The High Intensity Timber Area has no snag or coarse woody debris retention requirements.

Wildlife
Within the Harvest Land Base, Alternative A does not include—

- Specific protections for northern spotted owl known or historic sites;
- A requirement for surveys for the marbled murrelet prior to management actions;
- Specific management requirements for trees capable of providing marbled murrelet nesting structures in younger stands; or
- A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions.

Rare Plants and Fungi
The BLM would create new populations and augment existing populations of Federally-listed and other special status plants and fungi to meet recovery plan or conservation strategy objectives.

Invasive Species
Alternative A does not include treatment of sudden oak death infection sites.

Grazing
The BLM would manage allotments in compliance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). The BLM would adjust grazing levels and management practices when needed to meet or make progress toward meeting the standards for rangeland health. The BLM would make unavailable to grazing those allotments that have generally been vacant or inactive for 5 years or more.

Minerals
Under Alternative A, the BLM would recommend for withdrawal from locatable mineral entry 268,981 acres and would close 232,367 acres to salable mineral development.

Areas of Critical Environmental Concern
Under Alternative A, the BLM would designate 119 Areas of Critical Environmental Concern.

Recreation Management Areas
Alternative A includes designation of Special Recreation Management Areas at developed recreation sites. In the rest of the decision area, the BLM would not manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands.

Lands with Wilderness Characteristics
Alternative A includes management for wilderness characteristics of all lands with wilderness characteristics that are not within the Harvest Land Base.

Wild and Scenic Rivers
Under Alternative A, the BLM would not find any of the eligible Wild and Scenic River segments suitable for inclusion in the National Wild and Scenic River System.

Visual Resource Management

Under Alternative A, the BLM would manage Congressionally Reserved lands where decisions have been made to preserve a natural landscape (e.g., designated Wilderness Areas and the wild sections of Wild and Scenic Rivers) as Visual Resource Management Class I and scenic sections of Wild and Scenic Rivers as Visual Resource Management Class II. The BLM would manage ACECs according to their visual resource inventory class. The BLM would manage all other lands as Visual Resource Management Class IV.

Alternative B

Alternative B has a Late-Successional Reserve similar in size to Alternative A, though of a different spatial design (see **Figure 2-4**, **Table 2-5**, and **Map 2-3**). The Harvest Land Base is comprised of the Uneven-Aged Timber Area, Low Intensity Timber Area, and Moderate Intensity Timber Area. The portion of the Harvest Land Base in Uneven-Aged Timber Area is the largest of all action alternatives. The Low Intensity Timber Area and Moderate Intensity Timber Area include regeneration harvest with varying levels of retention.

A sub-alternative of Alternative B (hereafter Sub-alternative B) includes reserving all known and historic northern spotted owl sites that would be in the Harvest Land Base in Alternative B. All other features of Sub-alternative B are the same as Alternative B. The description of Sub-alternative B, including the acreage of each land use allocation and a map, follows the description of Alternative B.

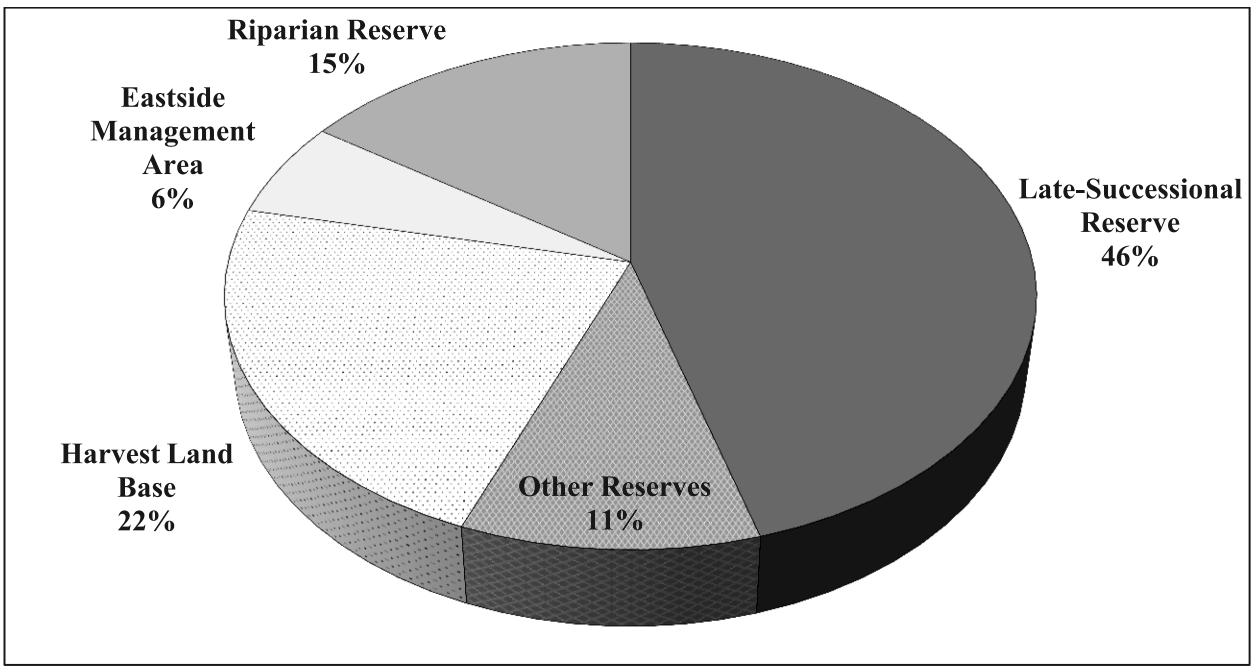
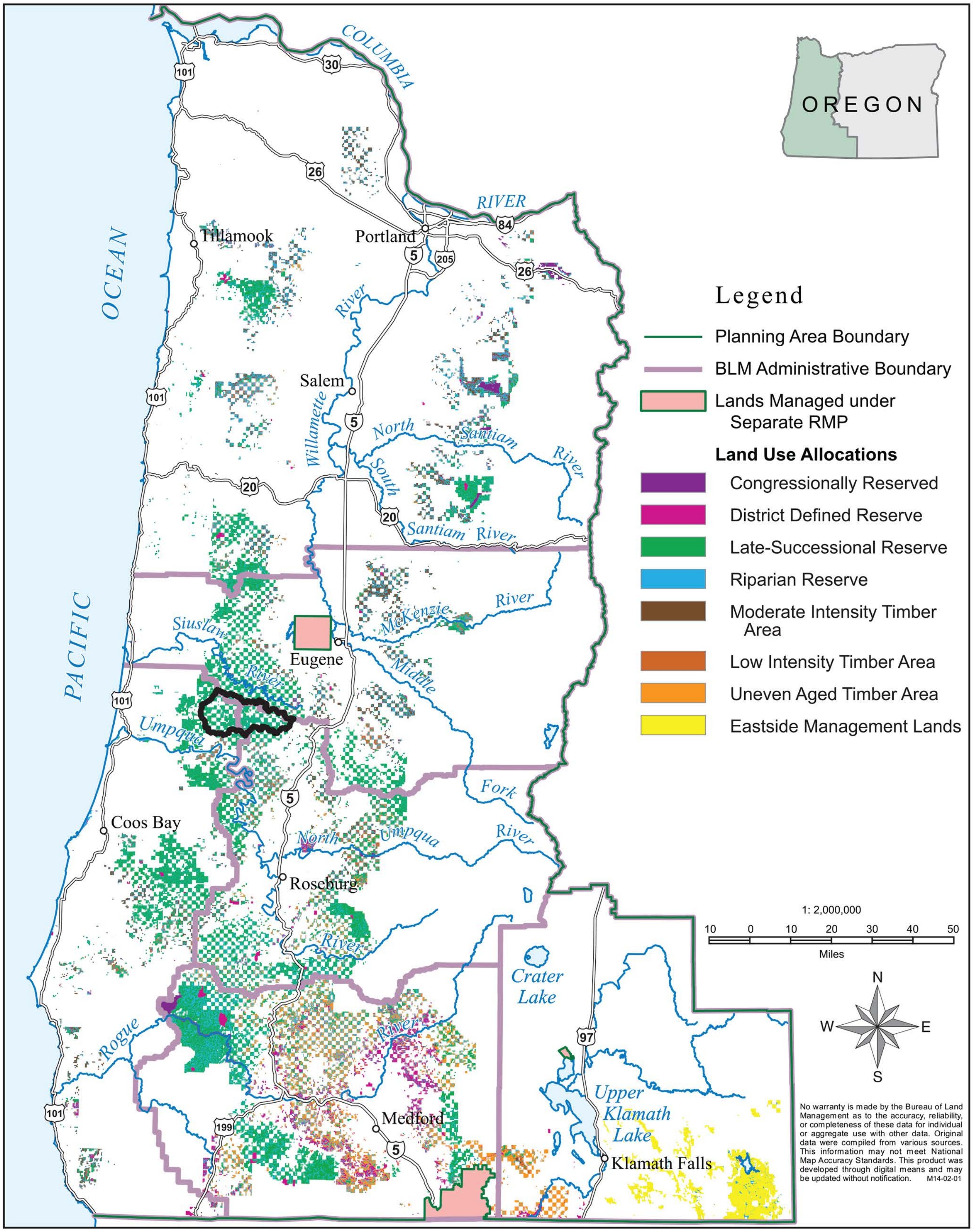


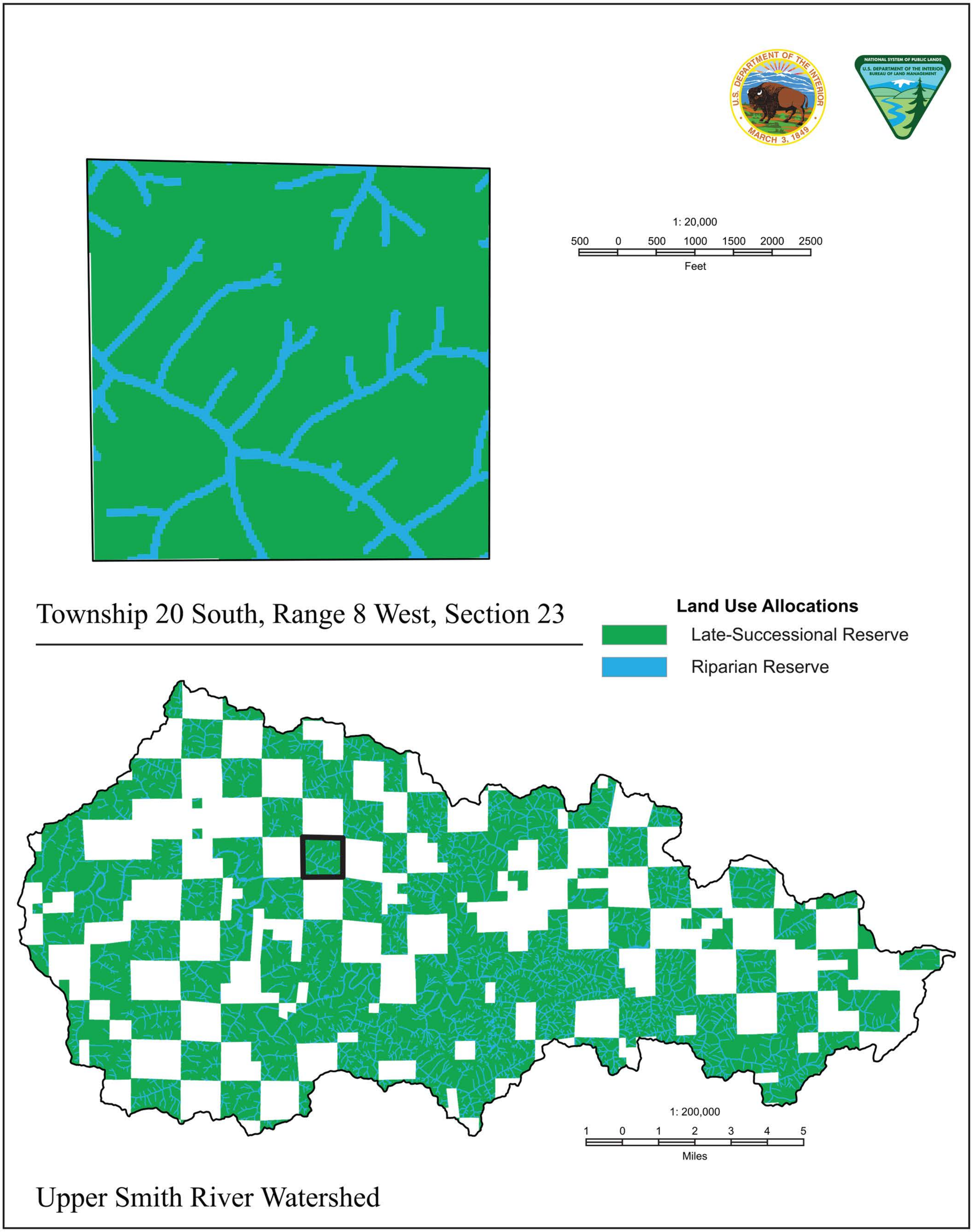
Figure 2-4. Alternative B land use allocations.

Table 2-5. Alternative B land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	1,127,320	46%	Structurally-Complex Forest	463,910	19%
			Late-Successional Reserve (Moist)	371,305	15%
			Late-Successional Reserve (Dry)	223,399	9%
			Occupied Marbled Murrelet Sites	41,633	2%
			Predicted Marbled Murrelet Sites	13,738	<1%
			Occupied Red Tree Vole Sites	297	<1%
			Predicted Red Tree Vole Sites	13,039	<1%
Riparian Reserve	382,805	15%	Riparian Reserve (Moist)	215,231	9%
			Riparian Reserve (Dry)	167,574	7%
Other Reserves	260,510	11%	Congressionally Reserved	40,537	2%
			District Designated Reserves	219,973	9%
Harvest Land Base	556,335	22%	Moderate Intensity Timber Area	210,087	8%
			Low Intensity Timber Area	72,358	3%
			Uneven-Aged Timber Area	273,890	11%
Eastside Management Area	151,885	6%	-	151,885	6%
			Totals	**2,478,856**	**-**



Map 2-3: Alternative B Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Township 20 South, Range 8 West, Section 23
Land Use Allocations
Late-Successional Reserve
Riparian Reserve
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

Late-Successional Reserve
The Late-Successional Reserve includes, primarily, Structurally-Complex Forest, Large Block Forest Reserves (Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)), and much smaller acreages from existing occupied marbled murrelet sites and existing sites of the North Oregon Coast Distinct Population Segment of the red tree vole. In addition, Alternative B includes requirements for surveys for the marbled murrelet and the North Oregon Coast Distinct Population Segment of the red tree vole, as described below; newly discovered sites would be included in the Late-Successional Reserve. Thus, this description of the Late-Successional Reserve includes predictions of the acreage of newly discovered marbled murrelet and red tree vole sites. Within the Late-Successional Reserve, the BLM would not conduct timber salvage after disturbance, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Structurally-Complex Forest Alternative B includes within the Late-Successional Reserve all stands identified by existing, district-specific information on structurally-complex forests.

Large Block Forest Reserves: Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)[17]
Alternative B includes within the Late-Successional Reserve blocks of functional and potential northern spotted owl habitat, sufficient to meet block size and spacing requirements (Thomas *et al*. 1990, pp. 24, 28) in all provinces except the Coast Range province, where reserves include blocks of habitat without limitations for size and spacing. In moist forests, the BLM would conduct restoration thinning to promote the development of structurally-complex forest, which may include commercial removal of cut trees. In dry forests, the BLM would conduct restoration activities including thinning and prescribed burning to promote the development of structurally-complex forest and to improve resilience to disturbance, which may include commercial removal of cut trees.

Riparian Reserve
In Alternative B, the Riparian Reserve encompass lands within—

- One site-potential tree height on either side of fish-bearing and perennial streams;
- 100 feet on either side of debris-flow-prone, non-fish-bearing, intermittent streams; and
- 50 feet on either side of other non-fish-bearing, intermittent streams.

The Riparian Reserve includes an inner zone in which thinning is not permitted. Inner zone widths are—

- 60 feet on either side of perennial and fish-bearing intermittent streams; and
- 50 feet on either side of non-fish-bearing, intermittent streams.

Outside of the inner zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to develop diverse and structurally-complex riparian stands.

Harvest Land Base
The Harvest Land Base is comprised of the Uneven-Aged Timber Area, Low Intensity Timber Area, and Moderate Intensity Timber Area. The allocation bases the Uneven-Aged Timber Area in Alternative B on dry and very dry forest types identified by potential vegetation types. The portion of the Harvest Land Base outside of the Uneven-aged Timber Area is divided between the Low Intensity Timber Area in

[17] For the purpose of Late-Successional Reserve and Riparian Reserve management in Alternative B, dry forests are defined by dry and very dry forest types identified by potential vegetation types.

designated northern spotted owl critical habitat and the Moderate Intensity Timber Area outside of designated northern spotted owl critical habitat. Timber harvest in the Low Intensity Timber Area includes thinning and regeneration harvest with retention of 15 to 30 percent of the stand. In the Low Intensity Timber Area, the BLM would rely on natural tree regeneration after timber harvest. Timber harvest in the Moderate Intensity Timber Area includes thinning and regeneration harvest with retention of 5 to 15 percent of the stand. In the Moderate Intensity Timber Area, the BLM would use either natural tree regeneration or replanting after timber harvest, but would maintain early seral habitat conditions for several decades after harvest.

Wildlife
Within the Harvest Land Base, Alternative B includes—

- No specific protections for northern spotted owl known or historic sites;
- A requirement for surveys for the marbled murrelet prior to management actions in marbled murrelet Zone 1 and protection of habitat within 300 feet around newly discovered occupied sites;
- The protection of trees capable of providing marbled murrelet nesting structures in younger stands in marbled murrelet Zone 1; and
- A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions and protection of habitat areas around newly discovered nest sites

Rare Plants and Fungi
The BLM would manage mixed hardwood and conifer communities outside of the Harvest Land Base to maintain and enhance oak persistence and structure.

Invasive Species
Alternative B includes treatment at all sudden oak death infection sites outside of the Riparian Reserve and no treatment at infection sites in the Riparian Reserve.

Grazing
The BLM would manage allotments in compliance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). The BLM would adjust grazing levels and management practices when needed to meet or make progress toward meeting the standards for rangeland health. The BLM would make unavailable to grazing those allotments that have generally been vacant or inactive for 5 years or more.

Minerals
Under Alternative B, the BLM would recommend for withdrawal from locatable mineral entry 266,473 acres and would close 226,367 acres to salable mineral development.

Areas of Critical Environmental Concern
Under Alternative B, the BLM would designate 114 Areas of Critical Environmental Concern.

Recreation Management Areas
Alternative B includes designation of Special Recreation Management Areas at currently developed recreation facilities. Alternative B includes designation of Extensive Recreation Management Areas where the BLM has developed and currently manages recreation activities outside of developed facilities, primarily where the BLM has authorized motorized and non-motorized trails, and where the BLM currently manages dispersed recreation activities. In the rest of the decision area, the BLM would not

manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands.

Lands with Wilderness Characteristics
Alternative B includes management for wilderness characteristics of all lands with wilderness characteristics that are outside of the Harvest Land Base and are compatible with existing and potential recreation opportunities.

Wild and Scenic Rivers
Under Alternative B, the BLM would recommend for inclusion in the National Wild and Scenic River System the eligible Wild and Scenic River segments with recreation identified as an Outstandingly Remarkable Value and the eligible river segments that the BLM found suitable during its administrative process (as outlined in BLM Manual 6400, USDI BLM 2012b).

Visual Resource Management
Under Alternative B, the BLM would manage Congressionally Reserved lands where decisions have been made to preserve a natural landscape (e.g., designated Wilderness Areas and the wild sections of Wild and Scenic Rivers) as Visual Resource Management Class I and scenic sections of Wild and Scenic Rivers as Visual Resource Management Class II. The BLM would manage ACECs according to their visual resource inventory class. The BLM would manage all other lands as Visual Resource Management Class IV.

Sub-Alternative B

Sub-alternative B is identical to Alternative B, except that it includes protection of habitat within the home ranges of all northern spotted owl known and historic sites that would be within the Harvest Land Base. This single change in design increases the Late-Successional Reserve to 57 percent of the decision area, which is larger than any other alternative, and reduces the Harvest Land Base to 12 percent of the decision area, which is smaller than any other alternative (**Figure 2-5**, **Table 2-6**, and **Map 2-4**).

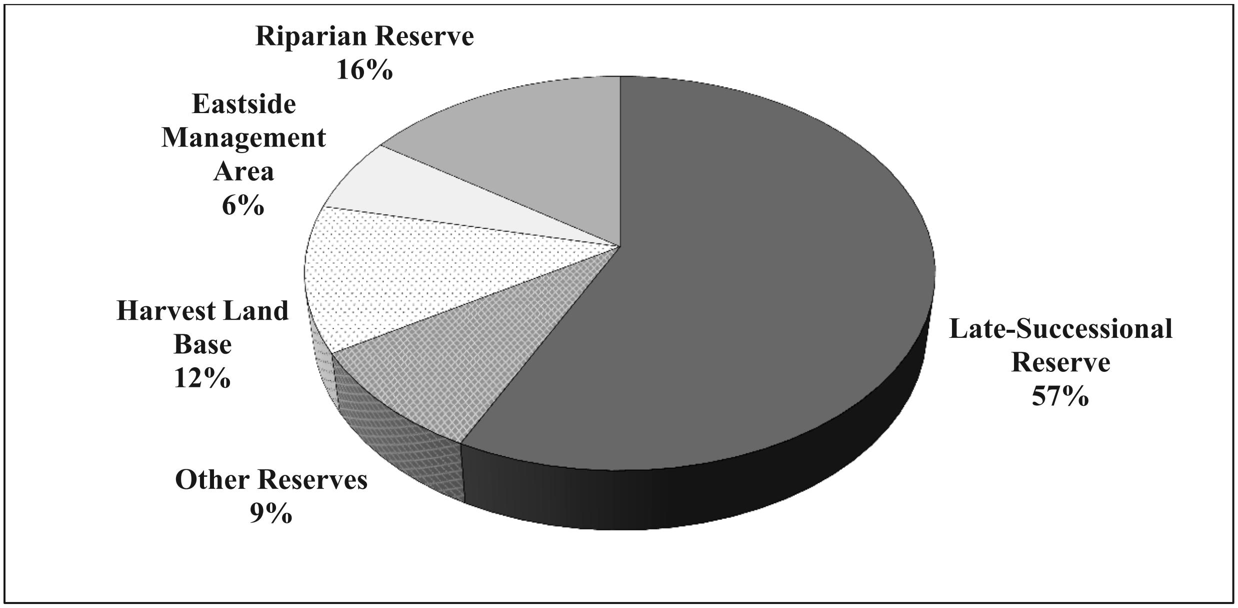


Figure 2-5. Sub-alternative B land use allocations.

Table 2-6. Sub-alternative B land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	1,422,933	57%	Structurally-Complex Forest	463,910	19%
			Late-Successional Reserve (Moist)	371,305	15%
			Late-Successional Reserve (Dry)	223,399	9%
			Northern Spotted Owl Sites	295,614	12%
			Occupied Marbled Murrelet Sites	41,633	2%
			Predicted Marbled Murrelet Sites	13,738	<1%
			Occupied Red Tree Vole Sites	297	<1%
			Predicted Red Tree Vole Sites	13,039	<1%
Riparian Reserve	382,805	15%	Riparian Reserve (Moist)	215,231	9%
			Riparian Reserve (Dry)	167,574	7%
Other Reserves	223,111	9%	Congressionally Reserved	40,537	2%
			District Designated Reserves	182,574	7%
Harvest Land Base	298,121	12%	Moderate Intensity Timber Area	129,120	5%
			Low Intensity Timber Area	30,761	1%
			Uneven-Aged Timber Area	138,239	6%
Eastside Management Area	151,885	6%	-	151,885	6%
			Totals	**2,478,856**	**-**

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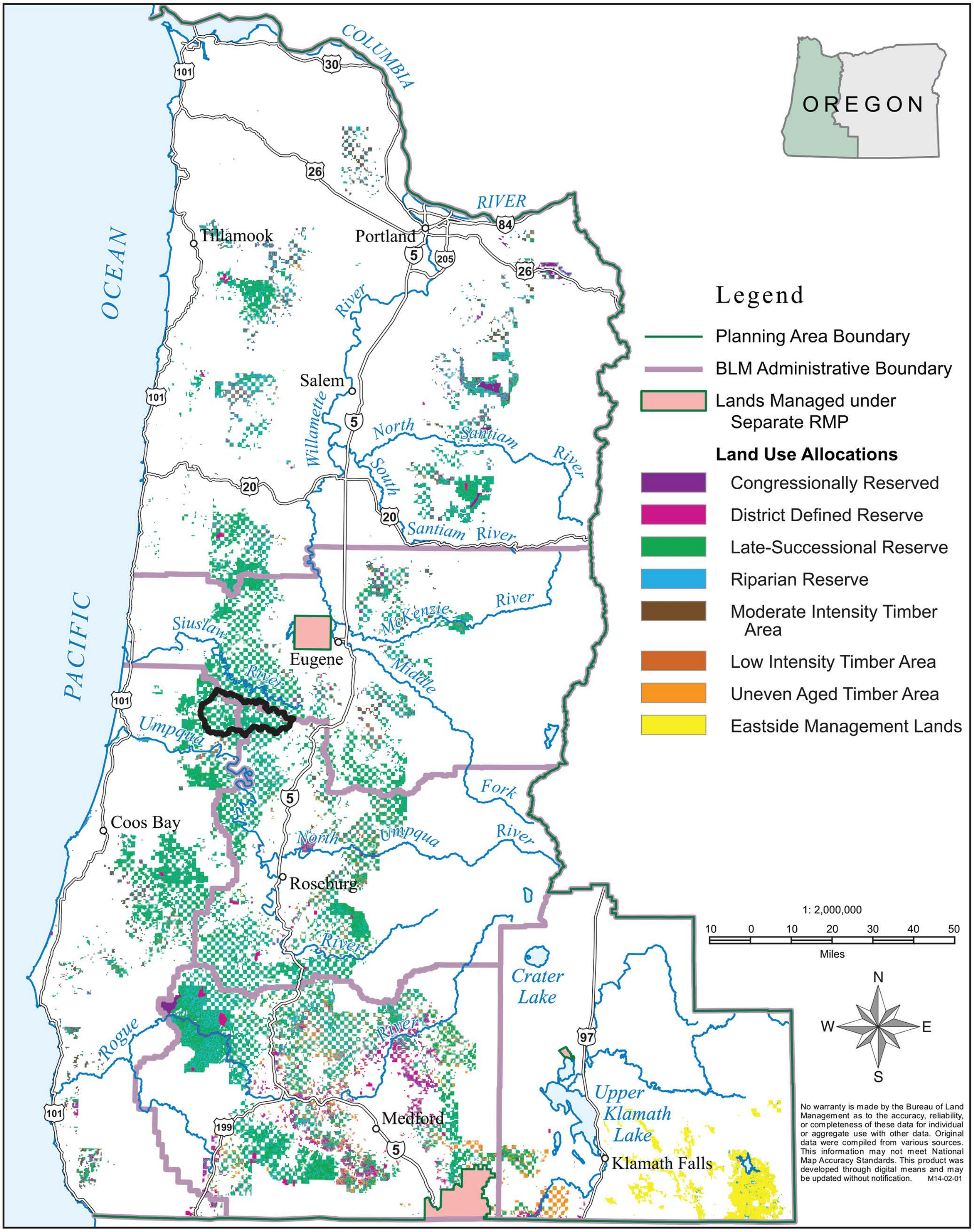
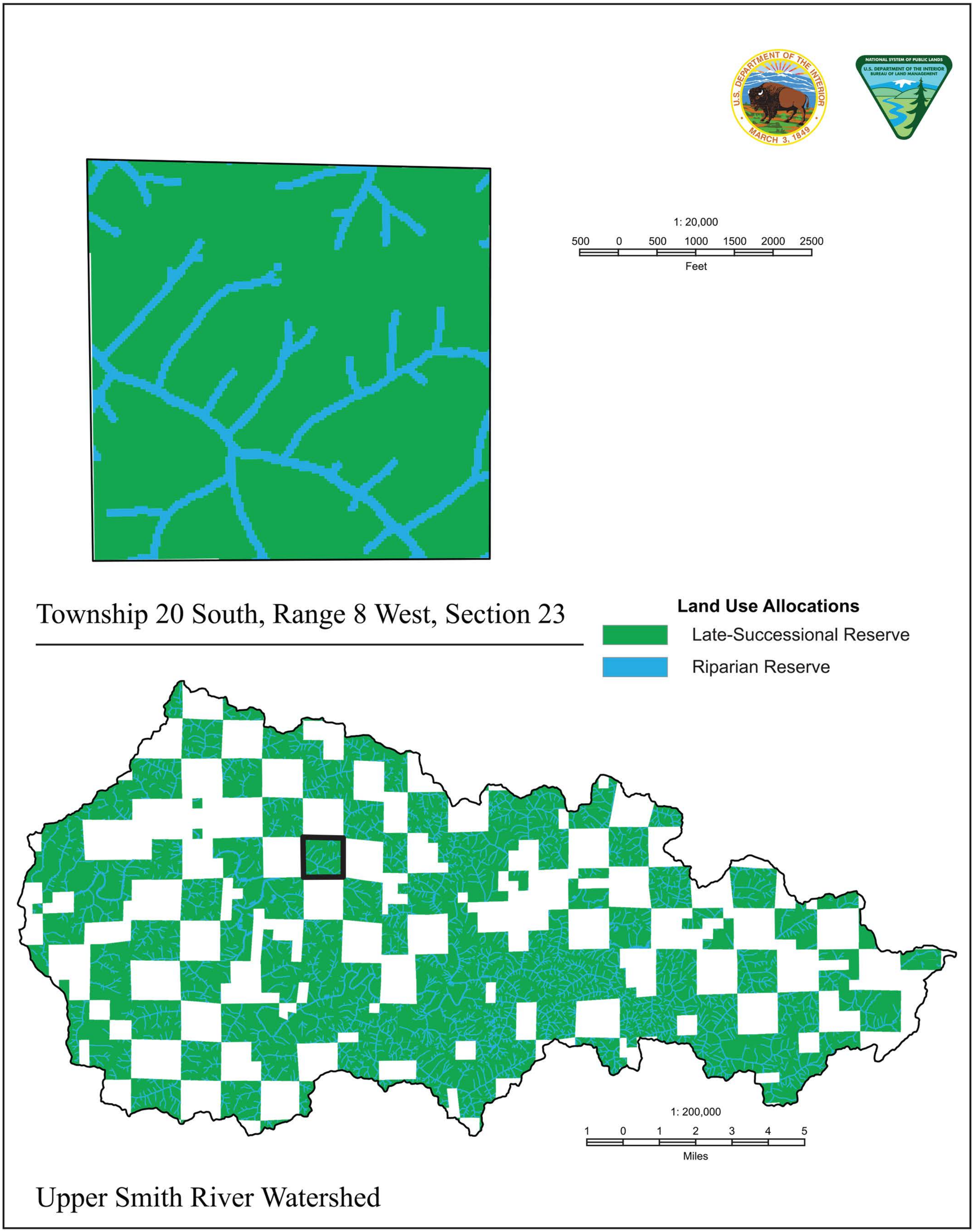


Map 2-4: Sub-Alternative B Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Township 20 South, Range 8 West, Section 23
Land Use Allocations
Late-Successional Reserve
Riparian Reserve
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

Alternative C

Alternative C has the largest Harvest Land Base of any of the alternatives (**Figure 2-6**, **Table 2-7**, and **Map 2-5**). The Harvest Land Base is comprised of the Uneven-Aged Timber Area and the High Intensity Timber Area. The High Intensity Timber Area includes regeneration harvest with no retention (clear cuts). Alternative C has the smallest acreage in the Riparian Reserve of all of the alternatives.

A sub-alternative of Alternative C (hereafter Sub-alternative C) includes reserving all forests 80-years old and older, based on the current age of stands in the BLM Forest Operations Inventory. All other features of Sub-alternative C are the same as Alternative C. The description of Sub-alternative C, including the acreage of each land use allocation and a map, follows the description of Alternative C.

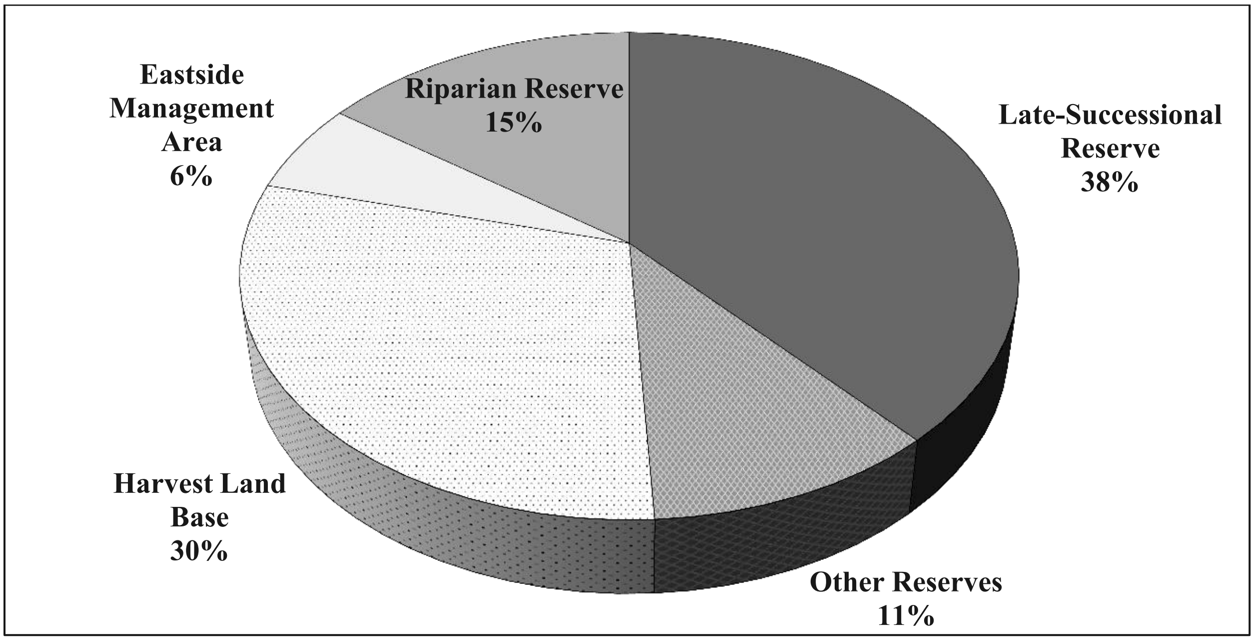
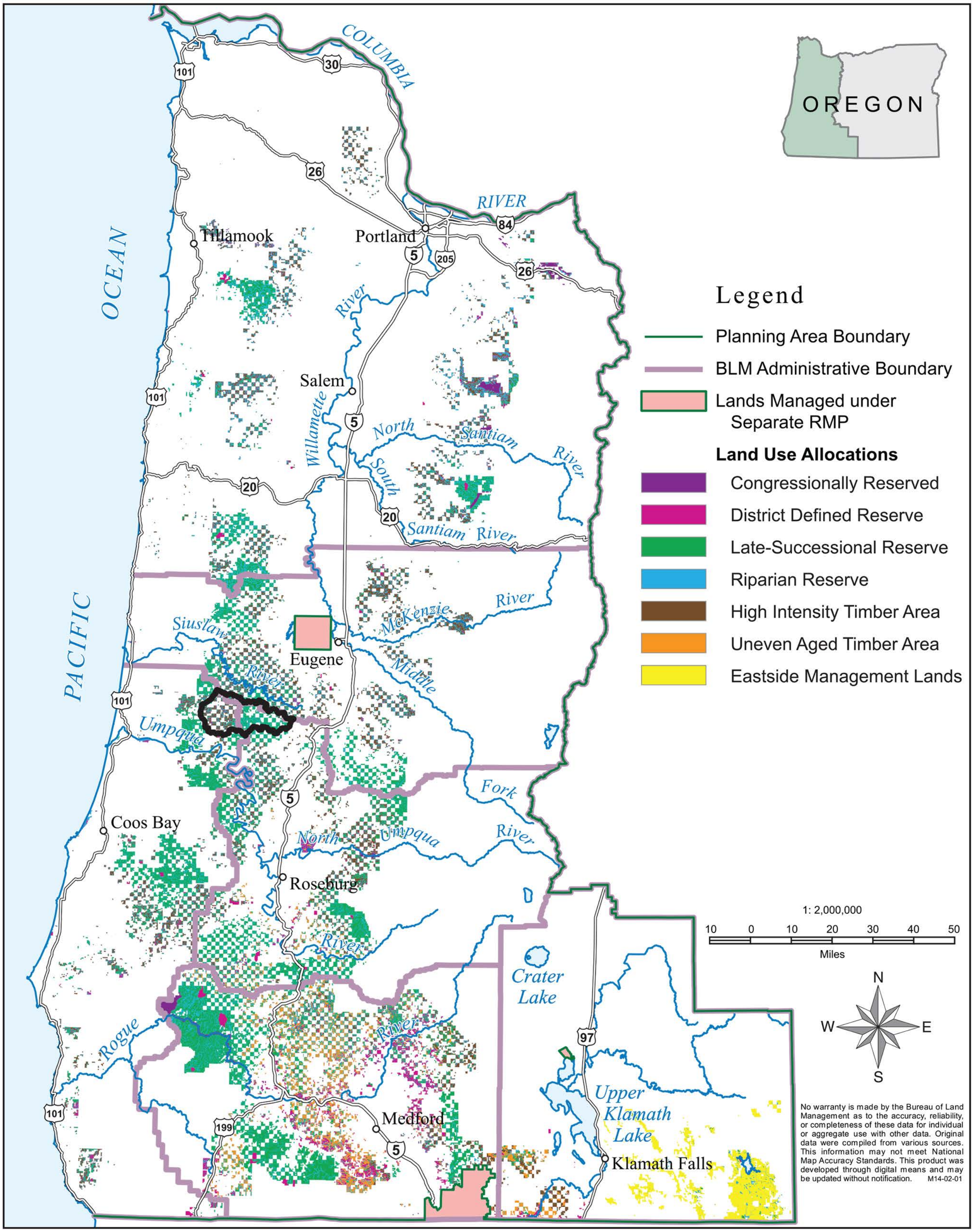


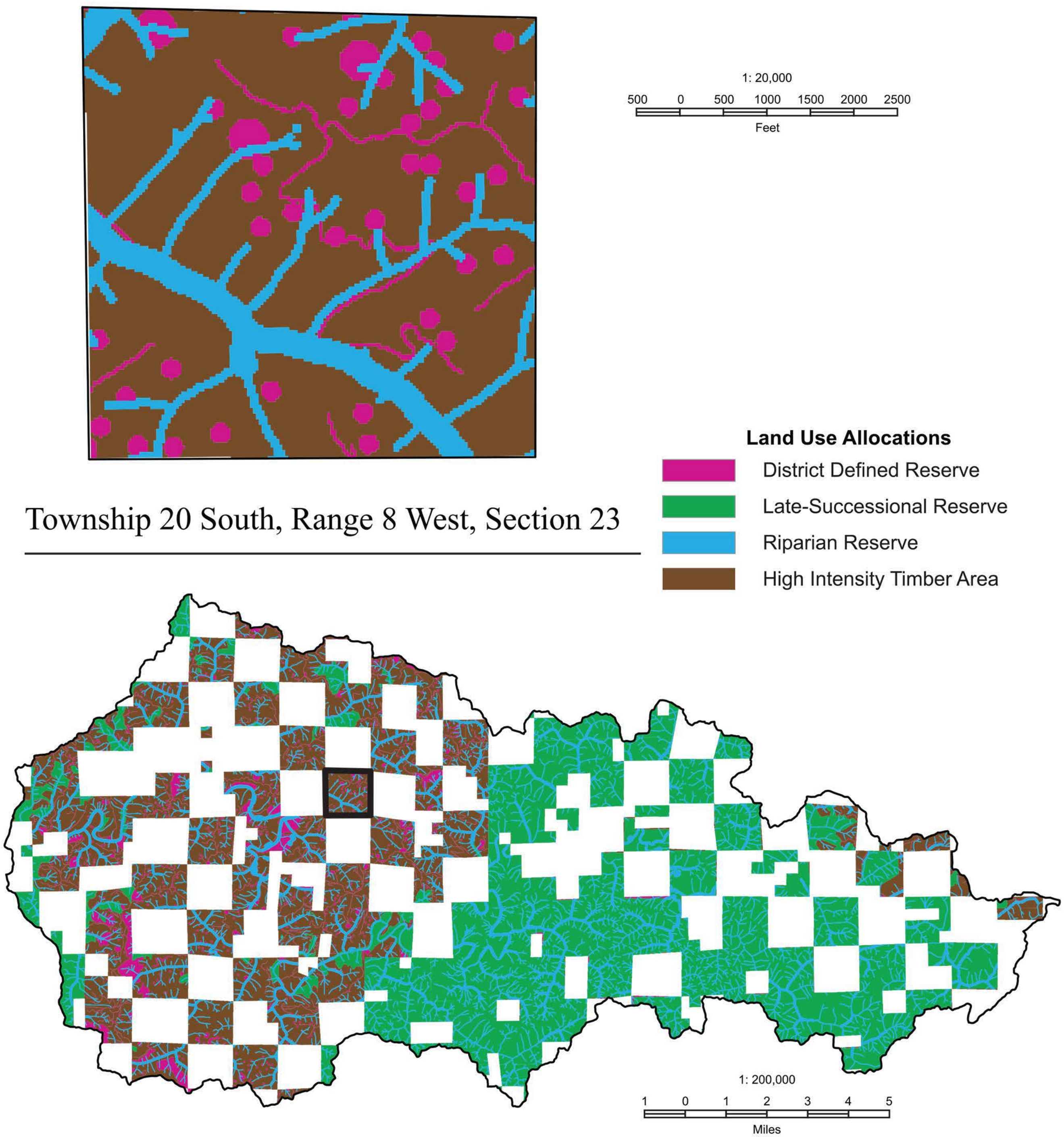
Figure 2-6. Alternative C land use allocations.

Table 2-7. Alternative C land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	949,279	38%	Structurally-Complex Forest	428,522	17%
			Late-Successional Reserve (Moist)	331,224	13%
			Late-Successional Reserve (Dry)	148,776	6%
			Occupied Marbled Murrelet Sites	40,468	2%
			Predicted Marbled Murrelet Sites	2,761	<1%
			Occupied Red Tree Vole Sites	287	<1%
Riparian Reserve	372,739	15%	Riparian Reserve (Moist)	244,694	10%
			Riparian Reserve (Dry)	128,045	5%
Other Reserves	267,678	11%	Congressionally Reserved	40,537	2%
			District Designated Reserves	227,141	9%
Harvest Land Base	741,332	30%	High Intensity Timber Area	553,857	22%
			Uneven-Aged Timber Area	184,715	7%
Eastside Management Area	147,828	6%	-	147,828	6%
			Totals	**2,478,856**	**-**



Map 2-5: Alternative C Land Use Allocations



Township 20 South, Range 8 West, Section 23

Upper Smith River Watershed

Late-Successional Reserve
The Late-Successional Reserve includes, primarily, Structurally-Complex Forest, Large Block Forest Reserves (Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)), and much smaller acreages from existing occupied marbled murrelet sites and existing sites of the North Oregon Coast Distinct Population Segment of the red tree vole. In addition, Alternative C includes requirements for surveys for the marbled murrelet and the North Oregon Coast Distinct Population Segment of the red tree vole, as described below, and newly discovered sites would be included in the Late-Successional Reserve. Thus, this description of the Late-Successional Reserve includes predictions of the acreage of newly discovered marbled murrelet and red tree vole sites. Within the Late-Successional Reserve, the BLM would conduct timber salvage after disturbance to recover economic value, to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Structurally-Complex Forest
Alternative C includes within the Late-Successional Reserve all stands 160-years old and older, based on the current age of stands in the BLM forest operations inventory.

Large Block Forest Reserves: Late-Successional Reserve (Moist) and Late-Successional Reserve (Dry)[18]
Alternative C includes within the Late-Successional Reserve blocks of functional and potential northern spotted owl habitat, sufficient to meet block size and spacing requirements (Thomas *et al.* 1990, pp. 24, 28) in all provinces. In moist forests, the BLM would conduct restoration thinning to promote the development of structurally-complex forest, which may include commercial removal of cut trees. In dry forests, the BLM would conduct restoration activities including thinning and prescribed burning to promote the development of structurally-complex forest and to improve resilience to disturbance, which may include commercial removal of cut trees.

Riparian Reserve
In Alternative C, the Riparian Reserve encompass lands within—

- 150 feet on either side of fish-bearing and perennial streams; and
- 50 feet on either side of non-fish-bearing, intermittent streams.

The Riparian Reserve includes an inner zone in which thinning is not permitted. Inner zone widths are—

- 60 feet on either side of fish-bearing and perennial streams; and
- 50 feet on either side of non-fish-bearing, intermittent streams.

Outside of the inner zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to develop diverse and structurally-complex riparian stands.

Harvest Land Base
The Harvest Land Base is comprised of the High Intensity Timber Area and the Uneven-Aged Timber Area. The allocation of the Uneven-Aged Timber Area in Alternative C is based on very dry forest types identified by potential vegetation. Timber management in the High Intensity Timber Area includes

[18] For the purpose of Late-Successional Reserve and Riparian Reserve management in Alternative C, dry forests are defined by very dry forest types identified by potential vegetation types.

thinning and regeneration harvest with no retention (clear cuts). The High Intensity Timber Area has no snag or coarse woody debris retention requirements.

Wildlife
Within the Harvest Land Base, Alternative C includes—

- No specific protections for northern spotted owl known or historic sites;
- A requirement for surveys for the marbled murrelet prior to management actions in stands 120-years and older and protection of habitat within 300 feet around newly discovered occupied sites;
- No specific management requirements for trees capable of providing marbled murrelet nesting structures in younger stands; and
- No requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions.

Rare Plants and Fungi
The BLM would create new populations and augment existing populations of federally listed and other special status plants and fungi to meet recovery plan or conservation strategy objectives.

Invasive Species
Alternative C includes treatment at all sudden oak death infection sites.

Grazing
The BLM would manage allotments in compliance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). The BLM would adjust grazing levels and management practices when needed to meet or make progress toward meeting the standards for rangeland health. The BLM would make unavailable to grazing those allotments that have generally been vacant or inactive for 5 years or more.

Minerals
Under Alternative C, the BLM would recommend for withdrawal from locatable mineral entry 269,963 acres and would close 246,584 acres to salable mineral development.

Areas of Critical Environmental Concern
Under Alternative C, the BLM would designate 111 Areas of Critical Environmental Concern.

Recreation Management Areas
Alternative C includes designation of Special Recreation Management Areas at currently developed recreation facilities. Alternative C includes designation of Extensive Recreation Management Areas where the BLM has developed and currently manages recreation activities outside of developed facilities, primarily where the BLM has authorized motorized and non-motorized trails, and where the BLM currently manages dispersed recreation activities. In addition, the BLM would designate Special Recreation Management Areas and Extensive Recreation Management Areas to address specific recreation demand and scarcity. In the rest of the decision area, the BLM would not manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands.

Lands with Wilderness Characteristics
Alternative C includes management for wilderness characteristics of lands with wilderness characteristics that are not within the Harvest Land Base and are compatible with existing and potential recreation.

Wild and Scenic Rivers

Under Alternative C, the BLM would recommend for inclusion in the National Wild and Scenic River System those eligible river segments that the BLM found suitable during the BLM's administrative process.

Visual Resource Management

Under Alternative C, the BLM would manage Congressionally Reserved lands where decisions have been made to preserve a natural landscape (e.g., designated Wilderness Areas and the wild sections of Wild and Scenic Rivers) as Visual Resource Management Class I and scenic sections of Wild and Scenic Rivers as Visual Resource Management Class II. The BLM would manage ACECs according to their visual resource inventory class. The BLM would manage all other lands as Visual Resource Management Class IV.

Sub-Alternative C

Sub-alternative C is identical to Alternative C, except that the Late-Successional Reserve includes all stands 80 years old and older, based on the current age of stands in the BLM forest operations inventory. This single change in design increases the Late-Successional Reserve to 55 percent of the decision area and reduces the Harvest Land Base to 20 percent of the decision area (**Figure 2-7**, **Table 2-8**, and **Map 2-6**).

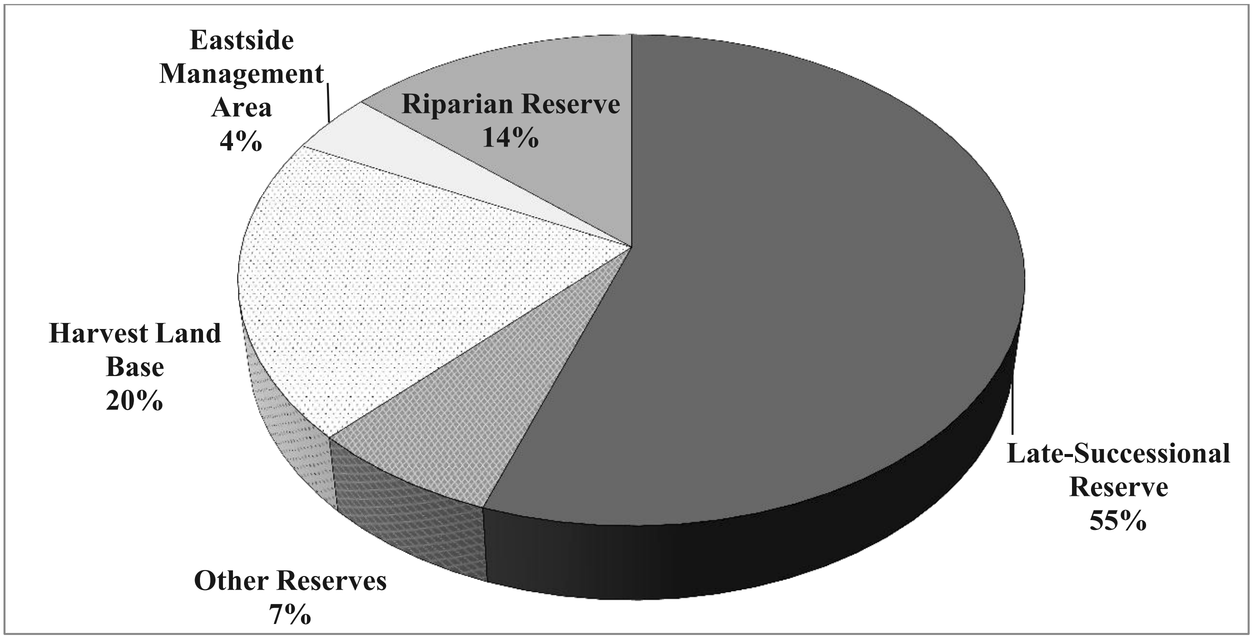


Figure 2-7. Sub-alternative C land use allocations.

Table 2-8. Sub-alternative C land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	1,373,206	55%	Structurally-Complex Forest	1,036,218	42%
			Late-Successional Reserve (Moist)	233,967	9%
			Late-Successional Reserve (Dry)	61,525	2%
			Occupied Marbled Murrelet Sites	40,468	2%
			Predicted Marbled Murrelet Sites	740	<1%
			Occupied Red Tree Vole Sites	287	<1%
Riparian Reserve	337,701	14%	Riparian Reserve (Moist)	253,674	10%
			Riparian Reserve (Dry)	84,026	3%
Other Reserves	172,232	7%	Congressionally Reserved	40,537	2%
			District Designated Reserves	131,694	5%
Harvest Land Base	495,507	2%	High Intensity Timber Area	402,665	16%
			Uneven-Aged Timber Area	92,842	4%
Eastside Management Area	100,210	4%	-	100,210	4%
			Totals	**2,478,856**	**-**

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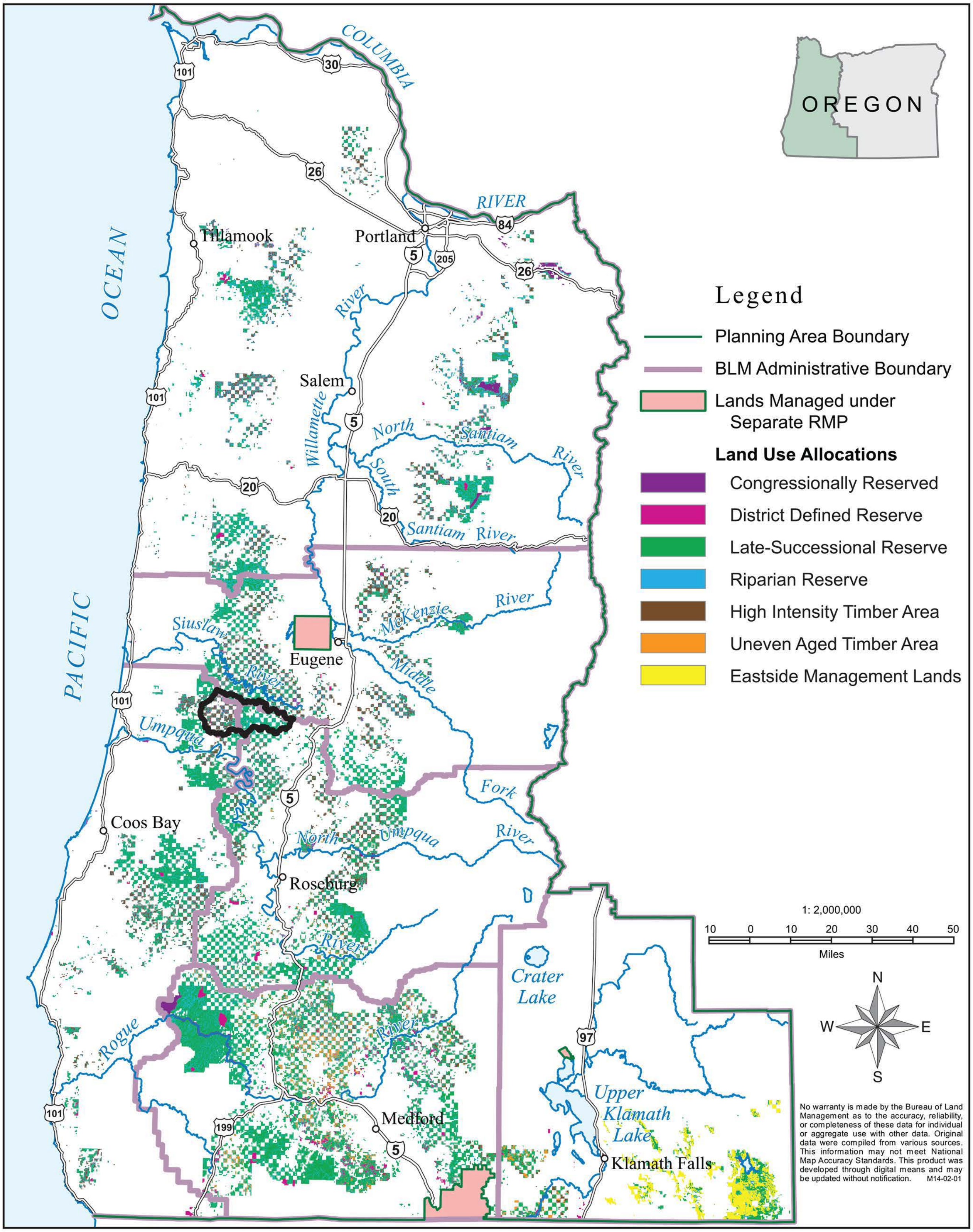
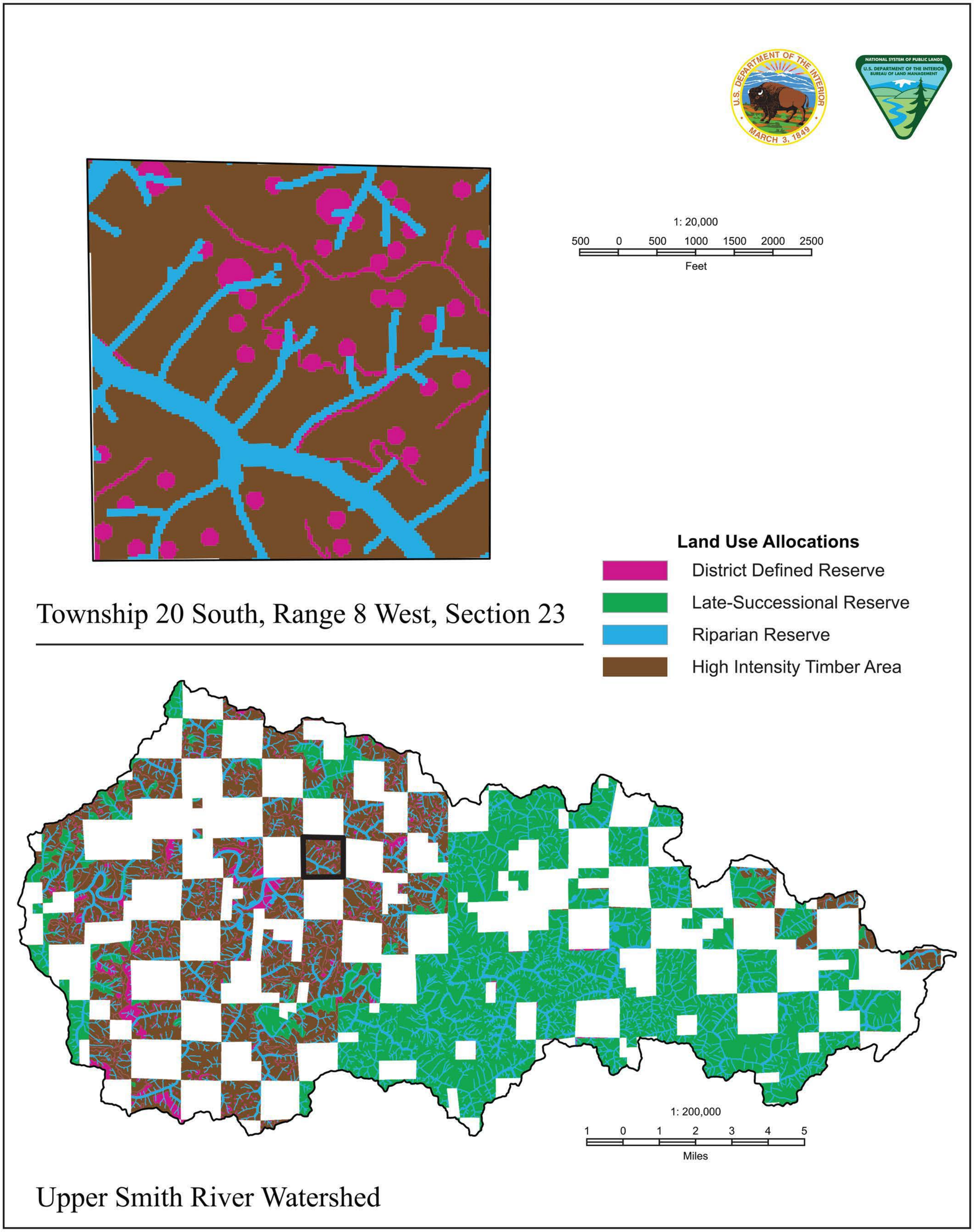


Map 2-6: Sub-Alternative C Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Land Use Allocations
District Defined Reserve
Late-Successional Reserve
Riparian Reserve
High Intensity Timber Area
Township 20 South, Range 8 West, Section 23
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

Alternative D

Alternative D has the smallest Late-Successional Reserve of any of the action alternatives (**Figure 2-8**, **Table 2-9**, and **Map 2-7**). The Harvest Land Base is comprised of the Uneven-Aged Timber Area, Owl Habitat Timber Area, and Moderate Intensity Timber Area. The Owl Habitat Timber Area includes timber harvest applied in a manner that would maintain northern spotted owl habitat. The Moderate Intensity Timber Area includes regeneration harvest with retention. Alternative D has the largest acreage in the Riparian Reserve of all of the action alternatives.

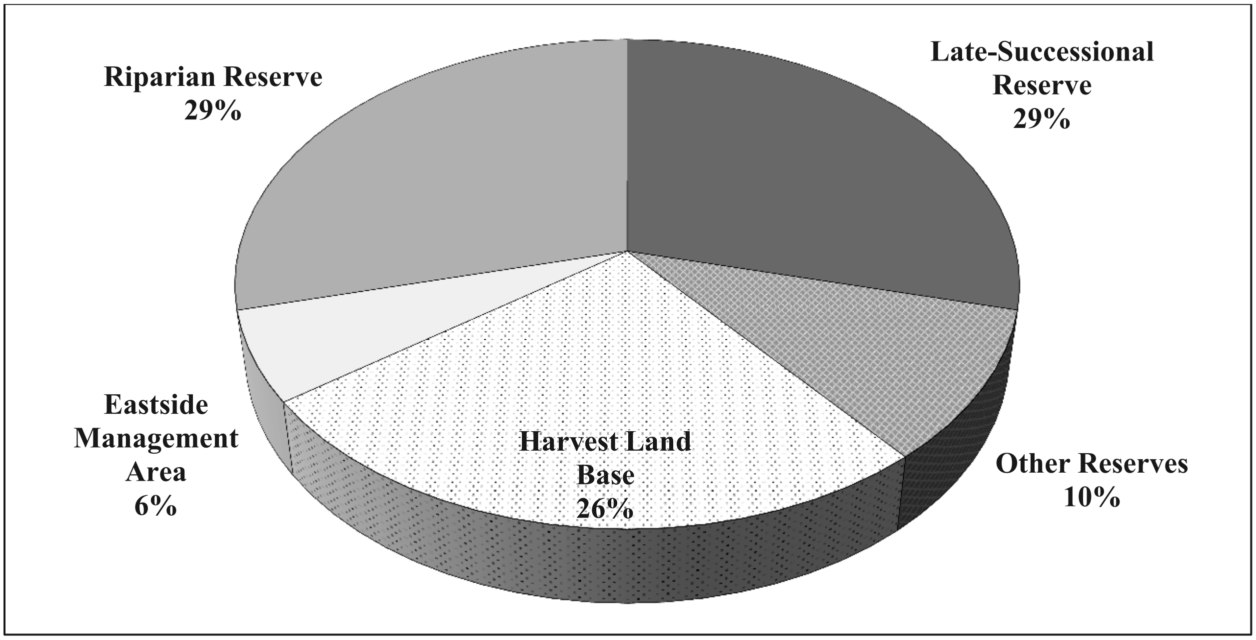
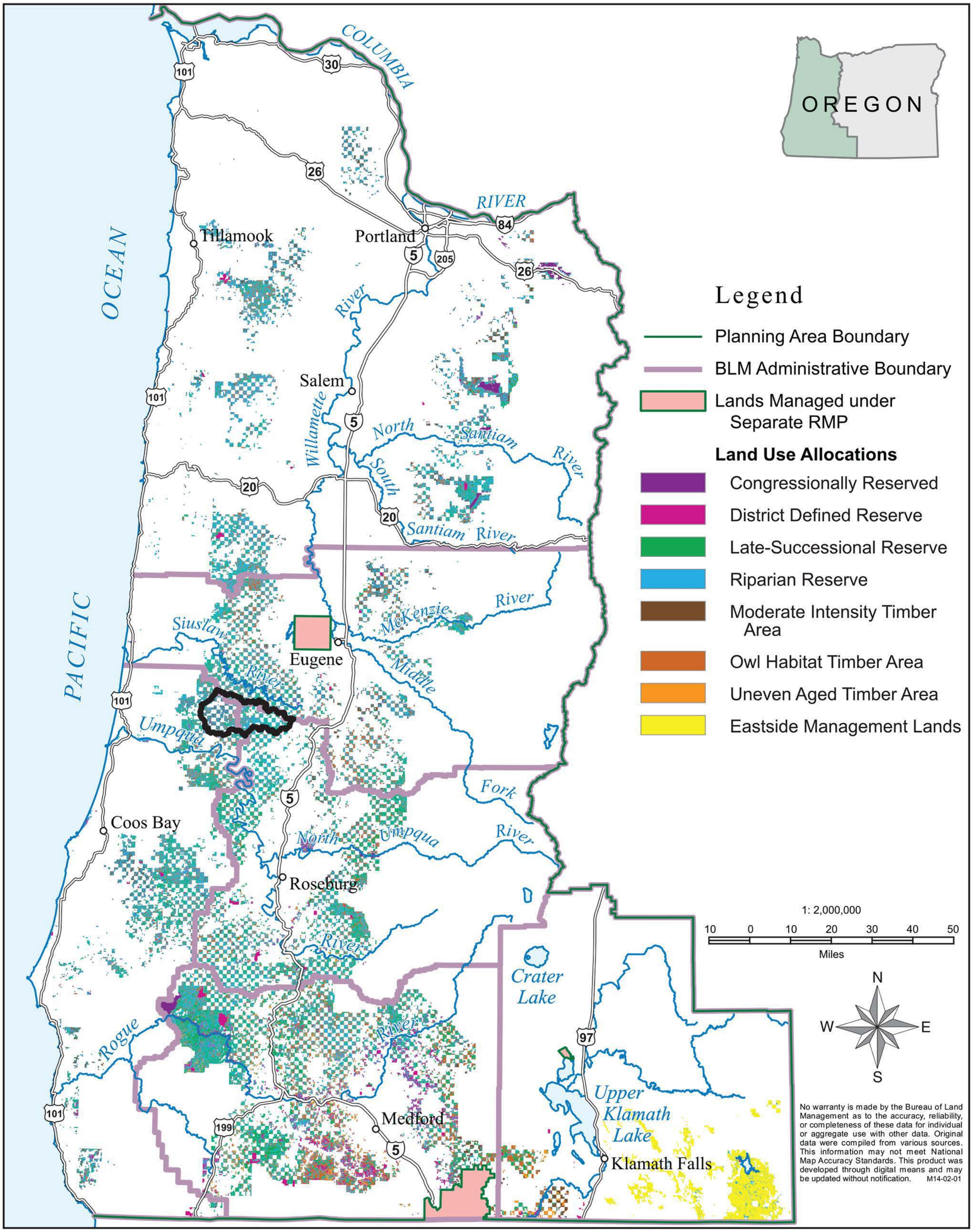


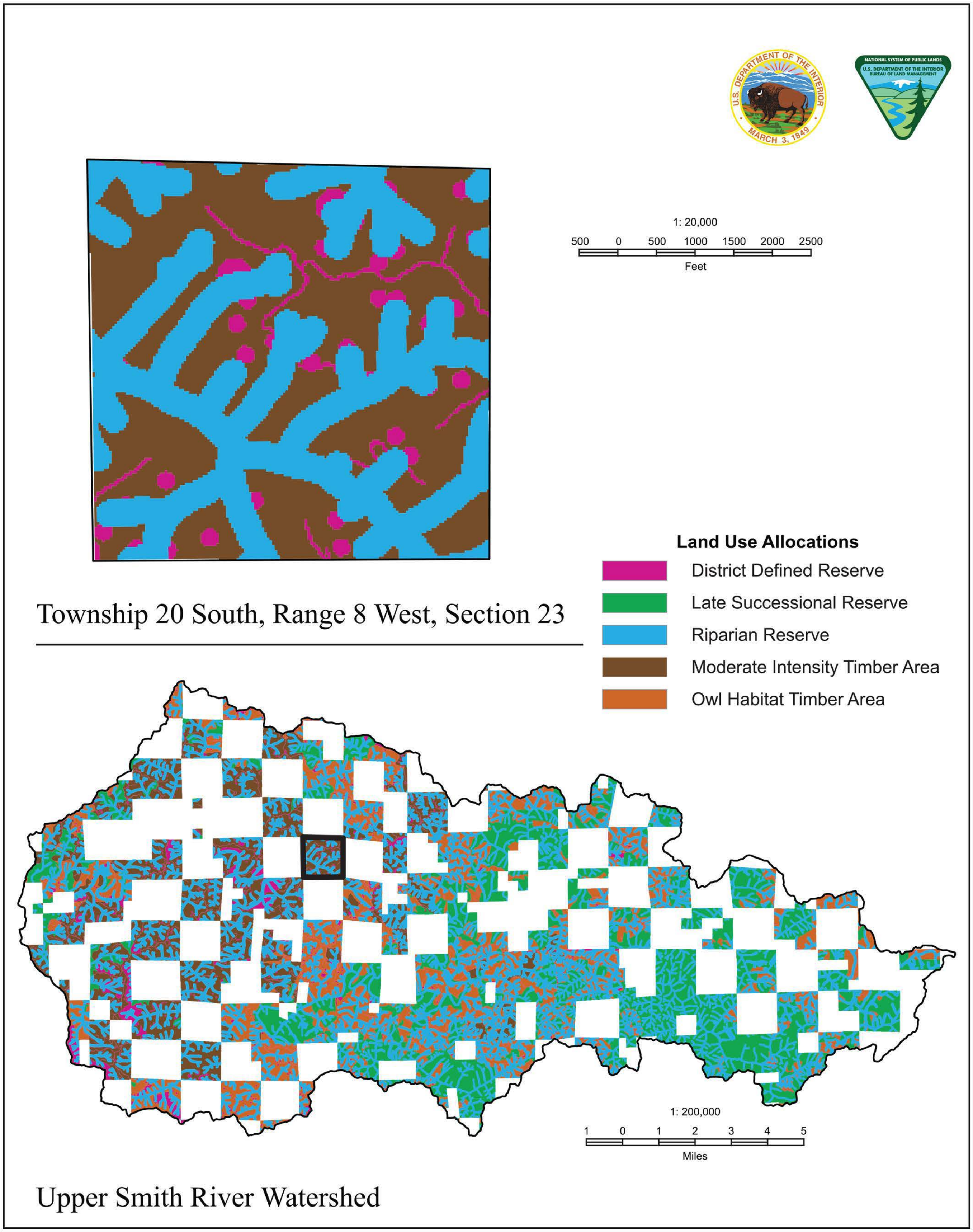
Figure 2-8. Alternative D land use allocations.

Table 2-9. Alternative D land use allocations.

Allocation	Acres	Total Acres (%)	Sub-Allocation	Acres	Total Acres (%)
Late-Successional Reserve	714,292	29%	Structurally-Complex Forest	482,920	19%
			Northern Spotted Owl Sites	96,666	4%
			Occupied Marbled Murrelet Sites	33,037	1%
			Predicted Marbled Murrelet Sites	91,816	4%
			Occupied Red Tree Vole Sites	245	<1%
			Predicted Red Tree Vole Sites	9,608	<1%
Riparian Reserve	714,629	29%	Riparian Reserve (Moist)	459,145	19%
			Riparian Reserve (Dry)	255,484	10%
Other Reserves	250,523	10%	Congressionally Reserved	40,537	2%
			District Designated Reserves	209,986	8%
Harvest Land Base	650,382	26%	Moderate Intensity Timber Area	160,575	6%
			Owl Habitat Timber Area	427,556	17%
			Uneven-Aged Timber Area	62,251	3%
Eastside Management Area	149,030	6%	-	149,030	6%
			Totals	**2,478,856**	**-**



Map 2-7: Alternative D Land Use Allocations


1: 20,000
500 0 500 1000 1500 2000 2500
Feet
Township 20 South, Range 8 West, Section 23
Land Use Allocations
District Defined Reserve
Late Successional Reserve
Riparian Reserve
Moderate Intensity Timber Area
Owl Habitat Timber Area
1: 200,000
1 0 1 2 3 4 5
Miles
Upper Smith River Watershed

Late-Successional Reserve

The Late-Successional Reserve includes, primarily, Structurally-Complex Forest/Large Block Forest Reserves, and much smaller acreages from nest patches of known and historic northern spotted owl sites, existing occupied marbled murrelet sites, and existing sites of the North Oregon Coast Distinct Population Segment of the red tree vole. In addition, Alternative D includes requirements for surveys for the marbled murrelet and the North Oregon Coast Distinct Population Segment of the red tree vole, as described below, and newly discovered sites would be included in the Late-Successional Reserve. Thus, this description of the Late-Successional Reserve includes predictions of the acreage of newly discovered marbled murrelet and red tree vole sites. Within the Late-Successional Reserve, the BLM would conduct no timber salvage after disturbance, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

> **Structurally-Complex Forest/Large Block Forest Reserves**
>
> Alternative D includes within the Late-Successional Reserve all stands 120-years-old and older on high productivity sites, 140 years old and older on moderate productivity sites, and 160-years-old and older on low productivity sites, based on the current age of stands in the BLM forest operations inventory. This structurally-complex forest also constitutes the Large Block Forest Reserves under Alternative D.

Riparian Reserve[19]

In Alternative D, the Riparian Reserve encompasses lands within one site-potential tree height on either side of all streams. The Riparian Reserve includes a no-thin inner zone of 120 feet on either side of all streams. Outside of the inner zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to ensure that stands are able to provide stable wood to the stream.

Harvest Land Base

The Harvest Land Base is comprised of the Owl Habitat Timber Area, Uneven-Aged Timber Area, and Moderate Intensity Timber Area. Alternative D includes the Owl Habitat Timber Area in all designated northern spotted owl critical habitat and within the home ranges of known and historic owl sites within the Harvest Land Base (though the nest patches themselves are included in the Late-Successional Reserve). Timber harvest in the Owl Habitat Timber Area includes thinning and uneven-aged timber harvest applied in a manner that would maintain northern spotted owl habitat. The portion of the Harvest Land Base outside of designated northern spotted owl critical habitat is divided between the Uneven-aged Timber Area and the Moderate Intensity Timber Area. The allocation of the Uneven-Aged Timber Area in Alternative D is based on very dry forest types identified by potential vegetation. The remainder of the Harvest Land Base in Alternative D is in the Moderate Intensity Timber Area. Timber harvest in the Moderate Intensity Timber Area includes thinning and regeneration harvest with retention of 5 to 15 percent of the stand.

Wildlife

Within the Harvest Land Base, Alternative D includes—

- Specific protections to maintain habitat within the home ranges of all northern spotted owl known and historic sites;
- A requirement for surveys for the marbled murrelet prior to management actions in marbled murrelet Zones 1 and 2 and protection of habitat within ½ mile around newly discovered occupied sites;

[19] For the purpose of Riparian Reserve management in Alternative D, dry forests are defined by very dry forest types identified by potential vegetation types.

- Protection of trees capable of providing marbled murrelet nesting structures in younger stands in marbled murrelet Zones 1 and 2; and
- A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions and protection of habitat areas around newly discovered nest sites

Rare Plants and Fungi
Under Alternative D, the BLM would protect known Bureau sensitive species sites from adverse impacts where protection does not conflict with sustained-yield forest management in the Harvest Land Base

Invasive Species
Alternative D includes treatment at all sudden oak death infection sites.

Grazing
Under Alternative D, the BLM would eliminate livestock grazing by terminating existing grazing authorizations and making the allotments unavailable for grazing.

Minerals
Under Alternative D, the BLM would recommend for withdrawal from locatable mineral entry 307,308 acres and would close 239,618 acres to salable mineral development.

Areas of Critical Environmental Concern
Under Alternative D, the BLM would designate 118 Areas of Critical Environmental Concern.

Recreation Management Areas
Alternative D includes designation of Special Recreation Management Areas where the BLM recognizes recreation opportunities and setting characteristics for their unique value, importance, and distinctiveness on public domain lands and acquired lands and on O&C lands not available for sustained-yield timber production ("The O&C Act and the FLPMA" in Chapter 1). Alternative D would include designation of Extensive Recreation Management Areas on all lands within the decision area where existing recreation use is occurring and the BLM has legal public access. In addition, Alternative D would include designation of Special and Extensive Recreation Management areas where the BLM is seeking to address activity-specific demand and to increase travel and tourism opportunities.

Lands with Wilderness Characteristics
Alternative D would not include the management for wilderness characteristics of any lands with wilderness characteristics.

Wild and Scenic Rivers
Under Alternative D, the BLM would recommend all eligible river segments for inclusion in the National Wild and Scenic River System.

Visual Resource Management
Under Alternative D, the BLM would manage Congressionally Reserved lands where decisions have been made to preserve a natural landscape (e.g., designated Wilderness Areas and the wild sections of Wild and Scenic Rivers) as Visual Resource Management Class I and scenic sections of Wild and Scenic Rivers as Visual Resource Management Class II. The BLM would manage ACECs according to their visual resource inventory class. The BLM would manage all other lands according to their visual resource inventory class, except that in the Harvest Land Base, lands inventoried as Visual Resource Inventory Class II would be managed as Visual Resource Management Class III.

Preferred Alternative

Consistent with the BLM planning regulations (43 CFR 1610.4-7) and as part of the BLM's commitment to an open and transparent planning process, the BLM is identifying Alternative B as its preferred alternative at the Draft RMP/EIS stage. In identifying the BLM preferred alternative, the BLM evaluated how well each of the alternatives in the Draft RMP/EIS would respond to the purpose and need for action and the guidance for the formulation of alternatives, as well as the effects of each of the alternatives relevant to the issues identified for detailed analysis. In this evaluation, the cooperating agencies provided feedback that the BLM considered in identifying the preferred alternative.

The identification of the preferred alternative does not constitute a commitment or decision. Nor does it mean that the BLM will necessarily present the preferred alternative as the Proposed RMP in the Proposed RMP/Final EIS. Instead, the BLM is simply identifying that Alternative B provides the most useful starting point from which to construct a Proposed RMP based on the analysis in this Draft RMP/EIS.

The BLM has identified Alternative B as the preferred alternative because the effects analysis demonstrates that it would—

- Create a network of large blocks of northern spotted owl habitat across the landscape;
- Provide active management with designated northern spotted owl critical habitat consistent with the recovery plan for the northern spotted owl;
- Increase marbled murrelet habitat over time;
- Create habitat for species associated with complex early-successional habitat;
- Speed the redevelopment of structurally-complex forest conditions after regeneration harvest;
- Protect the river values associated with the six river segments that the BLM has identified as meeting the Wild and Scenic River suitability requirements;
- Provide more sustained-yield timber harvest than the current Allowable Sale Quantity declared in the 1995 RMPs; and
- Provide more payments to counties from timber harvest on BLM-administered land than the counties would receive at the current Allowable Sale Quantity declared in the 1995 RMPs.

However, Alternative B does not provide the best possible response to the purpose and need for action and the guidance for the formulation of alternatives. Recognizing this, the BLM will seek to develop a Proposed RMP that would also—

- Reduce the risk of adverse effects to listed fish and water quality;
- Increase protection of unique recreation settings and increase recreation use;
- Increase protection of identified lands with wilderness characteristics; and
- Minimize the spread of Sudden Oak Death.

In developing the Proposed RMP, the BLM may therefore make modifications to the design of Alternative B; make modifications to the design of a different alternative analyzed in the Draft RMP/EIS; or develop a new alternative from within the spectrum of alternatives considered in the Draft RMP/EIS. In developing the Proposed RMP, the BLM will also consider public comments on the Draft RMP/EIS and feedback from cooperating agencies.

Alternatives Considered but not Analyzed in Detail

An EIS must rigorously explore and objectively evaluate all reasonable alternatives. The BLM may eliminate from detailed analysis alternatives that are not reasonable. As explained in the BLM NEPA Handbook (USDI BLM 2008, p. 52), an alternative need not be analyzed in detail if–

- It does not meet the purpose and need (see Chapter 1 for the purpose and need);
- It is technically or economically infeasible;
- It is inconsistent with the basic policy objectives for the management of the area (see Chapter 1 for the guidance for the formulation of alternatives);
- Its implementation is remote or speculative;
- It is substantially similar to an alternative being considered in detail; or
- It would have substantially similar effects to an alternative being considered in detail.

The BLM considered the following alternatives but eliminated them from detailed analysis, as explained below.

No Timber Harvest

This alternative would prohibit all timber harvesting on BLM-administered lands. The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need, which includes providing a sustained yield of timber.

This Draft RMP/EIS does make use of a reference analysis of no timber harvest on BLM-administered lands. This reference analysis is not a reasonable alternative. Instead, this Draft RMP/EIS includes discussion of this reference analysis to provide context and a point of comparison as needed to analyze and interpret the effects of the alternatives.

Continuation of the Current Practices

This management approach would seek to continue the varying current practices that the BLM has been implementing since the adoption of the 1995 RMPs. The BLM cannot analyze continuation of the current practices as the No Action alternative. Additionally, the BLM has eliminated from detailed analysis the continuation of the current practices as an action alternative.

As discussed earlier in this chapter, the No Action alternative in this Draft RMP/EIS is implementation of the 1995 RMPs as written (in contrast to using one of the variable years representing how the BLM has been implementing the 1995 RMPs). It is not possible to analyze continuation of the current practices within the decision area as the No Action alternative for two reasons. First, implementation of the timber management program has departed substantially from the outcomes predicted in the 1995 RMPs, and the manner and intensity of this departure has varied substantially over time and among districts (USDI BLM 2012, pp. 6-12). There is no apparent basis on which the BLM might select and project into the future continuation of the practices from a specific year (or set of years) since 1995. Second, continuing to harvest timber at the declared annual productive capacity level for multiple decades into the future would not be possible using the current practices (USDI BLM 2012, pp. 6-12). The No Action alternative provides a benchmark to compare outputs and effects, even though this alternative does not meet the purpose and need of the project. Because of the inherent unsustainability of current practices, the BLM cannot project their implementation into the future; thus, continuation of the current practices would not serve the essential function of the No Action alternative of providing a baseline for comparison of outputs and effects. In contrast, it is possible for the BLM to project the implementation of the 1995 RMPs for multiple decades into the future and provide a baseline for comparison to the action alternatives.

The BLM will not present the implementation of the 1995 RMPs as written and continuation of the current practices as two, separate No Action alternatives. The BLM developed two separate No Action alternatives in a previous planning effort to amend the 1995 RMPs, and the District Court for the Western District of Washington determined this approach was inconsistent with NEPA. The District Court for the Western District of Washington stated that agencies are "… obligated to provide a single, comprehensive no-action alternative that accurately represented the status quo …" *Conservation Nw.* v. *Rey*, 674 F. Supp. 2d 1232, 1251 (W.D. Wash. 2009). The status quo at this time is that the BLM must implement actions in conformance with the 1995 RMPs, consistent with 43 CFR 1610.5-3. Therefore, implementation of the 1995 RMPs as written, amended, and modified by court orders, represents the single No Action alternative for this RMP revision.

The BLM also eliminated continuation of the current practices from detailed analysis as an action alternative, because it would not be a reasonable alternative, in that it would not meet the purpose and need for this planning effort. The purpose and need includes providing a sustained yield of timber, which requires that the management of the forest provide a continuous volume of timber at the current intensity of management without decline. The current implementation practices in the timber program are not sustainable (USDI BLM 2012, pp. 6-12).

Timber harvest practices have varied since the adoption of the 1995 RMPs. Nevertheless, in recent years, all districts have implemented a timber harvest program that has been predominately thinning. The level of regeneration harvest has been substantially less than assumed in the 1995 RMPs for all districts, ranging from 4 percent to 16 percent of the assumed levels during the period from 2004 to 2010 (USDI BLM 2012, p. 7, Appendices 3-8). Thus, a management approach that would limit timber harvest to thinning would approximate the continuation of the practices of the past decade.

The 2008 RMP/EIS analyzed a sub-alternative of Alternative 1 that would limit timber harvest to thinning, which provides an approximation of the effects of continuation of the current practices. That analysis evaluated how long thinning alone could provide at least 90 percent of the annual productive capacity for Alternative 1. That analysis concluded that none of the sustained-yield units could maintain that harvest level for a decade. As concluded in that analysis, "This subalternative demonstrates that high levels of thinning cannot be maintained for extended periods to sustain an allowable sale quantity"[20] (USDI BLM 2007, p. 561). That analysis is incorporated here by reference (USDI BLM 2007, pp. 560-561). The timber harvest level of Alternative 1 would have been higher than the timber volume being produced under current practices. Thus, at the slower pace of harvesting under the current practices, compared to the harvest rates assumed under Alternative 1 in the 2008 RMP/EIS, it could be inferred that thinning might be able to support the current harvest volume for approximately one to two decades. However, during the years since the BLM conducted that analysis, the BLM has continued to harvest predominately with thinning, exhausting much of the thinning opportunities considered in that analysis. As a result, the overall analytical conclusion from the 2008 RMP/EIS that high levels of thinning can only be sustained for less than a decade is still applicable.

This analytical conclusion is consistent with the plan evaluations that the BLM conducted in 2012, which determined that the current timber harvest practices are "not sustainable at the declared ASQ level" due to reliance on predominately thinning (USDI BLM 2012, pp. 10-11).

[20] As noted in Chapter 1, the terms "annual productive capacity," "annual sustained yield capacity," and "allowable sale quantity" are synonymous.

In summary, the BLM cannot analyze continuation of the current practices as the No Action alternative, because the current practices have been variable and are not sustainable, preventing the projection of the current practices into the future. The BLM has eliminated from detailed analysis the continuation of the current practices as an action alternative, because it would not be a reasonable alternative, in that it would not provide for a sustained yield of timber over the long term. The analysis of a thinning only sub-alternative in the 2008 RMP/EIS provides an approximation of the effects of this management approach, concluding that thinning levels can only be sustained for less than a decade.

“Natural Selection Alternative” - Harvest Only Dead and Dying Trees

This alternative would remove only “naturally selected dead and dying trees, conditioned upon meeting the needs of other species.” Timber harvesting of such trees would be accomplished with small equipment from a network of narrow roads. The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need and the basic policy objectives described in the guidance for development of all action alternatives, in that it would not make a substantial and meaningful contribution to providing a sustained yield of timber. As explained in the Purpose and Need for Action in Chapter 1, O&C Act states that “[t]he annual productive capacity for such lands shall be determined and declared …” and that volume of timber “… shall be sold annually.” To limit the harvest of timber to trees that die or are dying would not reflect the annual productive capacity for such lands. Furthermore, the timber volume in dead and dying trees from year to year would be inherently unpredictable and variable, and thus would not support sustained-yield timber production because the annual volume for sale would fluctuate unpredictably based on annual conditions. Therefore, limiting the harvest of timber to trees that die or are dying would not be consistent with the requirements of the O&C Act and would not respond to the purpose for the action.

Maximize Carbon Storage

This alternative would maximize the storage of carbon on BLM-administered lands. This Draft RMP/EIS analyzes the effects of the alternatives on carbon storage. The BLM will consider those effects on carbon storage, as well as the effects on other resources, in the development of the Proposed RMP and the eventual selection of an RMP. However, the BLM has no specific legal or regulatory mandate or policy direction to manage BLM-administered lands for carbon storage, and carbon storage is not part of the purpose and need for action. Therefore, the BLM has not developed alternatives specifically and explicitly intended to maximize carbon storage.

The BLM has various climate-related policies, including the following:

- Executive Order 13514, which directs agencies to measure, manage, and reduce greenhouse gas emissions toward agency-defined targets for agency actions such as vehicle fleet and building management
- Executive Order 13653, which directs agencies to assess climate change related impacts on and risks to the agency's ability to accomplish its missions, operations, and programs and consider the need to improve climate adaptation and resilience
- Secretarial Order 3289, which establishes a Department of the Interior approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts
- Departmental Manual 523 DM 1, which directs the Department of the Interior agencies to integrate climate change adaptation strategies into programs, plans, and operations

These policies address topics related to greenhouse gas emissions and climate change, but none directs the BLM to manage BLM-administered lands specifically for carbon storage. This Draft RMP/EIS is consistent with these policies to the extent they address topics within the scope of this planning effort.

Protect All Nesting, Roosting, and Foraging Habitat for the Northern Spotted Owl

The BLM eliminated this alternative from detailed analysis because it would be substantially similar in design and effects to Sub-alternative C, which would reserve all forests 80 years of age and older. Although an age threshold of 80-years-old does not function as a *de facto* definition of nesting, roosting, and foraging habitat, the majority of forests over 80 years of age provide nesting, roosting, and foraging habitat for the northern spotted owl, and the majority of forests less than 80 years of age do not provide nesting, roosting, and foraging habitat. At the scale of analysis of the decision area, an alternative that would reserve all nesting, roosting, and foraging habitat for the northern spotted owl would not be sufficiently different from Sub-alternative C to warrant separate analysis.

Reserve All Forests 200 Years of Age and Older

The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need and the basic policy objectives described in the guidance for development of all action alternatives, in that it would not make a substantial and meaningful contribution to maintaining older, more structurally-complex multi-layered conifer forest. Forests 200 years of age and older only constitutes about two-thirds of the structurally-complex forest, according to the structural stage descriptions used in this Draft RMP/EIS. This alternative would leave too much older, more structurally-complex multi-layered conifer forest available for timber harvest to constitute a substantial and meaningful contribution to maintaining older, more structurally-complex multi-layered conifer forest.

Do Not Reserve Older, More Structurally-Complex Forest

The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need, which includes contributing to the conservation and recovery of listed species. As the purpose and need explains, contributing to the conservation and recovery of the spotted owl necessarily includes maintaining older and more structurally-complex multi-layered conifer forests. As such, any alternative that does not maintain older, more structurally-complex forest is not a reasonable alternative.

Increase Riparian Reserve Widths

This alternative would include Riparian Reserves that would be wider than the Riparian Reserves in the No Action alternative (i.e., more than two site-potential tree heights on fish-bearing streams and more than one site-potential tree height on non-fish-bearing streams). Such an alternative would be substantially similar to the Riparian Reserves in the No Action alternative, because of its effect on the conservation and recovery of listed fish and the protection of clean water. Based on the results in the interagency Aquatic and Riparian Effectiveness Monitoring Program, which evaluated watershed condition and trend for a fifteen-year period (1994-2008) in the Northwest Forest Plan area, the protections provided, in part, by the Riparian Reserves are improving watershed conditions (Lanigan *et al*. 2012). Additional width of Riparian Reserves would not provide additional protections for fish habitat or water quality. Furthermore, the Riparian Reserves in the No Action alternative were designed to meet an array of objectives, including broad ecological objectives and riparian and terrestrial species habitat. In contrast, the Riparian Reserves in the action alternatives are designed to meet narrower objectives: conservation and recovery of listed fish and protection of clean water, consistent with the purpose and need for action. Because of these narrower objectives, the action alternatives considered in detail do not include widening the Riparian Reserve widths.

2008 BLM RMPs (Western Oregon Plan Revisions)

This alternative would manage BLM-administered lands consistent with the 2008 Records of Decision/RMPs. The U.S. District Court, District of Oregon (*Pacific Rivers Council et al.* v. *Shepard*, 03:11--CV--442--HU, 2012 WL 950032 (D. Or. Mar. 20, 2012)) vacated the 2008 Records of Decision/RMPs on May 16, 2012. The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need and therefore is not a reasonable alternative. Specifically, the 2008 RMPs would not maintain older and more structurally-complex multi-layered conifer forests, because they would only defer the harvest of older forests for 15 years and therefore would not meet the purpose of the action to contribute to the conservation and recovery of listed species.

Oregon Forest Practices Act

This alternative would manage BLM-administered lands with only those protections required by the Oregon Forest Practices Act, such as riparian protections and retention requirements during timber harvest. The BLM eliminated this alternative from detailed analysis because it would not meet the purpose and need for action and therefore is not a reasonable alternative.

In the 2008 RMP/EIS, the BLM used a reference analysis of managing most commercial forest lands for timber production, which considered the effects of managing "… in a manner similar to private industrial lands" (USDI BLM 2008b, p. 484). The 2008 RMP/EIS used this reference analysis to provide context and a point of comparison where needed to analyze the effects of the alternatives, rather than as a reasonable alternative itself. Nevertheless, the information in the 2008 RMP/EIS on the effects of this reference analysis is sufficient to demonstrate that this management approach would not meet the purpose and need for action, in that it would not provide a substantial and meaningful contribution to the conservation and recovery of listed species, including the northern spotted owl, marbled murrelet, and listed fish. It would not meet the purpose and need for action because it would not provide a network of large blocks of forest to be managed for late-successional forests and maintain older and more structurally-complex multi-layered conifer forests and would not maintain marbled murrelet habitat (USDI BLM 2008b, p. 532). It would not meet the purpose and need for action because this management approach or similar management approaches would result in stream temperature increases after timber harvest, increased risk of sediment delivery to streams, and increased susceptibility to peak flows and subsequent adverse effects to fish habitat (USDI BLM 2008b, pp. 755-759; 762-764; 765).

Provide "Not Less Than One-Half Billion Feet Board Measure" of Timber

This alternative would include providing an annual productive capacity of at least 500 million board feet of timber. Several commenters have asserted during the planning process that the O&C Act makes this requirement of the BLM. The O&C Act directs, "The annual productive capacity for such lands shall be determined and declared as promptly as possible after August 28, 1937, but until such determination and declaration are made the average annual cut therefrom shall not exceed one-half billion feet board measure: Provided, That timber from said lands in an amount not less than one-half billion feet board measure, or not less than the annual sustained yield capacity when the same has been determined and declared, shall be sold annually, or so much thereof as can be sold at reasonable prices on a normal market."

The purpose and need for action includes providing a sustained yield of timber but does not specify a target volume of timber. The basic policy objectives described in the guidance for development of all action alternatives stipulate that the alternatives must make a substantial and meaningful contribution to each of the purposes for action to be considered reasonable. The BLM has not specified a quantitative threshold for the amount of timber harvest that would constitute a substantial and meaningful contribution to sustained-yield timber production, and does not accept that "one-half billion feet board measure" (that is, 500 million board feet) is a relevant or appropriate threshold.

Moreover, the BLM does not accept that the O&C Act requires that this RMP provide an annual productive capacity of "not less than one-half billion feet board measure" of timber. The O&C Act requires that the BLM offer for sale annually "… not less than one-half billion feet board measure, <u>or</u> not less than the annual sustained yield capacity when the same has been determined and declared …"(emphasis added). Previous BLM planning efforts, including the 1995 RMPs, determined and declared the annual sustained yield capacity, rendering obsolete the requirement to offer for sale "… not less than one-half billion feet board measure." This RMP revision will likewise determine and declare the annual sustained yield capacity based on the eventual RMP selected, again rendering obsolete the requirement to offer for sale "… not less than one-half billion feet board measure."

Change the O&C Act

This alternative would change or repeal the O&C Act, changing or removing the mandate for the BLM to manage the O&C lands "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principle of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities." Changes to existing laws or repeal of existing laws are not within the authority of the BLM and would be beyond the scope of this action, which is to revise the current RMPs with management objectives, land use allocations, and management direction that best meet the purpose and need. The purpose and need specifically includes providing a sustained yield of timber as required by the O&C Act.

Bills have recently been introduced to Congress that would change or repeal the O&C Act, including H.R. 1526 (O&C Trust, Conservation, and Jobs Act, passed House September 20. 2013) and S. 1784 (Oregon and California Land Grant Act of 2013, introduced December 9, 2013). Neither of these bills has yet become law. If Congress passes and the President signs into law any legislation that would change or repeal the O&C Act, the BLM would reconsider the purpose and need for action in this RMP revision, as appropriate. However, any such changes to the O&C Act or the purpose and need at this time would be speculative.

Comparison of Alternatives

Table 2-10 summarizes key features of the alternatives. This table is not comprehensive and focuses on design features that vary substantially among the alternatives and are easily quantified and summarized. Appendix B provides detailed descriptions of the management objectives and management direction for each action alternative.

Table 2-11 summarizes key effects of the alternatives. This table is not comprehensive and focuses on effects that vary substantially among the alternatives and are easily quantified and summarized. Inclusion or omission of effects from this table does not indicate the importance of the effects to the decision-making process. For example, the table does not include summarization of effects to northern spotted owls, because differences among the effects of alternatives cannot be summarized briefly or quantitatively. Nevertheless, the effects on northern spotted owls are directly related to the purpose for the action and these effects will be relevant in the decision-making process. Chapter 3 provides detailed analysis of the environmental consequences of the alternatives.

Table 2-10. Key features of the alternatives.

Alt.	Total Late-Successional Reserve (Acres)	Protection of Structurally-Complex Forest	Riparian Reserve Total Width	Riparian Reserve Inner Zone Width	Marbled Murrelet Survey and Protection
No Action	478,860	None specified	2 SPTH[21] on fish-bearing streams; 1 SPTH on non-fish-bearing streams	None specified	Survey in Zones 1 and 2; protect contiguous recruitment and existing habitat within ½ mile of sites
Alt. A	1,147,527	≥120 years	1 SPTH on all streams	120’ on fish-bearing and perennial streams; 50’ on non-fish-bearing intermittent streams	None
Alt. B	1,127,320	District-defined map based on existing, district-specific information	1 SPTH on perennial and fish-bearing streams; 100’ on debris-flow-prone non-fish-bearing intermittent streams; 50’ on other non-fish-bearing intermittent streams	60’ on fish-bearing and perennial streams; 50’ on non-fish-bearing intermittent streams	Survey in Zone 1; protect contiguous habitat within 300’ of sites
Sub. B	1,422,933				
Alt. C	949,279	≥160 years	150’ on fish-bearing streams; 50’ on non-fish-bearing streams	60’ on fish-bearing and perennial streams; 50’ on non-fish-bearing intermittent streams	Survey stands >120 years; protect contiguous habitat within 300’ of sites
Sub. C	1,373,206	≥80 years			None
Alt. D	714,292	≥120/140/160 years on high/moderate/low productivity sites	1 SPTH on all streams	120’ on all streams	Survey in Zones 1 and 2; protect habitat within ½ mile of sites

[21] Site-potential tree height

Alt.	Total Harvest Land Base (Acres)	Green tree retention	Areas of Critical Environmental Concern (# Designated)	Recreation Management Areas (SRMA[22] Acres ERMA[23] Acres)	Protection of Lands with Wilderness Characteristics (Acres)	Suitable Wild and Scenic Rivers (# of River Segments)
No Action	691,998	GFMA[24]: 6-8 trees per acre Connectivity/Diversity: 12-18 trees per acre Southern GFMA: 16-25 trees per acre	89 (and 53 potential)	168,968 2,397,460	None	9 (and 51 eligible)
Alt. A	343,900	No retention	119	20,065 0	88,070	0
Alt. B	556,335	Low Intensity Timber Area: 15-30% retention Moderate Intensity Timber Area: 5-15% retention	114	24,972 139,320	50,727	6
Sub. B	298,121					
Alt. C	741,332	No retention	111	59,046 357,771	50,727	6
Sub. C	495,507					
Alt. D	650,382	Owl Habitat Timber Area: maintain owl habitat Moderate Intensity Timber Area: 5-15% retention	118	86,693 580,458	None	59

[22] Special Recreation Management Area
[23] Extensive Recreation Management Area
[24] General Forest Management Area

Table 2-11. Key effects of the alternatives.

Current Conditions	Payments to Counties	Jobs	Allowable Sale Quantity of Timber (MMbf/Year)	Total Timber Volume (MMbf/Year)	Carbon Storage (Teragrams)	Greenhouse Gas Emissions (Megagrams of CO_2e/Year)
Current (2012)	$11.7 million[25]	7,403	203	205[26]	379	192,034
Alternative	**Payments to Counties, Mid-Point of First Decade (2012$/Year)**	**Jobs, Mid-Point of First Decade**	**Allowable Sale Quantity of timber (MMbf/Year)**	**Total Timber Volume, Average of First Decade (MMbf/Year)**	**Carbon Storage in 50 years (Teragrams)**	**Greenhouse Gas Emissions in 10 Years (Megagrams of CO_2e/Year)**
No Action	$46.5 million	10,298	277	400	484	363,864
Alt. A	$ 28.1 million	7,992	234	249	499	358,895
Alt. B	$36.4 million	9,230	234	332	494	418,316
Alt. C	$67.4 million	12,419	486	555	456	498,409
Alt. D	$18.7 million	6,915	176	180	517	265,463
Current Conditions	**High Fire Hazard (Acres)**	**Marbled Murrelet High-Quality Nesting Habitat (Acres)**	**Existing Roads (Miles)**	**Existing Sediment Delivery to Streams (Tons/Year)**	**Potential Wood Supply to Streams (Trees Per Acre >20" DBH)**	**Existing Detrimental Soil Disturbance (Acres)**
Current (2012)	232,686	233,219	14,330	51,988	18.8	139,299
Alternative	**High Fire Hazard in 50 Years (Acres)**	**Marbled Murrelet High-Quality Nesting Habitat in 50 Years (Acres)**	**New Road Construction in 10 Years (Miles)**	**Additional Sediment Delivery to Streams, Average of First Decade (Tons/Year)**	**Potential Wood Supply to Streams in 100 Years (Trees Per Acre >20" DBH)**	**Additional Detrimental Soil Disturbance in 10 Years (Acres)**
No Action	177,492	294,666	950	367	36.3	34,669
Alt. A	137,722	305,620	311	120	39.2	18,138
Alt. B	127,526	308,023	688	267	34.0	35,020
Alt. C	152,941	276,789	806	294	31.5	41,506
Alt. D	126,458	310,055	254	50	39.4	27,476

[25] Payments counties would have received in 2012 if payments had been based on timber receipts instead of Secure Rural Schools payments
[26] Total timber volume offered for sale in 2012

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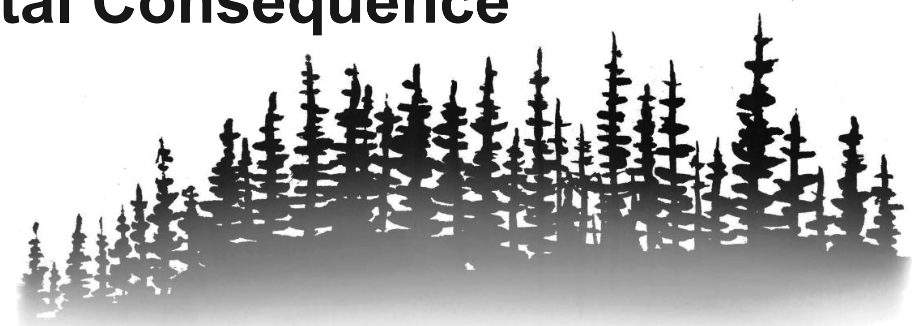
Chapter 3 – Affected Environment and Environmental Consequence



Introduction

This chapter describes the environment that the RMPs are likely to affect and the environmental consequences of the alternatives. Many EISs present the affected environment and environmental consequences in separate chapters. The BLM has combined these two topics into this single chapter to provide all of the relevant information on a resource in a single discussion.

This chapter includes sections on each resource that the RMPs are likely to affect. Each resource section begins with a summary of the methods used to analyze the effects of the alternatives on this resource. Each section includes one or more subsections that address a particular question about how the alternatives would affect the resource (the BLM refers to these questions as "issues"). Under each issue, the BLM describes the status and trends of the pertinent resource and then answers the question by describing the environmental consequences to the resource of the alternatives analyzed in detail, including the No Action alternative.

The Planning Area

The planning area includes approximately 2.5 million acres of Federal surface ownership and an additional 68,600 acres of Federal minerals with private surface ownership in western Oregon managed by the BLM's Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office (**Map 1-1**). Approximately, the entire planning area includes 22 million acres, but only 2.5 million acres, or 11 percent, are Federal lands administered by the BLM.[31] Private landowners own and manage the majority of lands within the planning area (**Figure 3-9).**

[31] As noted in Chapter 1, the BLM uses the term 'planning area' to refer to all lands within the geographic boundary of this planning effort regardless of jurisdiction and uses the term 'decision area' to refer to the lands within the planning area for which the BLM has authority to make land use and management decisions. Within the western Oregon districts, three BLM-administered areas are not included in the decision area: the Cascade Siskiyou National Monument (Medford District), the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District).

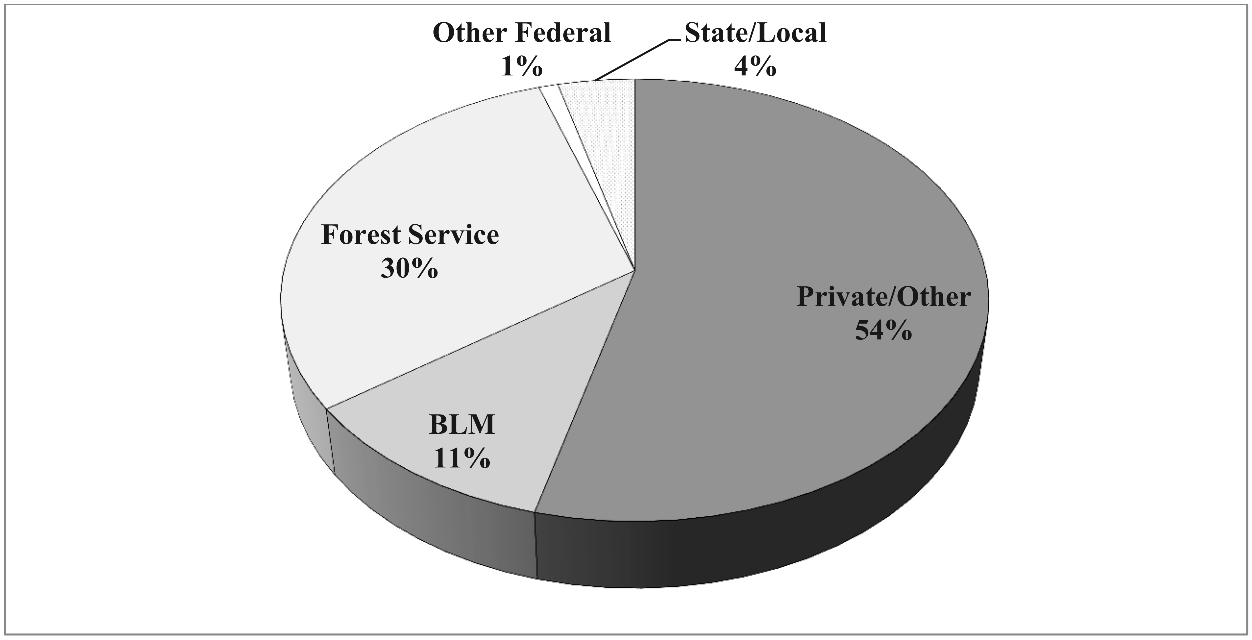


Figure 3-9. Major ownerships within the planning area.

There are five physiographic provinces within the planning area: Coast Range, Willamette Valley, West Cascades, Klamath, and East Cascades (**Figure 3-10**). The physiographic provinces vary in vegetation, hydrology, geology, and other processes (e.g., fire-return intervals) (FEMAT 1993).

Figure 3-10. Physiographic provinces within the planning area as described in FEMAT (1993).

The decision area includes O&C lands, Coos Bay Wagon Road lands, public domain lands, and acquired lands (**Map 1-2, Table 3-12**). The section "Major Authorizing Laws and Regulations" in Chapter 1 provides a description of the differing legal mandates that apply to these lands. The O&C lands are mostly scattered and intermingled with private, industrial forestlands. The O&C land pattern has a checkerboard character that results from the grid of the Public Land Survey System. The O&C lands are generally located in the odd-numbered sections, and the intermingled private lands are in the even-numbered sections. A section in the checkerboard is typically one mile on a side and encloses approximately 640 acres. About half of the public domain lands are scattered and intermingled with O&C lands, and the other half exist as larger blocks in the Salem, Coos Bay, and Lakeview BLM Districts (with the majority being concentrated in the Klamath Falls Field Office of the Lakeview District).

Table 3-12. Land status of the decision area.

Land Status	Acres	Percent of Decision Area
O&C Lands	2,025,826	81.2%
Coos Bay Wagon Road Lands	74,598	3.0%
Public Domain Lands	384,273	15.4%
Acquired Lands	8,958	0.4%
Totals	**2,493,655**	**100%**

Analytical Methodologies and Assumptions

This section describes the overall scope and analytical approach for this Draft RMP/EIS, as well as key analytical assumptions that are common to all analyses. The individual resource sections of this chapter and accompanying appendices include assumptions that are specific to that resource or program. In addition, Section C of the 2013 Planning Criteria for the RMPs for Western Oregon (Planning Criteria), which is incorporated here by reference, includes detailed descriptions of the assumptions that are specific to individual resources or programs (USDI BLM 2013, pp. 27-204). The individual resource sections in this chapter describe any substantial changes that the BLM has made to the methods and assumptions in the Planning Criteria since its publication.

Scope of the Analysis

The Council on Environmental Quality's regulations for implementing NEPA direct that "NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1[b]). Issues are "truly significant to the action in question" if they are necessary to make a reasoned choice between alternatives (i.e., the issue relates to how the alternatives respond to the purpose and need). Issues are also "truly significant to the action in question" if they relate to significant direct, indirect, or cumulative impacts caused by the alternatives. For this analysis, each resource section identifies the issues that are "significant to the action in question" and focuses the analysis on those issues.

The Council on Environmental Quality's regulations for implementing NEPA requires that an EIS disclose both the direct and indirect effects on the quality of the human environment of a proposed action or alternative.

Direct effects are those effects that are caused by the action and occur at the same time and place (40 CFR 1508.8(a)). For the most part, RMPs in and of themselves have minimal direct effects. This is because an RMP is typically implemented only through the approval of future proposed projects and activities consistent with the management direction of the RMP, and because there are numerous steps that must occur before any on-the-ground activities can actually occur. There are exceptions to this, in which an RMP could have direct effects on resources. For example, an RMP may designate an area as open to off-highway vehicle use, and thus the BLM would have no further decision-making before on-the-ground activities and effects on resources could occur. Additionally, an RMP may sometimes include implementation decisions within the RMP Record of Decision.

Indirect effects are those effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8(b)). With few exceptions as described above, the effects of an RMP represent indirect effects. That is, an RMP is designed to guide and control future management actions (43 CFR 1601.0-2), but those actions and their effects are later in time than the RMP Record of Decision. Although the specific timing, size, location, and design of future actions that would occur under each alternative are not certain, the BLM can project a reasonable forecast of future actions consistent with the management direction of the alternatives for the analysis in this Draft RMP/EIS. The section below on vegetation modeling includes more detailed description of this projection of future actions.

Cumulative effects result from the incremental impact of an action when added to past actions, other present actions, and reasonably foreseeable actions (40 CFR 1508.7). Due to the nature of the analysis in this large-scale and long-term planning effort, all environmental effects described in this Draft RMP/EIS would have incremental impacts that would have a cumulative effect together with past actions, other present actions, and reasonably foreseeable actions. Therefore, there is not a discrete and separate section labeled as cumulative effects. The discussion of effects on each resource incorporates the effects of past actions, and describes other present actions and reasonably foreseeable actions to provide context in which the incremental effects are examined, thus revealing the cumulative effects of the alternatives.

As the Council on Environmental Quality points out, in guidance issued on June 24, 2005, the "environmental analysis required under NEPA is forward-looking," and review of past actions is required only "to the extent that this review informs agency decision making regarding the proposed action." Use of information on the effects of past actions may be valuable in two ways according to the Council on Environmental Quality guidance: for consideration of the proposed action's cumulative effects and as a basis for identifying the proposed action's direct and indirect effects.

The Council on Environmental Quality stated in this guidance that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This is because a description of the current state of the environment inherently includes the effects of past actions. The Council on Environmental Quality guidance specifies that the "[Council on Environmental Quality] regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions." The existing baseline information used in this analysis is a result of the aggregation of all past actions. The information on the current conditions is more comprehensive and more accurate for establishing a useful starting point for a cumulative effects analysis than attempting to establish such a starting point by adding up the described effects of individual past actions to some environmental baseline condition in the past, which unlike current conditions can no longer be verified by direct examination.

The second area in which the Council on Environmental Quality guidance states that information on past actions may be useful is in "illuminating or predicting the direct and indirect effects of a proposed action." The basis for predicting the direct and indirect effects of this proposed action and its alternatives is published empirical research, the general accumulated experience of the resource professionals in the agency with similar actions, and using models based on current scientific knowledge regarding relationships of the proposed management directions and effects that are generally accepted by the scientific community in the various specialized fields.

Scoping for this project did not identify any need to list individual past actions nor to analyze, compare, or describe environmental effects of individual past actions in order to complete an analysis that would be useful for illuminating or predicting the effects of the proposed action.

In this Draft RMP/EIS, the BLM incorporated the effects of present actions into the description of the current condition, consistent with Council on Environmental Quality guidance and Department of Interior NEPA regulations at 43 CFR 46.115. For the purpose of this analysis, the BLM assumed that projects implementing the 1995 RMPs for which the BLM had made a decision prior to October 2012 have been implemented. For example, a timber sale sold prior to that date has been displayed and analyzed as harvested, whether or not that harvest has yet been completed. This assumption may overestimate the actual acreage harvested from sold sales, because some sales have not yet been harvested. This analytical assumption does not constitute a decision in principle about the disposition of these sales. The BLM integrated the effects of present actions on other ownerships into the broader analysis of current condition and assumptions about continued management consistent with existing plans or current trends.

For BLM-administered lands, reasonably foreseeable future actions are those actions that would occur as described under the various alternatives. For other ownerships within the planning area, reasonably foreseeable actions are those actions that would occur with the continuation of present management, also from a broad-scale perspective. It would be speculative for the BLM to presume knowledge of site-specific actions that would occur in the future on lands managed by others over the time period analyzed in the Draft RMP/EIS. The BLM based these assumptions about future management on other ownerships on existing plans or current trends, and these assumptions are broad and general in nature. However, the broad assumptions are sufficient to provide context for evaluating the incremental effect of the alternatives.

There are other broad-scale analyses currently underway that the BLM consider as reasonably foreseeable actions for analyzing cumulative effects, including the U.S. Forest Service revision of the Okanagan-Wenatchee Forest Plans and the Jordan Cove Energy and Pacific Connector Pipeline Project.

Revision of the Okanagan-Wenatchee Forest Plans

The U.S. Forest Service is revising the land and resource management plans for the Okanogan-Wenatchee National Forests. The U.S. Forest Service released their Forest Plan Revision proposed actions on June 30, 2011, followed by a 90-day comment period that closed on September 28, 2011. The Proposed Action is the first formal step to developing the draft revised plans. The U.S. Forest Service has not yet released a draft EIS or published an expected timeline for release of a draft EIS. The revisions of these plans are reasonably foreseeable future actions, in that there are formal proposals for these plan revisions. However, it would be speculative of the BLM to project any specific effects related to these plan revisions, given the early stage of the planning process and the undefined timetable for completion of the plan revisions.

Jordan Cove Energy and Pacific Connector Pipeline Project

The Federal Energy Regulatory Commission released the Jordan Cove Energy and Pacific Connector Pipeline Project Draft EIS in November 2014 (FERC 2014). The BLM is a cooperating agency in the preparation of that draft EIS. Jordan Cove Energy Project, L.P. proposes to construct and operate a liquefied natural gas export terminal at Coos Bay, Oregon. Pacific Connector proposes to construct and operate an approximately 232-mile-long, 36-inch diameter underground welded-steel pipeline between interconnections with the existing interstate natural gas systems of Ruby Pipeline LLC and Gas Transmission Northwest LLC near Malin, Oregon, and the Jordan Cove terminal. Implementation of the Pacific Connector pipeline would require a right-of-way grant from the BLM to cross BLM-administered lands. If the Pacific Connector pipeline were to be implemented prior to this RMP revision, implementation would require RMP amendments of the Coos Bay, Roseburg, and Medford District RMPs. If the Pacific Connector pipeline were to be implemented after the completion of this RMP revision, and if the BLM were to adopt any of the action alternatives as described in this Draft RMP/EIS as the eventual RMP, implementation would require RMP amendments as well.

The pipeline would cross portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon, including approximately 40 miles of BLM-administered lands. The construction of the pipeline would affect vegetation and habitat on approximately 800 acres of BLM-administered lands: 61 acres of urban-built-up and transportation-utility lands, less than 0.1 acre of agricultural land, 62 acres of rangeland, 674 acres of forest, 0.8 acre of wetlands, 1 acre of water, and 2 acres of barren lands/quarries. The construction of the pipeline would require the temporary clearing of vegetation within a 95-foot-wide construction right-of-way. During operation of the pipeline, a 30-foot-wide corridor centered on the pipeline would be kept in an herbaceous state, resulting in a permanent loss of forest. Across all ownerships, the construction of the pipeline would result in the clearing of 2,108 acres of forest and the permanent loss of 542 acres of forest. The potential effects of this proposed action on vegetation and habitat are described in more detail in the Jordan Cove Energy and Pacific Connector Pipeline Project Draft EIS, which is incorporated here by reference (FERC 2014, pp. 4-12 – 4-241; 4-369 – 4-546).

No Federal lands would be utilized for the Jordan Cove LNG terminal. Construction of the LNG terminal and associated facilities would affect a total of approximately 397 acres, of which 178 acres are currently industrial land, 111 acres forest land, 76 acres open land (including shrubs and grasslands), and 32 acres of open water. Permanent operation of the facilities would affect approximately 251 acres, of which 68 acres are open land, 76 acres industrial, 76 acres forest, and 32 acres open water. The potential effects of the construction and operation of the Jordan Cove LNG terminal are described in more detail in the Jordan Cove Energy and Pacific Connector Pipeline Project Draft EIS, which is incorporated here by reference (FERC 2014, pp. 4-2 – 4-11).

The Jordan Cove Energy and Pacific Connector Pipeline Project is a reasonably foreseeable future action, in that there is a formal proposal for the project. This Draft RMP/EIS addresses the cumulative effects of the Jordan Cove Energy and Pacific Connector Pipeline Project together with the effects of this proposed action in those specific resource sections for which analysis at this scale would provide meaningful information. However, the BLM did not explicitly incorporate potential future effects of the project, such as removal of vegetation and habitat along the proposed pipeline route, into the modeling for this analysis, because the modeling would not be able to detect or parse out any cumulative or synergistic effect due to the small acreage and localized effects of the proposed pipeline project. The vegetation clearing for the proposed pipeline would affect less than 0.1 percent of the BLM-administered lands in the planning area, which represents an exceedingly small portion of the decision area as a whole. Furthermore, the area that the pipeline would affect would be spread out across the Klamath Falls Field Office, Medford, Roseburg, and Coos Bay Districts, further attenuating the potential effects on vegetation and habitat that could be detected at this scale of analysis. Finally, the vegetation clearing for the proposed pipeline would occur as a narrow feature on the landscape, cutting across forest stands, rather than removing forest stands. Such a small overall acreage, spread out over multiple administrative units, as a narrow feature on the landscape would not reflect any meaningful differences in the vegetation modeling at this scale of analysis and would not have the potential to alter any of the analytical conclusions related to vegetation and habitat in this analysis. If constructed as described in the proposed action, the Jordan Cove Energy and Pacific Connector Pipeline Project would disturb and remove too little acreage of vegetation and habitat and therefore would not generate any relevant information that could be meaningfully included in the vegetation and habitat modeling of approximately 2.5 million acres on BLM-administered lands in this Draft RMP/EIS.

The BLM would address the cumulative effect of BLM implementation actions together with the effects of the Jordan Cove Energy and Pacific Connector Pipeline Project in project-level NEPA analysis, as appropriate. Project-level cumulative effects analysis would include the Jordan Cove Energy and Pacific Connector Pipeline Project if the effects of the Jordan Cove Energy and Pacific Connector Pipeline Project would be within the geographic and temporal scope of the effects of the BLM implementation action and would have a combined effect with the BLM implementation action (see generally USDI BLM 2008, pp. 57-61). The BLM would be better able to address the cumulative effects of the Jordan Cove Energy and Pacific Connector Pipeline Project together with BLM actions in project-level NEPA analysis than in this Draft RMP/EIS, given the small acreage and localized effects of the Jordan Cove Energy and Pacific Connector Pipeline Project.

Irreversible and Irretrievable Commitment of Resources

The Council on Environmental Quality's regulations for implementing NEPA require that an EIS discussion of environmental consequences include "any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented" (40 CFR 1502.16). Irreversible or irretrievable commitments of resources are those that cannot be reversed or that are lost for a long period. Examples include the extraction of minerals or the commitment of land to permanent roads. Although not specifically labeled, adverse environmental effects, the relationship between short-term uses and long-term productivity, and the irreversible and irretrievable commitment of resources are described, by resource, throughout the discussion of environmental consequences in this chapter.

Spatial and Temporal Scales of Analysis

The spatial and temporal scale of analysis varies by resource and by issue. Consistent with the BLM NEPA Handbook, the spatial and temporal scale of analysis should be bounded by the extent and duration of the direct and indirect effects of the proposed action (USDI BLM 2008, p. 58).

For some issues in this Draft RMP/EIS, the spatial scale is broader than the planning area. For other issues, the spatial scale is highly limited because of the nature of the resource and the potential effects of the proposed action on the resource. The individual resource sections of this chapter and accompanying appendices include descriptions of the spatial scales of analysis that are specific to that resource or program.

Specifying the temporal scale of analysis for an RMP/EIS is more challenging than for a discrete, site-specific action. Analysis of the effects of an RMP includes projecting future implementation actions. Because it is not possible to forecast the duration of the RMP itself, it is not possible to determine the duration of the effects of implementing the RMP. Instead, most analyses in this Draft RMP/EIS set the temporal scale of analysis based on a time frame that illuminates differences in the outcomes under the alternatives. For most analyses, this temporal scope extends beyond any reasonable anticipation of RMP implementation, because analysis of effects of different land management on many resources must be extended for many decades to show any discernable differences. Limiting the temporal scope of analysis to the anticipated duration of the RMP, such as one or two decades, would obscure differences in effects among the alternatives and thus fail to provide a clear basis for choice among alternatives. The individual resource sections of this chapter and accompanying appendices include descriptions of the temporal scales of analysis that are specific to that resource or program.

The temporal scope for the determination of the annual productive capacity for sustained-yield timber production for each alternative is somewhat different that for the other analyses, in light of the BLM's mandate for sustained-yield timber production under the O&C Act, as discussed in Chapter 1. The determination of the annual productive capacity for each alternative extends for 200 years, far beyond any reasonable anticipation of RMP implementation. The temporal scope for this determination extends beyond the other analyses to ensure that the BLM could produce the determined annual productive capacity of timber without any decline, even in future decades.

Data Used in this Analysis

The analyses in this Draft RMP/EIS use multiple data sources. Acreage totals for the planning area and the decision area vary based on how the BLM assembles the data to address the specific issue in question. The precise acreage of the planning area depends on what area the BLM includes within the geographic boundary of this planning effort, such as offshore areas within the official BLM district boundaries or areas within the geographic boundaries of separate BLM RMPs, ranging from 22,096,899 acres to 22,928,632 acres. In addition, the differing data sources for BLM-administered lands and other lands complicate combining acreage totals across ownerships. Similarly, the precise acreage of the decision area depends on the data source for defining BLM-administered lands within the planning area, ranging from 2,478,856 acres to 2,493,655 acres. Because of these varying acreages from various data sources, the acreage totals are not precisely the same in all resource sections of this analysis. The individual resource sections of this chapter and accompanying appendices include descriptions of the data sources that are specific to that resource or program.

The data that the BLM used in this analysis is at a far finer resolution than was available for the Northwest Forest Plan and the 1995 RMPs. The data for most of the analyses in this Draft RMP/EIS (such as the vegetation modeling described below) is at a resolution of units of 100 square meters in size, which is more than 1,600 times finer in resolution than the data available for the Northwest Forest Plan. As a result, this analysis can more precisely map resource conditions and accurately include fine-scale features, such as streams and roads, which the BLM could not previously consider. The data summaries in the analyses in the Draft RMP/EIS do not always reflect the precision of the underlying data. In many of the analyses, the BLM rounded acreage numbers to ensure that the precision of analytical results does not exceed the accuracy associated with the analytical assumptions. The BLM only requires sufficient precision of the analytical results to illustrate the comparative effects caused by the alternatives to support reasoned decision-making.

Analytical Assumptions about RMP Implementation

For the purpose of this analysis, the BLM assumed full and immediate implementation of each of the alternatives from the date of the decision. That is, the BLM has modeled and analyzed implementation of actions at the level directed by each alternative from January 2013 forward, as discussed further in the following section. For some alternatives, especially those that differ substantially from the current implementation of the 1995 RMPs, the necessary organization transition may take several years before the BLM would be able to implement a new RMP fully. For example, if the amount of timber harvest under a new RMP were to be substantially higher than the current timber harvest levels, the BLM might need up to five years to reach full implementation of the new RMP, given the time required to plan, prepare, and implement new timber sales. If the amount of timber harvest under a new RMP were to be similar to or lower than the current timber harvest levels, a lengthy transition period would not be required. Due to the speculative nature of this transition period and the widely varying difference in the alternatives from the current implementation of the 1995 RMPs, the BLM does not attempt to account for this transition period in the analysis of effects in the Draft RMP/EIS. If the eventual Proposed RMP differs substantially from the current implementation of the 1995 RMPs, such that the BLM anticipates a lengthy transition period, the BLM will address this transition period in the analysis for the Proposed RMP/Final EIS.

For the purpose of this analysis, the BLM assumed adequate funding and staffing to implement the alternatives as described.

Vegetation Modeling

The BLM used the Woodstock model as part of the Remsoft Spatial Planning System 2012.12.0 to simulate the management and development of the forested BLM-administered lands over time. The alternatives outline a range of approaches for managing BLM-administered lands by varying the land allocations and intensity with which the BLM manages these forests. These different approaches would result in a range of outcomes, habitat characteristics, and timber harvest levels. The Woodstock model simulated the application of management practices and forest development assumptions to characterize the forest in 10-year increments into the future. The Planning Criteria includes a description of the vegetation modeling in detail, including an explanation of why the BLM chose the Woodstock model over other types of models to conduct this analysis, and that discussion is incorporated here by reference (USDI BLM 2014, pp. 28-33). In addition, **Appendix C** provides detailed and technical information on the vegetation modeling.

The BLM mapped lands that would be allocated for sustained-yield timber production and lands that would be allocated to reserve land use allocations under each alternative. For each land use allocation, the BLM described treatments to reflect the management direction for each alternative. Within the Woodstock model, these treatments define the forest management activities that could occur for an individual stand. The BLM used the ORGANON growth model, version 9.1 (http://www.cof.orst.edu/cof/fr/research/organon/) to simulate the growth of stands through time.

The Woodstock model used starting conditions of the forest vegetation, treating January 2013 as analysis year zero. The BLM used information on forest conditions in the Woodstock model from three sources. The first is the Forest Operations Inventory, which contains information on forest stand condition for approximately 69,600 stands. The second source of vegetation information is the Current Vegetation Survey, which is a systematic, permanent plot grid inventory that has installed one plot every 1.7 miles on forested BLM-administered land. The third source is the BLM geographic information system, which contains information describing aspects of the environment that affect where timber harvest could take place. These include the productive capacity of the land, as well as threatened, endangered, and special status plant species locations.

The BLM incorporated into the Woodstock model a scenario for future wildfires in the planning area. **Appendix D** provides a detailed and technical description of the development of the wildfire scenario. To model the locations of these future wildfires, the BLM used the wildfire suitability model developed as part of the 15-year monitoring report for the Northwest Forest Plan (Davis *et al.* 2011). This model was based on the occurrence of large wildfires from 1970-2002, and represents a probability surface for large wildfire occurrence within the northern spotted owl range.

The BLM modelled this future wildfire scenario consistently for all alternatives. It is possible that management actions such as timber harvest and fuels treatments would alter the likelihood or severity of future wildfires and those management actions would vary by alternative. Nevertheless, it is not possible to model different future wildfire scenarios under different alternatives, given the following:

- The inherent challenges in predicting the location and timing of future stochastic events
- The inability at this scale of analysis to forecast the site-specific location and conditions of future management actions
- The uncertainty around the site-specific effects of individual management actions on the likelihood of wildfire occurrence and severity

Although it is possible that the alternatives would differentially affect how future wildfires would occur, such differences are not reasonably foreseeable at this scale of analysis. Therefore, it would be speculative to forecast different future wildfire scenarios under different alternatives. **Appendix D** provides more detailed discussion of the role of forest management actions in modeling the future wildfire scenario.

The BLM also modelled this future wildfire scenario based on past wildfire occurrence and did not incorporate projections of the effects of climate change on future wildfire occurrence and severity. As discussed later in this chapter, there is evidence that the fire season is becoming longer, potential fire severity is increasing in the planning area, and that climate change may be contributing to these trends. However, the inherent challenges in predicting future stochastic events coupled with the uncertainties in climate change predictions make it impossible to forecast specifically when and where future wildfires would occur differently than they have occurred in the recent past. **Appendix D** provides more detailed discussion of the role of climate change predictions in modeling the future wildfire scenario.

The BLM did not incorporate projections of future windstorms, disease outbreaks, or insect infestations into the simulation of the growth of stands through time within the Woodstock model. These disturbances will occur in the future under all alternatives, but predicting their location, timing, severity, and extent would be speculative. Unlike the wildfire suitability model reference above, there are no available theoretical approaches for estimating the location, timing, or severity of future windstorms, disease outbreaks, or insect infestations at the scale of the planning area over the time frame of this analysis.

The BLM did not incorporate projections of climate change into the simulation of the growth of stands through time within the Woodstock model. That is, the BLM modelled the management and development of the forested BLM-administered lands over time assuming that forest stands will continue to grow and respond to treatments in the future the same as they do now. There are substantial uncertainties in predicting how and when climate conditions will change at the regional scale, as discussed in detail later in this chapter. In addition to the uncertainty in climate change predictions, the available climate predictions cannot be downscaled to a meaningful level for use in forest stand growth and harvesting models. To translate these broad regional predictions with substantial uncertainties to projections of how and when specific groups of forest stands would change in their patterns of growth and response to treatment over the next several decades would be so speculative as to be arbitrary. Separate from the vegetation modeling with Woodstock, the BLM did review bioclimatic envelope model projections and evaluate the potential effects and associated uncertainty of projected climate changes on a variety of forest management outcomes for the planning area conducted using the Climate extension of the Forest Vegetation Simulator model. The climate change section in this chapter includes detailed discussions of these specific analytical efforts.

The BLM used the Woodstock model to simulate forest development within the decision area. On other land ownerships within the planning area, the BLM used an estimation of future forest conditions by applying assumptions to the 2006 version of the gradient nearest neighbor (GNN) imputation and Landsat time-series data (Ohmann *et al.* 2012). The BLM estimated future forest conditions on other land ownerships assuming that other landowners would continue to implement their present management.

The BLM did not use the Woodstock model to model vegetation change on the Eastside Management Area land use allocation (i.e., BLM-administered lands in the Klamath Falls Field Office east of Highway 97), because most of these lands are not in a forested condition. These lands do not include any O&C lands and are outside of the range of the northern spotted owl.

Vegetation Modeling Products

For each alternative, the Woodstock model projected development of the forest under the alternatives for many decades into the future. The model tracked the types of forest management treatments over time (short- and long-term), both numerically and spatially. The modeling utilized both numeric and spatially-explicit displays of development of the forest over time.

Within the modeling, the BLM described all land in the decision area as non-forest, woodland, or forested. The non-forested land includes sagebrush, grassland, water and other areas that are not expected to have forests within the time of the analysis. The woodland includes juniper and Oregon white oak plant associations, and other areas that have trees, but the BLM does not expect them to maintain a closed forest canopy.

Forest conditions at the scale of the planning area are discussed in terms of the structural stages of forests. Various interdisciplinary team members in their analysis used this common definition. The structural stage definitions rely heavily on the structural stage definitions that the BLM developed in the 2008 EIS, with one addition. The 2008 analysis divided the forest structure into four classifications (stand establishment, young, mature, and structurally-complex). The forest structure definitions used in this analysis include all of the 2008 definitions, as well as the new category of early-successional.

The BLM defined each of the structural stages for ‘moist’ and ‘dry’ forests. The BLM developed a map that labels all lands in the decision area as either moist or dry. The final groupings have incorporated recommendations from the BLM offices[32], and are similar to, but do not always correspond exactly to mapped plant series, or plant association groupings. In general, the moist forest includes western hemlock, Sitka spruce, Pacific silver fir, Shasta red fir, and tanoak plant associations. The dry forest includes Douglas-fir, Jeffery pine, grand fir, white fir, and ponderosa pine plant associations.

The structural stage definition further differentiates early-successional, stand establishment, and young structural stages by the presence or absence of structural legacies. For the purpose of this definition, a structural legacy is a tree that is 20 inches or larger diameter at breast height and is larger and older than other trees in the stand. The 2008 EIS provides more detailed information on the stand establishment, young, mature, and structurally-complex structural stages and is incorporated here by reference (USDI BLM 2008, pp. 206-211 and Appendix B, pp. 12-15).

The BLM defined the early-successional category to describe forested land that has low canopy cover and younger, shorter trees than the stand establishment stage. The early-successional structural stage has trees that are less than 50 feet tall and less than 30 percent canopy cover. Some combination of shrubs, grasses, and forbs appear visually dominant and are ecologically dominant at the beginning of this stage. The stand establishment structural stage has similar characteristics but has greater than 30 percent canopy cover, such that trees are both visually and ecologically dominant.

The following outline shows the different structural stages that the BLM used in this analysis:

- Non-forest
- Woodland
- Forest
  - Early-successional
    - With Structural Legacies
    - Without Structural Legacies
  - Stand Establishment
    - With Structural Legacies
    - Without Structural Legacies
  - Young High Density
    - With Structural Legacies
    - Without Structural Legacies
  - Young Low Density
    - With Structural Legacies
    - Without Structural Legacies
  - Mature
    - Single Canopy
    - Multiple Canopy
  - Structurally-complex
    - Existing Old Forest

[32] Since there are 5 Districts and 1 Field Office, for the rest of this analysis, these will be referred to as BLM offices or offices.

- Existing Very Old Forest
- Developed Structurally-complex

The BLM used the modeling output from this five-tiered structural stage definition to help assess changes in the forested landscape over time, including evaluating habitat conditions for most wildlife species other than the northern spotted owl.

The modeling also provided species-specific outputs on habitat conditions for the northern spotted owl. The BLM used these outputs in species-specific modeling as inputs for other models to analyze the effects of the alternatives on northern spotted owl habitat and populations, as discussed in detail later in this chapter.

The modeling also provided outputs related to timber production, including calculation of the annual productive capacity for sustained-yield timber production under each alternative. The BLM calculated the annual productive capacity for each of the six sustained yield units, which match the five western Oregon BLM district boundaries and the western portion of the Klamath Falls Field Office in the Lakeview District. The BLM constrained the calculation of the annual productive capacity to the volume of timber that could be produced continuously for 200 years with the management practices described in the alternatives from those lands allocated to the Harvest Land Base. Both the management practices and the lands allocated to the Harvest Land Base would vary among the alternatives, and, consequently, the calculated annual productive capacity varies among the alternatives as well.

The modeling also provided outputs related to timber production from the reserve land use allocations under each alternative. Both the management direction for reserve land use allocations and the lands allocated to the reserve land use allocations would vary among the alternatives, and, consequently, the calculated timber production from the reserve land use allocations varies among the alternatives as well. Unlike the annual productive capacity, this timber production would also vary over time for each alternative, because timber harvest would occur as a by-product of forest management treatments for purposes other than sustained-yield timber production.

The BLM used these modeling outputs related to timber production as inputs for other models to analyze the effects of the alternatives on socio-economic conditions, including employment and earnings, payments to the counties, and implementation costs to the BLM, as discussed in detail later in this chapter.

Analysis of Sub-alternatives

As explained in Chapter 2, sub-alternatives are variations of an action alternative that modify an individual component of the alternative to explore how the changes would alter certain outcomes. In this Draft RMP/EIS, the BLM has developed Sub-alternatives B and C, which are sub-alternatives of Alternative B and Alternative C, respectively. Both of these sub-alternatives vary the design of the Late-Successional Reserve to explore how the changes would modify outcomes for forest management and northern spotted owls. Because these sub-alternatives vary only this component of the alternatives and all other components of the alternative remain unchanged, the analysis of the sub-alternatives in this Draft RMP/EIS only includes the effects on forest management and northern spotted owls.

Reference Analysis

A reference analysis of No Timber Harvest is included in this Draft RMP/EIS. The BLM includes this reference analysis to provide additional information for interpreting the effects of one or more of the alternatives. The No Timber Harvest Reference Analysis is not a reasonable alternative, because it would not meet the purpose and need for action. However, this reference analysis provides information about the biological capabilities of the decision area in the absence of timber harvest and affords a point of comparison in the effects analysis of the alternatives. The discussion of the reference analysis is not comprehensive, as it is not a reasonable alternative. Instead, the BLM described outcomes under the No Timber Harvest Reference Analysis only for those issues for which it is useful in interpreting the effects of one or more of the alternatives.

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Air Quality

Key Points

- All action alternatives are expected to produce more particulate emissions than the No Action alternative and current conditions; however, adherence to the requirements of the Oregon Smoke Management Plan should continue to limit impacts to human health and visibility from prescribed fires.
- Based on the amount of area where active management would occur, Alternative C has the greatest potential to reduce adverse effects to human health and visibility from wildfires over the long-term while the No Action likely would have the least effect.

Issue 1

How will the proposed management actions affect $PM_{2.5}$, PM_{10}, and expected visibility?

Summary of Analytical Methods

The Woodstock model produced estimates of the acres of activity fuels treatments by treatment type (e.g., hand pile burning, machine pile burning, broadcast burning) for each alternative. The team fuels specialist provided pile dimensions, estimates of the number of piles per acre, and the amount of fuel typically consumed in broadcast burns. The fuels specialist provided similar details for the hazardous, or natural, fuels program along with the expected acres of each treatment type for each district. These details were used in Consume 3.0 to estimate particulate emissions. The Planning Criteria provides detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 33-35). Data sources include annual smoke reports from the Oregon Department of Forestry (available at http://www.oregon.gov/odf/pp./fire/smp/smkmgtannualrpts.aspx) and visibility information from the Interagency Monitoring of Protected Visual Environments (IMPROVE) program (available at http://vista.cira.colostate.edu/improve/) for the existing condition. Appendix E contains a more detailed description of the analytical methods used to estimate particulate emissions from prescribed burning and wildfires.

Background

Western Oregon has a history of air quality problems due to the combination of weather patterns and topography. Poor air quality develops when a major polluting activity or event combines with temperature inversions and strong high pressure systems that create stagnant air. The topography of the planning area contains several bowls that trap and concentrate pollutants in valley bottoms, exacerbating the effects of stagnant air. The worst air quality in winter typically occurs due to the combination of a strong and persistent inversion, high vehicle use, and biomass consumption associated with heat or power generation (particulates) (ODEQ 2012). The worst air quality in summer typically occurs due to the combination of strong persistent high pressure and high vehicle use (ozone) or widespread and large wildfires (particulates, ozone). Sources of pollutants may be chronic, such as from a factory or homes heating with wood during the winter, or transient, such as from prescribed burning or wildfires. Pollutants from BLM land management activities or wildfires can exacerbate existing air quality problems.

Smoke from prescribed fire and wildfire produces carbon monoxide, nitrogen oxide compounds, and particulates, along with certain air toxics such as acrolein, benzene, and formaldehyde. The main criteria pollutant of concern for BLM management activities is particulate matter (PM_{10} and $PM_{2.5}$) (ODEQ 2003, 2009, 2012, 2013a); in addition to posing a human health risk due to their small size, particulate matter from wildland fuels are excellent at scattering light, thereby reducing visibility. Carbon monoxide, on the other hand, while a substantial human health risk, dilutes rapidly, making it a hazard to firefighters only. The concentration of air toxics found in smoke are typically very low with regulations focused on industrial and commercial sources, vehicle emissions, and indoor air. Prescribed fire and wildfire do not produce ozone directly, but do produce two additional pollutants, nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are precursors for ground-level ozone under certain conditions.

The Oregon Department of Environmental Quality (ODEQ) Air Quality Division implements the U.S. Environmental Protection Agency's (EPA's) air quality regulations and this division has delegated smoke management responsibilities to the Oregon Department of Forestry (ODF). All prescribed burning in western Oregon is conducted under requirements in the Oregon Smoke Management Plan (http://arcweb.sos.state.or.us/pp./rules/oars_600/oar_629/629_048.html). This plan requires dispersion, dilution, and avoidance techniques to minimize smoke impacts on mandatory Class 1 areas, designated air quality non-attainment and maintenance areas, and smoke sensitive receptor areas. Mandatory Class 1 areas are areas, such as Congressionally-designated wilderness areas, identified under the Clean Air Act as requiring the highest level of protection.[33] Non-attainment and maintenance areas are areas that are either not attaining, or have a history of not attaining, the National Ambient Air Quality Standards. A Smoke Sensitive Receptor Area is an area that has the highest level of protection under the Oregon Smoke Management Plan due to a history of smoke incidents, its' population density, or from a legal protection related to visibility.

Visibility is protected in mandatory Class I areas as required by the Clean Air Act. The goal of the Regional Haze Rule (a part of the Clean Air Act) is to reduce haze in mandatory Class I areas to naturally occurring levels by 2064. Because visibility varies day by day, the rule requires that visibility on the 20 percent worst-case days be reduced to natural background conditions while ensuring no degradation of the 20 percent best-case days. States are to take reasonable measures to make progress towards this goal.

Crater Lake National Park and the Kalmiopsis, Mt. Hood, Three Sisters, Mt. Jefferson, Mt. Washington, Diamond Peak, Gearhart Mountain, and Mountain Lakes wildernesses are mandatory Class 1 areas within the air quality analysis area. Of these areas, visibility monitoring occurs at Crater Lake National Park and the Kalmiopsis, Three Sisters, and Mount Hood wilderness areas. Visibility is measured in deciviews with the lower the number, the better the visibility. The Interagency Monitoring of Protected Visual Environments (IMPROVE) program monitors air quality and visibility at selected mandatory Class 1 areas and has established natural condition deciviews at each monitored site for the clearest and haziest days. The program estimates annual values and trends for the clearest days and haziest days since 2003 (data summaries available at http://views.cira.colostate.edu/fed/AqSummary/VisSummary.aspx?siidse=1).

[33] Mandatory Class 1 Areas. Include 156 National parks, Wilderness Areas, international parks, and other areas identified by Congress in the 1977 amendment to the Clean Air Act. The areas designated include all National parks greater than 6000 acres in size and all designated wilderness areas and National memorial parks greater than 5000 acres in size in existence as of August 1977. The amendment also set a visibility goal for these areas to protect them from future human-caused haze, to eliminate existing human-caused haze, and require reasonable progress toward that goal.

The EPA regulates air quality under the Clean Air Act to protect human health and welfare, with visibility in mandatory Class 1 areas serving as the indicator for human welfare with respect to smoke. EPA has established National Ambient Air Quality Standards (NAAQS)[34] for seven criteria pollutants (**Table 3-13**). The primary standard addresses human health and the secondary standard human welfare.

Table 3-13. Criteria pollutants regulated under the Clean Air Act and the current NAAQ standards for each.

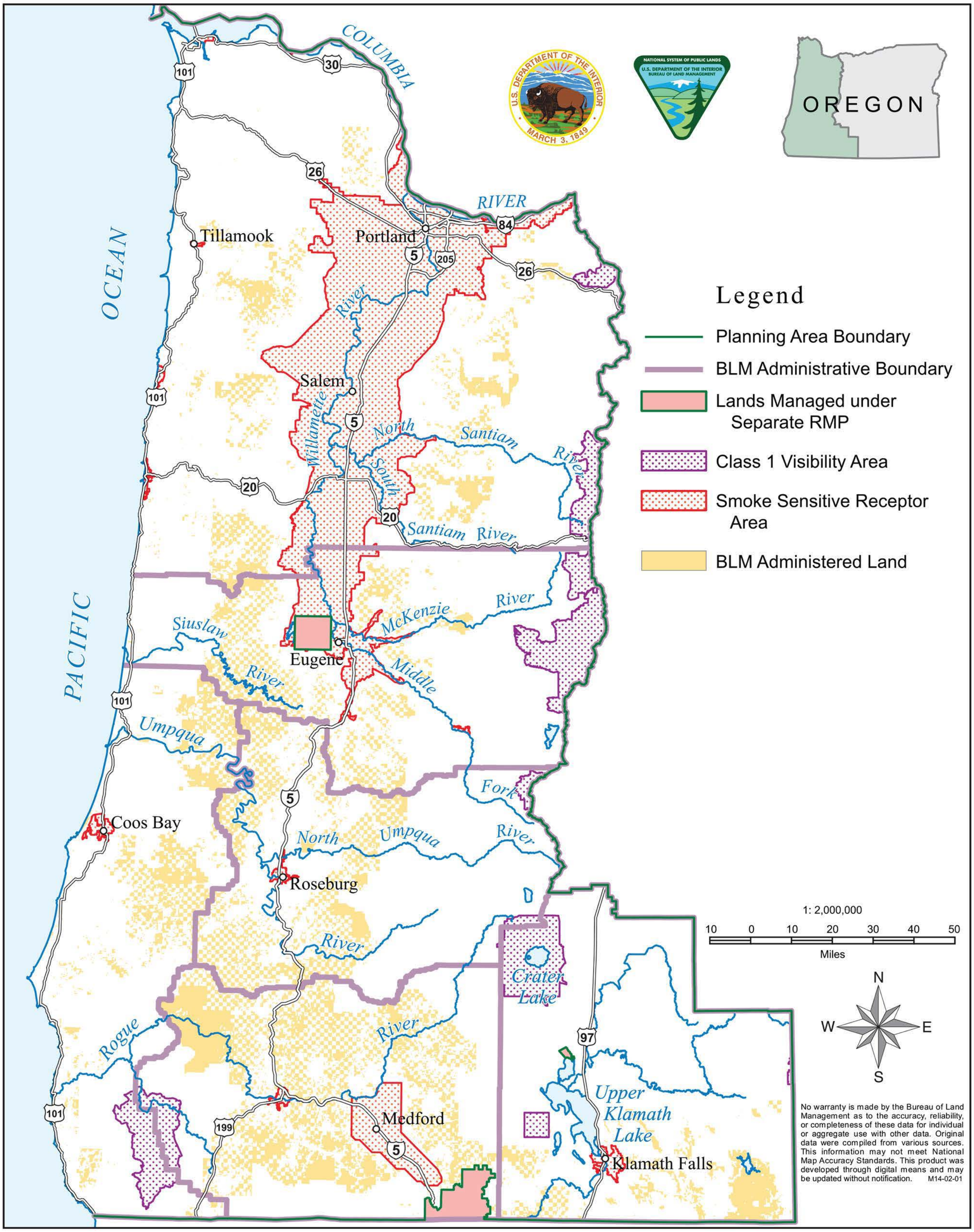
Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead	Primary and Secondary	Rolling 3 month average	0.15 $\mu g/m^3$	Not to be exceeded
Nitrogen Dioxide (NO_2)	Primary	1-hour	100 ppb	98^{th} percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb	Annual mean
Ozone (O_3)	Primary and Secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
$PM_{2.5}$	Primary	Annual	12 $\mu g/m^3$	Annual mean, averaged over 3 years
	Secondary	Annual	15 $\mu g/m^3$	Annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 $\mu g/m^3$	98^{th} percentile, averaged over 3 years
PM_{10}	Primary and Secondary	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	Primary	1-hour	75 ppb	99^{th} percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year.

ppm = parts per million, ppb = parts per billion, µg = micron

Air quality non-attainment areas include Eugene-Springfield and Oakridge for PM_{10}, and Oakridge and Klamath Falls for $PM_{2.5}$. Portland-Vancouver and Salem are air quality maintenance areas for ozone. The Oregon Smoke Management Plan identifies the following Smoke Sensitive Receptor Areas (SSRAs) within the planning area (**Map 3-1**):

- The cities of Carlton, Corvallis, Cottage Grove, Eugene, McMinnville, Portland, Sheridan, Silverton, Springfield, St. Helens, Stayton, Sublimity, Veneta, Willamina, and Yamhill;
- The acknowledged urban growth boundaries of the following cities: Astoria, Coos Bay, Grants Pass, Klamath Falls, Lakeview, Lincoln City, Newport, North Bend, Oakridge, Roseburg, and Tillamook;
- The area within the Bear Creek and Rogue River Valleys described in OAR 629-048-0160, including the cities of Ashland, Central Point, Eagle Point, Jacksonville, Medford, Phoenix, and Talent; and
- The area within the Columbia River Gorge Scenic Area, as described in 16 U.S.C. section 554b (2003).

[34] National Ambient Air Quality Standards- Specific target threshold concentrations and exposure durations of six pollutants based on criteria gauged to protect human health and the welfare of the environment.



Map 3-1: Smoke Sensitive Receptor Areas as Described in the Oregon Smoke Management Plan

BLM must register all prescribed burns on BLM-administered lands within the planning area with ODF. The registration includes the location, the planned date and time of ignition, and the estimated fuel load and consumption. The day before each planned burn, ODF meteorologists evaluate this information along with the forecasted weather for the next day to determine whether smoke from a given burn is likely to enter a SSRA. Meteorologists must not knowingly allow a burn to occur which will cause an intrusion of smoke into an SSRA. Thus, each day these meteorologists create burn instructions for different parts of the forest region to prevent smoke from entering SSRAs. The BLM must follow these instructions.

The air quality index is widely used to report relative daily air quality in a common framework related to potential impacts to human health (**Table 3-14**). Index values range from 0 to 300 and are typically displayed in a color-coded table or graph. The higher the value, the greater the level of air pollution and the greater the human health concerns. The air quality index is based on the combined 24-hour concentrations of $PM_{2.5}$ and O_3. As pollution standards are changed, the formula used to calculate the air quality index is also adjusted in order to maintain the relationship to human health concerns.

Table 3-14. Air Quality Index (AQI) with health advisories.

Air Quality	Air Quality Index	Health Advisory
Good	0-50	No health impacts expected.
Moderate	51-100	Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.
Unhealthy for Sensitive Groups	101-150	People with heart disease, respiratory disease (such as asthma), older adults, and children should reduce prolonged or heavy exertion. Active healthy adults should also limit prolonged outdoor exertion.
Unhealthy	151-200	People with heart disease, respiratory disease (such as asthma), older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy outdoor exertion.
Very Unhealthy (Alert)	201-300	People with heart disease, respiratory disease (such as asthma), older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.

Ozone Maintenance Areas

Prescribed burning produces precursor emissions (e.g., oxides of nitrogen (NO_x) and volatile organic compounds (VOCs)) that under higher temperatures and sunny days produce ground-level ozone. However, BLM prescribed burning activities are projected to be a long distance from the two ozone maintenance areas within the planning area. As a result, effects would be expected to be very low for the precursors of ozone. Local vehicular traffic in Portland, Vancouver, and Salem represents a primary source of air emissions that may lead to the development of ozone. Furthermore, the highest levels of ozone in the maintenance areas occur during summer while the greatest activity for prescribed burning is during spring and fall. Therefore, it is very unlikely that any of the alternatives would have a notable effect on problematic ozone levels in the planning area and are not analyzed for this pollutant.

Conformity

The General Conformity Rule (a part of the Clean Air Act) applies to Federal actions occurring in non-attainment or maintenance areas when the net change in total direct and indirect emissions of non-attainment pollutants (or their precursors) exceeds specific thresholds (known as *di minimis* levels). The intent of the General Conformity requirements is to prevent the air quality impacts of Federal actions from causing or contributing to a violation of the National Ambient Air Quality Standards (EPA 2013) or interfering with the purpose of the State Implementation Plan. This means that under the Clean Air Act, Section 176 and 40 CFR, Part 93, Subpart W, Conformity Rules (available at http://www.epa.gov/air/genconform/), Federal agencies must make a determination that proposed actions in Federal non-attainment areas conform to the applicable EPA-approved State Implementation Plan before an action is taken.

All prescribed burns within western Oregon must comply with the Oregon Smoke Management Plan, which prohibits smoke intrusions into smoke sensitive receptor areas. As a result, the Conformity Rule is not applicable for BLM prescribed burning actions within non-attainment areas since the burning would: 1) not likely cause or contribute to new violations of Federal air quality standards; 2) would not increase the severity of existing violations for Federal and State air quality standards; or 3) would not delay the timely attainment of Federal air quality standards.

Affected Environment

Particulate Matter Emissions

Most broadcast-type prescribed burning (broadcast burning, under-burning, jackpot burning) occurs in spring and fall, when frequent cold fronts and short-wave troughs create atmospheric instability during the day. This instability promotes air mixing and transport of pollutants away from SSRAs and air quality non-attainment and maintenance areas. Most pile burning (hand piles, machine piles, landings) occurs in fall and winter, when the atmosphere is typically more stable, with a higher potential to affect air quality adversely for relatively short periods.

Large wildfires contribute to air quality issues over large areas and for prolonged periods. During 2002, wildfires resulted in 14 daily $PM_{2.5}$ exceedences in Klamath Falls and one in Medford (ODEQ 2003); at that time the daily $PM_{2.5}$ standard was 65 $\mu g/m^3$ (it has since been lowered) . Elevated particulate levels were reported between late July and the end of August at Bend, Brookings, Cave Junction, Grants Pass, Klamath Falls, and Medford (ODEQ 2003). Similar issues developed in 2008 from extensive wildfires burning in northern California; smoke from those fires reached as far north as Portland (ODEQ 2009).

ODF began estimating $PM_{2.5}$ emissions from wildfires as part of their annual smoke management reports beginning in 2002, although only a statewide accounting is available. Estimated wildfire $PM_{2.5}$ emissions commonly exceed 1000 tons per year and exceeded 6000 tons per year in 2006, 2007, and 2012. The 2012 fire season resulted in the highest estimated $PM_{2.5}$ emissions from wildfire at nearly 12,000 tons. However, most of these emissions were from the large rangeland wildfires in southeastern Oregon. Data for the 2013 fire season were not available; however, there were several large wildfires in southwestern Oregon in 2013 that likely contributed a significant amount of particulate pollution, and potentially created problematic surface ozone concentrations as well.

Based on ODF annual reports of tons consumed by prescribed burning in the Other Federal category from 1995 through 2012, actual emissions have averaged 840 tons (range 376 – 1,538 tons) of PM_{10} and 753 tons (range 337 – 1,378 tons) of $PM_{2.5}$ per year, primarily from hazardous fuels reduction treatments in southwest Oregon and slash disposal following forest management operations (**Figure 3-11**). These estimated emissions account for approximately 7.5 percent of total PM_{10} and $PM_{2.5}$ emissions from prescribed burning in western Oregon. The Other Federal category consists mostly of burning by BLM with only minor contributions from the National Park Service and U.S. Fish and Wildlife Service.

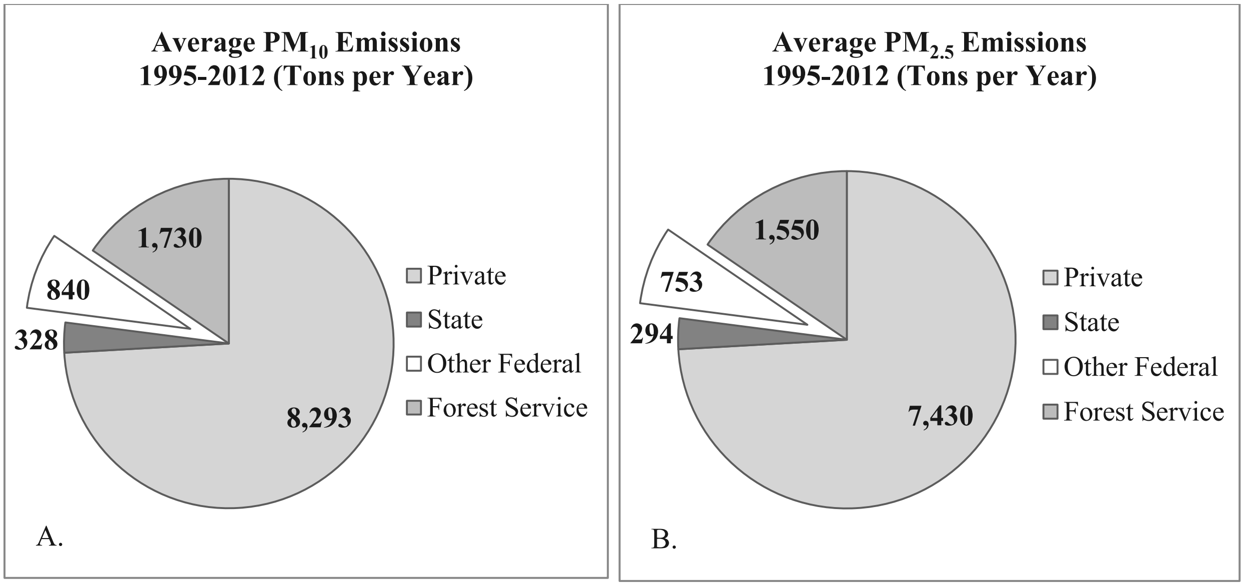


Figure 3-11. Estimated emissions from prescribed burning in western Oregon for A.) particulate matter 10 microns in size and smaller, and B.) particulate matter 2.5 microns in size and smaller.
BLM prescribed burning comprises most of the Other Federal category.

The Oregon Department of Environmental Quality (ODEQ) (2013a) reports that trends have been downward for most pollutants in most areas except for daily $PM_{2.5}$ in Klamath Falls and Oakridge. Both Klamath Falls and Oakridge have exceeded the daily $PM_{2.5}$ standard of 35 $\mu g/m^3$ nearly every year since 2006, when the standard was lowered to that level. Residential home heating in winter is associated with most exceedences of the $PM_{2.5}$ standard with summer wildfires a secondary factor. The EPA (2013) lowered the primary annual $PM_{2.5}$ standard to 12 $\mu g/m^3$, effective 18 March 2013. Whether this change will result in any areas designated as non-attainment for the annual $PM_{2.5}$ standard will not be known until 2015 at the earliest. The daily $PM_{2.5}$ standard remains unchanged.

Despite the best efforts of both ODF smoke forecasters and BLM personnel, intrusions into smoke sensitive receptor areas can and do occur. The occurrence of intrusions is not related to the number of acres burned in any given year (**Figure 3-12**), but, according to an evaluation of six smoke intrusion reports for 2008 and 2012, is most commonly a result of an unexpected shift in wind direction from the forecasted direction. Many of these shifts likely resulted from localized meteorological patterns, which could not be resolved with coarse-scale weather forecast models.

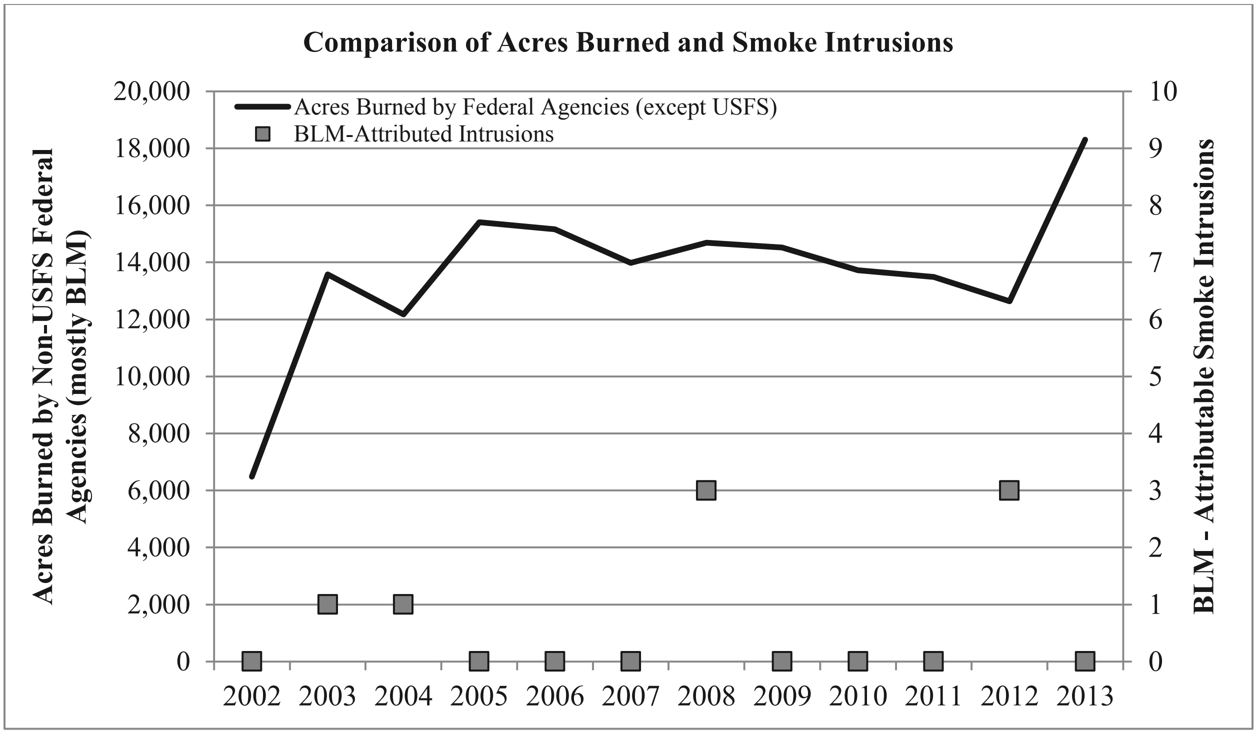


Figure 3-12. Number of smoke intrusions attributed to BLM prescribed fires into sensitive receptor areas compared to annual acres burned from 2002 through 2013 in western Oregon.
Nearly all intrusions were in southwest Oregon. Sources: ODF annual smoke reports 2002-2013, available at http://www.oregon.gov/odf/pages/fire/smp/smkmgtannualrpts.aspx.

Visibility and Air Quality

Of the four monitored mandatory Class 1 areas within or adjacent to the planning area, none meet the natural background conditions for haze for either the clearest or the haziest days, although Crater Lake National Park and Mount Hood Wilderness come the closest for the clearest days (**Table 3-15**). Visibility is generally improving at Crater Lake National Park and the Mount Hood and Kalmiopsis wildernesses, although not all trends are significant. Visibility at Three Sisters Wilderness is slowly degrading, although the trend is not significant yet.

Table 3-15. Visibility conditions and trends at four mandatory Class 1 areas within or adjacent to the planning area from 2003 through 2012. The main contributors to the haziest days are organic carbon and ammonium sulfate.

Parameter	Crater Lake National Park	Kalmiopsis Wilderness	Mount Hood Wilderness	Three Sisters Wilderness
Natural condition: clearest days	246 miles (0 deciviews)	~161 miles (~4 deciviews)	229 miles (1 deciview)	211 miles (2 deciviews)
Current condition: clearest days	>211 miles (<2 deciviews)	~143 miles (~ 6 deciviews)	211-229 miles (1-2 deciviews)	174-198 miles (2.5-3.5 deciviews)
Trend in clearest days	Significant downward	Non-significant downward	Significant downward	Non-significant upward
Natural condition: haziest days	~112 miles (~8 deciviews)	~90 miles (~9.5 deciviews)	~112 miles (~8 deciviews)	92 miles (9 deciviews)
Current condition: haziest days	40-87 miles (10-18 deciviews)	37-68 miles (13-19 deciviews)	47-81 miles (11-17 deciviews)	37-62 miles (13-18 deciviews)
Trends in haziest days	Non-significant downward	Significant downward	Non-significant downward	Non-significant upward

Source: IMPROVE website: http://vista.cira.colostate.edu/improve/. Accessed 18 November 2014

In 2013, ODEQ evaluated the contribution of prescribed fire to the 20 percent worst-case visibility days in Oregon's Class I areas, concluding that prescribed burning in close proximity to mandatory Class I areas was a significant contributor to the 20 percent worse days (ODEQ 2013b). The Kalmiopsis Wilderness and Crater Lake National Park were particularly affected, especially in October and November (**Figure 3-13**). As a result, ODF revised the Oregon Smoke Management Plan to require that any personnel conducting a prescribed fire within 31 miles (50 km) upwind of these two mandatory Class I areas follow a checklist of procedures designed to keep the main plume out of Crater Lake National Park or the Kalmiopsis Wilderness.

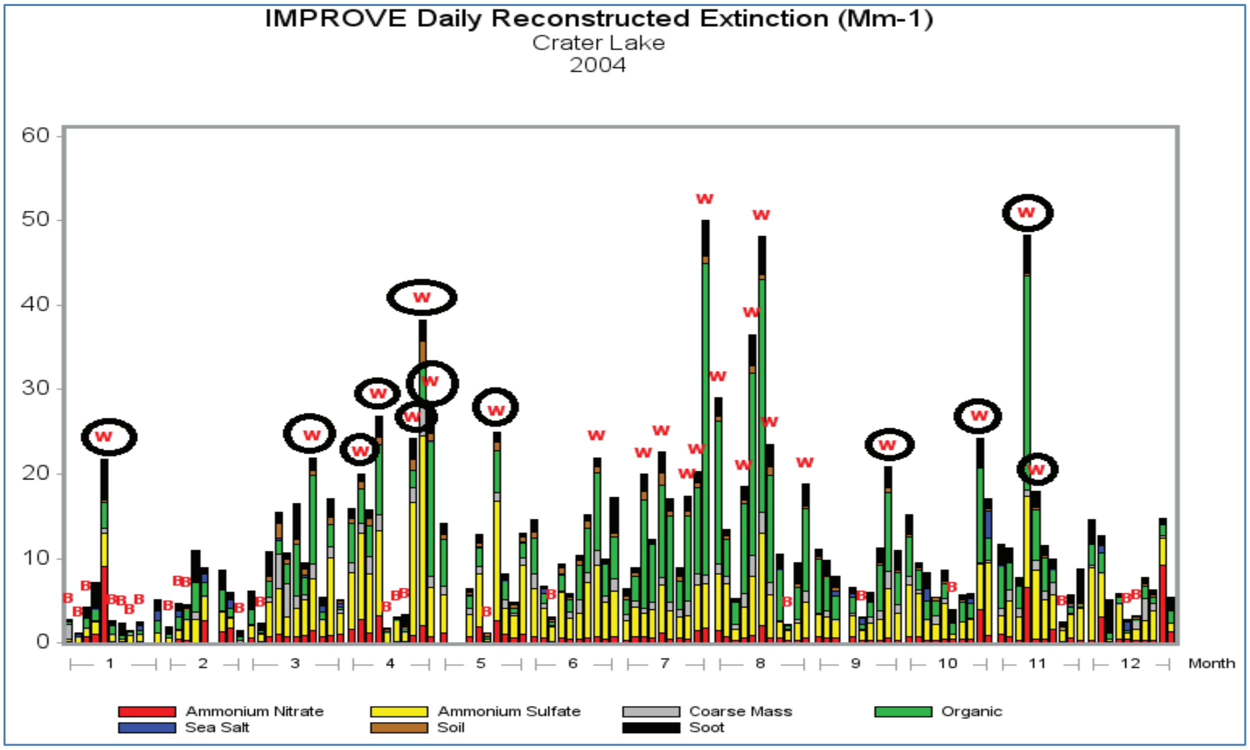


Figure 3-13. Example of identification of the 20 percent worse days in a given year and the proportional contribution of various factors to reduced visibility.

Black and green indicate vegetation burning as the source of the pollutant. "W" identifies a worse day and a circled "W" indicates prescribed fire as the probable cause. Source: ODEQ 2013b.

Adverse impacts to air quality that are caused by prescribed burning, including effects to visibility and human health, generally tend to be of short duration (hours) and limited to the local area. Conversely, wildfire adverse impacts tend to be of longer duration (days to weeks) and occur over a much broader area and produce much unhealthier conditions (**Figure 3-14**).

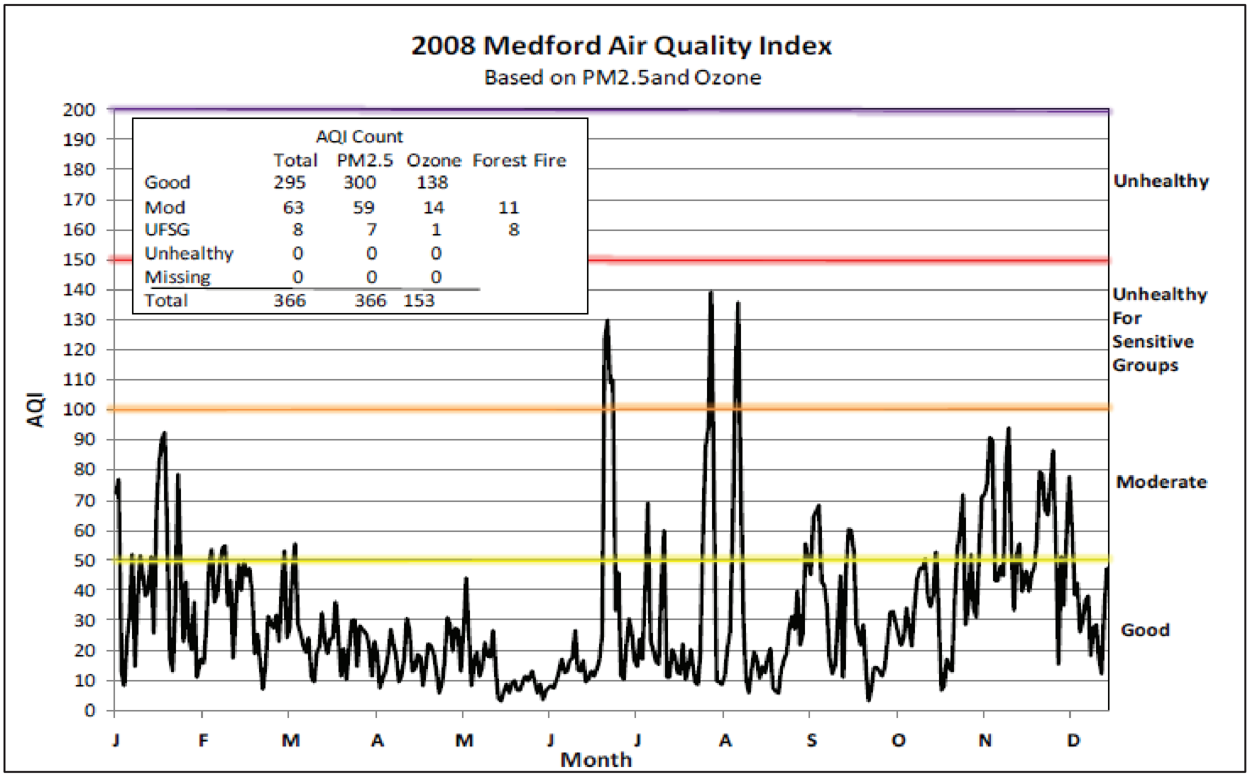


Figure 3-14. Daily air quality index for Medford in 2008.
Large spikes in July and August are from wildfires while moderate air quality in September through January is primarily woodstoves with some smoke from pile burning possible. Three intrusions attributed to BLM-prescribed burning into mandatory Class 1 areas did occur. Source: ODEQ 2009.

Air quality and visibility data from 2013 illustrate the impacts from wildfires. During that summer, wildfire impacts in southwest Oregon produced unhealthy or more severe levels for seven days in Medford (**Figure 3-15**) and for nine days in both Grants Pass and Cave Junction (**Figure 3-16**). It also resulted in severe degradation of visibility in Crater Lake National Park (**Figure 3-17**) and the Kalmiopsis Wilderness (data not shown).

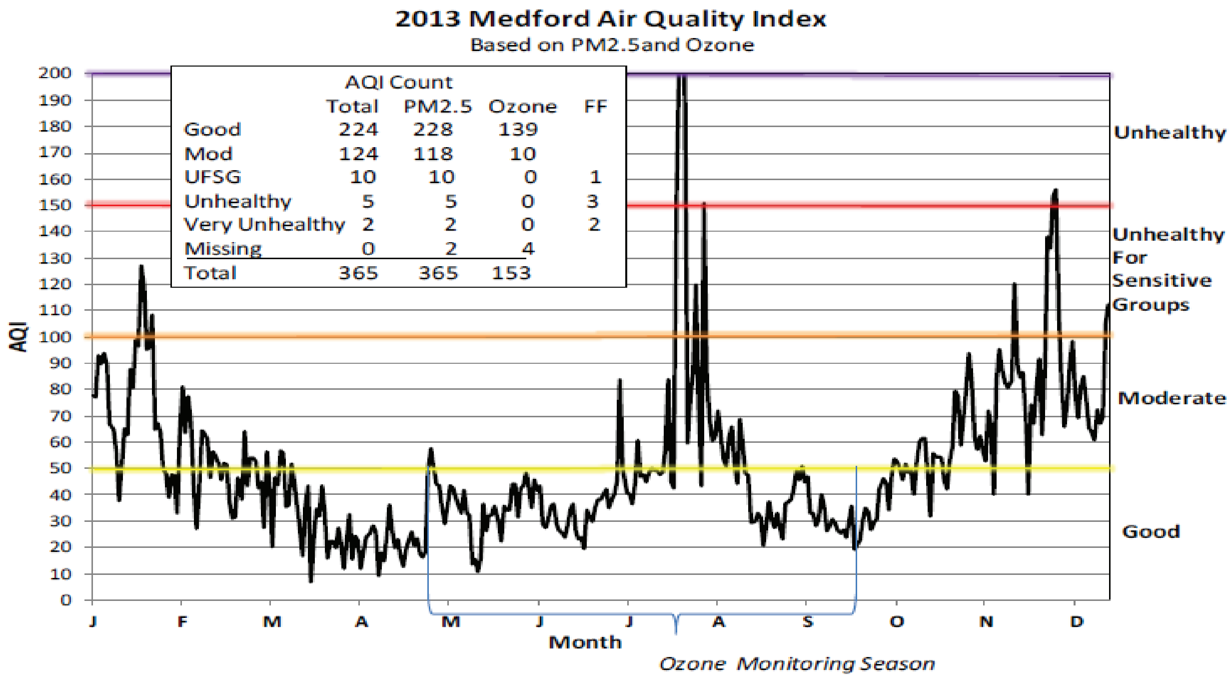


Figure 3-15. Air quality index for 2013 for Medford.
The large spike in late July was due to a series of wildfires, of which the Douglas Complex was the largest. "FF" refers to the days where air quality degradation was attributed to forest fires. Additional air quality degradation occurred from November through February from sources other than prescribed fire. Source: ODEQ 2014.

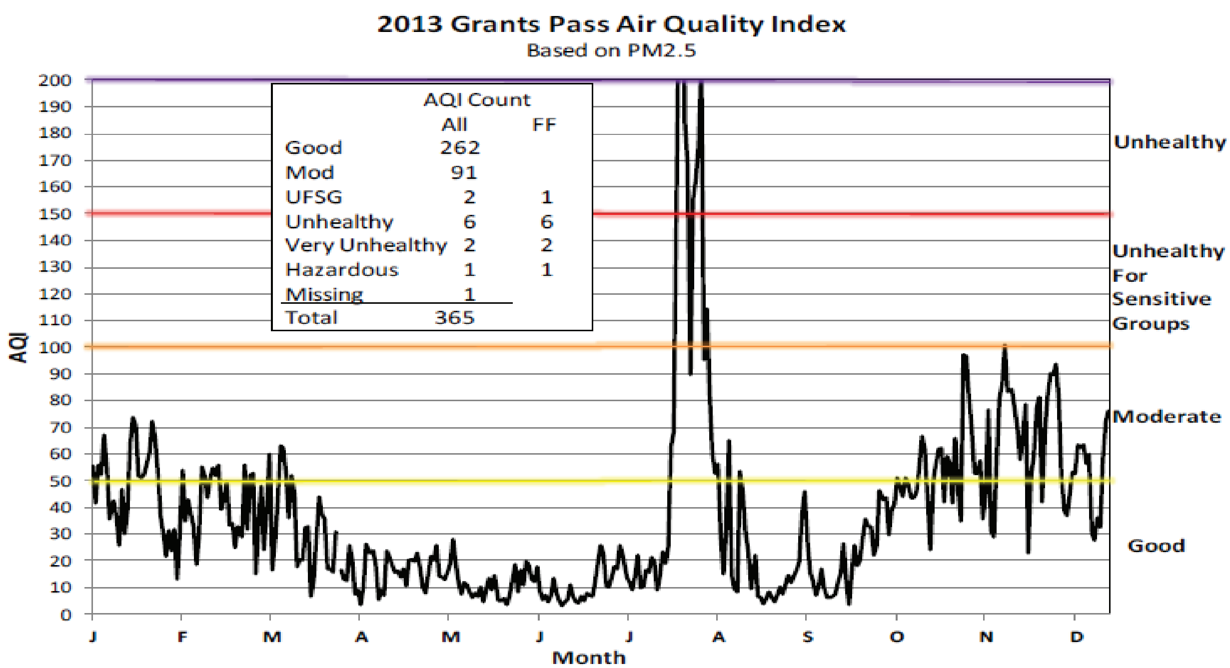


Figure 3-16. Air quality index for 2013 for Grants Pass.
The large spike in late July was due to a series of wildfires, of which Douglas Complex was the largest. "FF" refers to the days where air quality degradation was attributed to forest fires. Source: ODEQ 2014.

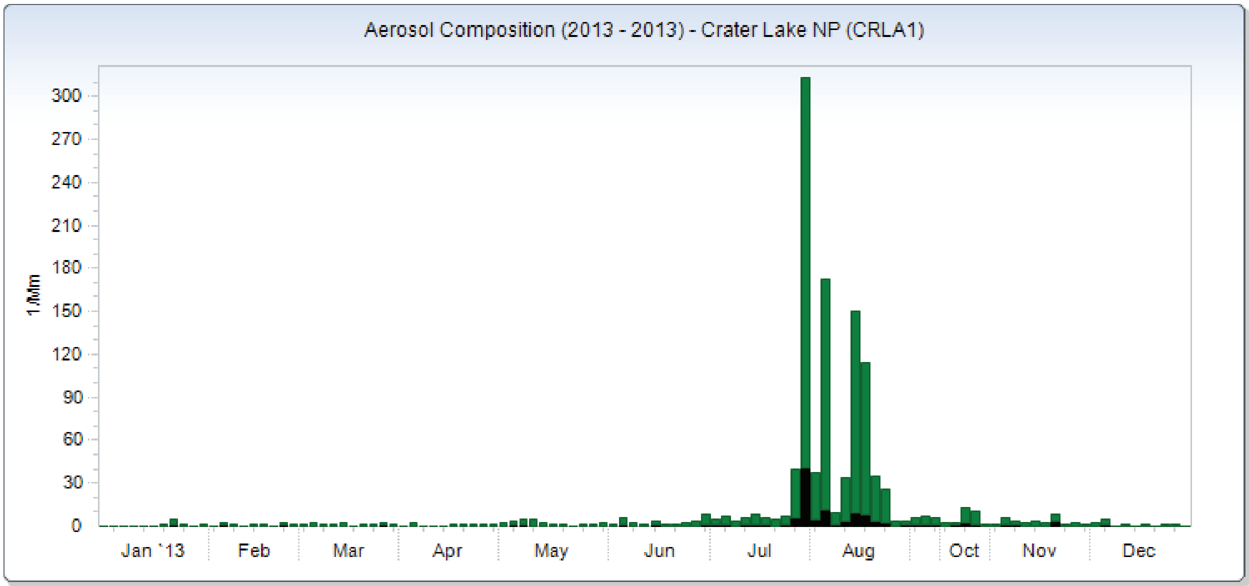


Figure 3-17. Degradation of visibility from burning vegetation in 2013 as measured through light scattering (inverse megameters) at Crater Lake National Park.

Wildfires typically create 5-10 times greater impacts than other types of events and over several weeks. Source: IMPROVE website, available at http://views.cira.colostate.edu/fed/DataWizard/Default.aspx , accessed 25 November 2014.

Environmental Effects

Particulate Matter Emissions

Since the hazardous fuels prescribed fire program does not vary between alternatives or over time, the expected emissions are constant. Estimated wildfire emissions vary over time, but not between alternatives. Therefore, the main variable in estimated particulate emissions is the amount of activity fuels prescribed burning both over time and between alternatives. Since fuel treatment levels are projected to increase under all alternatives, including the No Action alternative, relative to actual levels in the past, emissions of both PM_{10} and $PM_{2.5}$ are expected to increase relative to the 2013 baseline (**Figures 3-18 and 3-19**).

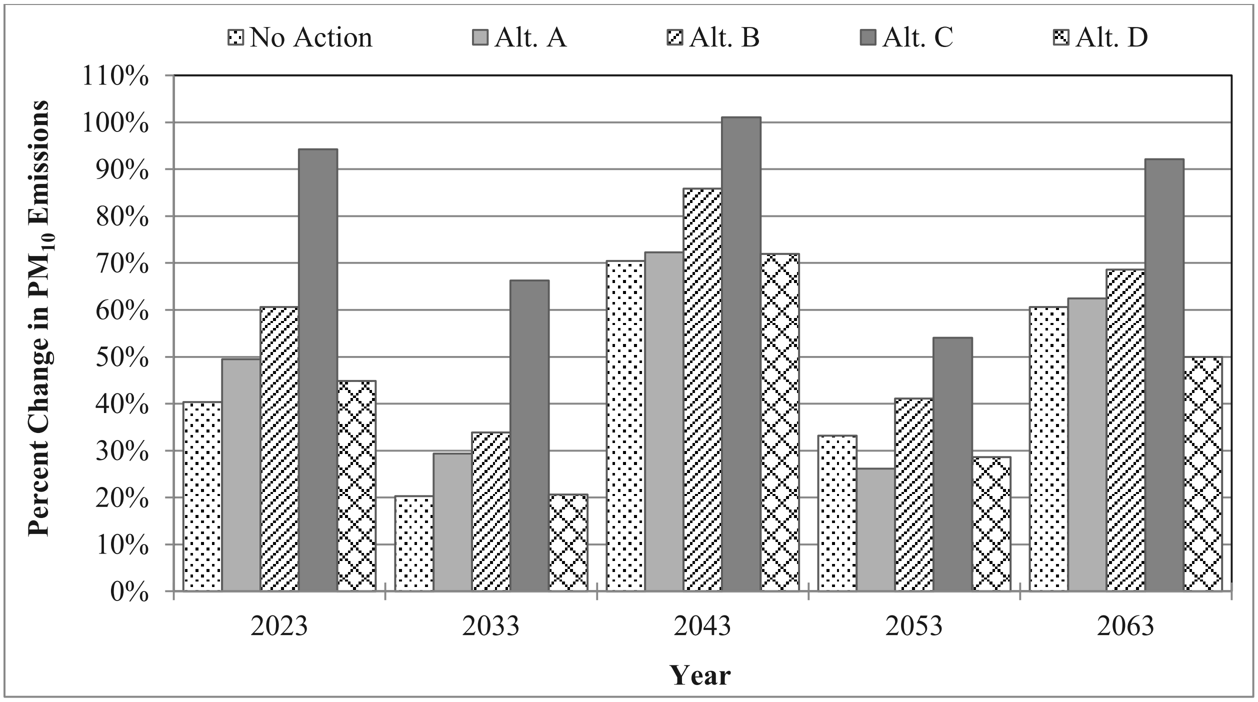


Figure 3-18. Expected increases in PM_{10} emissions from prescribed fire and wildfire over time and under each alternative relative to the estimate for current prescribed fires and wildfires.

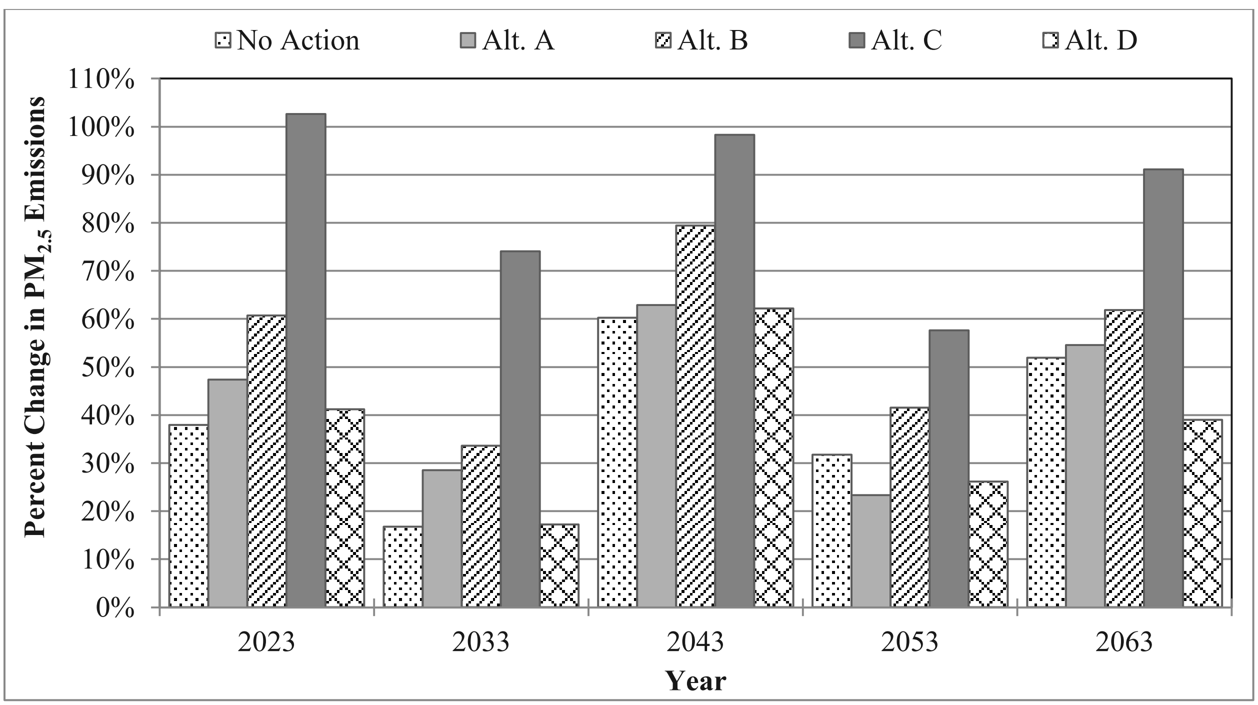


Figure 3-19. Expected increases in $PM_{2.5}$ emissions from prescribed fire and wildfire over time and under each alternative relative to the estimate for current prescribed fires and wildfires.

Some of the difference between the estimated current and projected emissions is likely due to the differing estimation methods used for each. Fuel treatment method (e.g., hand or machine pile burning, broadcast burning) affects the amount of particulates emitted by affecting the amount of fuel consumed and the relative proportions of flaming and smoldering combustion (Hardy *et al*. 2001). Smoldering combustion emits more than twice the particulates as flaming combustion (Hardy *et al*. 2001). The current condition is based on the tons consumed reported to ODF, with insufficient information to determine the proportions of actual treatment methods. Thus, the current condition is based on a generic multiplier applied to the reported tons consumed. Whether this value represents an under-estimation or over-estimation of current conditions is not known. The projected emissions were based on more detailed information using more sophisticated tools than a generic multiplier.

Similar to the current condition, the Medford District is projected to have the largest number of acres burned by wildfire, followed by the Roseburg District and then the Eugene and Salem Districts, with much smaller acres projected to burn over time on the Coos Bay District and the Klamath Falls Field Office. Since the projected hazardous fuels program is the same as the current program, the Medford District would continue to have the largest hazardous fuel program, followed by the Klamath Falls Field Office and then the Roseburg District. The Coos Bay District would have a small hazardous fuels program while The Eugene and Salem Districts essentially would have no hazardous fuels program. In contrast, which district has the largest activity fuels program varies by alternative.

Under all alternatives, including the No Action alternative, the Medford District would produce the most emissions from prescribed burning (**Figure 3-20**), with the highest emissions under Alternative B and lowest under Alternative A. Emissions under the No Action alternative and Alternative D would be similar. The Roseburg District would produce its highest emissions under Alternative C and lowest under Alternative A. Between these two districts, in combination with expected emissions from wildfire, the greatest potential impacts to air quality in the planning area would occur in the Rogue River and Umpqua River valleys and their associated smoke sensitive areas, along with the Kalmiopsis Wilderness and Crater Lake National Park. Much of the activity for natural fuels burning consists of pile burning, which typically occurs in fall and winter. In fall, atmospheric instability and relatively frequent storms tends to limit smoke impacts during the day, but areas down drainage from burn locations could experience smoke effects at night. Inversions in winter could result in prescribed fire smoke mingling with woodstove smoke to adversely affect air quality (e.g., **Figure 3-15**), although compliance with the smoke management plan usually limits degradation of air quality.

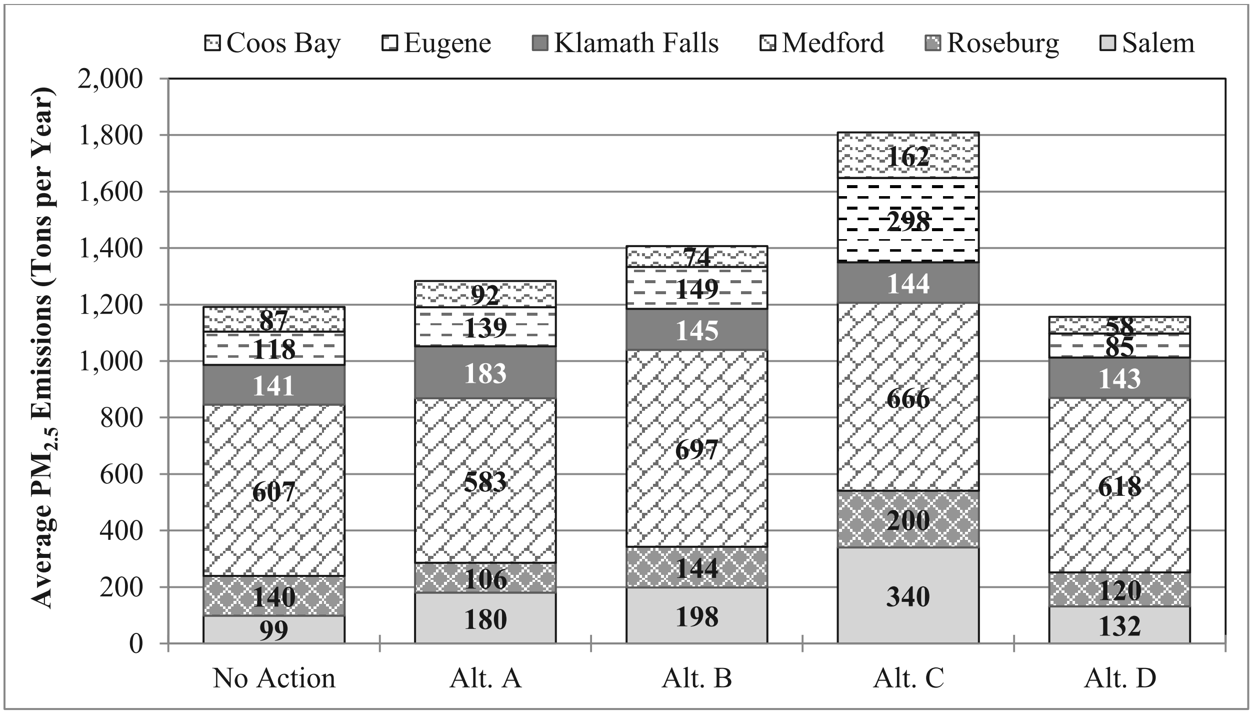


Figure 3-20. Average annual $PM_{2.5}$ emissions from prescribed burning over the 50-year analysis period by district or field office and alternative.

The Klamath Falls Field Office would produce its highest emissions under Alternative A with no difference in emissions under the No Action alternative and Alternatives B through D (**Figure 3-20**). Potential effects to the Klamath Falls Field Office non-attainment area likely would not differ from those currently experienced. Similarly, emissions from the Coos Bay District would change little from present emissions under all alternatives.

Emissions from the Eugene and Salem Districts would increase under all alternatives, except for Alternative D in the Eugene District, relative to the current condition, with the biggest increases under Alternative C (**Figure 3-20**). As a result, the probability of adverse impacts to smoke sensitive receptor areas in the Willamette Valley would increase, likely due to unexpected wind shifts, although the overall probability would remain low. Increased burning on the Eugene District may result in additional adverse impacts to air quality in Oakridge, although the combined effects of the location of BLM-administered parcels relative to Oakridge, compliance with the smoke management plan, terrain, and the timing of burns relative to the timing of the worst air quality in Oakridge would keep the probability of such effects very low.

Visibility and Air Quality

Continued adherence to the smoke management plan is expected to limit adverse effects to visibility and air quality across all alternatives, although some issues are likely to remain in southwest Oregon where the efficacy of the new requirements as of 2014 have not yet been established. The increased amount of prescribed burning, particularly under Alternative C, may increase the risk of additional smoke intrusions into mandatory Class I areas, although past intrusions have not been correlated with the number of acres burned. At present, there are no factors that provide a clear indication that the increased prescribed burning under the action alternatives would result in additional effects on visibility and air quality from smoke intrusions as compared to the observed past.

The relative proportion of the landscape under some degree of active management can influence subsequent wildfires and the potential to affect human health and visibility adversely in summer. Active management, particularly where a primary objective is to alter fire risks, can reduce the potential for adverse impacts to human health and visibility from wildfires by increasing landscape diversity in terms of the mix of stand sizes, age classes, structure, and species compositions. Landscape heterogeneity tends to create burn pattern heterogeneity and can reduce the potential for large, homogeneous stand-replacing patches and long-term smoldering within large wildfires, especially in landscapes with active fire regimes (e.g., Mitchell *et al*. 2009, Miller *et al*. 2012, Loudermilk *et al*. 2014, Volkova *et al*. 2014). Less active management under the 1995 RMPs has tended to create more homogeneous landscapes, particularly with respect to stand structure, promoting larger patches of similar burn severity, longer-term smoldering, and resulting emissions.

The number of acres receiving active management indicates the potential to reduce adverse effects from wildfires over time. How much area would need to be treated before such an effect occurred is not known, but likely would take two or more decades of increased land management activity to begin to become apparent. **Table 3-16** depicts a relative rating for each alternative for each district within the planning area using land allocation as a basis for identifying the amount of area expected to receive some degree of active management. Administrative reserves, Congressional reserves, Late-successional Reserves where the primary approach is protection and the inner, no-cut areas of Riparian Reserves are assumed to have little to no active management.

Table 3-16. Relative risk to human health and visibility by alternative based on the estimated acres expected to receive some degree of active management. The highest risk is 5, the lowest risk is 1, and a tie between two alternatives is x.5.

District	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Coos Bay	5	2.5	2.5	1	4
Eugene	5	2	3.5	1	3.5
Medford	4.5	4.5	2	1	3
Roseburg	5	2	3.5	1	3.5
Salem	5	2	3	1	4
Means	**5**	**3**	**3**	**1**	**4**

A high proportion of the Klamath Falls Field Office (over 80 percent) would be available for active management due to the high number of acres in the eastside management area, so it was not rated. Risks to human health and visibility from wildfires likely would not differ from current conditions. On all other districts, the No Action alternative would have the lowest number of acres under active management. Current trends towards forest homogenization would continue, increasing the risk of large wildfires, large, homogeneous burn patches, and prolonged smoldering. Those factors, in turn, are expected to increase the risks to human health and visibility from wildfires over time.

Alternative C would have the most area under active management on each office, so would have the highest potential to create sufficient landscape heterogeneity and lower risks to human health and visibility over time. Alternative C also includes a large amount of clear-cutting, which can create landscape homogeneity although it does not necessarily follow that it will. Harvest levels would remain below that of the 1980s and a greater diversity of general harvest prescriptions would occur. Whether the amount of active management would generally have a larger influence than the amount of clear-cutting on wildfire burn patterns, would depend on the distribution and sizes of clearcut patches and subsequent management of the next stand, particularly in relation to adjoining private forestlands.

The potential risk of adverse effects under alternatives A, B, and D depend more on the BLM office in question. As such, no other alternative clearly stands out in its potential to reduce the potential risks to human health and visibility from wildfires. Overall, alternatives A and B would result in similar effects over the planning area as a whole, with some reduced risks relative to No Action and Alternative D, but greater risks relative to Alternative C. In the Medford and Roseburg Districts, the two with the most active fire regimes, the order of potential risk reduction from greatest to least would be Alternative C, Alternative B, Alternatives A and D, and the No Action alternative.

Climate Change

Over time, climate change may result in a reversal of the trend in visibility and a worsening of air quality in summer and fall. Many climate projections foresee longer fire seasons and more severe burning conditions, which would lead to more acres burned, increased fire severity (e.g., Mote *et al*. 2014 and references therein), and greater particulate production over the life of such wildfires. One result would be an increase in the number of unhealthy days and reduced visibility in mandatory Class 1 areas. In addition, as the atmosphere warms, it holds more moisture; an increasing trend in relative humidity has already been documented in the United States (Walsh *et al*. 2014 and references therein). Certain pollutants are very responsive to even small increases in relative humidity, potentially degrading visibility with no change in pollutant level (Hand *et al*. 2011).

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Areas of Critical Environmental Concern

Key Points

- The No Action alternative would provide special management attention or interim special management attention to all 126 existing and potential Areas of Critical Environmental Concern.
- The action alternatives consider the designation of 121[35] potential (designated, old, and 14 new) Areas of Critical Environmental Concern including 106,546 acres or about 4 percent of the planning area in this EIS for designation.
- Alternative A would designate the most and Alternative C the least Areas of Critical Environmental Concern at 119 and 111 respectively.
- All action alternatives would maintain 90 to 99 percent of the relevant and important values within the potential Areas of Critical Environmental Concern.
- Across the planning area, the potential Areas of Critical Environmental Concern represent a high level of diversity in both the values protected and the number and categories of values within any one Area of Critical Environmental Concern.

Issue 1

How would alternatives affect the relevant and important resource values of existing and proposed Areas of Critical Environmental Concern?

Summary of Analytical Methods

The BLM defined special management needed to protect or maintain each potential Area of Critical Environmental Concern's relevant and important values. The BLM then determined if the management direction for other resources under each alternative protects or maintains the relevant and important resource values associated with each potential Area of Critical Environmental Concern (ACEC). They also considered whether the BLM could apply special management needed to protect relevant and important values so as not to preclude sustained-yield timber harvest in the Harvest Land Base. The presence or amount of O&C Harvest Land Base within the potential ACECs varies by alternative. The BLM would not designate ACECs under alternatives where the needed special management would preclude O&C Harvest Land Base sustained-yield production.

For every alternative, the BLM assigned each potential ACEC to one following categories:

- Yes, the BLM would designate the entire potential ACEC under the given alternative. The area requires special management to maintain relevant and important values and management would not preclude O&C sustained-yield timber harvest at the stand level in the Harvest Land Base Special management may condition, but not preclude, O&C sustained-yield timber production
- Yes, the BLM would designate a portion of the potential ACEC under the given alternative. The BLM removed portions of the potential ACEC where special management would conflict with O&C sustained-yield timber harvest; the BLM determined that the remaining area still supports relevant and important values needing special management

[35] Five would be consolidated into existing ACECs or dropped from consideration for other reasons.

- No, the BLM would not designate the potential ACEC under the given alternative because the area does not require special management to maintain the relevant and important values in the given alternative
- No, BLM would not designate the potential ACEC under the given alternative because the special management required to maintain the relevant and important values would preclude O&C sustained-yield timber harvest in the Harvest Land Base

The BLM assumed that the relevant and important values associated with an ACEC that the BLM designates under any particular alternative would be adequately protected by the special management direction and would persist for at least the life of this plan.

The Planning Criteria provides detailed information on authorities, guidance for ACEC designation on O&C lands, analytical assumptions, methods and techniques, which the BLM incorporates here by reference (USDI BLM 2014, pp. 35-36).

Background

Areas of Critical Environmental Concern (ACECs), defined in the Federal Land Policy and Management Act, represent areas within the public lands where special management attention is required to protect or to prevent irreparable damage to any of the following categories:

- Important historic, cultural, or scenic values
- Fish and wildlife resources
- Other natural processes or systems
- Life and safety from natural hazards

The BLM develops special management direction to protect relevant and important values. The BLM does not apply special management where other management mechanisms adequately protect the relevant and important values or where designation is not warranted.

The BLM designed some special management direction to move the relevant and important value onto a trajectory to reach a desired condition. The BLM designed other special management attention to protect the relevant and important values from management actions or other human activities. This may include prohibiting or modifying certain management activities.

An area must meet relevance and importance criteria and require special management attention to qualify for consideration for designation as an ACEC. An area meets the relevance criterion if it contains one or more of the categories of values described in the first paragraph of this section.

The value, resource, process or system, or hazard described above must have substantial significance to satisfy the importance criteria. This generally means that one or more of the following characterize the value, resource, process or system, or hazard:

- The qualities that give it special worth, consequence, meaning, distinctiveness, or cause for concern, especially compared to any similar resource, are more than locally significant
- It has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change
- It has been recognized as warranting protection to satisfy national priority concerns or to carry out the mandates of the FLPMA
- It has qualities that warrant highlighting to satisfy public or management concerns about safety or

public welfare
- It poses a significant threat to human life or safety, or to property

The BLM describes relevant and important values in four categories as shown in **Table 3-17**. These categories are:

- ***Historic, cultural, or scenic values*** include, but are not limited to, rare or sensitive archeological resources and religious or cultural resources that are important to Native Americans.
- ***Fish and wildlife resources*** include, but are not limited to, habitat needed for endangered, sensitive, or threatened species, or habitat essential for maintaining species diversity.
- ***Natural processes or systems*** include, but are not limited to, endangered, sensitive, or threatened plant species; rare, endemic, or relic plants or plant communities that are terrestrial, aquatic, or riparian; or rare geological features.
- ***Natural hazards*** include, but are not limited to, areas of avalanche, dangerous flooding, landslides, unstable soils, seismic activity, or dangerous cliffs. The BLM may consider human caused hazards a natural hazard if the BLM determines through the resource management planning process that it has become part of a natural process.

Table 3-17. Value categories for designated and formerly identified potential ACECs by district or field office.

District/ Field Office	Fish and Wildlife	Historic, Cultural, and Scenic	Natural Hazard	Natural Process or System
Coos Bay	14	2	-	18
Eugene	12	2	1	20
Klamath Falls	3	3	-	4
Medford	7	5	-	31
Roseburg	3	1	-	11
Salem	22	9	1	36
Totals	**61**	**22**	**2**	**120**

Research Natural Areas (RNAs) represent a specific type of ACEC. These areas are established and maintained for the primary purpose of research and education because the land has one or more of the following characteristics:
- Typical representation of a common plant or animal association
- Unusual plant or animal association
- Threatened or endangered plant or animal species
- Typical representation of common geologic, soil, or water feature
- Outstanding or unusual geologic, soil, or water feature

The Research Natural Area network in the Pacific Northwest represents a wide range of elevation, geology, topography, soils, and vegetation communities throughout the region. The BLM manages these in partnership with the U.S. Forest Service, State natural resource agencies, and key private organizations. This network allows for evaluation of differential responses to environmental change in comparison to forests managed for sustained yield.

Outstanding Natural Areas are also specific types of ACECs. Outstanding Natural Area designations aim to protect unique scenic, scientific, educational, and recreational values of certain areas within the public lands. It is important to note that when applied by Congress, the term “outstanding natural area” has a different meaning than when the BLM applies it through a planning decision to create a type of ACEC. A congressionally-designated "outstanding natural area" provides permanent protection for the values for which Congress designated the area.

After the development of the 2008 FEIS, the BLM received nominations for ACECs for consideration in subsequent planning efforts. During the development of this Draft RMP/EIS planning effort, the BLM found 17 of the 32 nominated areas to meet the relevance and importance criteria and recommended them for further analysis as new potential ACECs. Although not currently designated as ACECs, the relevant and important values in these formerly identified and new potential ACECs receive interim protective management. The Medford District identified West Fork Illinois River as a new potential RNA and the Roseburg District expanded an existing RNA in the potential Beatty Creek ACEC. The BLM received no nominations for Outstanding Natural Areas.

Affected Environment

There are 87 ACECs currently designated in the planning area, 39 previously nominated ACECs that have been under interim protective management since late in the 1995 RMP planning process or during the 2008 RMP planning effort (**Table 3-18**), and 14 new potential ACECs nominated after the 2008 RMP planning effort (**Table 3-19**). The BLM currently protects the relevant and important values, whether identified in a plan decision or in a nomination, for areas in all of these categories.

Table 3-18. Designated (1994) and formerly identified (1995-2008) potential ACECs. Potential ACECs have been under interim management.

District/ Field Office	Designated ACECs (#)	Potential ACECs (#)	Research Natural Areas[a] (#)	Outstanding Natural Areas (#)	Designated and Potential ACECs (Acres)	BLM Lands (Acres)	Percentage of BLM Acres in Designated and Potential ACECs
Coos Bay	11	5	1	-	14,258	325,824	4.4%
Eugene	13	8	5	2	14,841	313,705	4.7%
Klamath Falls	4	3	1	-	7,398	215,077	3.4%
Medford	24	7	10	1	21,125	810,261	2.6%
Roseburg	9	3	7	-	10,504	425,805	2.5%
Salem	26	13	8	6	24,713	402,983	6.1%
Totals	**87**	**39**	**32**	**9**	**92,839**	**2,493,655**	**3.7%**

[a] The research natural areas and outstanding natural areas are dually designated as ACEC, and their numbers are already counted within the designated and potential numbers.

Table 3-19. New potential ACECs.

District/ Field Office	New Potential ACECs (#)[36]	New Potential ACECs (Acres)	BLM Lands (Acres)	Percentage of BLM Acres in New Potential ACECs
Coos Bay	1	45	325,824	<0.01%
Eugene	7	6,280	313,705	2%
Klamath Falls	2	318	215,077	<0.14%
Medford	3	6,332	810,261	1%
Roseburg	0	-	425,805	-
Salem	1	805	402,983	<0.20%
Totals	**14**	**13,780**	**2,493,655**	**1%**

Although it is only necessary for an area to meet the relevance and importance criteria for one value to qualify as an ACEC, many potential ACECs within the planning area meet these criteria for several values. However, the number of values that meet the relevance and importance criteria can vary widely, as can the combination of values that meet these criteria within an ACEC. For example, ACEC values range from a historical gold mining ditch in the Sterling Mine Ditch Potential ACEC in Roseburg, to a combination of unique geologic features, vernal pools, special status plants (natural processes and systems), listed fairy shrimp (fish and wildlife), a developed interpretive educational area, and scenic and cultural values at the Table Rocks ACEC in Medford.

Environmental Effects

This analysis examines the designation of ACECs and the effects on relevant and important values under each alternative.

Under the alternatives, the varying designations of ACECs would have differing effects on the relevant and important values that the designations protect. **Appendix F** - provides the names of the ACECs that the BLM would designate under the various alternatives, their associated acres, and their relevant and important values. This analysis provides a broad discussion of the various resources that the BLM would protect through ACEC designations under the alternatives. Acres the BLM removed from ACECs to avoid precluding O&C Harvest Land Base sustained-yield production create all of the variation in the number and acres of ACEC designations under the action alternatives. As described below, the BLM's assessments of the need for continuing protective management of existing and proposed ACECs are the primary driver of differences between the action alternatives and the No Action alternative.

The BLM considered 121 of the 140 existing and potential ACECs in the planning area for designation under the action alternatives. Of the 19 the BLM is not considering for designation under the action alternatives, the BLM found that 9 did not meet the criteria: 2 are not on BLM-administered land and 8 were incorporated other potential ACECs.

In all cases, where the BLM would designate ACECs or continue the protection of potential ACECS, the effect of the application of special management attention would be the continued persistence of the relevant and important value, or a change to those values in a trend towards a desired condition.

[36] While 17 were found to meet the relevance and importance criteria, 3 were merged with existing ACECs, leaving 14 new potential ACECs.

Under the action alternatives, the BLM is considering for designation:

- 76 of 87 currently designated ACECs
- 31 of 39 old potential ACECs that are currently under interim management
- 14 new potential ACECs that are currently under interim management
- 32 designated and one new potential ACECs that are also Research Natural Areas
- 6 of 9 designated ACECs that are also Outstanding Natural Areas

No Action

Under the No Action alternative, there would be no change to the designation of 87 existing ACECs or the application of interim protective management to the 39 formerly identified and 14 new potential ACECs (**Table 3-20**). The BLM offices would continue to implement special management attention in these areas. The effect of the application of interim special management attention on the resource values in these areas would be to maintain those values, as they currently exist, or to change those values in a trend towards the desired condition for those values.

Table 3-20. All potential ACECs designations by alternative.

District/ Field Office	No Action		Alt. A		Alt. B		Alt. C		Alt. D	
	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres
Coos Bay	11	10,159	17	14,002	17	14,002	17	14,002	17	14,002
Eugene	13	2,560	22	20,994	22	20,994	21	20,644	23	21,071
Klamath Falls	4	6,277	8	7,653	5	1,436	5	1,436	7	7,516
Medford	24	12,944	32	27,284	30	26,937	31	27,028	32	27,284
Roseburg	9	10,272	9	9,854	9	9,854	9	9,854	9	9,854
Salem	26	7,861	31	26,203	31	26,203	28	25,140	30	26,057
Totals	**87**	**50,073**	**119**	**105,990**	**114**	**99,427**	**111**	**98,104**	**118**	**105,784**

Alternative A

Under Alternative A, the BLM would designate of 119 of the 121 existing and potential ACECs (**Table 3-20).** Not precluding O&C Harvest Land Base sustained-yield production would require boundary revisions for three of the areas. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values, as they currently exist, or to change those values in a trend toward the desired condition for those values.

The BLM would not designate two potential areas. The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them (**Table 3-21**). The areas would eventually experience a loss or degradation of these values.

Table 3-21. Potential ACECs not designated under each alternative.

District/ Field Office	No Action*		Alt. A		Alt. B		Alt. C		Alt. D	
	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres
Coos Bay	7	4,092	-	-	-	-	-	-	-	-
Eugene	15	18,159	2	85	2	85	3	436	1	9
Klamath Falls	5	1,437	-	-	3	6,217	3	6,217	1	137
Medford	10	14,506	-	-	2	347	1	256	-	-
Roseburg	3	158	-	-	-	-	-	-	-	-
Salem	14	15,958	-	-	-	-	3	1,063	1	146
Totals	**54**	**54,310**	**2**	**85**	**7**	**6,649**	**10**	**7,972**	**3**	**292**

* While the BLM would not designate these areas under the No Action alternative, they would continue to receive protective management as potential ACECs.

Alternative B

The BLM would designate 114 of the 121 existing and potential ACECs under Alternative B (**Table 3-20)**. Avoiding the preclusion of sustained-yield production in the Harvest Land Base would require boundary revisions for four of the areas. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values, as they currently exist, or to change those values in a trend toward the desired condition for those values.

The BLM would not designate would not occur for seven of the areas under Alternative B (**Table 3-21**). The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. The areas would eventually experience a loss or degradation of these values.

Alternative C

The BLM would designate 111 of the 121 existing and potential ACECs Alternative C (**Table 3-20)**. Avoiding the preclusion of sustained-yield production in the Harvest Land Base would require boundary revisions for five of the areas. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values, as they currently exist, or to change those values in a trend toward the desired condition for those values.

The BLM would not designate ten of the areas under Alternative C (**Table 3-21**). The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. The area would eventually experience a loss or degradation of these values.

Alternative D

The BLM would designate 118 of the 121 existing and potential ACECs under Alternative D (**Table 3-20)**. Avoiding the preclusion of sustained-yield production in the Harvest Land Base would require boundary revisions for ten of the areas. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values, as they currently exist, or to change those values in a trend toward the desired condition for those values.

The BLM would not designate three of the areas under Alternative D (**Table 3-21**). The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. The area would eventually experience a loss or degradation of these values.

The No Action alternative would provide special management attention or interim special management attention to all 126 existing and potential ACECs. Alternative A would designate the most areas and the most acres as ACECs. Alternative C would designate the fewest and the least amount of acres as ACECs and would provide special management attention to the least number of relevant and important values.

The following table (**Table 3-22)** shows the summary of the values categories that would not receive special management attention by each alternative.

Table 3-22. Relevant and important value categories that would not receive special management attention.

Value Category	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Fish and Wildlife	-	-	5	8	1
Historic, Cultural, and Scenic	-	-	-	3	1
Natural Hazard	-	-	-	-	-
Natural Process or System	-	2	6	8	2
Totals	-	**2**	**11**	**19**	**4**

Areas not designated as ACECs under the Action Alternatives

The BLM determined that nine existing and proposed ACECs no longer meet the ACEC designation criteria. The BLM made the majority of these determinations on the basis either that the values no longer exist as relevant and important, or that these values would be protected without additional special management. Because of this, there would be no effects to relevant and important values without ACEC designation. The BLM found the following areas longer meet the ACEC criteria:

- Long Gulch in the Medford District
- China Ditch, Stouts Creek, and the Umpqua River Wildlife Area in the Roseburg District
- Little Grass Mountain, North Santiam, Sheridan Peak, Wells Island, and Yampo in the Salem District

The Medford District determined that special management associated with ACEC designation would not be required to protect or maintain the unique trellised drainage pattern at Long Gulch. The Roseburg District determined management consistent with the requirements of the Endangered Species Act would adequately protect the relevant and important values at China Ditch and Stouts Creek without additional special management. Therefore, the values would persist under the action alternatives despite their lack of designation.

The bald eagle is the single relevant and important value needing special management for the Umpqua River Wildlife Area ACEC. Over time, the bald eagle population has grown and the species has been delisted and this population no longer meets the relevance and importance criteria. In addition, Congress designated the North Umpqua River as a Wild and Scenic River in 1992. This designation provides the special management needed for the area's relevant and important values. Therefore, there would be no effects to relevant and important values through the lack of designation.

The Salem District determined there were no relevant and important values present at the Little Grass Mountain, North Santiam, Sheridan Peak, and Yampo ACECs. The BLM found that the grassy bald at Little Grass Mountain does not contain any values to set it apart from other Coast Range grassy balds. The North Santiam area's highly valued river meander channels and associated alluvial forest habitat are not on BLM-administered land. The adjacent BLM-administered land does not have these relevant and important values. A large population of former Special Status botanical species, *Poa marcida* occupies

Sheridan Peak, but it does not meet the relevance and importance criteria. Two special status botany species occurred at the Yampo ACEC. Tall bugbane (*Cimicifuga elata*) is no longer a Special Status Species and the BLM has not observed thin-leaved peavine (*Lathyrus holochlorus*) on this small parcel since the 1980s. Therefore, relevant and important values no longer exist at Yampo. Since the values no longer meet the relevance and importance criteria, there would be no effect to relevant and important values through the lack of designation.

The Salem District determined that while the Wells Island ACEC's values continue to meet the relevance and importance criteria, their maintenance does not require special management associated with ACEC designation. Wells Island, in the Willamette River has no road access which protects the relevant and important values from threatening activities. Any special management that would be prescribed would be the same as what is already in place without ACEC designation by way of having no road access to Wells Island. The BLM would only continue to apply special management associated with ACEC designation under the No Action alternative, but the values would persist under the action alternatives despite their lack of designation.

The Klamath Falls Field Office discovered that its Miller Creek existing ACEC lies on Bureau of Reclamation withdrawn lands and is thus outside of the BLM's decision area. Salem District discovered the Jackson Bend old potential ACEC is also not on BLM-administered land. The BLM can only designate ACECs on BLM-administered lands.

In several instances, the BLM integrated existing and potential ACECs in the formation of potential ACECs for consideration under the action alternatives. While this changed the number of ACECs considered under the action alternative it did not remove acres or relevant and important values from potential protection under the action alternatives.

References

USDI BLM. 2014. Resource management plans for western Oregon planning criteria. Bureau of Land Management, Oregon/Washington State Office, Portland, OR. http://www.blm.gov/or/plans/rmpswesternoregon/plandocs.php.

Climate Change

Key Points

- Carbon storage would increase under all alternatives.
- Greenhouse gas emissions associated with BLM-administered lands would increase under all alternatives, but would remain less than one percent of the 2010 statewide greenhouse gas emissions.
- Climate change provides uncertainty that reserves will function as intended and that planned timber harvest levels can be attained, with the uncertainty increasing over time.
- Active management would provide opportunities to implement climate change adaptive strategies and reduce potential social and ecological disruptions arising from warming and drying conditions.

Issue 1

What would be the effects of BLM forest management on long-term carbon storage?

Summary of Analytical Methods

The BLM estimated carbon storage on BLM-administered lands in the planning area by first estimating the amount of biomass on these lands and converting that to the carbon in live trees, standing and downed dead wood, understory vegetation, litter and duff, and in the upper one meter (3.3 ft.) of soil, except where noted. The Planning Criteria provides detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 36-38). As the nature of the data provided by the Woodstock model became available, the BLM changed some aspects of the analytical methods for estimating carbon. The volume harvested, whether part of the Harvest Land Base or reserves, in the different alternatives drives variation in carbon storage among the alternatives. Due to lack of data on the amount of biomass present prior to treatment or the amount removed by treatment, the BLM could not estimate the effects on carbon storage from the hazardous, or natural, fuels program. The BLM assumed the following categories to be constant across all alternatives:

- Carbon stored in soils
- Carbon stored in unmodeled polygons
- Carbon stored in polygons with no data
- Carbon loss from wildfire

The BLM did not estimate the amount of live and dead biomass in savannahs, shrublands, shrub-steppe, and grasslands. A relatively small number of polygons had no data. Most of these consisted of slivers in the vegetation layer, but could also include roads and water.

Although the BLM used much of the analytical approach described in the Planning Criteria, the BLM modified the data source for above-ground carbon. Instead of using stand structure as the basis for estimating the amount of above-ground carbon, as described in the Planning Criteria, the BLM used approximate stand age in combination with the information available through the Carbon OnLine Estimator version 3.0 (COLE, available at http://www.ncasi2.org/GCOLE3/gcole.shtml) to estimate the amount of carbon stored in standing and downed dead wood, understory vegetation, the forest floor (litter and duff) and soil. Instead of using only two regions, the BLM filtered the COLE outputs to report carbon storage for all Federal lands in the counties in which the majority of each BLM district occurs. For example, the BLM used all Federal lands in Coos and Curry Counties as the basis for estimates for Coos Bay District. This approach allowed for estimates that were more refined and better captured the variability in carbon stored than using the two regions. The BLM used all Federal lands instead of all lands, as the data for privately-owned forests tended to be skewed towards younger age classes than is typically present on the Federal lands and the data for BLM-administered lands appeared to lack a sufficient number of the Forest Inventory and Analysis plots used by COLE to provide robust estimates. The Woodstock outputs did not specifically identify which cells were woodlands, so the BLM did not carry out this portion of the analysis as described in the Planning Criteria. Because wildfire was not included in the volume estimates for year 100, the BLM dropped that year from the analysis and added year 40, resulting in estimates for years 10, 20, 30, 40, and 50. **Appendix G** describes the carbon estimation method in further detail along with sources of uncertainty in the results.

In addition to comparing the alternatives, the BLM also considered two reference analyses as a means of providing additional context for the alternatives: the No Timber Harvest Reference Analysis without wildfire (providing an estimate of potential carbon storage resulting from the vegetation growth) and the No Timber Harvest reference with wildfire. Comparing these two reference analyses allowed the BLM to estimate the effect of this natural disturbance alone and then in conjunction with harvesting in the alternatives.

There are multiple sources of uncertainty in estimating the amount of carbon stored on the BLM-administered lands within the planning area, which are discussed in more detail in Appendix G. Although it is not possible to quantify all of the sources of error, the potential error in the estimate for any one alternative likely exceeds the amount of variance between the alternatives.

Affected Environment

The BLM-administered lands within the planning area currently store an estimated 373 teragrams[37] of carbon (Tg C) (**Table 3-23**). In the 2008 RMP/EIS, BLM estimated current carbon storage at 427 Tg, using a similar but more simplified approach that relied primarily on regional averages (USDI BLM 2008, pp. Appendices-28-29). The type of data available in 2008 for estimating carbon storage did not allow the more detailed approach used in this analysis.

Table 3-23. Estimated current total carbon stored in vegetation and soil and carbon density by district/field office.

District/Field Office	Acres	Total Carbon (Tg C)	Carbon Density (Mg C/Acre)
Coos Bay	324,236	61.21	1,152.2
Eugene	311,063	61.12	1,188.8
Klamath Falls	214,084	8.92	143.5
Medford	806,675	98.13	713.0
Roseburg	423,639	65.95	934.9
Salem	399,157	77.69	1,160.2
Totals	-	**373.02**	-

[37] Scientific literature on carbon storage at this scale of analysis reports carbon amounts in metric tons, which are equal to approximately 2,205 pounds. One million metric tons equals one teragram.

The Medford District currently stores the most carbon, with an estimated 98 Tg C, largely due to the size of the district. The Klamath Falls Field Office stores the least, approximately 9 Tg C, largely due to the high proportion of non-forest plant communities within the Field Office boundaries and the small size of the Field Office. Approximately 5.6 Tg C is currently stored in products made from wood harvested from BLM-administered lands that are either still in use or located in sanitary landfills where decay rates are minimal (Earles *et al.* 2012). In the 2008 RMP/EIS, the BLM estimated carbon storage in landfills and wood products was 11 Tg C using an approach based on the assumed proportion of pulpwood to saw logs and estimates of the cumulative emissions of carbon over time by each type of product (USDI BLM 2008, p. Appendices-30). In this analysis, the BLM estimated carbon storage in landfills and wood products using a decay function derived from Earles *et al.* (2012) that consolidated the same type of information used in 2008 with estimates from the Oregon Department of Forestry on the annual board foot volumes harvested from BLM-administered lands within the planning area from 1965 through 2012. The combination of carbon stored on the districts and in wood products brings the total estimated carbon storage currently associated with BLM–administered lands in the planning area to 373 Tg C.

Carbon density, the amount of carbon per acre, provides a comparable measure between the districts that reflects carbon storage capability and general productivity. The Eugene and Salem Districts are moderate in size but have a high carbon density (**Table 3-23**). The Medford District is the largest district, and has the largest amount of total carbon storage, but has the second lowest estimated carbon density. The Klamath Falls Field Office is the smallest office and has the lowest carbon density.

Environmental Effects

Timber harvest volume removed is the primary driver of differences across alternatives in carbon storage on BLM-administered lands in the planning area, although a portion of the material harvested remains stored for up to 150 years in the form of wood products in use or in sanitary landfills (Earles *et al.* 2012). Comparing the No Timber Harvest Reference Analysis without fire to the No Timber Harvest Reference Analysis with fire indicates that wildfire will reduce estimated carbon storage by less than 1 percent across the planning area through 2063. For the Eugene District, Klamath Falls Field Office, and Salem District, the reduction will generally be less than 0.3 percent, while it will be close to 0.5 percent on the Coos Bay and Roseburg Districts. The reduction on the Medford District will be more substantial, ranging from 1 percent to around 2.5 percent, given that approximately 82.5 percent of the acres burned are forecast to occur on that district.

All alternatives, including the No Action alternative, would increase carbon storage over time relative to the current condition (**Figures 3-21** and **3-22**). Differences between the alternatives, and in comparison to the No Timber Harvest Reference Analysis with fire, would be minor until around 2033, and afterwards would become increasing apparent. Alternative D would store the most carbon of all alternatives. Although Alternative D has the second largest Harvest Land Base of the alternatives, the volume removed per acre would be low due to the overall approach to timber management (see the Forest Management section in this chapter). Alternative A would store the second-most amount of carbon.

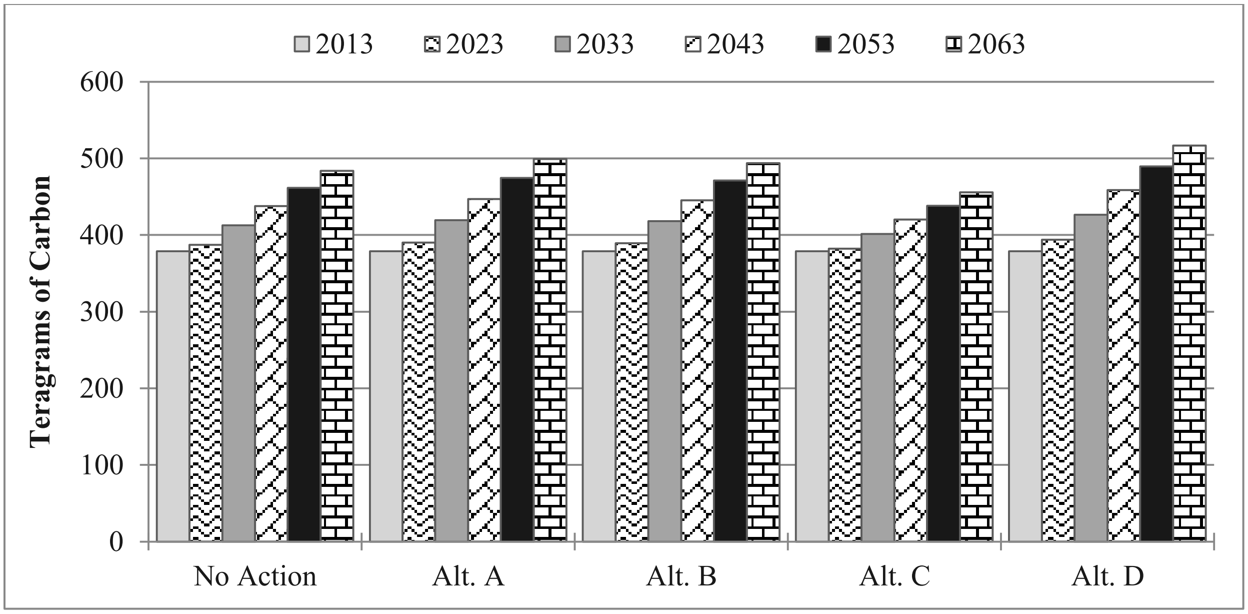

Figure 3-21. Estimated carbon storage over time by alternative.

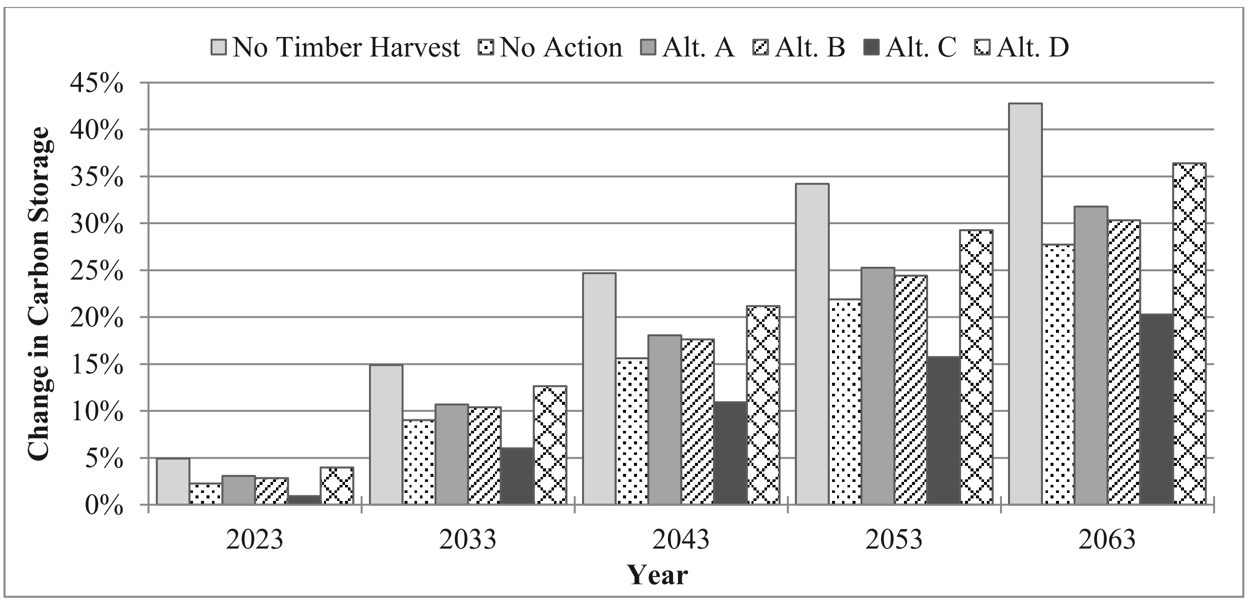

Figure 3-22. Change in carbon storage relative to the estimated total storage as of 2013.

The No Action alternative and Alternative B would store similar amounts of carbon over time, only slightly less than Alternative A. Alternative C would store the least carbon. The relative outcomes of the alternatives for carbon storage generally reflect the relative outcomes for the alternatives in total timber volume harvested.

All alternatives would increase carbon storage, but not as much as under the No Timber Harvest Reference Analysis with fire (**Figure 3-23**). The difference in the increase in carbon storage occurs as harvesting removes carbon and shifts stand characteristics, such as mean diameters and heights, in more of the landscape to smaller trees and younger age classes that store less carbon. Since Alternative C would harvest the most volume over time and would have the highest percentage of the landscape in younger age classes dominated by smaller trees, relative to the No Timber Harvest Reference Analysis.

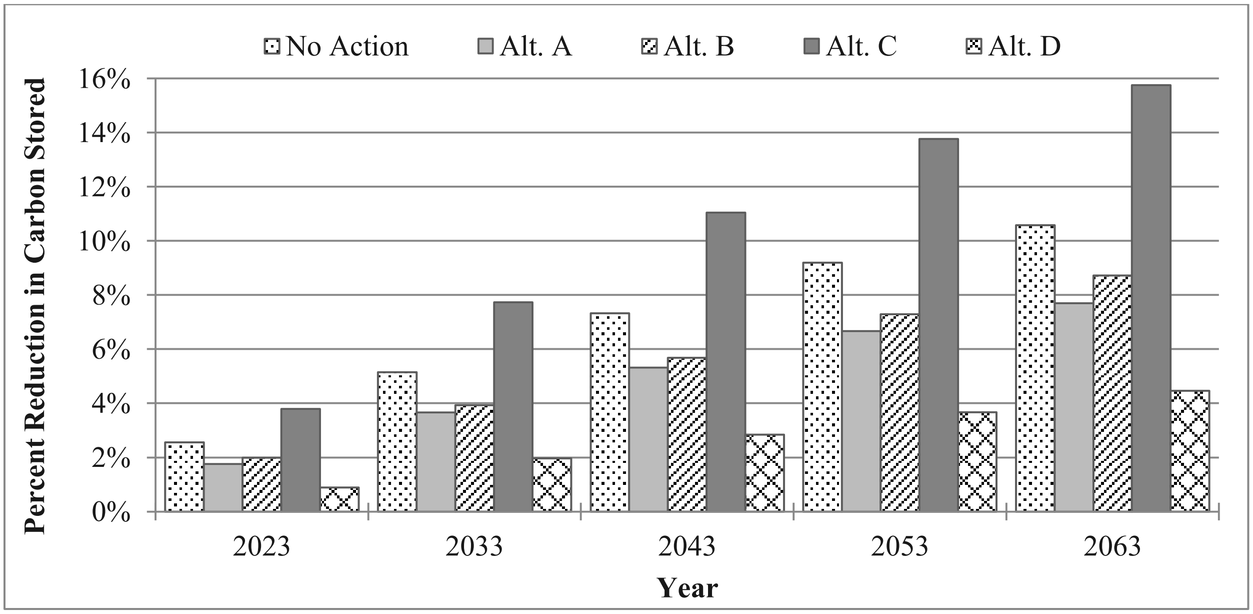

Figure 3-23. Percent reduction in aboveground carbon storage from timber harvest relative to projected carbon storage in the No Timber Harvest Reference Analysis with fire.

Issue 2

What would be the BLM's expected contribution to greenhouse gas emissions from vegetation management activities such as timber management and hazardous fuels reduction?

Summary of Analytical Methods

A wide variety of BLM activities produce greenhouse gases, but the absence of reliable data limits the BLM's ability to estimate emissions. For example, BLM-authorized mining operations are a source of greenhouse gases, but there is no data on which to base estimates of emissions from this sector, particularly since mining operations within the decision area currently involve salable and locatable minerals only (USDI BLM 2013, pp. 57-58). Greenhouse gas emissions from BLM-authorized activities that are most likely to be substantial and to vary among alternatives are timber harvesting, grazing, and prescribed burning.

The BLM estimated greenhouse gas emissions for each alternative, expressed in the form of carbon dioxide equivalent (CO_2e), using projected timber harvest, permitted levels of grazing, and prescribed burning. To provide context, the BLM also estimated greenhouse gas emissions from wildfires. The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, p. 38). The BLM changed the method for this analysis from what it described in the Planning Criteria by providing a greenhouse gas emission for year 40 and by not estimating emissions past year 50, since that was the last year for which it modeled wildfire.

The BLM estimated emissions from harvesting by converting the estimates of board feet harvested to cubic feet and applying the emissions factor listed in the Planning Criteria (USDI BLM 2014, p. 38). It estimated methane emissions from public lands grazing using the emission factor described by the Intergovernmental Panel on Climate Change (Eggleston *et al.* 2006). Instead of the emission factor listed in the Planning Criteria for prescribed fires, the BLM used estimated emissions from Consume 4.2 for carbon dioxide and methane and the emission factor provided by the Environmental Protection Agency for burning wood and wood products as a stationary source for nitrous oxide (EPA 2014a Table 1). The BLM used a combination of wildfire records, fuelbeds from the Fuels Characteristic Class System (FCCS) version 3.0, and emissions estimates from Consume 4.2 to estimate emissions from wildfires. **Appendix G** details the estimation methods and associated uncertainties.

Background

Globally, atmospheric carbon dioxide (CO_2) concentrations have increased from an estimated 277 ppm (parts per million) before 1750 to 395.31 ± 0.1 ppm in 2013, the highest level in the last 800,000 years according to the Global Carbon Project (http://www.globalcarbonproject.org/index.htm). Carbon dioxide is the primary greenhouse gas, comprising over 80 percent of total emissions globally, as well as in both the U.S. and Oregon. Fossil fuel combustion is the primary source of CO_2 (McConnaha *et al*. 2013, Le Quéré *et al*. 2014, EPA 2014b). United States emissions of greenhouse gasses (6,526 Tg CO_2e) were 14 percent of global emissions (~46,000 Tg CO_2e) in 2012 (Le Quéré *et al*. 2014, EPA 2014b). In 2010, the latest year in which data are available, Oregon's emissions were about 1 percent of the US emissions (McConnaha *et al*. 2013, EPA 2014b). Globally, ocean and land greenhouse gas sinks removed about 51 percent of that emitted in 2012 (Le Quéré *et al*. 2014). Land sinks in the U.S. effectively reduced total greenhouse gas emissions by nearly 18 percent nationally in 2012, with forests and wood products accounting for about 16 percent (Joyce *et al*. 2014, EPA 2014b). The forests of western Oregon sequester more carbon per acre than the national average (Joyce *et al*. 2014, Figure 7.5).

Affected Environment

Total greenhouse gas emissions from timber harvest operations, grazing, prescribed fire, and wildfires on BLM-administered lands within the planning area average 192,034 Mg CO_2e yr^{-1} over the past 19 years (1995-2013), or approximately 0.3 percent of the Oregon in-boundary[38] greenhouse gas emissions in 2010 (McConnaha *et al.* 2013). Most greenhouse gas emissions from BLM-administered lands within the planning area come from prescribed fires (**Figure 3-24**). With wildfire emissions excluded, total estimated current greenhouse gas emissions are 122,398.1 Mg CO_2e yr^{-1}, or about 0.2 percent of Oregon's in-boundary 2010 emissions, with most emissions from prescribed fires. Emissions for any one year vary widely, largely depending on the amount of prescribed fire and wildfire.

[38] In-boundary emissions are those that occur within Oregon's borders and emissions associated with electricity use within Oregon.

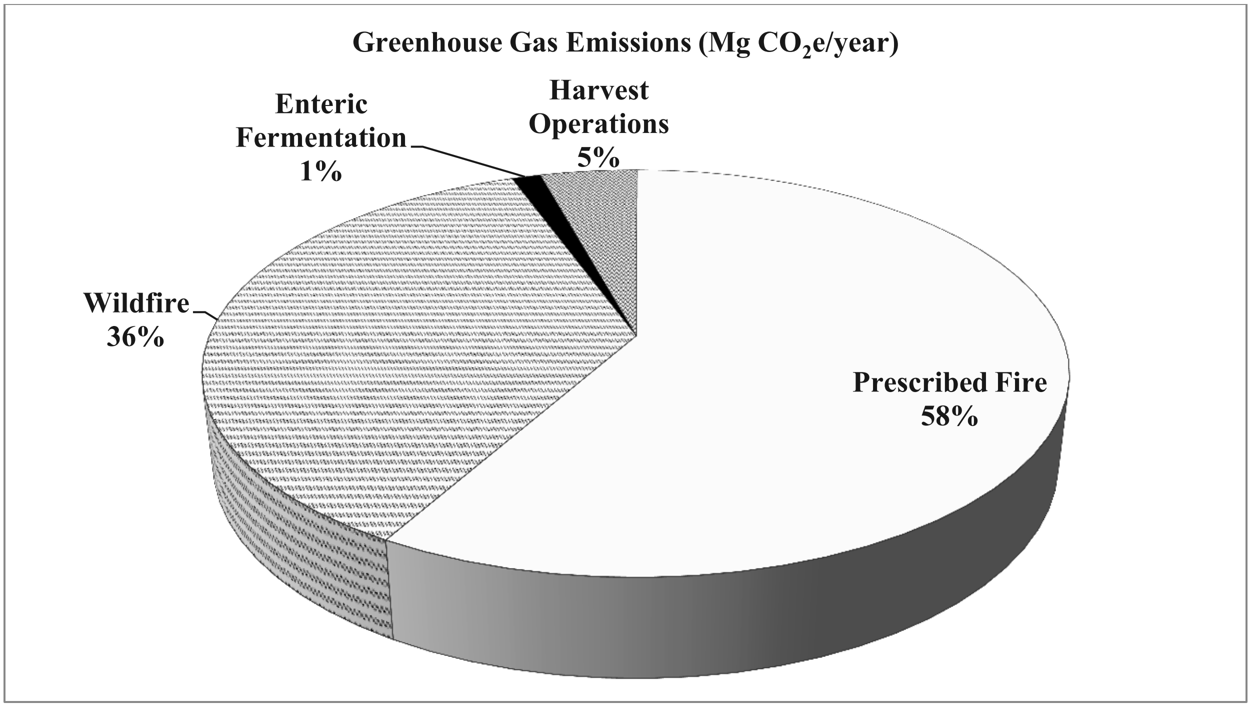

Figure 3-24. Proportion of estimated greenhouse gas emissions from grazing (enteric fermentation), harvest operations, prescribed fires, and wildfires on BLM-administered lands within the planning area.

The estimate of current greenhouse gas emissions for BLM-administered lands within the planning area represent the actual level of activity. This is in contrast to the analysis of the No Action alternative in the following section, which projects future implementation of 1995 RMPs as written. Actual harvest levels and grazing have been below what was anticipated in the 1995 RMPs (USDI BLM 2013). Prescribed burning of activity fuels created by harvesting activities is generally less than what was anticipated in 1995, but prescribed burning of so-called natural fuels, or hazardous fuels, under the National Fire Plan has partially compensated for the reduction in activity fuels burning. The National Fire Plan increased funding for hazardous fuels reduction beginning in 2001.

The BLM is a relatively small emitter of greenhouse gases from harvest operations and prescribed fire within the planning area (**Figure 3-25**). Management on privately-owned forests and on the National Forests each results in greater emissions. In large part, the differences reflect the differences in land base and, in the case of privately-owned forests, management intensity. Prescribed fire emissions in privately-owned forests are largely due to clean up of harvest-generated residue (activity fuels), whereas a portion of the prescribed fire emissions from National Forests and BLM-administered lands arises from the hazardous fuels reduction program in both agencies under the National Fire Plan.

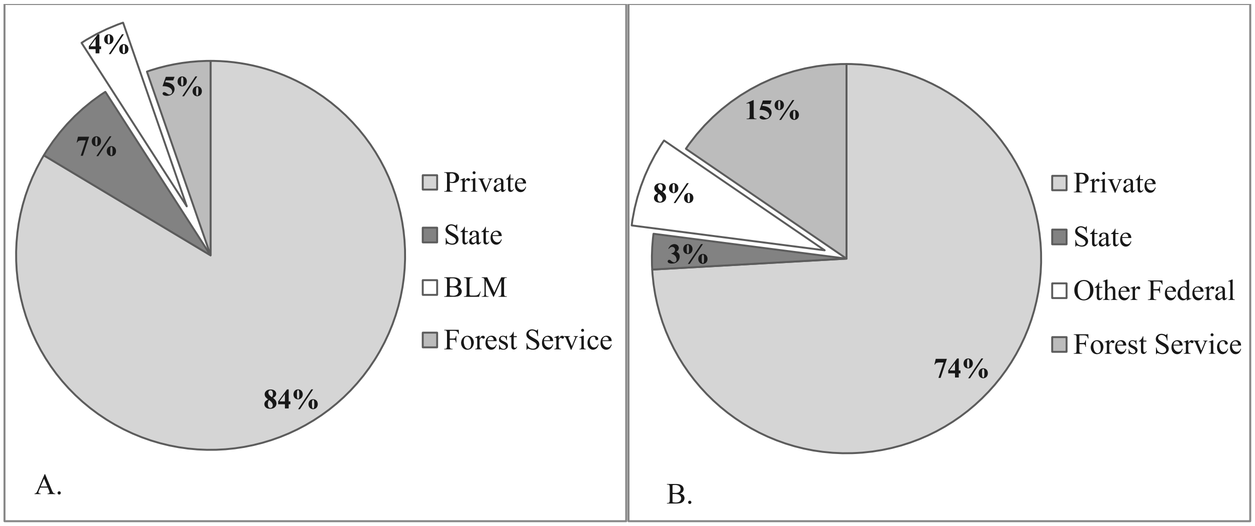

Figure 3-25. Proportion of estimated greenhouse gas emissions from (A) harvest operations and (B) prescribed burning by different entities.
The Other Federal category in B is largely BLM.

Trends in emissions are more difficult to ascertain. Emissions from grazing on BLM-administered lands within the planning area have very slightly declined since 1995 as more allotments became vacant and the number of active animal unit months declined. No trend is evident in wildfire emissions due to very high interannual variability in the acres burned on BLM-administered lands over the period of record (1980-2013).

Although interannual variability in emissions from harvest operations and prescribed burning is also high, some trends are apparent. Harvesting on privately-owned forests reflects current economic conditions, particularly in the housing market. During the recent housing boom, harvesting and the resulting greenhouse gas emissions from private land harvesting increased from the late 1990s until 2007. Between 2007 and 2009, emissions declined sharply, reflecting the economic downturn, which had a substantial impact on housing demand and lumber. This same effect on greenhouse gas emissions was also apparent nationally (EPA 2014b). Since 2009, harvesting levels and associated emissions have recovered to pre-recession levels. In contrast, harvesting levels and resulting emissions have been slowly increasing on both BLM-administered and National Forest System lands since 2001, with a slightly higher trend on National Forest System lands.

The trends in emissions from prescribed burning do not track the trends in emissions from harvesting operations. On private forests, emissions from prescribed burning have fallen since about 2006, even when harvest levels have risen. Whether the continued fall represents a lag between time of harvest and time of site preparation, a reduction in activity fuels due to higher utilization, or a shift in how the land managers handled activity fuels is unknown. Fluctuations in emissions from prescribed burning on BLM-administered lands and National Forest System lands within the planning area may reflect a combination of higher utilization and fluctuations in the hazardous fuels program. Since 2009, prescribed fire emissions from National Forest System lands have risen slowly, while emissions have fallen slowly on BLM-administered lands.

Environmental Effects

Greenhouse gas emissions would increase substantially relative to the estimate of current actual emissions under all alternatives, with the exception of Alternative D (**Figures 3-26** and **3-27**). This increase would be largely due to the amount of prescribed burning that would occur in conjunction with harvesting. Alternative C would result in the greatest increases. However, even the highest projected emissions under Alternative C would remain less than 1 percent of Oregon's 2010 in-boundary greenhouse gas emissions and approximately 0.0008 percent of total U.S. greenhouse gas emissions in 2012 (EPA 2014b, Figure ES-1). Alternative B greenhouse gas emissions would be the second-most of all alternatives. The No Action alternative and Alternative A would result in similar emissions, lower than Alternative B. Alternative D would result in the lowest emissions of all alternatives, only slightly higher than current emissions.

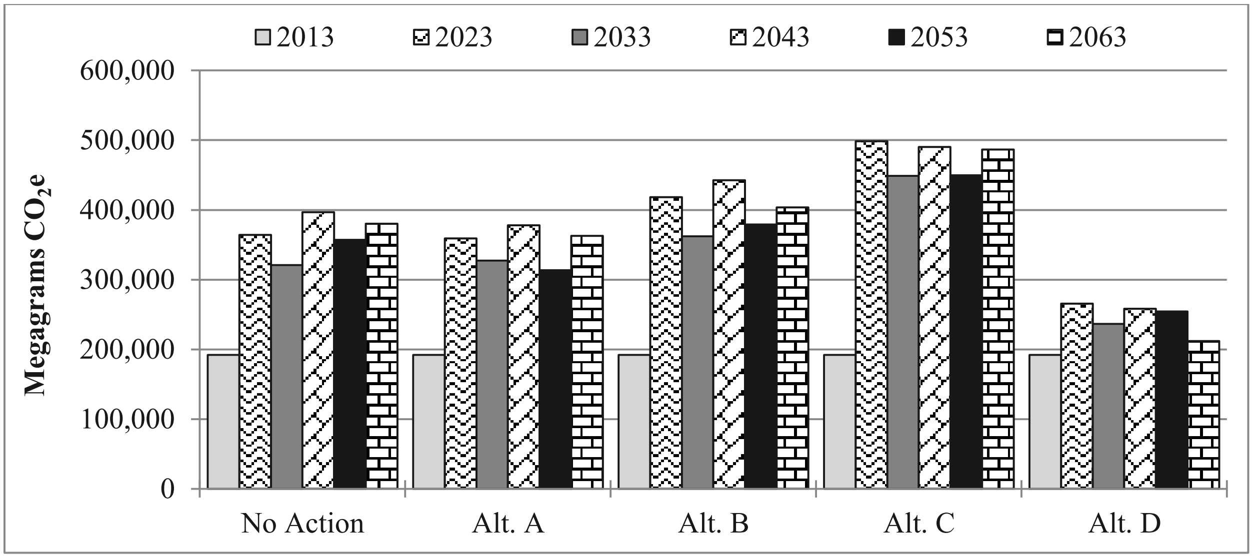

Figure 3-26. Estimated average annual greenhouse gas emissions from the combination of harvesting, grazing, prescribed fire, and wildfire. Variation in the amount of wildfire and prescribed fire cause most of the fluctuation in expected emissions between decades.

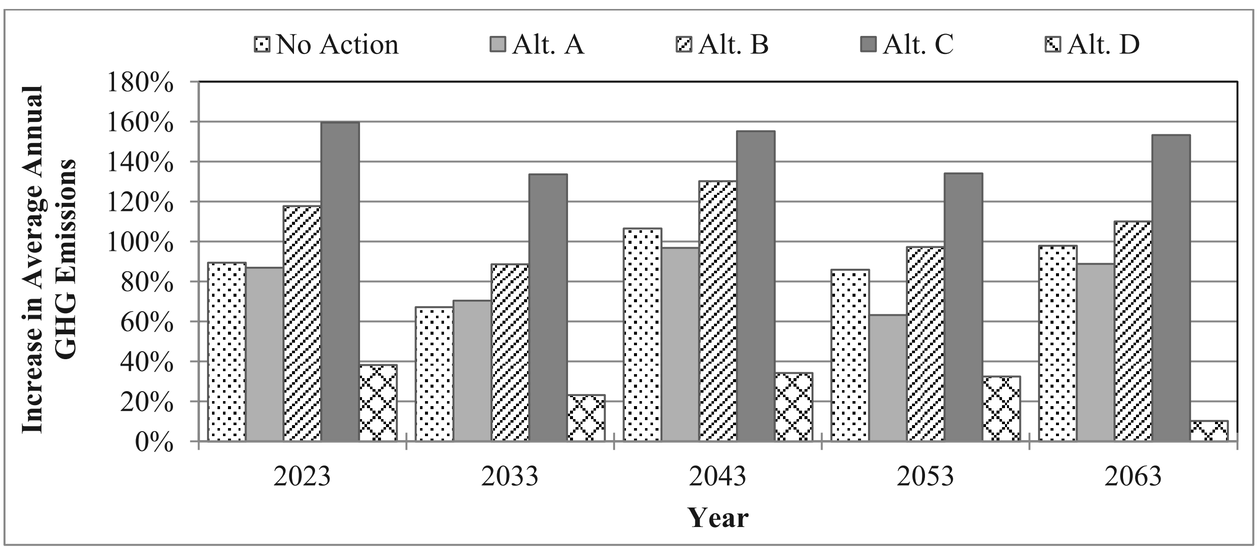

Figure 3-27. Projected increases in average annual greenhouse gas emissions from harvesting, grazing, prescribed burning and wildfires relative to average annual emissions as of 2013.

Issue 3

How would climate change interact with BLM management actions to alter the potential outcomes for key natural resources?

Summary of Analytical Methods

In this analysis, the BLM considered both how climate change would introduce uncertainty into outcomes described in other sections of this chapter and how the alternatives might allow the BLM to undertake actions to adapt to climate change during plan implementation. The BLM described current and projected climate trends and analyzed how these trends could affect the resources described in other sections. The BLM then considered the extent to which the alternatives would allow BLM to consider actions that promote adaptation to climate change during the implementation of the RMP.

The potential climate change impacts of most concern to the BLM are the indirect effects of changes in temperature, precipitation, and snow within the planning area, as these factors affect forest productivity and species composition, habitat for terrestrial and aquatic wildlife, and key disturbance regimes. This analysis focuses on the possible impacts to tree species composition and growth, fire regimes, insect outbreaks, certain diseases such as Sudden Oak Death and Swiss needle cast, stream flow and temperature in the context of fish habitat, and habitat for species such as northern spotted owl and marbled murrelet.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 39-40). The existing analyses in the NatureServe Climate Change Vulnerability Index website (http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index) did not include any species of birds, fish, or mammals relevant to BLM-administered lands in the planning area as of September 3, 2014. The bulk of this analysis consists of a review and synthesis of key literature.

To assess observed changes in climate, the BLM elected to use temperature and precipitation data available through WestMap (http://www.cefa.dri.edu/Westmap/), a tool developed by the Desert Research Institute, extracting the data by three hydrologic units- the Willamette River basin, Oregon coastal basins, which include southwest Oregon, and the Klamath River Basin. Data for the Klamath River basin includes northern California. Data extracted included precipitation, average annual temperature, average maximum temperature, and average minimum temperature, both annually and seasonally. The BLM used the water year (October 1 to September 30) for the annual basis and meteorological/climatological seasons (winter = December to February, spring = March to May, summer = June to August, and fall = September to November). The BLM imported the data into Excel spreadsheets, summarized, and conducted linear trend analyses using Sigma Plot 12.3. The BLM considered the results statistically significant at P-values of 0.05 or less. The BLM also extracted snow course data from the Natural Resources Conservation Service website (http://www.wcc.nrcs.usda.gov/snow/) and evaluated long-term trends in April 1 snow water equivalent using an Excel spreadsheet. The BLM did not analyze these data for statistical significance.

Background

Global assessments of climate over time have increased the certainty that climate is changing and that humans are a primary cause of that change through emissions of greenhouse gases, carbon dioxide in particular (IPCC 2013). According to the latest assessment from the Intergovernmental Panel on Climate Change (IPCC) global temperatures have increased by 1.53 ºF since 1880; the number of cold days and nights have decreased while the number of warm days and nights have increased; the frequency and intensity of heavy precipitation events have increased in North America and Europe; glaciers, sea ice, major ice sheets, and spring snow cover continue to shrink; and atmospheric concentrations of carbon dioxide, methane, and nitrous oxide exceed those of the last 800,000 years (IPCC 2013).

The latest national assessment for the United States affirms these same general trends. Average temperature in the United States has increased 1.3 to 1.9 ºF with most of this increase since 1970. The year 2012 was the warmest year on record. The length of the frost-free season has decreased and the subsequent growing season increased; heavy downpours have increased in frequency over the last three to five decades; heat waves are more frequent and intense, while cold waves are less frequent and less intense; winter storms have increased in frequency and intensity since the 1950s, and the general track has shifted northward; glaciers and snow cover are shrinking (Walsh *et al.* 2014).

The Pacific Northwest (Oregon, Washington, Idaho, and western Montana) has experienced many of the changes noted globally and nationally. The Pacific Northwest has warmed by 1.3 ºF since 1895, with statistically-significant warming in all seasons except spring, lengthening the frost-free period by 35 days (Snover *et al.* 2013). The frequency of extreme high nighttime temperatures has increased, with a statistically-significant increase west of the Cascade Mountains; however, no clear change in other temperature extremes has emerged (Dalton *et al.* 2013, Snover *et al.* 2013). Annual precipitation has no clear trend either upward or downward with high interannual variability (Snover *et al.* 2013). Although annual snowpack also fluctuates widely, generally snow accumulation is declining, and spring snowmelt is occurring earlier, leading to an earlier peak in streamflow in snowmelt-influenced streams (Snover *et al.* 2013).

Affected Environment

Three different climate types characterize the planning area: maritime, Mediterranean, and continental. The Coos Bay, Eugene, and Salem Districts have a maritime climate, typified by relatively cool, moist conditions year-round, although the Willamette Valley can be quite warm and dry in summer. The western portion of the Klamath Falls Field Office and Medford District have a Mediterranean climate, characterized by cool to warm, moist conditions in winter and hot, dry conditions in summer. The eastern portion of the Klamath Falls Field Office has a continental climate with cold, dry winters and hot, dry summers. The Roseburg District encompasses a transition zone between the Mediterranean and maritime climates, with no clear demarcation between the two climate types.

Based on the WestMap data, annual precipitation increased slightly in all three basins since 1896, and in some seasons, although the increases were not statistically-significant (**Figure 3-28**). The one exception is a statistically significant increase in spring precipitation in the Willamette River and Klamath River basins. All basins show a non-significant decline in fall precipitation, and the Oregon coastal basins have a non-significant decrease in winter precipitation.

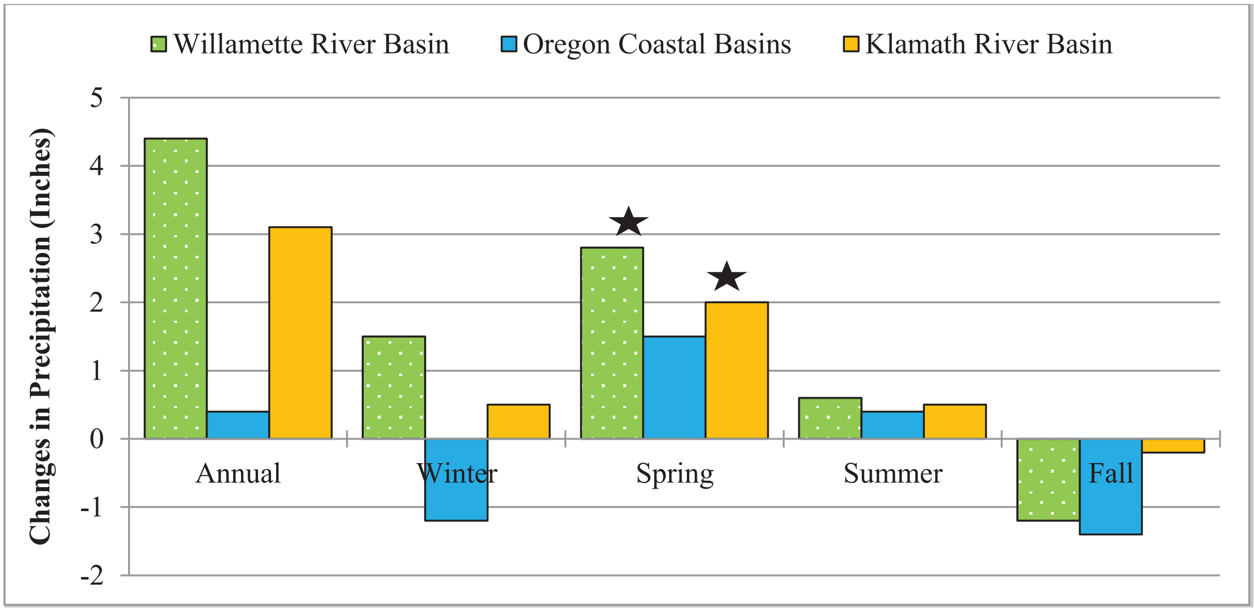

Figure 3-28. Observed changes in annual and seasonal precipitation by basin.
Star indicates change is statistically-significant. Annual = Oct 1-Sep 30, Winter = Dec-Feb, Spring = Mar-May, Summer = June-Aug, Fall = Sep-Nov.

The WestMap data also indicate that average annual and seasonal temperatures have experienced statistically-significant increases across the planning area (**Figure 3-29**). Since 1896, average annual temperature has increased by 1.4 ºF in the Oregon coastal basins, by 1.6 ºF in the Willamette River basin, and by 1.8 ºF in the Klamath River basin. Increases in average spring temperature are not statistically-significant in the Willamette River and Klamath River basins. Increases in minimum temperatures are statistically-significant in all basins, both annually and seasonally, whereas increases in maximum temperatures are significant only annually and in winter in all basins. The increase in summer temperature is also statistically-significant in the Klamath River Basin. Increases in minimum temperature are greater than the increases in maximum temperature. Given the small increases in precipitation and the more statistically-significant increases in temperature, the entire planning area is becoming warmer and drier, particularly in winter and at night. The amount of effective change in the Willamette River basin is smaller than the change in the Oregon coastal basins and Klamath River basin.

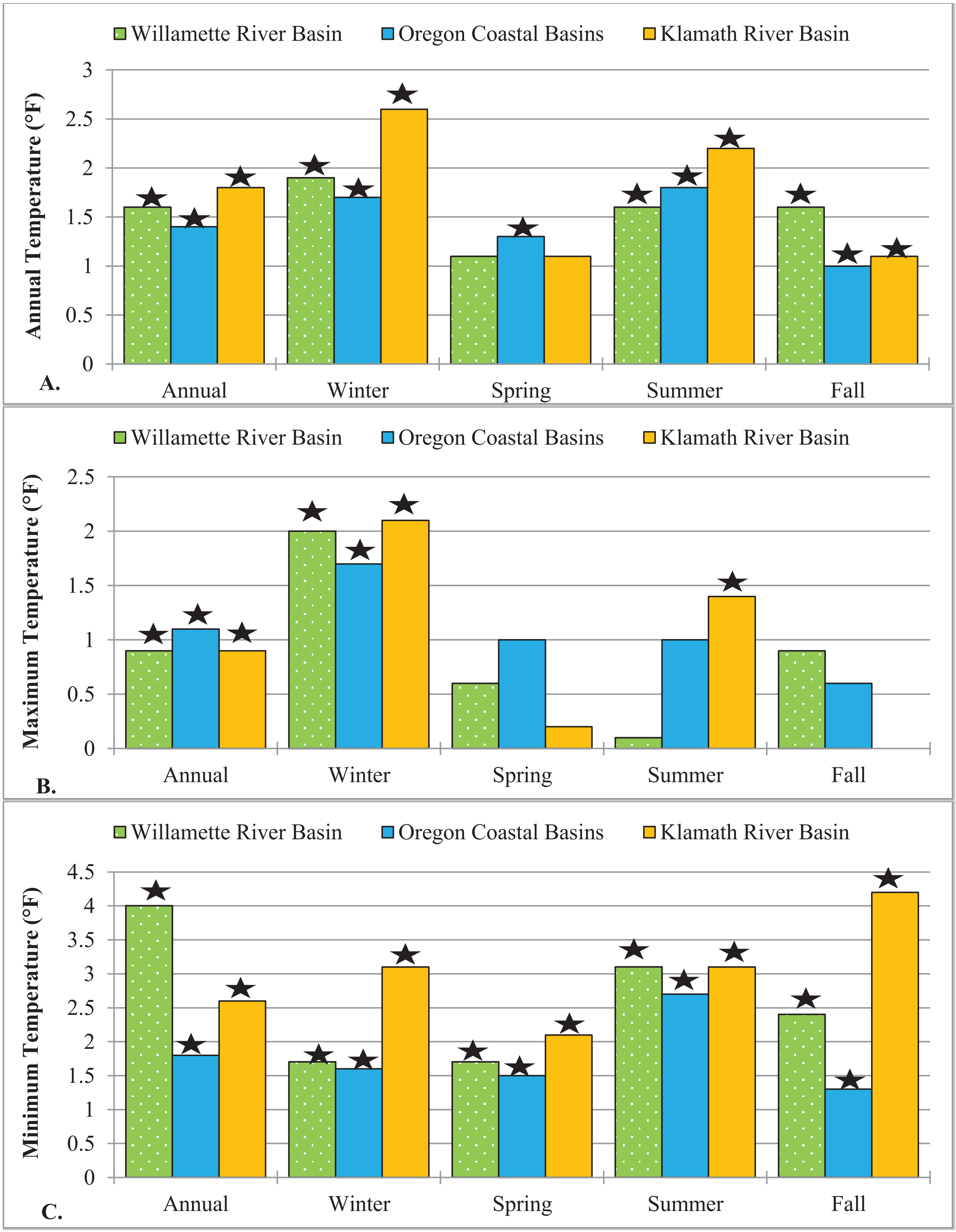

Figure 3-29. Observed changes in (A) annual, (B) maximum, and (C) minimum temperature in each basin.

Star indicates the change is statistically-significant. Annual = Oct 1-Sep 30, Winter = Dec-Feb, Spring = Mar-May, Summer = June-Aug, Fall = Sep-Nov.

Winter precipitation, in particular the amount, type, and timing, is an important factor in the response of vegetation and streams to climate change (Dalton *et al.* 2013, Peterson *et al.* 2014). Winter precipitation typically falls as rain in the coastal mountains and western Oregon valleys and a mix of rain and snow in the Cascade foothills and mountains (Safeeq *et al.* 2013, Klos *et al.* 2014). In the Cascades, only small differences in temperature differentiate between a rain event and a snow event (Lute and Abatzoglou 2014). Interactions between the phase of El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) influence winter temperatures and precipitation, resulting in high interannual variability in winter precipitation amount and timing (Dalton *et al.* 2013, Lute and Abatzoglou 2014). El Niño winters (ENSO warm phase) typically result in 20-60 percent less snow while La Niña winters (ENSO cool phase) typically result in 30-70 percent more snow (Lute and Abatzoglou 2014); the larger differences tend to occur when the phases of ENSO and PDO align (Dalton *et al.* 2013).

Reflecting the observed changes in temperature in particular, April 1 snow water equivalent (the time when snowpack historically has peaked) has been decreasing across much of the western United States, with some of the largest relative decreases in western Oregon (Mote *et al.* 2005, Peterson *et al.* 2014). Snow course data for western Oregon indicate that decreases are occurring at all elevations across the planning area, although there is high interannual variability in snow amounts. Both the Cascade and Klamath Mountains can have high accumulations of snow, but that accumulation period is typically short, and the snowmelt period begins early and occurs more rapidly that most of the western United States (Trujillo and Molotch 2014). In contrast, the Coast Range has only intermittent snow all winter. Winter atmospheric rivers, often associated with La Niña winters, typically deliver the most snow and over short periods (1 to 2 days), but can also result in rain-on-snow events that result in very rapid melting and flooding (Lute and Abatzoglou 2014, Trujillo and Molotch 2014).

Thus far, the observed changes in climate have not yet lead to noticeable changes in forests, most disturbance regimes, and terrestrial wildlife species ranges or habitat within the planning area. Assessments at larger spatial and temporal scales suggest some changes could be occurring already, but at levels indistinguishable from natural variability. In other words, within the planning area, climate-related changes in ecosystems cannot be detected over the “noise” of interannual and interdecadal variability at this geographic scale.

Tree Species

In their evidence-based review of the science, Allen *et al*. (2010) found that tree mortality from climate-induced stress driven by drought and warmer temperatures appears to be increasing worldwide in all forest types. In North America, drought and warmer temperatures have been correlated to increases in the mortality of several pine species, several spruce species, white fir, incense-cedar, two species of juniper, and Douglas-fir (Allen *et al.* 2010). In the western United States, background rates of mortality have increased in recent decades across elevation, tree size, dominant genera, and past fire histories with warming and increased water stress believed to be a major contributor to the increase (van Mantgem *et al.* 2009). The patterns of mortality are patchy with higher levels in drier forests, but increased mortality has been documented on productive sites where changes in moisture stress may well interact with density-dependent factors (Allen *et al.* 2010). In conifer forests and woodlands, climate-related mortality is more common during multi-year droughts than during seasonal droughts, and warmer temperatures can increase moisture stress independent of precipitation amount (Allen *et al.* 2010). Given these findings, climate change may have increased background tree mortality in the Klamath Falls Field Office and the Medford and Roseburg Districts, but it is less clear if background mortality may have increased in the Coos Bay, Salem, and Eugene Districts.

Devine *et al.* (2012) developed climate vulnerability rankings for major tree species on the National Forests in Oregon and Washington, breaking out the results by geographic area. The authors based the ratings on tree species distribution, reproductive capacity, habitat affinity, adaptive genetic variation, and risk of insects and disease. Species deemed more vulnerable were those that were rare, had low seed production and low seed viability with very short dispersal distances, were habitat specialists, were either disjunct or at the edge of the species' range, and had insect pests or diseases that were increasing in distribution and impacts with typically high mortality of mature trees, among other characteristics. Species rated as less vulnerable were those with opposite characteristics (e.g., widespread, common, habitat generalists, and high seed production with high seed viability). The rankings used data on the distribution of species within the National Forests, although the rankings provide an indicator of potential vulnerability on BLM-administered lands within the planning area. The authors normalized rankings so they varied between 0 and 100, with the higher the ranking, the more vulnerable the species.

Rankings sometimes differed for species that occur in both northwest and southwest Oregon (**Table 3-24**). For example, the authors rated Engelmann spruce as less vulnerable in northwest Oregon than in southwest Oregon, whereas the opposite was true for sugar pine. The authors rated Douglas-fir as slightly more vulnerable in northwest Oregon than in southwest Oregon, largely due to differences in adaptive genetic variation and insects and disease risks. Generally, species found primarily at higher elevations tended to be ranked as more vulnerable than those found primarily at lower elevations. Some species may be more widespread on BLM-administered lands, which tend to be lower elevation, than on National Forests so may actually have a somewhat lower vulnerability, whereas the opposite may also be true for other species. Examples of the former would be the various oak species, while the latter would be the higher elevation species.

Table 3-24. Climate change vulnerability scores for different tree species in western Oregon from Devine *et al.* 2012.

Species	Northwest Oregon	Southwest Oregon
Subalpine fir	77	69
Pacific silver fir	66	56
Noble fir	60	
Noble fir-Shasta red fir complex		48
Grand fir	59	
Grand fir-white fir complex		55
Douglas-fir	41	36
Western hemlock	52	42
Western larch	52	
Engelmann spruce	55	71
Sitka spruce	39	
Whitebark pine	67	67
Lodgepole pine	56	42
Shore pine	17	
Sugar pine	59	39
Ponderosa pine	46	46
Western white pine	39	36
Jeffrey pine		39
Knobcone pine		30
Western redcedar		
Alaska yellow-cedar	59	
Port-Orford-cedar	36	35
Incense-cedar		33
Western juniper		27
Bigleaf maple	50	39
Red alder	38	33
Tanoak		46
Oregon white oak	54	48
California black oak		45
Canyon live oak		40
Black cottonwood	27	
Pacific madrone		46

* A higher score indicates greater vulnerability. Northwest Oregon roughly corresponds to the Eugene, Roseburg, and Salem Districts, Southwest Oregon to the Coos Bay and Medford Districts and the Klamath Falls Field Office.

One factor in the ratings was whether the species was at or near the limits of its range, although it is not clear if the authors rated species at the southern end of their range differently than species at the northern limit. A common climate change effect prediction is that species ranges would tend to shift poleward and upward in elevation; numerous studies of taxa other than trees have documented shifts consistent with this prediction (e.g., Parmesan and Yohe 2003, Root *et al.* 2003, Tingley *et al.* 2012, Comte and Grenouillet 2013, Cahill *et al.* 2014). Pacific silver fir, subalpine fir, Alaska yellow-cedar, and Engelmann spruce are at or near the southern limits of their range in western Oregon, so may well be more vulnerable in southwestern Oregon. Conversely, incense-cedar, sugar pine, Jeffrey pine, canyon live oak, California black oak, and tanoak are at the northern limits of their range in western Oregon and could be expected to expand northward, making them less vulnerable.

Insects and Pathogens

Many insects and pathogens are influenced by temperature and precipitation amount and timing (Sturrock *et al.* 2011, Vose *et al.* 2012, Peterson *et al.* 2014). Sturrock *et al.* (2011) reviewed much of the literature concerning the potential impact of climate change on a variety of important forest diseases. Generally, warming winters and minimum temperatures and increasing moisture during the growing season favor pathogens that require leave or needle wetness to spread, while drying conditions disfavor such pathogens. Examples include Sudden Oak Death (Venette and Cohen 2006), *Dothistroma* needle blight (Woods *et al.* 2005), Swiss needle cast (Manter *et al.* 2005, Lee *et al.* 2013, Tillmann and Glick 2013), and white pine blister rust (Sturrock *et al.* 2011). Although not specifically discussed, Port-Orford-cedar root disease, another *Phytophthora* species, likely responds similarly to Sudden Oak Death. In contrast, warming and drying conditions will favor pathogens that increase when host species are water-stressed, such as *Armillaria* root disease and various canker species (Sturrock *et al.* 2011, Vose *et al.* 2012). The response of pathogens that depend on insects for spread will likely be complex, depending on how the particular insect vector responds to changing climate (Sturrock *et al.* 2011).

Since temperature is a primary control on insect development and survival (Peterson *et al.* 2014), warming temperatures will and are altering insect pest dynamics (Chmura *et al.* 2011). The best-known and documented example is mountain pine beetle with the recent outbreak across western North America the subject of many studies. Warming temperatures and increased drought stress are commonly cited factors in the scale of the current mountain pine beetle outbreak (Vose *et al.* 2012). Conditions that create water-stress in trees limit the effectiveness of tree defenses and favors bark beetles (Evangelista *et al.* 2011, Vose *et al.* 2012, Tillmann and Glick 2013, Creeden *et al.* 2014). How changing climate is and will potentially affect defoliating insects is less clear. Outbreaks of this class of insects tend to be cyclical and involve predators, parasitoids, and pathogens of the individual insect species, and the role of climate in such cycles is not clear (Vose *et al.* 2012, Tillmann and Glick 2013). For example, outbreaks of western spruce budworm in the interior west tend to occur near the end of droughts (Flower *et al.* 2014), but in British Columbia tend to be associated with dry winters followed by average spring temperatures (Campbell *et al.* 2006). Chen *et al.* (2003) noted that the degree of damage in Douglas-fir was also correlated with close matches between the phenology of budburst and larval emergence. Changing atmospheric CO_2 concentrations will also influence insect dynamics by increasing carbon availability for tree defenses and altering the carbon:nitrogen ratios in leaves and needles, thereby reducing food quality (Peterson *et al.* 2014).

Other than a documented increase in the incidence, damage, and inland spread of Swiss needle cast in northwest Oregon (Manter *et al.* 2005), no obvious climate change-related changes in the incidence of insects and diseases have been clearly noted within the planning area. Determining both whether increasing atmospheric CO_2 has a bigger impact than increasing temperature and whether the effects of increasing atmospheric CO_2 concentrations on insect dynamics has occurred within the planning area remains elusive.

Fire

Many studies have examined changes in area burned, individual fire severity, and fire season severity, concluding that changes in climate are a major factor driving these observed changes. Westerling *et al.* (2006) documented an increase in the length of fire season west-wide by at least one month, based on start dates of fires at least 1,000 acres in size, attributing this change to earlier snowmelt and longer, drier summers. Van Mantgem *et al.* (2013) reported an increase in the probability of tree mortality due to the combination of drought and warming temperatures. Dry, warm conditions, particularly in the years of fire, are also strongly associated with greater annual area burned in the northwestern United States (Littell *et al.* 2009). Larger fires in recent decades also tend to have a higher proportion of high severity burn area in terms of tree mortality, and larger high severity patch sizes when conditions are warm and dry (Abatzoglou and Kolden 2013, Cansler and McKenzie 2013).

Within the planning area, fire season length and potential severity, as measured by energy release component, a measure of seasonal dryness used in fire danger rating, has increased (Dalton 2014, unpublished data). The changes in fire season severity and the severity of individual fires have occurred consistent with the west-wide results above; however, there are simply too few fires that have originated on BLM-administered lands (or in western Oregon), to provide a clear signal of such changes. An analysis of Oregon large fires using data from the Monitoring Trends in Burn Severity site (http://mtbs.gov/index.html) indicates that the proportion of high-severity fire in forests generally has increased by 11 percent since 1984, with much of the increase since 2000.

Streamflow and Temperature

Several studies have concluded that observed changes in stream flow regimes and temperature in the western U.S. are a result of climate change, but that these changes depend on more than just changes in air temperature, precipitation amount, and timing. Geology, topography, vegetation, and other factors also play a role (Dalton *et al.* 2013, Safeeq *et al.* 2013). Safeeq *et al.* (2013) report that streams that are primarily groundwater-sourced respond differently to changing climate from those that are surface water-sourced. In western Oregon, streams arising in the Coast Range are surface water-sourced from rain, whereas streams arising in the Cascades are groundwater-sourced from a mix of rain and snow, with predominately rain below 1,300 feet elevation, predominately snow above 4,900 feet, and a mix of rain and snow between 1,300 and 4,900 feet (Tague and Grant 2004, Safeeq *et al.* 2013, Klos *et al.* 2014). Total annual streamflow has been declining in the Pacific Northwest and current flows are similar to those in the 1930s, one of the driest periods on record (Luce *et al.* 2013). While scientists do not understand the exact causes, some combination of warming temperatures, decreasing snow, and decreasing mountain precipitation due to weakening of the westerly winds in winter appear to play a role (Dalton *et al.* 2013, Luce *et al.* 2013, Berghuijs *et al.* 2014).

The timing of peak flows is also shifting west-wide with an increased proportion of the annual flow occurring in winter and a decreasing proportion in summer (Safeeq *et al.* 2013). Rain-dominated streams have earlier peak spring flows and declining late fall and winter flows, whereas snow-dominated streams have greater reductions in summer flows (Safeeq *et al.* 2013). However, the response of individual streams varies, depending on underlying geology. For example, streams originating in geology that supports slow-draining, deep groundwater exhibit less variability in flow regimes than streams originating in geology that supports shallow, rapid subsurface flow (Tague and Grant 2004 and 2009). However, as snowpack declines, the absolute change in summer base flows is greater in the deep groundwater systems than in the shallow, rapid subsurface systems (Tague *et al.* 2008, Tague and Grant 2009, Safeeq *et al.* 2013).

Stream temperatures in the United States as a whole and in the Northwest have been increasing (Bartholow 2005, Kaushal *et al.* 2010, Dalton *et al.* 2013). However, there is local and regional variation. Kaushal *et al.* (2010) reported statistically-significant upward trends for Fir Creek, the North Santiam River and Rogue River, non-significant trends for the Bull Run, South Fork Bull Run, and North Fork Bull Run rivers, and no trend for the South Santiam River. Blue River had a statistically-significant cooling trend, although all records for Oregon were relatively short. The direction and significance of stream temperature trends depend on the period of record, sample size, and spatial extent of the samples (Arismendi *et al.* 2012).

Northwest streams typically have cooling trends in spring, consistent with increasing precipitation, but warming temperatures in summer, fall, and winter. The cooling in spring is not enough to fully offset warming in the other seasons, leading to an overall warming trend in stream temperatures (Isaak *et al.* 2012). The rates of warming are highest in summer, with greater summer warming occurring in streams with the greatest decrease in discharge instead of the streams with the lowest discharge (Isaak *et al.* 2012). Overall, stream temperatures track with air temperatures, although there is often a slight lag (Isaak *et al.* 2012, Arismendi *et al.* 2013). Diabat *et al.* (2013) found that increasing nighttime temperatures appears to be a bigger driver of stream temperature changes than increasing daytime temperatures, indicating that the observed increasing minimum temperatures in all seasons may be important factors. In the John Day River in eastern Oregon, the time lag between stream temperature maxima and stream flow minima has decreased by approximately 24 days since 1950, potentially due to earlier timing of stream flow minima, especially given no observed change in the timing of stream temperature maxima (Arismendi *et al.* 2013). Similar changes are likely within the planning area, given that the same air temperature and stream flow changes are occurring across Oregon.

Wildlife and Wildlife Habitat

Several different studies have documented changes in fish and wildlife species consistent with those expected with increasing temperatures worldwide, nationally, and statewide. These observed effects include changes in migration timing, species ranges, species abundance, and similar impacts (Parmesan and Yohe 2003, Hixon *et al.* 2010, Tillmann and Glick 2013, Groffman *et al.* 2014). Detailed discussion of any observed climate change effects on all fish and wildlife species found within the planning area is not possible. However, a brief discussion of climate influences on northern spotted owl and marbled murrelet illustrates how climate change may be influencing two important species.

Climate can affect species persistence directly by affecting survival of the young and indirectly by altering habitat, such as nesting sites or prey abundance. With northern spotted owls, climate conditions that affect prey abundance affect owl survival, with populations decreasing when winters and early spring were cold, wet and stormy or summers are droughty, and populations increasing when late spring through early fall are moist (Franklin *et al.* 2000, Glenn *et al.* 2010, Glenn *et al.* 2011). In Cascade populations, owl survival also decreases as the number of summer days with temperatures at or above 90 ºF increases (Glenn *et al.* 2010, Glenn *et al.* 2011). Under stable habitat conditions, climate is apparently the dominant influence on owl populations, but as habitat quality declines, the effects of climate variation on survival increases (Franklin *et al.* 2000). Climate effects appear to be local, rather than regional, with some locations experiencing lags in effect with respect to sub-adult survival (Glenn *et al.* 2010, Glenn *et al.* 2011).

Marbled murrelets are affected by both land and ocean conditions. Various studies have attributed population declines in the 1990s and 2000s to loss of nesting habitat and low food availability at sea (Strong 2003, Peery *et al.* 2004, Becker *et al.* 2007, Norris *et al.* 2007, Miller *et al.* 2012b, Raphael *et al.* In Press), but disagree on which is more important. Poor ocean conditions arising from climate may have contributed to murrelet population declines in the 1990s by affecting food availability at sea, but given improved ocean conditions since the mid-2000s, climate may not have been a substantial factor in continued declines. Norris *et al.* (2007) found that since the 1950s, murrelet populations in southern British Columbia were adversely affected by low food quality, specifically by less abundance of small fish in the bird's diet. Off the central California coast, Becker *et al.* (2007) found that murrelet productivity was correlated with rockfish and krill productivity, which were higher when ocean temperatures were cooler. When food resources are low, murrelet adults must fly further and dive more often, using more energy (Peery *et al.* 2004). As with northern spotted owls, these findings indicate that even when sufficient high-quality nesting habitat is available, climate events and climate change can influence murrelet populations by affecting the conditions important for prey species.

Climate Change Projections and Potential Effects on Resources

Dalton *et al*. (2013) summarized the most recent climate change projections for the Pacific Northwest (Oregon, Washington, Idaho, and western Montana) under representative concentration pathways (RCP) 4.5 and 8.5. These pathways represent a substantial reduction in greenhouse gas emissions in the near future and "business as usual," respectively. Current greenhouse gas concentrations and atmospheric CO_2 concentrations are tracking with the RCP 8.5 pathway (Peters *et al.* 2013, Le Quéré *et al.* 2014). By 2041-2070, temperatures are projected to increase in all seasons, with the greatest increase in summer (**Table 3-25**). Precipitation is projected to increase modestly in winter, spring and fall and decrease in summer throughout the Pacific Northwest. The area west of the Cascades where the maritime influence is strong would not warm as much as elsewhere in the Pacific Northwest, particularly in spring. Dalton *et al.* (2013) did not identify any sub-regional differences in precipitation.

Table 3-25. Expected changes in mean annual and seasonal temperature and precipitation by 2041-2070 as compared to means in the 1950-1999 for RCP 4.5 and RCP 8.5. Ranges are in parentheses.

Season	Temperature		Precipitation	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Annual	4.3 ºF (2.0-6.7 ºF)	5.8 ºF (3.1-11.5 ºF)	+2.8% (-4.3-10.1%)	+3.2% (-4.7-19.8%)
Winter (Dec-Feb)	4.5 ºF (1.0-7.2 ºF)	5.8 ºF (2.3-9.2 ºF)	+5.4% (-5.6-16.3%)	+7.2% (-10.6-19.8%)
Spring (Mar-May)	4.3 ºF (0.9-7.4 ºF)	5.4 ºF (1.8-8.3 ºF)	+4.3% (-6.8-18.8%)	+6.5% (-10.6-26.6%)
Summer (Jun-Aug)	4.7 ºF (2.3-7.4 ºF)	6.5 ºF (3.4-9.4 ºF)	-5.6% (-33.6-18%)	-7.5% (-27.8-12.4%)
Fall (Sep-Nov)	4.0 ºF (1.4-5.8 ºF)	5.6 ºF (2.9-8.3 ºF)	+3.2% (-8.5-13.1%)	+1.5% (-11.0-12.3%)

Some of the projected changes displayed in **Table 3-25** are not consistent with observed trends displayed in **Figures 3-28** and **3-29**, with differences in precipitation especially notable. Climate models project an increase in fall precipitation, yet the observed trend is a decrease. Similarly, the observed trend in summer precipitation is a slight, statistically-insignificant increase, whereas the projection is for a decrease. Observed and projected temperature changes are more consistent, but the magnitude of change shows some differences. For example, the observed increase in maximum summer temperatures in the Willamette basin is small, suggesting that the mid-century increase may not be as large as projected.

The differences between the projections and observed trends likely arise due to differences in the size of area assessed and resolution of the data used. Trends in a smaller part of the Pacific Northwest can differ from those for the area as a whole. The WestMap data is at a finer resolution than the climate projection data, so likely better reflects the effects of topography on both temperature and precipitation. The projected changes in precipitation in particular encompass large ranges, including both increases and decreases in all seasons in both climate change scenarios, even though the ensemble mean indicates increases in winter, spring, and fall and decreases in summer. Lastly, observed trends in precipitation may not continue in the future if increasing temperatures result in fundamental changes in the atmospheric circulation patterns that bring moist air into Oregon.

By 2014-2070, the number of frost-free days is projected to increase by 35 days (± 6 days) relative to 1971-2000. Climate modeling indicated the number of growing degree-days using a base of 50 ºF would increase by 51 percent (±14 percent). The number of hot days (i.e., days with maximum temperatures greater than 90 ºF, 95 ºF and 100 ºF, as well as the number of consecutive days above 95 ºF and 100 ºF) would increase, while the cold days (with minimum temperatures of less than 32 ºF, 10 ºF, and 0 ºF) would decline. The number of very wet days (with precipitation above 1 inch, 2 inches, 3 inches, and 4 inches) would increase, as would the dry spells (maximum run of days with less than 0.1 inch).

As temperatures continue to warm, the extent of snow-dominated winter precipitation would continue to decline (Mote *et al.* 2005). By mid-century, none of the Cascades ecoregion (EPA Level-III ecoregion 4) would remain strongly snow-dominated, and the extent of strongly rain-dominated area would increase by 42 percent to an estimated 59 percent of the ecoregion. Although none of the Coast Range (EPA Level-III ecoregion 1) and the Klamath Mountains (EPA Level-III ecoregion 78) are strongly snow-dominated, all of the Coast Range and 95 percent of the Klamath Mountains are projected to become strongly rain-dominated by mid-century (Klos *et al.* 2014).

Several different climate change assessments project that the frequency, duration, and severity of drought will increase globally, nationally, and regionally (Dai 2011, Gutzler and Robbins 2011, Jung and Chang 2012, Vose *et al.* 2012, Dalton *et al.* 2013, Walsh *et al.* 2014). However, the term “drought” remains ill-defined, making projections of changing drought risks difficult to evaluate. Drought is not just a deficit in precipitation but insufficient water to meet needs; temperature plays a very important role that many drought assessment tools either do not incorporate or incorporate inadequately (Bumbaco and Mote 2010). At least three and possibly four different types of drought occur in the Pacific Northwest (Bumbaco and Mote 2010). The first type is very low winter precipitation with seasonally typical temperatures (dry drought) as represented by conditions in 2001. The second type of drought consists of warm winter temperatures with normal precipitation, resulting in more rain and low snow packs followed by a very warm, dry summer (hot-dry drought) as represented by conditions in 2003. This type of drought tends to develop suddenly with little or no warning and is associated with low summer streamflow in western Oregon. The third type of drought consists of a warm, dry winter followed by a near normal summer (warm-dry drought) as represented by conditions in 2005. The fourth type of drought, which has not been formally described, consists of very warm temperatures and near normal precipitation (very hot drought) as represented by conditions in 2013. A characteristic of all these drought types is a low winter snowpack combined with high evapotranspiration demand during the growing season. The warm-dry drought; hot-dry drought; and very hot drought are also associated with more severe fire seasons in western Oregon. Based on the temperature and precipitation projections, the warm-dry drought, hot-dry drought, and very hot drought are expected increase in frequency while the dry drought would likely decrease in frequency (Bumbaco and Mote 2010).

There are substantial uncertainties associated with the various predictions discussed below. The choice of global climate model used is typically the largest source of variability in simulation study results (Hurteau *et al.* 2014). There is also a fundamental scale mismatch between the spatial resolution of climate predictions, even those that have been downscaled, and the size of the typical management unit simulated in many studies (Hurteau *et al.* 2014).

Tree Species

Understanding how climate change may affect species composition and forest productivity has been the topic of numerous studies. Results vary depending on the spatial and temporal scale of the studies and assumptions about climate drivers and the interaction between climate and non-climate drivers that underpin such studies. Therefore, interpreting what these results might mean for land management remains challenging. Generally, trees can respond to changing climate through phenotypic plasticity (altering physiology), morphology, and reproduction within their existing genetic capability, through natural selection, or through migration, as summarized by Peterson *et al.* (2014, Chapter 5).

There are several approaches to modeling potential vegetation change based on statistics, ecological processes, or a mix of the two, all with their strengths and weaknesses (Peterson *et al.* 2014, Chapter 6). Most studies of how tree species compositions may shift use bioclimatic envelope models, a statistical method that bases predictions on the climate where species are present and absent. Despite their limitations, bioclimatic envelope models are the most widely used, due to ease of use and applicability at a number of scales (Araújo and Peterson 2012, Peterson *et al.* 2014). Other factors, such as competition, land uses, soils, topography, and disturbance regimes, can prevent a species from occupying an area that is otherwise suitable climatically, or allow it to remain in a location that broader-scale climate predictions indicate would not remain suitable (Peterson *et al.* 2014). Process-based models and hybrid models can incorporate many non-climate drivers. However, these models remain rarely used to date, due to the lack of information needed to parameterize such models for most species, high computational demand, and lack of information on how climate affects many forest tree processes, particularly regeneration, growth and mortality (Peterson *et al.* 2014).

Using the climate module of the Forest Vegetation Simulator (Climate-FVS), the climatically suitable area for many important timber species in the planning area would contract by mid-century, primarily from the lower elevations, with generally much greater contraction under RCP 8.5 than under RCP 4.5 (Diaz *et al.* 2014). The suitable climate for western hemlock, western redcedar, Pacific yew, incense-cedar, Port Orford-cedar, grand fir, white fir, noble fir, and sugar pine are projected to contract substantially in western Oregon under both pathways. Several modeling approaches indicate probable loss of climatically-suitable areas for western hemlock and western redcedar, primarily in southwest Oregon, but the projected losses from Climate-FVS are likely too high (Diaz *et al.* 2014). The area climatically suitable for Douglas-fir may increase in the Klamath Falls Field Office. The Climate-FVS analysis projected that the climatically-suitable area for several species more typically found in California, such as several species of oak, white alder, California laurel, and knobcone pine would expand into Oregon and up the eastern side of the Coast Range and foothills of the Cascades.

The fate of Douglas-fir is of particular interest due to its current dominance throughout western Oregon and importance for both timber and wildlife habitat. Many studies predict some degree of decline in the extent of Douglas-fir, particularly at lower elevations. The degree of decline varies widely between studies, ranging from major contractions, especially from the Coast Range, to little change (Bachelet *et al.* 2011 and references therein, Coops and Waring 2011, Peterson *et al.* 2014, Rehfeldt *et al.* 2014a).

Using the dynamic global vegetation model MC2, Bachelet (2014 in Diaz *et al.* 2014) projected substantial contraction of the maritime conifer forest and expansion of both the temperate conifer forest more typical of eastern Oregon and temperate cool mixed forest more typical of the central and southern Coast Range (data available at http://climate.databasin.org/). Douglas-fir is a substantial component of all three forest types, but consists of different ecotypes, or climatypes,[39] of the species (Rehfeldt *et al.* 2014c). In addition, the temperate, cool, mixed-conifer forest type includes a number of so-called hardwoods, such as tanoak, madrone, and several species of oaks, suggesting broad consistency between the statistical approach used by Climate-FVS and the process-based approach used in MC2.

With shifting bioclimate suitability, a primary concern is the rate at which climate is changing (climate velocity), relative to the rate at which a given species can migrate. For plants, migration rates depend on seed production rates, seed dispersal distances, average seed viability, presence or absence of barriers, biotic interactions between migrating species and current species, and the presence of suitable habitat between the current location of a given climatype and the likely future location of suitable climate (Peterson *et al.* 2014). Climate velocity is generally slower in complex terrain, and complex terrain is more likely to provide climate refugia (Peterson *et al.* 2014), such as is present in western Oregon. Further, species migration rates typically lag behind climate velocity rates with considerable regional variation in both rates and direction (Dobrowski *et al.* 2013). Thus, while several studies indicate that climate velocity exceeds the migration rate of many plant species, including many tree species,

[39] A climatype is a population defined primarily by the temperature and precipitation ranges to which it is presumably adapted genetically.

determining the vulnerability of individual species to climate change based on climate velocity is difficult with large uncertainties.

As climate shifts, forest scientists expect background mortality will increase, but do not expect major die-offs of mature trees because of changing climate alone. Instead die-offs are expected from the interaction between changing climate and disturbance events, such as drought and fire (Allen *et al.* 2010, Peterson *et al.* 2014) or climate and increased competition for water and carbon (Clark *et al.* 2014). Changes in vegetation are likely to be abrupt following an event such as prolonged drought, insect outbreak, or wildfire, when mature trees are killed and regeneration fails. The bioclimatic envelope for seedlings of montane species, such as Douglas-fir and ponderosa pine, typically differ from and are narrower than the bioclimatic envelope in which established trees can persist (Bell *et al.* 2014). Species with broad distributions typically have ecotypes/climatypes adapted to local conditions; as local conditions change, a given climatype may not be able to reestablish following a disturbance. Using climate variables, Rehfeldt *et al.* (2014b, 2014c) predicted that the varieties of Douglas-fir and ponderosa pine found in western Oregon are likely to persist, although probably would not persist in an area that includes the Klamath Falls Field Office. In contrast, St. Clair and Howe (2007), using characteristics such timing of bud set and bud break and root:shoot ratios predicted that most coastal Douglas-fir ecotypes in western Oregon and Washington would be maladapted to the expected climate at the end of the 21st century. The authors posited that much of the risk arises from differences in drought hardiness in the different ecotypes relative to expected changes in seasonal and prolonged drought, and lengthening of the growing season (St. Clair and Howe 2007).

Available soil water during the growing season and soil water storage capacity are important drivers of which tree species can grow where and how well, particularly at lower and middle elevations (Chen *et al.* 2010, Weiskittel *et al.* 2011, Clark *et al.* 2014, Mathys *et al.* 2014, Peterson *et al.* 2014). Year-round soil water availability and evapotranspiration demand are primary factors in the distribution of western hemlock (Gavin and Hu 2006, Mathys *et al.* 2014). Western redcedar distribution is controlled in part by the availability of soil water in summer and winter (Mathys *et al.* 2014). Climate change is projected to extend growing seasons and increase evapotranspiration demand in summer, increasing the amount of drought stress forests in western Oregon will experience (Peterson *et al.* 2014). Site index for many species in western Oregon could decrease by 10-30 percent by 2060, largely due to increased dryness in the growing season (Weiskittel *et al.* 2011).

Potentially mediating the expected increased drought stress, is the increasing atmospheric CO_2 concentrations. As atmospheric CO_2 concentrations increase, trees do not have to open stomates as frequently or for as long to obtain the amount of CO_2 necessary to drive photosynthesis, thereby reducing water loss that occurs at the same time (photorespiration) and increasing drought tolerance (Peterson *et al.* 2014). A recent study in the northern Rockies indicates that while both ponderosa pine and Douglas-fir have experienced increases in water use efficiency with increases in basal area increment in the latter half of the 20th century, ponderosa pine had greater increases, suggesting a possible shift in competitive advantage (Soulé and Knapp 2014). However, few studies have examined how different tree species might respond to changing atmospheric CO_2 concentrations, particularly in conjunction with changing temperatures.

Insect Outbreaks and Pathogen Spread

Warming temperatures, wetter springs, and increased drought stress may increase the extent and impact from Swiss needle cast, sudden oak death, Port Orford-cedar root disease, other root diseases such as *Armillaria* and *Heterobasidion*, bark beetles, and western spruce budworm in western Oregon (Chen *et al.* 2003, Manter *et al.* 2005, Campbell *et al.* 2006, Venette and Cohen 2006, Stone *et al.* 2008, Bentz *et al.* 2010, Chmura *et al.* 2011, Evangelista *et al.* 2011, Sturrock *et al.* 2011, Vose *et al.* 2012, Lee *et al.* 2013, Creeden *et al.* 2014, Flower *et al.* 2014, Peterson *et al.* 2014) (the discussion under Insects and Pathogens above has more detail). With their short generation times, both insects and pathogens can evolve more quickly than trees. Most insects and pathogens can migrate at faster rates than hosts, since wind and water disperse many of them farther than tree seeds (Sturrock *et al.* 2011, Peterson *et al.* 2014).

An additional effect may be the appearance of new insects and pathogens currently not present in western Oregon or the emergence of a minor insect or pathogen into a major disturbance factor (Bentz *et al.* 2010, Vose *et al.* 2012, Tillmann and Glick 2013, Peterson *et al.* 2014). Climate change will also alter biological synchrony between hosts and pests, since most pests are host-specific, but such changes and the resulting impacts are difficult to predict (Chmura *et al.* 2011, Sturrock *et al.* 2011). For example, both Douglas-fir bark beetle and spruce bark beetle have obligate adult dormancy periods (diapause) triggered by low temperature that could be disrupted by increasing minimum temperatures (Bentz *et al.* 2010).

Fire

A number of recent studies have examined the potential effects of climate change on wildfire, as well as what the potential changes in wildfire could mean to greenhouse gas emissions and carbon storage. Most studies have examined how annual burned area may change, while an increasing number of studies have begun examining how the probability of wildfire and wildfire severity may change.

All studies examined indicate that the annual area burned would increase, although they differ on how much of an increase will occur, when, or where. Differing scales of analysis and analysis methods make direct comparisons between studies difficult. The National Research Council (2011) reported that for a 1 ºC increase in global temperature, burned area in the Cascades and Coast Range could increase by 428 percent and burned area in southwest Oregon could increase by 312 percent. Other estimates include a 78 percent increase in burned area by mid-century in the Pacific Northwest as a whole (Spracklen *et al.* 2009) and at least a 60 percent increase in western Oregon and Washington by the end of the century (Rogers *et al.* 2011). Warmer and drier conditions are the primary drivers behind these projected increases in burned area, as well as predictions of increased fire severity (Littell *et al.* 2009, Abatzoglou and Kolden 2013, Cansler and McKenzie 2013, Peterson *et al.* 2014). The wetter forests of western Oregon, mixed severity fire regimes, and high severity fire regimes are projected to see greater changes as warmer and drier conditions in summer and increased frequency of drought lengthen the fire season, the probability of severe fire weather increases, and the combination of drought and heating from fire adversely affect tree xylem conductivity (Hessl 2011, Rogers *et al.* 2011, Abatzoglou and Kolden 2013, van Mantgem *et al.* 2013, Peterson *et al.* 2014).

These same changes would also increase fire severity and the occurrence of very large fires (50,000 acres and larger) (Stavros *et al.* 2014b). Very large fires in the Pacific Northwest geographic area (Oregon and Washington) tend to occur under hotter, drier conditions, particularly in the first week following discovery of the fire, which historically occurred in three weeks (Stavros *et al.* 2014a, Stavros *et al.* 2014b). By mid-century, the number of weeks potentially supporting the occurrence of very large fires increases to 6 to 8weeks (Stavros *et al.* 2014b, supplementary table 1).

Other changes in wildfire include changes in fire probability and variability. Romps *et al.* (2014) projected a 50 percent increase in lightning occurrence across the continental U.S. by the end of the century. Guyette *et al.* (2014) predicted a 40-80 percent increase in fire frequency in western Oregon, with the largest changes predicted for colder and wetter ecosystems. Liu *et al.* (2013) also predicted increased inter-seasonal and inter-annual variability in fire potential along the Pacific coast. Using a process similar to one used in the Northwest Forest Plan 15-year monitoring report (Davis *et al.* 2011), Davis *et al.* (2014) projected that by 2060, the area where large wildfires are highly and very-highly probable would expand in the Klamath Falls Field Office, and the Medford and Roseburg Districts, and where large fires are at least moderately probable would expand into the Eugene, Salem, and Coos Bay Districts. However, the probability of large wildfires would remain low in most of the Coos Bay and Salem Districts.

Changes in annual area burned and fire severity have clear implications for air quality, carbon storage potential, and greenhouse gas emissions as well. Greenhouse gas emissions would increase and carbon storage decrease as burned area and fire severity increase. Air quality typically degrades in years with higher acres burned and higher fire severity, due to longer duration burning on individual fires and greater degree of smoldering combustion that occurs during more severe fire seasons. This degradation typically results in more intrusions into mandatory Class I areas and greater effects to human health in smoke sensitive areas. Earles *et al.* (2014) expect that as drought and fire frequency increase, carbon storage will destabilize where fire suppression has increased stand densities and ladder fuels and altered species compositions. The authors also assert that studies that compare the carbon effects of active management to no management in fire-suppressed forests are using the wrong baseline, based on a definition of carbon carrying capacity provided by Keith *et al.* (2009) (Earles *et al.* 2014). Keith *et al.* (2009) defined carbon carrying capacity in a manner that includes natural disturbance regimes, such as fire, but excludes anthropogenic disturbance, such as logging. Under this definition, as fire frequency and drought-induced mortality increases, carbon carrying capacity decreases with the implication that variability in carbon storage is much higher in fire-suppressed forests than in fire-included forests (Earles *et al.* 2014).

Scale mismatches means that important bottom-up controls on fire (e.g., topography, vegetation, and fuel availability) cannot be adequately incorporated into projections of how climate change may affect wildfires (Cansler and McKenzie 2013). Other sources of uncertainty include whether drought-induced tree mortality will increase and tree responses to increased atmospheric CO_2 concentrations (Hurteau *et al.* 2014). Predictions of changes in burned area, fire size, and fire severity assume that past relationships between climate and fire continue to hold (Cansler and McKenzie 2013). If past relationships between climate and fire do not hold, it is not clear what would change, how, or when. If they do hold, then the landscapes of the future are likely to have a higher proportion in homogeneous, early seral patches, lower biodiversity, and lower resilience to other stressors (Cansler and McKenzie 2013). Climate and weather are top-down controls on fire, but bottom-up controls are also important; the greater the spatial complexity of bottom-up controls, the less likely that top-down controls will override them (Cansler and McKenzie 2013).

Streamflow and Temperature

By mid-century, climate modeling indicates peak flows from snowmelt would occur 3-4 weeks earlier in the Pacific Northwest as compared to the current timing (Dalton *et al.* 2013 and references therein). All streams in western Oregon would be rain-dominant by the end of the century (Dalton *et al.* 2013 and references therein, Figure 3.2; Klos *et al.* 2014). Since rain-dominant streams tend to experience peak flows earlier than snow-dominant systems, some streams originating in the Cascades would experience earlier peak flows and reduced spring and summer flows (Dalton *et al.* 2013). If winter precipitation increases as projected, peak flows would increase in magnitude, but timing would otherwise not change in systems that are already rain-dominated (Dalton *et al.* 2013). Mean annual streamflow could initially decrease by the 2020s, possibly due to increased evapotranspirational demand, and then increase through the end of the century by 0.6-5.5 percent, apparently driven by projected increases in winter precipitation (Wu *et al.* 2012). Mean summer streamflow is expected to continually decrease, becoming approximately 30 percent less by the end of the century (Wu *et al.* 2012)

Non-climate factors, such as degree of stream shading, amount of groundwater input, and how streams and reservoirs are managed are also important drivers of stream temperatures, and can result in stream cooling at the same time that air temperatures are warming (Arismendi *et al.* 2012). Regardless, in the Northwest, warming air temperatures and declining summer base flows are strongly associated with warming stream temperatures (Kaushal *et al.* 2010, Isaak *et al.* 2012), with additional warming expected through the 21st century. If past trends continue, then some streams would be 1.6 to 2.0 ºF warmer by mid-century than the 1980-2009 baseline (Isaak *et al.* 2012, Wu *et al.* 2012).

Wildlife and Wildlife Habitat

Very few studies have examined the potential implications of climate change for northern spotted owls, and the BLM found no studies that directly addressed marbled murrelet. Rapid climate change could place additional stress on species already at risk of extinction from habitat loss, such as Fender's blue butterfly (Hixon *et al.* 2010). Fish and wildlife species considered most vulnerable to climate change include several terrestrial and many aquatic invertebrates; amphibians and cold-water fish, especially those with restricted ranges or narrow temperature requirements; and shorebirds, long-distance migratory birds that winter or stop over in western Oregon, and forest birds, especially those associated with either early seral habitat or old-growth habitat (Hixon *et al.* 2010 and references therein, NABCI 2014). Projecting climate change effects on most terrestrial species is limited by the current inability of vegetation models to project changes in stand structure in response to climate changes, and the lack of knowledge of how climate directly influences the presence, absence, and fecundity of a given species (Carroll 2010, Hixon *et al.* 2010). Carroll (2010) projected that the extent of suitable habitat for northern spotted owl could contract in the Coast Range and southwest Oregon and shift upward in elevation in the Cascades by the end of the century, primarily due to changes in precipitation regimes that affect survival (see also Franklin *et al.* 2000, Glenn *et al.* 2010, Glenn *et al.* 2011).

Changes in disturbance regimes could disfavor species associated with old-growth forests, by shifting more of the landscape into earlier seral stages, altering species compositions to ones less preferred, reducing the extent of large trees and structurally-complex forest, and decreasing patch sizes preferred for different life stages, such as nesting (Vose *et al.* 2012, Dalton *et al.* 2013, section 5.4.2, Peterson *et al.* 2014). These same types of changes could also adversely affect preferred prey species for predators like the northern spotted owl, although the ability of the owl to shift prey preferences is not well documented. Ocean warming and changes in ocean chemistry along with increasing extent and duration of dead zones (Hixon *et al.* 2010, Section 7.4 and references therein, Dalton *et al.* 2013, Chapter 4) could adversely affect the prey base used by species such as marbled murrelet.

Potential Effects of Alternatives in Adapting to Climate Change

In general, actions that would respond to changes in climate (such as modifying seed stock for replanting after harvest) would be implementation-level decisions that are made in the years after the completion of this planning effort. This discussion considers how the alternatives would set the stage for the BLM to take such actions in the future.

The current Douglas-fir-western hemlock-western redcedar forests typical of western Oregon developed in the last 5,600 years, apparently in response to cooling climate (Shafer *et al.* 2010 and references therein, p. 178). Historical tree migration rates during the Holocene range from 6-93 miles per century, whereas the current climate velocity is estimated at 186-311 miles per century (Tillmann and Glick 2013 and references therein, p. 200). Given the expected climate velocity and the potential changes discussed above, scientists who study climate change impacts on natural resources recommend varying levels of active management in order to preserve or protect social and ecosystem values (e.g., Joyce *et al.* 2009, Spies *et al.* 2010, Peterson *et al.* 2011, Stein *et al.* 2014). Stein *et al.* (2014) classify potential management actions into three general categories:

1. Resistance actions – those intended to maintain the status quo of species and systems

2. Resilience actions – those intended to improve the capacity of the system to return to desired conditions or to maintain some level of desired functionality in an altered state
3. Realignment actions – those intended to enable or facilitating the transition to a new functional state

However, many of the recommended types of forest management actions tend to overlap at least two of the categories. Generally, recommended actions for responding to climate change consist of reducing existing stresses, increasing resistance and resilience to climate change and other stressors, and enabling change where it is inevitable (Joyce *et al.* 2009, Spies *et al.* 2010, Peterson *et al.* 2011, Vose *et al.* 2012, Peterson *et al.* 2014, Stein *et al.* 2014). As summarized by Joyce *et al.* (2009), Spies *et al.* (2010), and Peterson *et al.* (2011) specific types of recommended actions include—

- Thinning forest stands to reduce competition and drought stress, increase diversity (species, structure, age classes, sizes, patch sizes, spacing) at the stand and landscape scales, increase resistance to fire, insects, and pathogens;
- Protecting large old trees, large snags, and large downed wood; and
- Planting new genotypes/ecotypes/climatypes and species to aid development of communities that can persist under both the current and expected future climate.

These approaches are known as "no regrets" decisions and bet-hedging, given the large uncertainties over the rate and magnitude of climate change in any one location (Vose *et al.* 2012).

Within the scientific community, the use of assisted, or facilitated, migration as a climate change adaptation technique is controversial. Assisted migration consists of the deliberate movement of species or ecotypes into locations where they presently do not occur instead of waiting for natural migration into these locations. Hewitt *et al.* (2011) provides the most recent paper summarizing the nature of the scientific debate. Sixty percent of the papers the authors examined were supportive of assisted migration, 20 percent opposed, and 20 percent did not have a clear position. Arguments in favor of assisted migration include climatically-suitable ranges outpacing migration rates, the risks of adverse outcomes are manageable with decision tools, the need for proactive measures to prevent biodiversity losses and extinctions, and the lack of appropriate or sufficient migration corridors. Arguments against assisted migration include risks of a species becoming invasive, costs, uncertainties over outcomes, the risk of legitimizing unauthorized and unregulated introductions, diversion of resources from higher conservation priorities, and bias toward species humans or societies deem important. Invasion risks are a particularly common argument against assisted migration, but seem to have the most relevance with respect to introducing completely new species or transferring species between continents (Vitt *et al.* 2010, Hewitt *et al.* 2011 and references therein, Winder *et al.* 2011). Moving different genotypes of species within its current range or assisting in relatively short-distance range expansions appears to be much less controversial, although these moves are not risk-free either (Aitken *et al.* 2008, Vitt *et al.* 2010, Hewitt *et al.* 2011, Winder *et al.* 2011). Some studies identified assisted migration as a primary need in order to preserve the presence of a forest, although not necessarily the present type of forest, in the face of climate change and associated changes in disturbance risks (Woods *et al.* 2010, Buma and Wessman 2013).

Management to adapt to climate change may not necessarily be consistent with management to maximize carbon storage. D'Amato *et al.* (2011) caution that rigid adherence to a single objective, such as maximizing carbon storage, is likely to result in adverse effects to other ecosystem components critical to long-term functioning in the face of changing climate. Increased burned area from wildfires in the mesic maritime forests of the Pacific Northwest could result in loss of up 1,900 Tg of carbon by the end of the century, an amount equal to 23 times the current combined emissions from all sources in Oregon and Washington (Rogers *et al.* 2011). Many studies have found that active management, particularly in forests adversely affected by fire suppression, could reduce both carbon losses and increases in greenhouse gas emissions from wildfires. Results from various thinning and burning prescriptions indicate that the short-term reductions in carbon result in long-term benefits to carbon storage and greenhouse gas emissions by reducing fire-induced mortality, maintaining a higher fraction of carbon in live trees, increasing drought resistance, and reducing competition for water, nutrients, and light (Stephens *et al.* 2009, Hurteau and North 2010, North and Hurteau 2011, Stephens *et al.* 2012, Hurteau *et al.* 2014, Loudermilk *et al.* 2014, Volkova *et al.* 2014).

The degree to which an alternative promotes active management provides opportunities to mitigate the effects of and adapt to changing climate. In dry forests under all action alternatives, management would emphasize increasing fire resistance and resilience, which would often also increase resistance to drought, insects, and pathogens. The No Action alternative does not explicitly prohibit management to increase fire resistance and resilience, but does not have the same emphasis as in the action alternatives, especially within the Late-Successional Reserve and the Riparian Reserve. This uncertainty in the management direction of the No Action alternative adds uncertainty to the implementation of actions to increase fire resistance and resilience, especially within reserve land use allocations in the dry forest.

Retaining portions of stands through uneven-aged management would reduce risks associated with reforestation failure in dry forests. All action alternatives would manage the Harvest Land Base in the driest forests with uneven-aged management. In contrast, the No Action alternative would include regeneration harvest throughout the Harvest Land Base in the driest forests, increasing the risk of reforestation failure.

Reforestation after timber harvest or disturbance would provide opportunities to shift tree species composition or genotypes/ecotypes/climatypes under all alternatives, except Alternative B in the LITA, where the BLM would use only natural regeneration harvest. In addition to the risk of reforestation failures, the inability to replant after timber harvest or disturbance in this portion of the Harvest Land Base under Alternative B would limit the ability to adapt to climate change through replanting (see the Forest Management section in this chapter).

Reserves with minimal or no active management may provide areas of greater ecological stability on the landscape and provide benchmarks for comparison with actively managed areas. Comparing recent satellite imagery of western Oregon with that collected in the mid-1990s, Reserves with minimal or no active management tended to become homogeneous with respect to stand density, age, and condition. Such landscapes appear to be increasingly vulnerable to large, stand-replacing fire and the development of large, stand-replacing patch sizes based on recent fires and maps of burn severity. Fire, insects, and pathogens often interact such that the occurrence of one of these disturbance types facilitates the occurrence of another (Vose *et al.* 2012, Tillmann and Glick 2013, Peterson *et al.* 2014). The larger the area in Reserves with minimal management, the more limited BLM's management options would be to adapt to climate change over time. However, it is unclear to what extent such minimally-managed Reserves would be more stable and more resistant to climate change effects.

The ability of active management to mitigate projected changes in stream temperature appear to be limited since changing air temperatures account for much of the expected changes in stream temperature (Holsinger *et al.* 2014). Equally important, however, is that wildfires and fuels management appear to have limited ability to adversely affect stream temperatures much beyond the immediate affected area.

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Cultural and Paleontological Resources

Key Points

- The BLM can reduce or eliminate effects to cultural and paleontological resources through systematic and thorough cultural and paleontological resource inventories.
- Implementation of alternatives A and D are the least likely to result in potential adverse effects to cultural and paleontological resources because they allow for the type of ground-disturbing activity most likely to disturb cultural and paleontological resources on the least amount of acres within the decision area.

Issue 1

How would BLM land management actions affect cultural resources across the decision area under each alternative?

Summary of Analytical Methods

Each BLM office in the decision area provided Gnomon Inc. with cultural site and survey information, which Gnomon Inc. then digitized. The BLM synthesized this digitized information in the sections below. The BLM used a model created by Gnomon Inc. for the purposes of forecasting the likelihood for cultural resources to occur within the decision area. The model used two key factors to determine the relative probability that cultural properties would be present within any given acre in the decision area. The two factors used were slope and distance to perennial water. Archaeological data in western Oregon shows that past human activity most often took place on level ground and near freshwater sources, as revealed by the location of archaeological sites across the landscape (USDI BLM 2014 OHIMS). The BLM provided Gnomon with all of the datasets used to run the model. For the model, Gnomon assigned weighted values between 0 and 50 to different slope breakpoints as well as distance to water breakpoints (**Table 3-26**). The breakpoints for distance to water represent discrete sets of distance in meters along a range from 0 to >1000. Similarly, the breakpoints for degrees of slope represent discrete sets of slope degrees that range from 0 to >20. Gnomon assigned the breakpoints based on previously recorded site data by looking at which value ranges in each dataset were most associated with site presence. The model then calculated total values between 0 and 100 for the entire decision area and subsequently assigned a probability based on that value (**Table 3-27**). More details of the modeling methodology can be found in Ingbar *et al.* 2014.

Table 3-26. Values for slope and distance to water break points.

Slope (Degrees)	Weighted Value	Distance to Water (Meters)	Weighted Value
0-5	50	0-250	50
5-10	25	250-500	25
10-20	12	500-1000	12
>20	0	>1000	0

Table 3-27. Total value scores and corresponding probability.

Total Value Score (Product of Slope Value and Distance to Water Value)	Probability Zone
0-24	Low
25-50	Medium
51-100	High

The model placed each of the 2.5 million acres of BLM-administered lands in the decision area into one of three categories: high, medium, or low probability for finding cultural resources (**Table 3-28**). Then, for each alternative, the BLM overlaid these three categories with the land use allocations that allow commercial thinning and regeneration harvest. The BLM calculated acres of land allowing commercial thinning and regeneration harvest for each probability category to determine which alternatives are most likely to create the potential for disturbance of cultural resources from timber harvesting activities (**Table 3-32**). This portion of the analysis focused on potential impacts from timber harvest (including both commercial thinning and regeneration harvest) because it is one of the most impactful activities to the ground and varies substantially by alternative.

Table 3-28. Distribution of all acres within the decision area by probability zone.

Probability Level	Acres
High	913,639
Medium	1,167,907
Low	397,309

Additionally, the BLM considered the risk of disturbance to cultural resources from road construction by comparing the total number of estimated new miles of road construction in the first decade by alternative. The BLM used new road construction miles as a factor because it is also one of the most impactful activities to the ground. Finally, the BLM considered potential effects from OHV area designation. In comparing the potential effects of the alternatives' OHV destinations on cultural resources, the BLM assumed that *open* areas are the most likely to cause unintended disturbance of cultural resources from OHV use, while such disturbance is much less likely in *limited* areas and very unlikely in *closed* areas.

In this analysis, the BLM assumed that OHV users would operate vehicles consistent with BLM decisions about OHV use. Although the BLM has some site-specific and anecdotal information about illegal OHV use, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal OHV use. In addition, much of the decision area has physical limitations to potential illegal OHV use, including dense vegetation, steep slopes, and locked gates. In most of the interior/south, the ability to track numerous different routes across the open spaces can lead to degradation and erosion in a greater proportion than most of the coastal/north. However, the BLM lacks a basis for characterizing current illegal OHV use or forecasting such potential illegal OHV use in the future under any of the alternatives at this scale of analysis.

As described below, this analysis considered the potential for impacts from timber harvest, new road construction, and OHV designation but also assumed that pre-disturbance surveys will prevent impacts in most instances.

It is important to note that phenomena that the BLM does not manage, such as wildfire and looting, may also negatively affect cultural resources in unpredictable ways.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 41-43). The analytical methods described above differ from those set out in the Planning Criteria. BLM annual reporting over the last seven years spurred this change in analysis. The annual reports state that the implementation of project activities inadvertently damaged very few sites (two). Conversely, the BLM and project proponents discovered 641 sites prior to implementation of project activities. As a result, the BLM applied mitigation measures to avoid adverse impacts to these sites. In the end, predicting the numbers of sites within each physiographic province, as the BLM described in the Planning Criteria, does not tell us the effects to cultural resources. Without more accurate data that tracks all impacts to sites through inadvertent discovery, the BLM must assume that it will conduct adequate and thorough cultural resource inventories prior to ground disturbing activities and that these inventories will result in the avoidance of damage to cultural resources in nearly all cases. Regardless, it is still useful to understand how the alternatives vary between the activities most likely to create impacts and the distribution of these activities across the three probability categories.

Background

The BLM and members of the public discover cultural resources in a multitude of ways, from finding artifacts during a hike, to systematic cultural resource inventories, and even occasionally through the implementation of project activities. The primary mechanism for identifying cultural resources is through inventories conducted by trained archaeologists. BLM archaeologists plan and implement cultural surveys in a strategic manner focusing on areas of high probability to yield cultural resources. The Analysis of the Management Situation (USDI BLM 2013) contains a synthesized explanation of cultural resources in Oregon.

Cultural resources inventories are primarily project driven and conducted in support of other resources such as timber, recreation, aquatic restoration, road building etc. The BLM conducts this type of survey in compliance with section 106 of the National Historic Preservation Act. In addition, each district undertakes a strategic and proactive survey strategy in compliance with section 110 of the National Historic Preservation Act. Section 110 surveys focus on inventorying pieces of land deemed to have high probability for yielding cultural resources. These areas are determined using the cultural resource model described in the Analytical Methods section above.

Affected Environment

According to current district records, there are 2,470-recorded cultural sites on BLM-administered lands within the decision area. Since much of these lands remain un-inventoried, it is very likely that there are far more undocumented cultural sites on these lands.

The following tables provide a snapshot of cultural resources and inventories on BLM-administered lands in the decision area. **Table 3-29** illustrates that the BLM has inventoried 10.5 percent of the BLM-administered lands in the decision area for cultural resources. These acres only reflect Class III - intensive field surveys, as conducted per BLM Manual 8110.21C. It is notable that the Klamath Falls Field Office has completed inventory of over 70 percent of their land base due to multiple large-scale projects (e.g. vegetation management, fuels treatments) where contractors surveyed thousands of acres at a time. Of the 259,693 acres inventoried in the decision area, 40 percent (103,877 acres) occurred in high probability areas, 44 percent (114,265 acres) occurred in medium probability areas, and 16 percent (41,551 acres) occurred in low probability areas. With 89.5 percent of the decision area considered unsurveyed, the BLM anticipates that inventories will continue for the near future in compliance with section 106 and 110 of the National Historic Preservation Act. Given that 89 percent of the high probability acres on BLM-administered lands in the decision area are unsurveyed, it is highly likely that the BLM will find more cultural properties in the future.

Table 3-29. Summary of acres of cultural resource inventories by district or field office.

District/Field Office	Inventoried (Acres)	Totals (Acres)	Inventoried (Percent)
Coos Bay	3,430	324,236	1%
Eugene	4,801	311,064	1.5%
Klamath Falls	155,262	214,084	72.5%
Medford	78,782	806,675	9.8%
Roseburg	14,977	423,640	3.5%
Salem	2,441	399,157	0.6%
Totals	**259,693**	**2,478,856**	**10.5%**

Table 3-30 shows the distribution of site types across the districts. Ground disturbing activities may be more or less likely to damage sites depending on their type. The term "prehistoric site" generally refers to archaeological sites that Native Americans occupied prior to European contact; in the decision area, most prehistoric sites are subsurface. Approximately 56 percent of the recorded sites in the decision area are prehistoric. Historic sites refer to both subsurface and above ground sites, including structures that date from the contact period up to the recent historic period 50 years ago or earlier. Multicomponent sites are sites that date to multiple occupation periods and include both prehistoric and historic components. Ground-disturbing activities are more likely to affect subsurface sites inadvertently due to the lack of visibility of artifacts on the surface, especially in the densely vegetated landscape that composes a large majority of the lands administered by the BLM in the decision area.

Table 3-30. Distribution of site types by district or field office.

District/Field Office	Prehistoric	Historic	Multicomponent	Unknown	Totals
Coos Bay	30	24	1	1	56
Eugene	132	15	-	-	147
Klamath Falls	762	284	62	61	1,169
Medford	148	492	22	6	668
Roseburg	250	34	14	-	298
Salem	67	62	3	-	132
Totals	**1,389**	**911**	**102**	**68**	**2,470**

Table 3-31 shows the last recorded condition of all the recorded sites in the decision area. The BLM monitors recorded sites to assess their condition over time and note impacts that affect the integrity of the site such as erosion, looting, weathering or impacts from BLM actions. The BLM categorizes the largest percentage of sites as "unknown" (39 percent); the lack of a known site condition is likely due to the large amount of subsurface prehistoric sites within the decision area. Without subsurface testing and evaluation of these sites, it is hard, if not impossible, to assess the level of intact deposits within the site. The BLM has determined > 0.5 percent of recorded sites have been destroyed. Thirty-seven percent of the sites are in excellent or good condition and 22 percent are in fair or poor condition.

Table 3-31. Distribution of site conditions.

Site Condition	Count
Excellent	232
Good	693
Fair	256
Poor	282
Destroyed	34
Other	11
Unknown	962
Totals	**2,470**

Environmental Effects

Under all alternatives, the BLM would conduct adequate and thorough cultural resource inventories in advance of federal undertakings and in accordance with Oregon BLM and Oregon State Historic Preservation Office Protocol (2015). The BLM anticipates avoiding or mitigating impacts to the vast majority of cultural resources through: 1) identification of cultural resources and potential impacts through inventory; and 2) applying appropriate mitigation measures.

Table 3-32 shows the number of acres of potential commercial thinning and regeneration harvest activities by each alternative along with their distribution across the probability zones. The resulting acres reflect the range of both commercial thinning and regeneration harvest across the alternatives. Overall, Alternative A, which has no commercial thinning in the moist forest reserves, and Alternative D, which has substantial acres of selection cutting and thinning, would have the lowest potential for disturbance to cultural resources through timber harvest; they have the lowest total acreage of harvest types that have the potential to damage cultural resources and the lowest acreage of potential harvest in high probability zones. Alternatives B and C would have the highest potential for disturbance of cultural resources through timber harvest, with both the highest total acreage of potential harvest and the highest acreage of potential harvest in high probability zones. The No Action alternative would have a slightly lower potential for disturbance of cultural resources through timber harvest than Alternatives B and C.

Table 3-32. Acres of potential harvest activity in each probability zone by alternative.

Alternative	Low (Acres)	Medium (Acres)	High (Acres)	Total (Acres)
No Action	258,612	605,715	345,566	1,209,893
Alt. A	122,886	277,250	203,535	593,671
Alt. B	206,294	623,600	480,746	1,310,640
Alt. C	193,890	634,520	491,341	1,319,751
Alt. D	126,746	376,129	294,975	797,850

The No Action alternative would have the greatest potential for the disturbance of cultural resources through new road construction, while alternatives A and D have the lowest potential for this type of disturbance. **Table 3-33** shows that the number of miles of estimated new road construction corresponds generally with the total acres of commercial harvest.

Table 3-33. Total number of new miles of estimated road construction by alternative.

Alternative	Total Estimated New Road Construction (Miles)
No Action	944
Alt. A	303
Alt. B	687
Alt. C	790
Alt. D	246

For all action alternatives, the BLM will apply interim management guidelines for OHV use until travel management planning is completed (**Appendix N**). On the majority of the BLM-administered lands OHV use would be *limited* to existing roads and trails (**Table 3-34**). Shotgun Creek in Eugene, Blue Ridge Parkway in Coos Bay, and Upper Nestucca in Salem are the only areas that would remain as *limited to designated* across all alternatives. None of the action alternatives has lands designated as OHV *open* areas. This differs from current practices and the No action Alternative, under which there are 330,394 acres of land designated as *open*. Due to this change, the BLM would expect a reduction in inadvertent impacts to cultural resources from OHV use under all action alternatives. The BLM is deferring implementation level transportation management planning until after completion of this RMP. Route designation will occur at that time and the BLM will consider affects to cultural resources in compliance of Section 106 of the National Historic Preservation Act. The Trails and Travel Management section contains more information on transportation management planning.

Table 3-34. OHV area designations by alternative.

Trails and Travel Management Designations	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Closed to OHV Use	84,589	128,757	148,551	178,001	153,305
Limited to Designated Routes	1,119,686	10,469	76,200	244,785	91,857
Limited to Existing Routes	1,037,026	2,335,106	2,249,464	2,051,528	2,229,130
Open to Cross-country Travel	330,394	-	-	-	-

Issue 2

How would land management actions affect paleontological resources?

Summary of Analytical Methods

The BLM does not maintain a central or consolidated dataset of paleontological resources within the decision area. Therefore, analysis of effects is difficult. The BLM must assume prior to ground disturbing activities it will conduct adequate paleontological resource inventories in areas of known paleontological localities as well as in areas where geologic formations lend themselves to contain paleontological resources. The BLM assumed that these inventories would result in the avoidance of damage to paleontological resources in nearly all cases.

As with the cultural resources analysis, despite the assumption that affects would be avoided through pre-disturbance inventories, the BLM also considered the extent to which the alternatives would create the potential for disturbance to paleontological resources. To compare the potential for disturbance across alternatives the BLM considered the range of acres allowing commercial thinning and regeneration harvest activities and the estimated number of miles of new road construction. The BLM assumed that these two ground-disturbing activities were the most likely of the activities considered under the alternatives to create the potential for disturbance to paleontological localities.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 41-43).

Background

Paleontological resources include the fossil remains of plants (leaves and wood), vertebrates, and invertebrates. They also include the traces of animals or plants, such as the tracks or claw marks and skin impressions. Geologic processes important in the formation of fossils can also be paleontological resources. The BLM refers to fossil locations on the ground as “localities.”

Fossils are fragile and non-renewable resources, and are susceptible to damage from weathering and erosional processes as well as from the public and Federal land management activities. The BLM is required to identify locations likely to contain vertebrate fossils or exceptional invertebrate or plant fossils on land it administers. A BLM permit system regulates the collection of vertebrate or other scientifically important fossil specimens, including trace fossils on lands it administers. Qualified paleontologists and academic institutions can obtain permits from the BLM for collecting. Permits are not necessary for collecting most invertebrate and plant fossils. The public may to collect reasonable amounts for personal use. The rules for the collection of petrified wood are addressed in 43 CFR 8365.

The primary indicator for the significance of a paleontological resource is the characteristics of the fossil locality or feature that gives it importance and value for scientific or educational use. Natural weathering, decay, erosion, and improper or unauthorized removal can damage those characteristics that make the paleontological resource scientifically important.

Affected Environment

Most of the paleontological localities of scientific interest in Oregon exist on the central and east side of the state. However, there are scattered fossil localities within the decision area.

There are a number of geologic formations that occur across the decision area, all of which span the Mesozoic and Cenozoic Eras (approximately 213-2 million years ago). The majority of paleontological resources within these formations are invertebrates and plants. Although vertebrate fossils are relatively less common, there are isolated occurrences of vertebrate fossils that are located mostly in cave settings within the decision area. The most prominent time period represented by vertebrate fossil localities within the decision area date from the late Miocene to early Pliocene epochs (approximately 23-1.8 million years ago, while the time frames for plants and invertebrates covers the Jurassic and Tertiary periods (245-145 million years ago). Some marine mammal fossils dated from the Mesozoic epoch occur in the decision area's coastal areas. In addition, there are small samples of terrestrial mammals from the late Cenozoic epoch.

Currently, the BLM does not maintain a comprehensive database with paleontological localities mapped in the decision area. Each district and the Klamath Falls Field Office have recorded localities to varying degrees (**Table 3-35**). The recorded localities may provide a sense of the distribution of paleontological resources throughout the decision area. **Table 3-35** lists the number of paleontological localities reported in the FEIS (USDI BLM 2008, Vol. I, p. 444). The BLM compiled these numbers by querying each districts' specialists for the number of recorded or known localities on their district. The condition of these localities is currently unknown.

Table 3-35. Number of reported paleontological localities by district or field office.

District/Field Office	Paleontological Localities (2008)
Coos Bay	19
Eugene	1
Klamath Falls	1
Medford	2
Roseburg	18
Salem	6
Totals	**47**

Environmental Effects

As described in the analytical methods section above, the BLM would avoid the majority of damage to paleontological localities under all alternatives by conducting adequate paleontological inventories in areas of known localities or in high probability landforms prior to implementation of projects that could damage paleontological resources. Under all alternatives, each office would implement suitable protection measures for known paleontological localities that it manages. However, some inadvertent loss is possible due to the lack of a strategic inventory plan for paleontological resources within the decision area.

Table 3-36 shows the number of acres of potential commercial thinning and regeneration harvest activities by each alternative along with total miles of new road construction estimated for the first decade of implementation of the RMP. Alternatives A and D have by far the least acreage of commercial timber harvest and thus creates the least potential for the destruction of paleontological localities through timber harvest. Alternatives B and C have the most acreage of commercial timber harvest and thus creates the most potential for the destruction of paleontological localities through timber harvest The No Action alternative, Alternative B and C have the highest number of miles of estimated new road construction, while Alternatives A and D have the lowest number. Alternatives A and D are the alternatives that would create the least potential for the destruction of paleontological localities through timber harvest, while the No Action alternative would create the most potential for the destruction of paleontological localities through road construction.

Table 3-36. Acres of commercial harvest allowed and total miles of estimated new road construction by alternative.

Alternative	Total Commercial Harvest (Acres)	Total Estimated New Road Construction (Miles)
No Action	1,209,893	944
Alt. A	593,671	303
Alt. B	1,310,640	687
Alt. C	1,319,751	790
Alt. D	797,850	246

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Fire and Fuels

Key Points

- In the absence of natural fire as a disturbance agent, management activities, including prescribed fire and mechanical management of vegetation, can serve as a partial surrogate for natural disturbance, and promote and maintain desired structural and compositional changes.
- The BLM-administered lands constitute only a small portion of the entire interior/south dry forest landscape. Consequently, the modest shifts under any alternative would not result in any substantial change in the overall landscape fire resilience. The dry forest landscape would continue to have an overabundance of mid-seral closed forest and a deficit of late-seral open forest.
- All alternatives would increase stand-level fire resistance and reduce wildfire hazard on BLM-administered lands compared to current conditions. Within the Harvest Land Base, there would be greater variation in these variables among the alternatives over time.

Background

Fire History and Fire Regimes

Fire has played a major role as a natural disturbance agent shaping vegetation patterns and structures across western Oregon landscapes for millennia (Agee 1991a and b, and Hessburg and Agee 2003).

Fire regimes quantify the historic spatial and temporal interaction of fire disturbance. Most fire regime classifications describe the presumed conditions under which vegetation communities have evolved and been maintained for a given ecosystem or landscape (Sommers *et al.* 2011). Different fire regime classifications exist, some of which focus on specific and specialized plant communities (grasslands, chaparral, peat systems), while others include seasonality of burn and other nuanced factors (Sommers *et al.* 2011). This discussion will focus on the five fire regime groups recognized by LANDFIRE (Barrett *et al.* 2010), based on fire frequency, and expected severity (**Table 3-37**).

Table 3-37. Fire regime groups and descriptions used in current LANDFIRE Fire Regime Condition Class Guidebook Version 3 (Barrett *et al.* 2010).

Fire Regime Group	Frequency	Severity	Severity Description
I	0-35 years	Low/Mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35-200 years	Mixed/Low	Generally mixed-severity; can also include low severity fires
IV	35-200 years	Replacement	High-severity fires
V	200+ years	Replacement/ Any Severity	Generally replacement severity; can include any severity type in this frequency range

In the mixed-severity fire regime, the influence of fuels, topography, and weather on fire behavior and fire effects plays out across the landscape, resulting in highly variable forest structure, patterning and successional stages (Perry *et al.* 2011). In low severity fire regimes, fuels tend to be the dominant factor influencing fire behavior, while in high severity fire regimes weather primarily drives fire behavior (Halofsky *et al.* 2011, Hessburg *et al.* 2005, Jain *et al.* 2012, Sommers *et al.* 2011), both of which result in less edge and larger patch sizes than mixed-severity regimes. At both local and regional scales, the influence of terrain, slope position, aspect, management actions, and ignition loading can result in a fine-scale mosaic of fire regimes (Agee 1991b, 1998, and 2005, Odion *et al.* 2004 Taylor and Skinner 2003).

Within the administrative boundaries of the Coos Bay, Eugene, and Salem Districts, high proportions of the landscape, ranging from 44 to 53 percent, fall into the infrequent and commonly replacement-severity fire regime group, with fire return intervals (FRIs) measured in hundreds of years (**Table 3-38**). Historically, fire was not an important frequent change agent acting to influence stand structure distribution of these forested ecosystems. Natural ignitions, weather, and fuel conditions to support wildfires in these areas rarely aligned, and fires that burned were large and of high severity (Morrison and Swanson 1990).

Table 3-38. Percent distribution of burnable lands by Historic Fire Regime Groups (LANDFIRE 2010 (LF_1.2.0)) across the planning area within district/field office administrative boundaries.

District/ Field Office	Historic Fire Regime Group and Description				
	I	II	III	IV	V
	0-35 Year FRI*, Low and Mixed Severity	0-35 Year FRI, Replacement Severity	35-200 Year FRI, Mixed and Low Severity	35-200 Year FRI, Replacement Severity	>200 Year FRI, Any Severity
Coos Bay	39%	-	16%	-	44%
Eugene	17%	-	34%	-	50%
Klamath Falls	42%	6%	25%	23%	4%
Medford	91%	-	7%	1%	1%
Roseburg	40%	-	48%	1%	12%
Salem	22%	-	25%	-	53%

*FRI- Fire return interval

The Klamath Falls Field Office and the Medford and Roseburg Districts have high proportions, 73 to 98 percent, of lands within their administrative boundaries classified as frequent, to moderately frequent low and mixed severity fire regime groups (**Table 3-38**).

Much of the southern portion of the planning area is within the Klamath ecological province, recognized for floristic diversity, geographic complexity, highly varied climatic gradients, and the prominent historic role of fire (Whittaker 1960, Atzet and Wheeler 1982). Prior to the 20th century, low- to mixed-severity fires burned regularly in most dry forest ecosystems in the southern portion of the planning area, with ignitions caused by both lightning and humans (Agee 1991a, Sensenig 2002, Atzet and Wheeler 1982, Lalande 1995). Native Americans influenced vegetation patterns for over a thousand years by igniting fires to enhance values that were important to their culture, sustainability, and for vegetation management (Lalande 1991). Early settlers used fire to improve grazing and farming and to expose rock and soil for mining and set frequent and extensive fires (Atzet and Wheeler 1982). Regional studies have found historic pre-settlement median fire return intervals ranging from 8 to 20 years in the drier and southern portions of the planning area (Sensenig *et al.* 2013, Taylor and Skinner 1998 and 2003) and longer median fire return intervals (35-120 years) in more mesic locations of the dry forest (Agee 1991b, Olson and Agee 2005, Van Norman 1998).

Frequent low- to moderate-severity fire interacted with the complex landscape, vegetation, and climate to create and maintain patchy, mixed seral stages of shrubland, woodland, and mixed conifer/hardwood forests, in both open and closed conditions (Taylor and Skinner 1998, Hickman and Christy 2011, Duren *et al.* 2012). Frequent fire also cultivated large open grown trees, hindered the regeneration of fire intolerant species, promoted fire tolerant species and understory diversity, reduced forest biomass, and decreased the compounding impacts of insects and diseases (Jain *et al.* 2012, Halofsky *et al.* 2011, Perry *et al.* 2011). These heterogeneous landscape patterns and uneven-aged, uneven-structured stands of fire-dependent species contributed towards the fire resilience of the southern Oregon landscape.

Fire Exclusion in the Dry Forest

In the early 1900s, suppression of all fires became a goal of land management agencies and policy (Graham *et al.* 2004). This effectively took hold in the 1940s with the advent of mechanized equipment and the establishment of the smoke jumper base in Cave Junction (Atzet 1996, Atzet and Wheeler 1982). Effective fire exclusion, along with other land management practices, has altered natural fire return intervals, and many areas have missed two to five fire cycles in the interior south (Agee 1991b, Taylor and Skinner 1998 and 2003, Olson and Agee 2005). Currently, many of the dry forest stands are overly dense, are missing large fire-resistant trees or are at risk from encroachment or fire-induced mortality (Jain *et al.* 2012, North *et al.* 2009, Comfort *et al. in review*). Dry forest stand species composition has shifted resulting in significant reductions in the proportion and diversity of fire-adapted conifers, hardwoods, shrubs, and herbaceous species (Franklin and Johnson 2010, Comfort *et al. in review,* Duren *et al.* 2012, Taylor and Skinner 2003 and 1998), and understory and canopy fuels have increased (Sensenig 2002, Hessburg *et al.* 2005).

The absence of frequent low and mixed severity fire has allowed for homogenization of landscape vegetation patterns and fuel conditions, resulting in a loss of finer scale diversity (Perry *et al.* 2011; Halofsky *et al.* 2011), and fewer and smaller forest openings (Taylor and Skinner 1998, Skinner 1995, Larson and Churchill 2012). Open areas, such as forest gaps, shrublands, savannahs, grasslands, and hardwood woodlands, have been converting to closed areas via the recruitment of conifers, threatening the persistence of these ecosystems and landscape patterns (Comfort *et al. in review*, Taylor and Skinner 1998, Hosten *et al.* 2007).

The absence of fire has also changed successional pathways and the development of forest structure (Halofsky *et al.* 2011), landscape seral distribution, and tree establishment (Comfort *et al. in review,* Sensenig *et al*. 2013, Donato *et al*. 2012). The proportion of shade-tolerant species to fire-tolerant species has increased along with the proportion of small trees to large trees (Comfort *et al. in review*). The abundance of dense forest and homogenization of vegetation patterns compromises individual tree vigor, overall forest health, and resistance and resilience to disturbance from fire, insects, and disease (Sensenig, *et al*. 2013, Franklin and Johnson 2012). Densely forested conditions result in extremely slow tree growth and delay or hinder the development of structurally-complex forest (Sensenig 2002, Sensenig *et al.* 2013).

Additionally, these shade-tolerant species accumulate to abnormally high densities and, together with an increase of dead material, can easily transmit fire to the upper canopies (Peterson *et al.* 2005). These changes to forest structure have altered the horizontal and vertical stand structure and fuel profile. Surface, ladder, and canopy fuels have increased in loading and continuity, increasing the potential for larger scale crown and stand-replacing fires (Hessburg *et al.* 2005, Graham *et al.* 2004, Agee 1998). As a result, the landscape that had been composed of forests adapted to frequent fire is now at risk of uncharacteristically large, severe fires that can be destructive to habitats, species, and people (Hessburg and Agee 2003, Perry *et al.* 2011, Stein *et al.* 2013).

Current Fire Climate Environment and Future Trends

The area south of the Rogue-Umpqua divide generally has more severe and frequent thunderstorms with little precipitation, relative to the northern and coastal portions of the planning area (Agee 1991a), Atzet and Wheeler 1982, Sensenig 2002). While dry lightning is still infrequent in the northern and coastal districts, human ignitions are prevalent and account for greater than 90 percent of all ignitions within these districts (**Figure 3-30**). Human caused ignitions typically occur in relatively accessible locations and do not come in droves compared to lightning events; coupled with overarching climatic patterns, human ignitions are typically manageable for suppression resources. Relative to frequent fire systems, fire exclusion in these infrequent fire systems is an insignificant factor influencing current fire frequency, fire severity, and structural stage distribution (Brown *et al.* 2004).

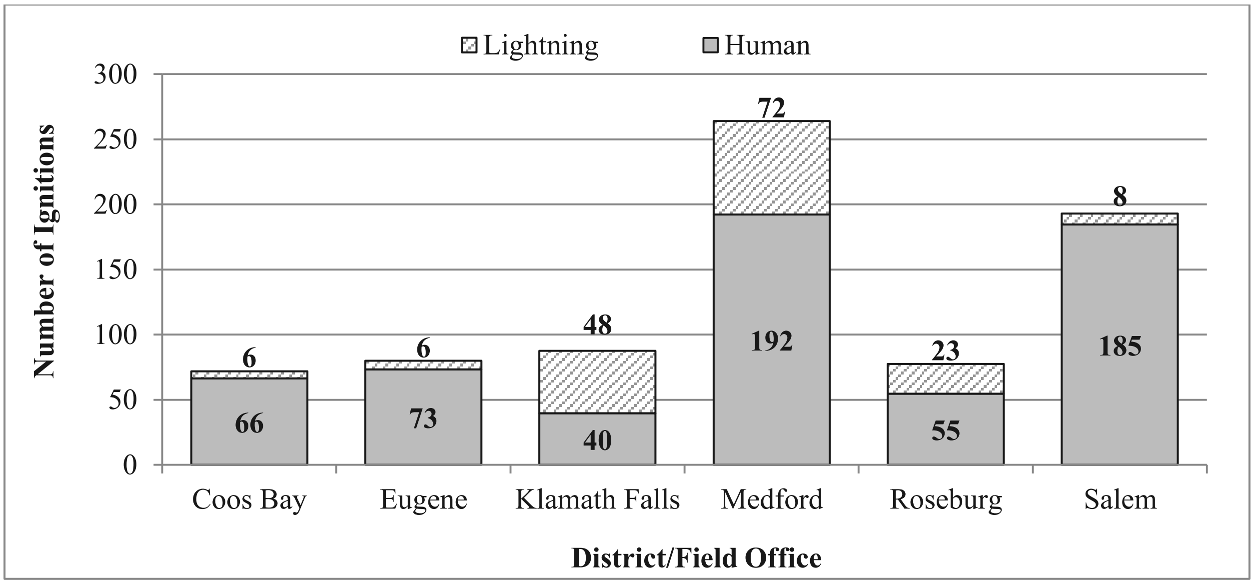


Figure 3-30. Average annual number and cause of ignitions (1984-2013) within the planning area by district or field office.
Source: Oregon Department of Forestry ignition data.

While fire regime groups represent historic conditions, the prevailing climatic patterns (hot, dry summers) influencing fire frequency and fire potential still exist in southern portions of the planning area, along with sufficient sources of both naturally and human-caused ignitions (**Figure 3-30**). Depending on fuel conditions, lightning from these storms can start numerous fires in dry receptive fuels.

In the recent past, these multiple ignition events have on occasion overwhelmed suppression resources and have been a significant factor in the development of large wildfires within the southern portion of the planning area (notable years include 1987, 2002, 2013, and 2014). Currently, the vast majority (93 percent) of acres burned are within fire perimeters greater than 1,000 acres, even though these fires account for > 1 percent of all ignitions (**Table 3-39**). These large fires tend to burn during more extreme fire weather conditions, when fire behavior and growth potential exceed or challenge suppression resource availability, and capabilities (Planning Level 4 and 5; NIFC 2014). This pattern of fire on the landscape is contrary to historic patterns of frequent fires burning throughout the dry season under various weather conditions across the landscape.

Table 3-39. Fire ignitions within the planning area by acre size class categories, 1984-2013.

Fire Size Class (Acres)	All Ignitions (Percent)	Total Acres Burned (Percent)
<10	96%	1%
10-99	3%	2%
100-999	1%	4%
1,000+	<1%	93%

Source: Oregon Department of Forestry ignition data.

In recent decades, the frequency of large fires and the annual acres burned have increased across the West (Westerling *et al.* 2006) and in Oregon (OFRI 2014, USDI BLM 2013). Modeled projections indicate the trend will continue (Mote *et al.* 2014). Based on an analysis of fire start dates for fires greater than 1,000 acres, Westerling *et al.* (2006) found that the fire season is already longer than it was in the 1980s by at least a month. With observed increase in mean summer temperatures and earlier snowmelt, some climate changes have already begun to play out. These changes in climate strongly correlate with increasing fire size, large wildfire frequency, and longer wildfire durations (Littell *et al.* 2010, Miller *et al.* 2012, Westerling *et al.* 2006, see Climate Change section in this chapter). These observed trends and forecasts suggest that wildland fire will continue to be a major change agent affecting ecosystem structure and spatial distribution, further exacerbating the problems of fire exclusion and previous land management activities. Recognition of both the spatial and temporal process and vegetative structure of fire regimes is necessary to increase resilience in frequent fire-adapted forests (Agee 2002, Jain *et al.* 2012). In the absence of natural fire as a disturbance agent, management activities can serve as a partial surrogate to promote and maintain desired structural and compositional changes. Recently, there has been a growing body of evidence (Martinson and Omi 2013) demonstrating that vegetation management, incorporating mechanical and prescribed fire treatments, has successfully moderated fire behavior and fire effects, even under extreme weather events (Prichard and Kennedy 2014), and has contributed toward more resilient future forest structure (Stevens-Rumann *et al.* 2013). Kennedy and Johnson (2014) also found that these types of treatments improved wildfire management opportunities.

Issue 1

How would the alternatives affect fire resiliency in the fire-adapted dry forests at the landscape scale?

Summary of Analytical Methods

To measure dry forest fire resilience at the landscape scale, the BLM[40] quantified the departure of current vegetation structure and landscape composition patterns from a set of reference conditions that represent the historic range of variability (Barrett *et al.* 2010, Keane *et al.* 2009). In this approach, less departure from reference conditions represents greater fire resiliency. Historic conditions within the dry forests were more resilient to fire disturbance than current conditions, in large part, because frequent fire was present on the landscape (Brown *et al.* 2004, Hessburg and Agee 2003, North *et al.* 2009).

In this analysis, the BLM quantified how the seral stage distribution would vary in 50 years for each alternative, relative to the reference condition. This analytic process built upon the conceptual framework of the LANDFIRE Fire Regime Condition Class concept (Barrett *et al.* 2010, Schmidt *et al.* 2002). The LANDFIRE Fire Regime Condition Class conceptual framework assumes that, given natural disturbance

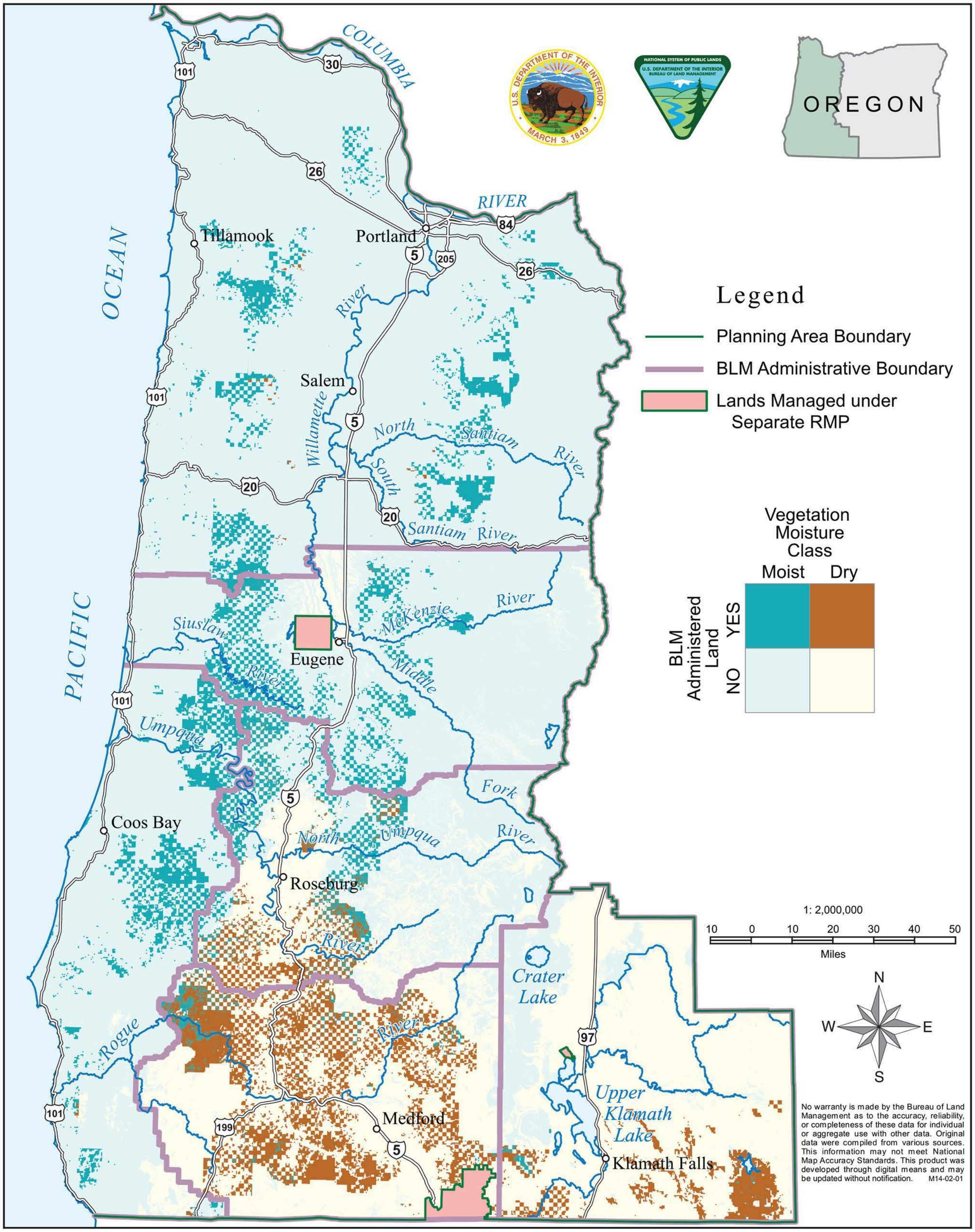
[40] The Nature Conservancy conducted this analysis of landscape-scale fire resiliency under an agreement with the BLM.

processes (e.g., historic fire regime), a biophysical setting will have a sustainable range of variation in the proportion of each successional stage for a given landscape (Barrett *et al*. 2010). This reference condition—the percentage of a biophysical setting in each seral stage—does not represent a specific historical date, but instead approximates an equilibrium condition, or ecological reference condition, based upon the natural biological and physical processes.

This issue presents an analysis of the cumulative effects on landscape-scale fire resiliency of past, present, and reasonably foreseeable future actions, including both land management on BLM-administered lands and non-BLM-administered lands.

Four primary data inputs provided the foundation for this assessment of successional stage departure:

1. A classification and map of forested biophysical settings to identify “dry” forest and “moist” forest (ILAP Potential Vegetation Types; **Map 3.2**)
2. A reference condition for the natural range of variability for each biophysical setting (LANDFIRE BPS 2008, Rollins 2009, Ryan and Opperman 2013)
3. A delineation of “landscape units” for each biophysical setting (i.e., the dry forest within the administrative boundaries of the Klamath Falls Field Office, Medford and Roseburg Districts) (**Map 3.2**)
4. A spatial delineation of both current and future forest vegetation structure using BLM structural stages cross-walked to seral stages and gradient nearest neighbor (GNN) imputation datasets derived from inventory field plots, environmental gradients and Landsat imagery (Ohmann and Gregory 2002) classified into seral stages (Haugo *et al.* 2015).



Map 3-2: Moist and Dry Vegetation within the Planning Area

The BLM used the Integrated Landscape Assessment Project (ILAP) Potential Vegetation Type spatial data, which approximate an aggregation of plant associations and Plant Association Groups, to classify forests within the planning area into “moist” and “dry” forest categories, based on Franklin and Johnson (2012). United States Forest Service Region 6 Ecologists reviewed the initial categorizations of moist and dry Plant Association Groups, and BLM district staff refined the data, based on local knowledge of the ground. Using the refined ILAP Potential Vegetation Type 30-meter spatial data, the BLM categorized as “dry” any Forest Operations Inventory polygons that had more that 50 percent of its area within a dry Potential Vegetation Type (**Appendix H**).

The analysis area is the dry forest area within the boundaries of the western portion of the Klamath Falls Field Office, Medford District, and Roseburg District administrative boundaries. Each of these three administrative units constituted a landscape for the purpose of this analysis. The BLM also refers to this area as the “interior/south” portion of the decision area. These three administrative units encompass the majority of the dry forest landscape within the planning area (**Map 3-2**). Although the Coos Bay district has a large portion (39 percent) of lands classified as fire regime I within the district boundary (**Table 3-38**), the overwhelming majority of the BLM-administered lands in the Coos Bay District is classified as moist forest (**Figure 3-31**). Therefore, lands within the Coos Bay District are not included in this analysis. The Coos Bay, Eugene, and Salem Districts comprise the moist or “coastal/north” portion of the decision area

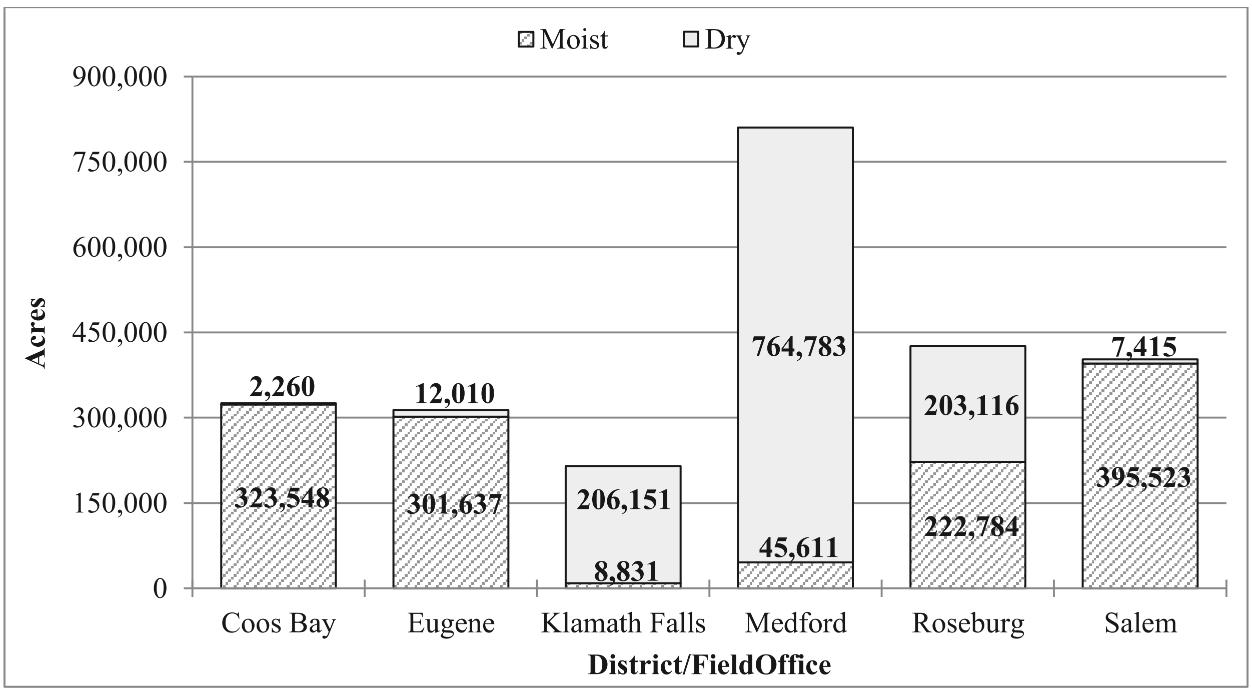


Figure 3-31. Forest type (moist and dry) distribution on BLM-administered lands by district/field office.

In this analysis, the BLM created a cross-walk between the structural stages used in the Woodstock model (see the Vegetation Modeling section in this chapter) and the five seral stages used in the LANDFIRE Fire Regime Condition Class conceptual framework: early seral, mid-seral closed, mid-seral open, late-seral closed, and late-seral open (**Appendix H**). Although necessary to produce data suitable for this analytical methodology, the crosswalk from structural stages to seral stages may have resulted in the misclassification of some stands.

The vegetation growth Woodstock model is not able to depict precisely or accurately the within-stand heterogeneity that would result from the management approach in the Uneven-aged Timber Area. Under the action alternatives, the Uneven Aged Timber Area makes up most or all of the Harvest Land Base within this analysis area. Implementation of the management direction in the Uneven-aged Timber Area would likely result in a mix of open and closed stand conditions. This analysis likely represents this fine-scale heterogeneity as closed stand conditions. Therefore, this analysis likely overestimated the extent of mid-seral closed (and, to a lesser extent, late-seral closed) stand conditions that would result from management in the Uneven-aged Timber Area, and potentially underestimated the extent of mid-seral open (and late-seral open stand conditions). However, given the small percentage of the overall dry forest landscape in Uneven-aged Timber Area in any of the alternatives, these errors would not alter the overall trend and magnitude of changes over time at the scale of this analysis.

The BLM assumed that changes in seral stage distribution in the moist forest portions within the Klamath Falls Field Office, Medford District, and Roseburg District would not be as relevant to landscape-scale fire resilience, because of the difference in fire severity and frequency associated with fire regimes in those vegetation types.

For the purpose of this analysis, the BLM assumed that the future distribution of forest structure conditions on non-BLM-administered lands would continue to reflect the current distribution of forest structure conditions. The assumption that the future distribution of forest structure conditions on non-BLM-administered lands would continue to reflect the current distribution of forest structure conditions is consistent with the assumption used in the analysis of forest structure and spatial pattern in the 2008 RMP/EIS, which describes the limitations on analyzing future changes on non-BLM-administered lands and is incorporated here by reference (USDI BLM 2008, pp. 532-536).

The BLM acknowledges that the distribution and spatial arrangement of seral stages would change in the future, but lacks information to make specific projections of how successional stages relevant to this analysis of fire resiliency would change over time on non-BLM-administered lands. Seral stage is a key component of this this analysis, and the BLM lacks information on stand attributes on non-BLM-administered lands that are directly relevant to this analysis. Holding seral stages constant on non-BLM-administered lands provides a reasonable benchmark to determine relative differences in how the management of BLM-administered lands would contribute towards the larger landscape resilience within the analysis period.

The BLM-administered lands comprise 28 percent of the analysis area. Therefore, BLM-administered lands have a relatively small ability to influence the overall landscape distribution of seral stages at the scale of the entire analysis area.

This analysis evaluated the departure, relative to the reference condition, of each vegetation type, for each seral stage, in each of the three administrative units. Presenting all of these results together would produce an analysis of bewildering complexity. For example, summing all vegetation types within an administrative unit would show simultaneous overabundance and deficits in each seral stage, because some vegetation types would be overabundant in that seral stage, while other vegetation types would be deficit. Therefore, this analysis focused on the two most common vegetation types in the analysis area: the Douglas-fir/dry and Douglas-fir/moist vegetation types, which account for most (74 percent) of the analysis area (**Table 3-40**).

Table 3-40. Amount of dry forested vegetation types in the interior/south portion of the planning area included in departure analysis.

Vegetation Types	All Interior/South Dry Forest	
	(%)	(Acres)
Douglas-fir/Dry	41%	1,336,438
Douglas-fir/Moist	33%	1,090,723
Douglas-fir/White oak	8%	250,616
Tan oak/Douglas-fir	8%	277,579
Shasta Red fir	5%	157,989
Jeffrey pine	2%	59,152
Ponderosa pine/Lodgepole pine	2%	66,714
Western hemlock	1%	20,192
Lodgepole pine	<1%	443
Mixed Conifer	<1%	15,833
Oregon white oak/Ponderosa pine	<1%	43
Ponderosa pine/Dry	<1%	8,776
Total Dry Forested Acres in Analysis Area		**3,284,497**

The results of this analysis do not include vegetation changes resulting from non-commercial hazardous fuels work, which would likely contribute toward decreasing acres in the mid-closed seral stage similarly among all alternatives.

Appendix H provides detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales in this analysis.

Affected Environment and Environmental Consequences

The Douglas-fir/dry vegetation type shows similar general patterns both currently and in the future for all three administrative units. Therefore, this discussion sums the results for all three administrative units.

Currently, the Douglas-fir/dry vegetation type has a slight overabundance of early seral and a substantial overabundance of mid-seral closed forest (**Figure 3-32**). The Douglas-fir/dry vegetation type has a slight deficit of mid-seral open forest[41] and late-seral closed forest and a substantial deficit of late-seral open forest.

[41] In contrast to the Medford and Roseburg Districts, the Klamath Falls Field Office has a slight overabundance of mid-seral open forest (approximately 3,000 acres), both currently and in the future under each alternative. **Figure 3-32** does not depict this slight overabundance.

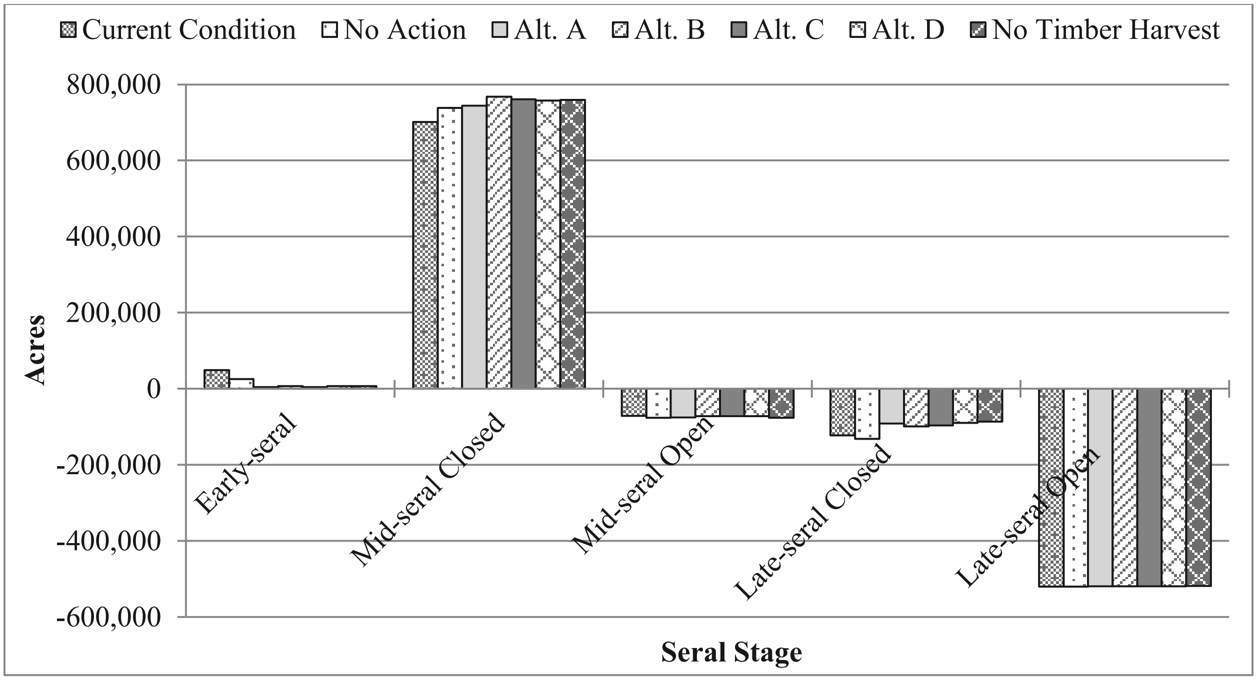


Figure 3-32. Departure from reference conditions in the Douglas-fir/dry vegetation type by seral stage; current conditions and by alternative and the No Timber Harvest Reference Analysis in 2063.

In 50 years, conditions in the Douglas-fir/dry vegetation type under any alternative and the No Timber Harvest Reference Analysis would generally result in continued departure from reference conditions (**Figure 3-32**). The alternatives would result in only modest shifts in the seral stage distribution on the BLM-administered lands. There would be continued overabundance of mid-seral closed forest conditions, due in large part to continued fire exclusion. The action alternatives and the No Timber Harvest Reference Analysis would result in slight improvements in the early seral and late-seral closed departure and no change to the late-seral open forest departure. Because the BLM-administered lands constitute only a small portion of the analysis area, these modest shifts would not result in any substantial change in the overall landscape condition in the Douglas-fir/dry vegetation type. Under all alternatives and the No Timber Harvest Reference Analysis, the landscape condition in the Douglas-fir/dry vegetation type would continue to be shaped by an overabundance of mid-seral closed forest and a deficit of late-seral open forest.

The Douglas-fir/moist vegetation type has differing patterns both currently and in the future for the three administrative units. Therefore, this discussion presents the results for the three administrative units separately.

Currently within the Klamath Falls Field Office, the amount of Douglas-fir/moist early-seral vegetation is within the historic range of variability. There is a substantial overabundance of mid-seral closed forest and slight overabundance of mid-seral open forest (**Figure 3-33**). The Douglas-fir/moist vegetation type is also slightly deficit of late-seral closed forest and substantially deficit of late-seral open forest.

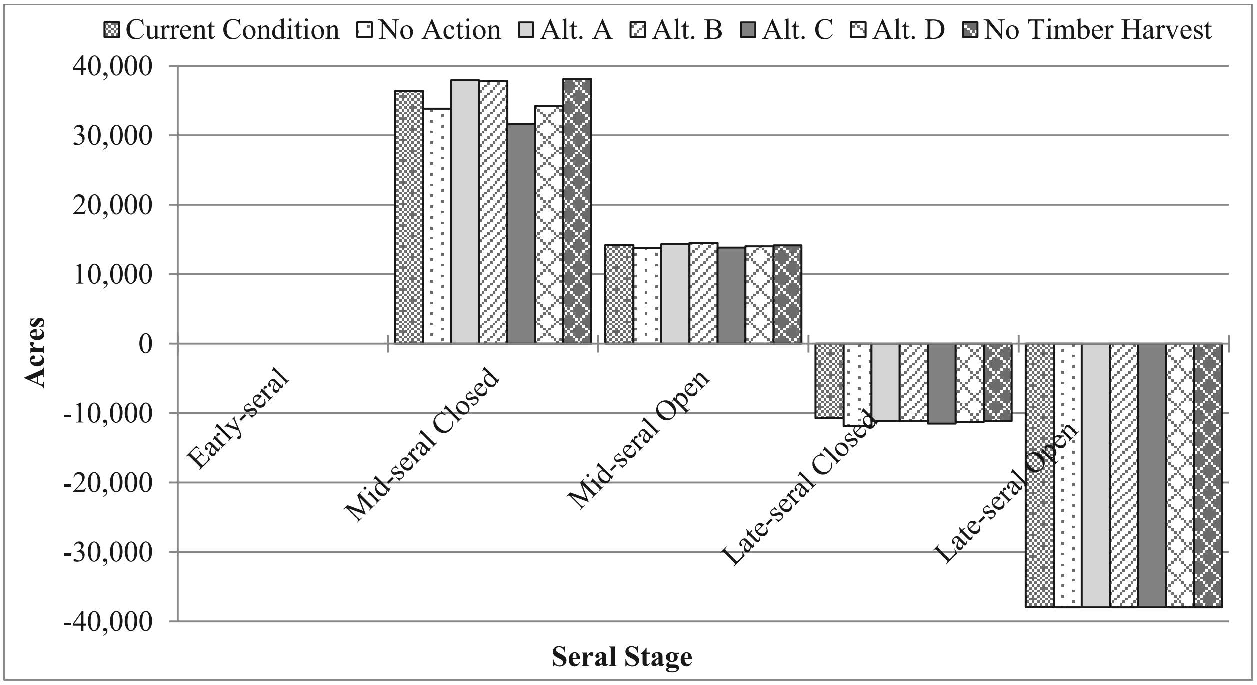


Figure 3-33. Departure from reference conditions in the Douglas-fir/moist vegetation type by seral stage for the Klamath Falls Field Office. This includes the current conditions and by alternative and the No Timber Harvest Reference Analysis in 2063.

In 50 years, the alternatives would only result in modest shifts in the seral stage distribution on the BLM-administered lands in the Klamath Falls Field Office. The No Action alternative and alternatives C and D would slightly reduce the overabundance of mid-seral closed forest, from current conditions. For all other seral-stages conditions in the Douglas-fir/moist vegetation type under any alternative and the No Timber Harvest Reference Analysis would result in essentially no change in current departure from reference conditions.

Currently within the Medford District, the Douglas-fir/moist vegetation type is slightly deficit in early-seral and mid-seral open forest (**Figure 3-34**). There is a substantial overabundance of mid-seral closed forest and slight overabundance of late-seral closed forest. The Douglas-fir/moist vegetation type is also substantially deficit in late-seral open forest.

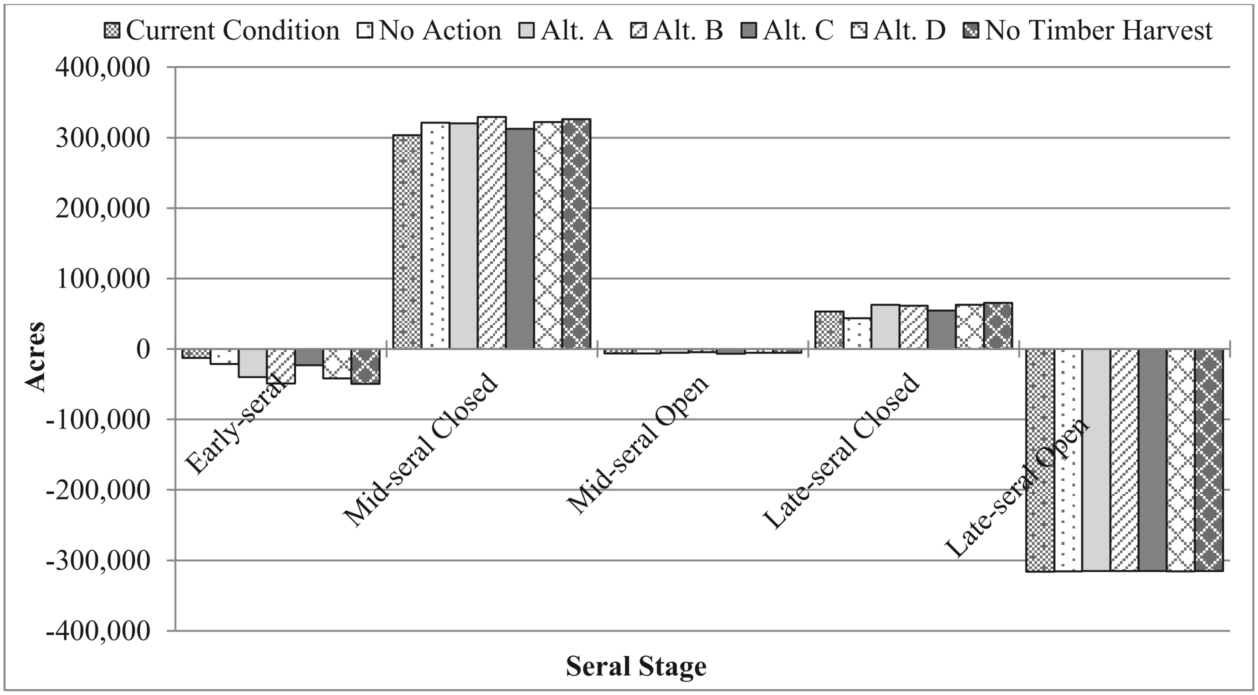


Figure 3-34. Departure from reference conditions in the Douglas-fir/moist vegetation type by seral stage for the Medford District. This includes the current conditions and by alternative and the No Timber Harvest Reference Analysis in 2063.

In 50 years, conditions in the Douglas-fir/moist vegetation type in the Medford District under any alternative and the No Timber Harvest Reference Analysis would generally result in continued departure from reference conditions (**Figure 3-34**), due in large part to continued fire exclusion. In the late-seral open forest, there would be essentially no change in current departure from reference conditions.

Currently within the Roseburg District, the Douglas-fir/moist vegetation type has a slight overabundance of early seral and mid-seral closed forest (**Figure 3-35**). There is a substantial overabundance of mid-seral closed forest and slight overabundance of late-seral closed forest. The Douglas-fir/moist vegetation type is also substantially deficit in late-seral open forest and slightly deficit in mid-seral open forest.

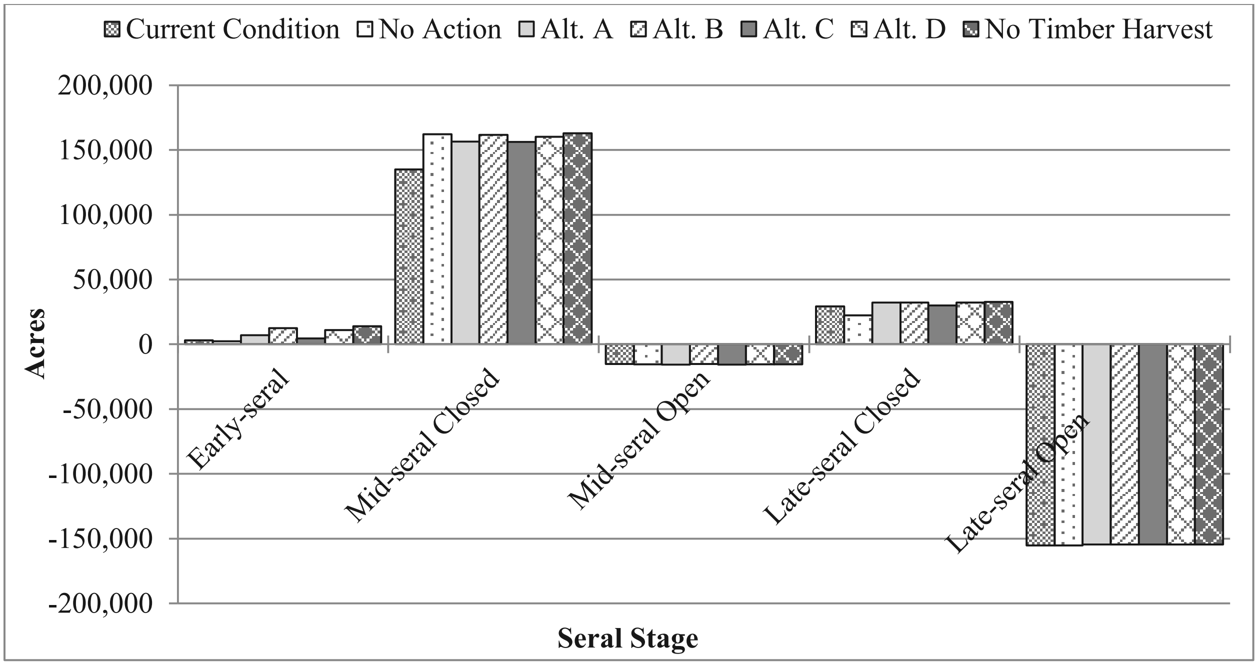


Figure 3-35. Departure from reference conditions in the Douglas-fir/moist vegetation type by seral stage for the Roseburg District; current conditions and by alternative and the No Timber Harvest Reference Analysis in 2063.

Again, in 50 years, conditions in the Douglas-fir/moist vegetation type in the Roseburg District under any alternative and the No Timber Harvest Reference Analysis would generally result in continued departure from reference conditions, due in large part to continued fire exclusion. There would be little change from current departure in both the mid-seral and late-seral open forest under any alternative.

Similar to the Douglas-fir/dry vegetation type, in 50 years, conditions in the Douglas-fir/moist vegetation type under any alternative and the No Timber Harvest Reference Analysis would generally result in continued departure from reference conditions (**Figures 3-33**, **3-34**, and **3-35**). The alternatives would result in only modest shifts in the seral stage distribution on the BLM-administered lands. Because the BLM-administered lands constitute only a small portion of the analysis area, these modest shifts would not result in any substantial change in the overall landscape condition in the Douglas-fir/moist vegetation type. Under all alternatives and the No Timber Harvest Reference Analysis, the landscape condition in the Douglas-fir/moist vegetation type would continue to be shaped by an overabundance of mid-seral closed forest and a deficit of late-seral open forest.

In both the Douglas-fir/dry and Douglas-fir/moist vegetation types, the differing BLM management under the alternatives would result in little change in the departure from reference conditions over time, for several reasons. First, the BLM-administered lands represent a small portion of the analysis area. Second, under all alternatives, the BLM would allocate only a small portion of the BLM-administered lands to the Harvest Land Base, in which BLM would implement the most active management capable of shifting seral stages. Management within reserve allocations would be unlikely to shift seral stages substantially, given the reserve land use allocation objectives. Finally, the 50-year analysis period may be too short in length to show substantial shifts in seral stages (e.g., for development of mid-seral closed forests into late-seral open forests).

Fire exclusion continues to have an overwhelming influence on departure from reference conditions. Due to the configuration of BLM-administered lands within the larger landscape, restoring wildfire as a process would have limited application because of the high risk of wildfire affecting adjacent lands. Under any alternative, management with fire would primarily be limited to the application of prescribed fire to the landscape.

In summary, the landscape would remain departed from reference conditions similarly under any alternative, with a continued overabundance of mid-seral closed forest and a deficit of late-seral open forest. Changes in seral stage distribution on BLM-administered lands would account for only small shifts in the landscape departure under any alternative.

Issue 2

How would the alternatives affect fire resistance in the fire-adapted dry forests at the stand level?

Summary of Analytical Methods

Resistance refers to the capacity for an ecosystem to resist the impacts of disturbances without undergoing significant change. For example, wildfire can burn through a resistant forest without substantially altering its structure, composition, or function (Franklin *et al.* 2013).

In this analysis, the BLM assigned forest structural stages to a relative ranking of stand-level resistance to replacement fire (**Table 3-41**).

Table 3-41. Stand-level resistance to replacement fire by structural stage.

Structural Stages	Subdivisions	Resistance to Stand Replacement Fire
Early-successional	With Structural Legacies	Moderate
	Without Structural Legacies	Moderate
Stand Establishment	With Structural Legacies	Moderate
	Without Structural Legacies	Low
Young Stands – High Density	With Structural Legacies	Low
	Without Structural Legacies	Low
Young Stands – Low Density	With Structural Legacies	Moderate
	Without Structural Legacies	Moderate
Mature	Single-Layered Canopy	High
	Multi-layered Canopy	Mixed
Structurally-complex	Developed Structurally-complex	Mixed
	Existing Old Forest	Mixed
	Existing Very Old Forest	Mixed

While the structural stage classification does not specifically account for surface fuel loading, the BLM assumed that vegetation community structure is an important factor affecting potential fire behavior, post-fire effects, and fire resistance, particularly to crown fire (Jain and Graham 2007), which has the largest immediate and long-term ecological effects (Graham *et al.* 2004). Particularly in the frequent fire-adapted dry forest, fire resistant stand structure reduces the likelihood of atypical large-scale crown fire (Agee and Skinner 2005, Franklin *et al.* 2013, Jain *et al.* 2012). In general, stands with higher fire resistance have reduced surface fuel loading, lower tree density, large diameter trees of fire-resistant species, increased height to live crown (Brown *et al.* 2004, Peterson *et al.* 2005, USDI BLM 2008), and discontinuous horizontal and vertical fuels. Mechanical and prescribed fire treatments that alter these aspects of the fuel profile can create conditions that result in improved stand level resistance to replacement fire (Agee and Skinner 2005, Jain *et al.* 2012, Scott and Reinhardt 2001).

This analysis does not account for the complex interaction among fuels (including vertical and horizontal composition and moisture), topography (e.g., slope, topographic position, elevation, and aspect), and weather (e.g., wind, temperature, relative humidity, fuel moisture, and drought) that influence fire behavior, resultant burn severity, and fire effects (Andrews and Rothermel 1982, Scott and Reindhard 2001) and the specific conditions related to crown fire initiation and spread (Van Wagner 1977). As fire weather indices increase throughout the summer, stand resistance to replacement fire decreases. Weather events and climatic conditions, including drought, have the potential to result in unexpected and extreme fire behavior, and subject every structure class to high-severity fire. Nevertheless, at this scale of analysis with the data available, the assignment of structural stages to a relative ranking of stand-level resistance provides a robust and consistent basis for comparing the effects of the alternatives.

The analysis area is the dry forest area within the interior/south: the Klamath Falls Field Office, Medford and Roseburg Districts, as described in Issue 1. The BLM quantified the acreage of BLM-administered lands in the dry forest in the Klamath Falls Field Office, Medford and Roseburg Districts in each fire resistance categories for each alternative over 50 years.

The results of this analysis do not include effects from non-commercial hazardous fuels work, which would contribute toward improving fire resistance similarly among all alternatives.

Appendix H provides detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales.

Affected Environment and Environmental Consequences

Currently, about half of the BLM-administered lands in dry forest have moderate or low fire resistance (i.e., relatively greater tendency of a stand-replacement fire). Approximately 5 percent of the BLM-administered lands in dry forest currently have high fire resistance (i.e., less probability of a stand-replacement fire (**Figure 3-36**).

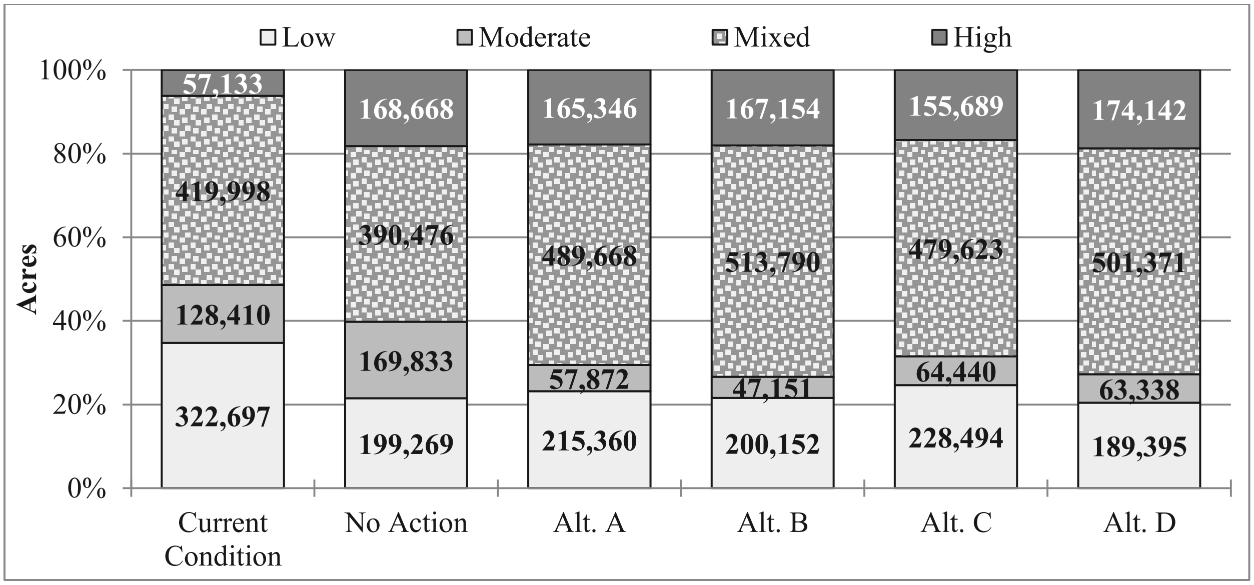


Figure 3-36. Stand-level fire resistance categories in the dry forest in the interior/south for the current condition and each alternative in 50 years.

In 50 years, all alternatives would result in an increase in stand-level fire resistance across the dry forest. All alternatives would reduce the acres of moderate or low fire resistance and increase the acres of high fire resistance, relative to current conditions across the dry forest. The No Action alternative would result in the least reduction in the acreage of moderate or low fire resistance. Although the differences among the action alternatives are minor, Alternatives B and D would result in the greatest reduction in the acreage of low or moderate fire resistance, followed by Alternatives A and C.

The effects of the alternatives on stand-level fire resistance in both the Medford and Roseburg Districts in 50 years would approximate the effects across the dry forest (**Figures 3-37 and 3-38**). Differences among the alternatives would be more evident for the Klamath Falls Field Office than for the entirety of the dry forest or for the Roseburg and Medford Districts (**Figure 3-39**). In the Klamath Falls Field Office, the No Action alternative would result in only a slight increase in the acreage of mixed or high fire resistance from current conditions, and, consequently, only a slight reduction in the acreage of moderate or low fire resistance. Alternative C would result in no increase in the acreage of high fire resistance among all alternatives and less increase in the acreage of mixed fire resistance than the other action alternatives.

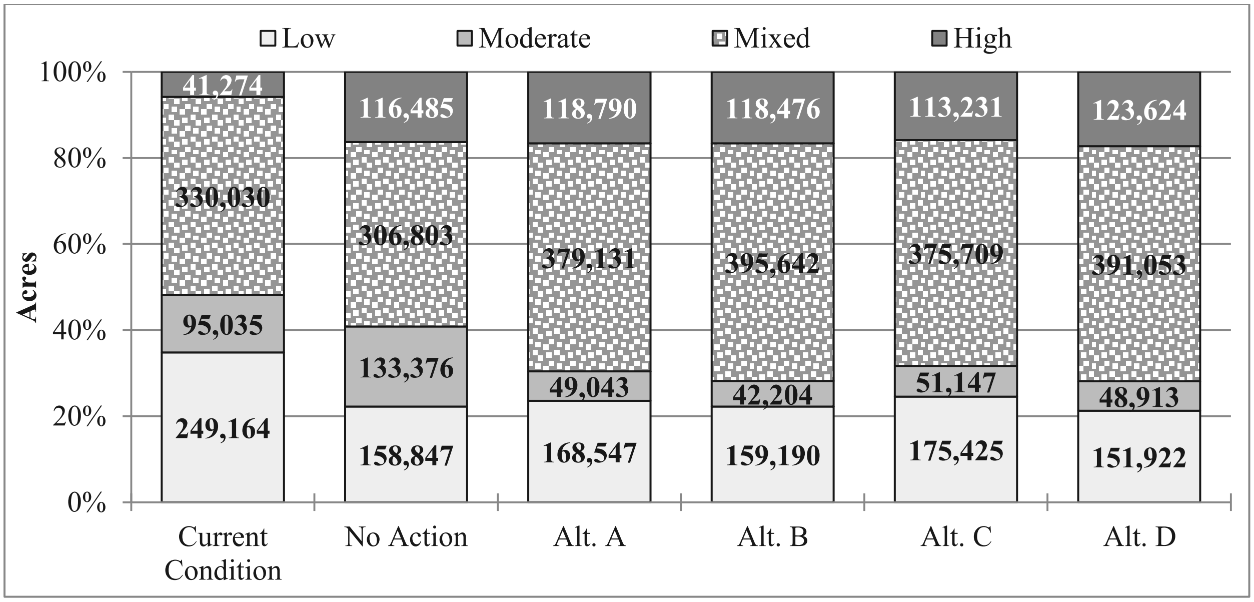


Figure 3-37. Stand-level fire resistance categories in the dry forest in the Medford District for the current condition and each alternative in 50 years.

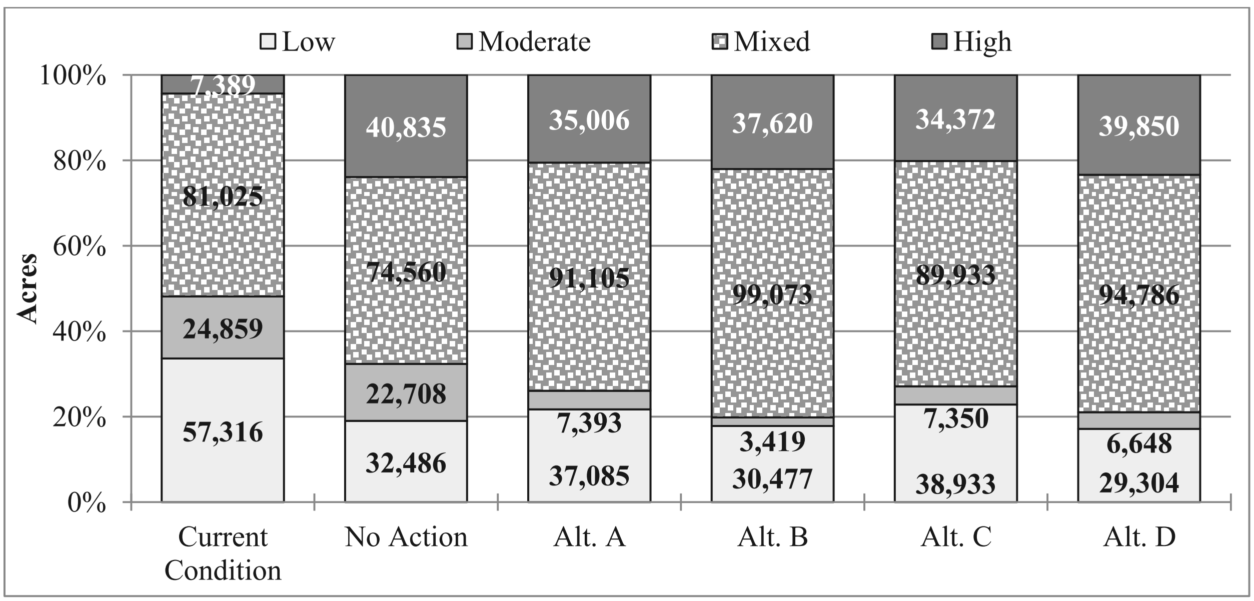


Figure 3-38. Stand-level fire resistance categories in the dry forest in the Roseburg District for the current condition and each alternative in 50 years.

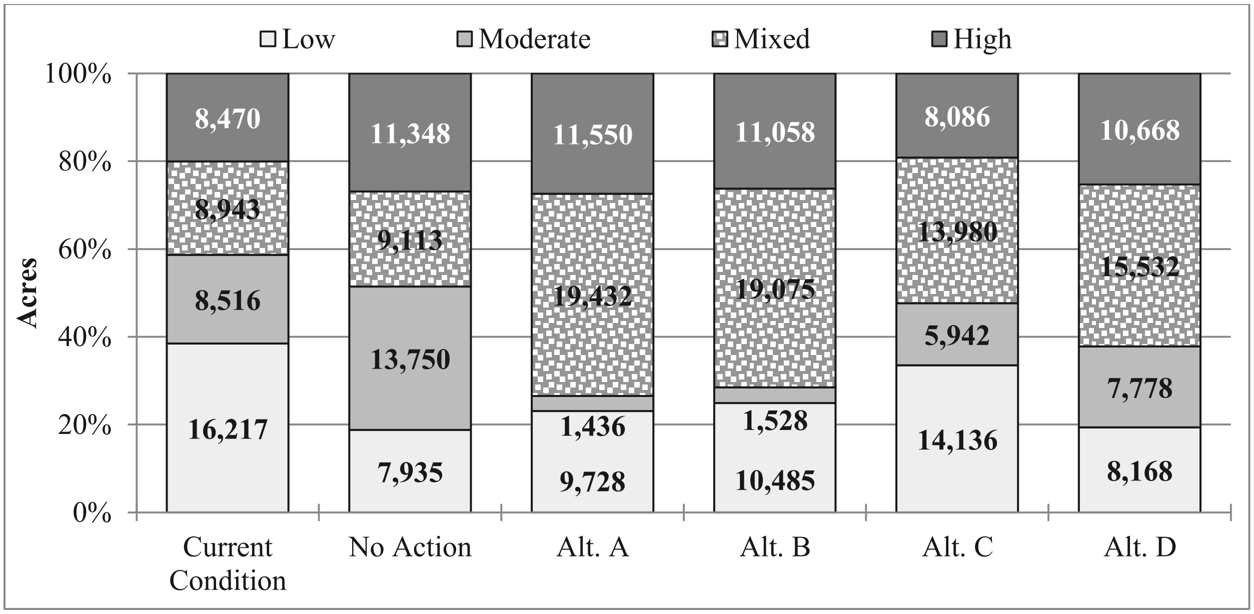


Figure 3-39. Stand-level fire resistance categories in the dry forest in the Klamath Falls Field Office for the current condition and each alternative in 50 years.

The alternatives differ in the extent and location of both the Harvest Land Base and the Late-Successional Reserve system. The associated changes in vegetation, due to different extents and management direction within the Harvest Land Base among the alternatives, would influence the overall patterns of stand-level fire resistance, rather than changes occurring within the reserves. Even though the alternatives differ substantially in the extent and location of the Late-Successional Reserves in the dry forest, current fire resistance within the Late-Successional Reserves is similar among all alternatives (**Figure 3-40**). Additionally, all alternatives would similarly reduce the acreage in the low or moderate fire resistance categories within the Late-Successional Reserves after 50 years, thus not influencing the overall patterns of change within the dry forest. However, within the Harvest Land Base, there would be greater variation in the patterns of change in stand-level fire resistance among the alternatives over time, and this would drive the differences among the alternatives across the dry forest overall.

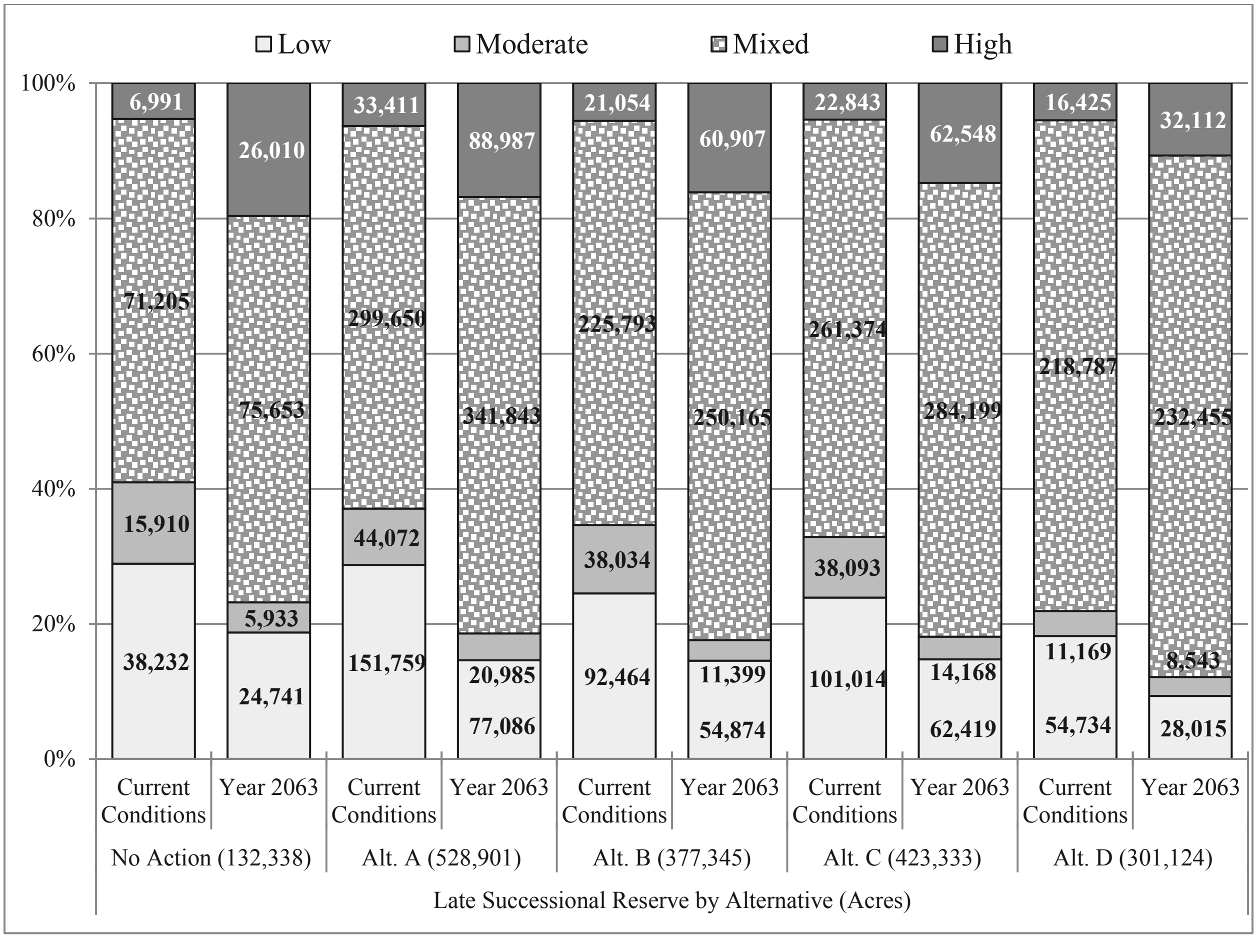


Figure 3-40. Stand-level fire resistance categories in the Late-Successional Reserves in the dry forest in the interior/south for the current condition and each alternative in 50 years.

Within the Harvest Land Base, the current stand-level fire resistance conditions differ among the alternatives, due to the differing extents and locations of the Harvest Land Base among the alternatives (**Figure 3-41**). The No Action alternative has the largest Harvest Land Base (i.e., Matrix and Adaptive Management Areas) and the smallest proportion (52 percent) currently in low or moderate fire resistance. The size of the Harvest Land Base is relatively similar in Alternatives B, C, and D, and approximately 60 percent of the acreage is in low or moderate fire resistance. Alternative A has the smallest Harvest Land Base and the largest proportion (75 percent) in low or moderate fire resistance.

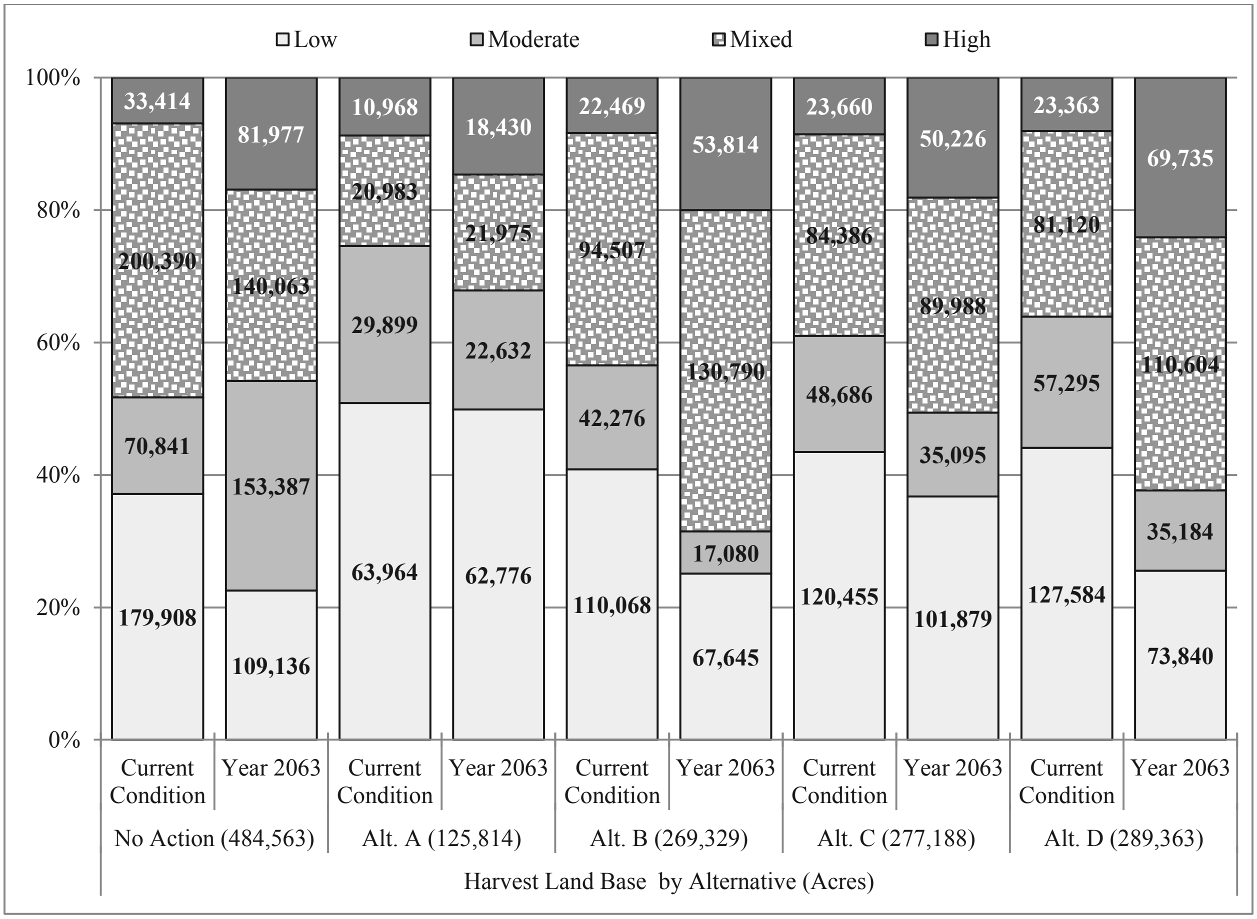


Figure 3-41. Stand-level fire resistance categories in the Harvest Land Base in the dry forest in the interior/south for the current condition and each alternative in 50 years.

In 50 years, all of the action alternatives would reduce the proportion of the Harvest Land Base in low or moderate fire resistance (**Figure 3-41**). Alternative A would reduce this proportion by 7 percent, while Alternative C would result in a decrease of 12 percent. Alternatives B and D would result in the greatest decrease (25 and 26 percent, respectively) in the proportion of the Harvest Land Base in low or moderate fire resistance. In contrast to all action alternatives, the No Action alternative would slightly increase the proportion of the Harvest Land Base in low or moderate fire resistance in 50 years. BLM office results approximate the same trends as the entire dry forest Harvest Land Base (**Appendix H**).

The differences among alternatives, in stand-level fire resistance within the Harvest Land Base, largely would result from the type of management and associated management direction.

The Harvest Land Base within the dry forest for the interior/south in Alternatives A and C is comprised of both the High Intensity Timber Area and the Uneven-Aged Timber Area (**Table 3-42**). A greater proportion of the Harvest Land Base in Alternative A is in the High Intensity Timber Area, which would result in only a slight improvement in stand-level fire resistance in the Harvest Land Base, relative to the current condition. In Alternative C, a greater proportion of the Harvest Land Base is in the Uneven Aged Timber area than in Alternative A. While having a larger portion of the Harvest Land Base in the Uneven Aged Timber Area would improve overall stand-level fire resistance slightly more than Alternative A, Alternative C has a larger Harvest Land Base and thus has more acres in both the High Intensity Timber Area and the Uneven Aged Timber Area.

Table 3-42. Land use allocations in the Harvest Land Base in the dry forest in the interior/south by alternative.

<table>
<tr><th>Alternative</th><th>Dry Forest Harvest Land Base – Harvest Type</th><th>Acres</th></tr>
<tr><td>No Action</td><td>HLB in Decision Area</td><td>484,563</td></tr>
<tr><td rowspan="3">Alt. A</td><td>HLB in Decision Area</td><td>125,814</td></tr>
<tr><td>HLB - High Intensity Timber Area</td><td>71,474</td></tr>
<tr><td>HLB - Uneven Aged Timber Area</td><td>54,340</td></tr>
<tr><td rowspan="2">Alt. B</td><td>HLB in Decision Area</td><td>269,329</td></tr>
<tr><td>HLB - Uneven Aged Timber Area</td><td>269,329</td></tr>
<tr><td rowspan="3">Alt. C</td><td>HLB in Decision Area</td><td>277,188</td></tr>
<tr><td>HLB - High Intensity Timber Area</td><td>92,588</td></tr>
<tr><td>HLB - Uneven Aged Timber Area</td><td>184,528</td></tr>
<tr><td rowspan="4">Alt. D</td><td>HLB in Decision Area</td><td>289,363</td></tr>
<tr><td>HLB - Moderate Intensity Timber Area</td><td>31,258</td></tr>
<tr><td>HLB - Owl Habitat Timber Area</td><td>195,891</td></tr>
<tr><td>HLB - Uneven Aged Timber Area</td><td>62,214</td></tr>
</table>

The High Intensity Timber Area includes management such as thinning and regeneration harvest with no retention and rapid reforestation on a relatively short rotation. This management approach would result in continuous horizontal and vertical fuel profiles and conditions more closely aligned with high severity fire. Although mixed fire regimes would have historically included some small patches of high severity fire, there currently exists an overabundance of young and closed conditions and the likelihood of large, high severity fire has increased. Large areas of no retention are not representative of the prevailing vegetative patterns and structure associated with frequent fire, low-severity or mixed-severity fire regimes (Taylor and Skinner 2003, Larson and Churchill 2012). Additionally, contiguous fuel profiles have reduced stand-level fire resistance.

Alternative B has all of the Harvest Land Base in the dry forest in the interior/south in the Uneven-Aged Timber Area. Alternative D has most of the Harvest Land Base in the dry forest in the interior/south in the Uneven-Aged Timber area or Owl Habitat Timber Area. Alternatives B and D, would result in the greatest decrease in low and moderate fire resistance, relative to current conditions. Alternative D also has a little more than 30,000 acres of the Harvest Land Base in the Moderate Intensity Timber Area. The Moderate Intensity Timber Area includes thinning and regeneration harvest with 5-15 percent basal area retention, and longer rotations and rapid reforestation. This management approach would result in more continuous horizontal and vertical fuel profiles and conditions more closely aligned with high severity fire. However, the Moderate Intensity Timber Area constitutes only about 11 percent of the Harvest Land Base in the dry forest in the interior/south under Alternative D, diminishing its influence on overall stand-level fire resistance.

The management approach in the Uneven-Aged Timber Area includes reducing stand densities and promoting or enhancing heterogeneity and large tree growth, through a combination of silviculture treatments, harvest, and prescribed fire. Management in the Owl Habitat Timber Area includes both lighter thinning and uneven-aged management. Both of these management scenarios would result in the greatest reduction of low and moderate stand-level resistance and the largest increase in the mixed- and high-resistance acres. These mixed- and higher-resistance stands would result in more discontinuous fuel profiles, and thus greater resistance to replacement fire. Additionally, discontinuous fuels tend to reduce the complexities associated with implementation of prescribed fire (Jain *et al.* 2012), presenting more opportunities to apply fire on the landscape and maintain fire-resistant stand conditions.

The Uneven-Aged Timber Area management direction also provides the latitude to increase fine-scale within-stand heterogeneity in response to topographic and vegetative complexity, as well as create strategic landscape conditions that provide fire management opportunities through a combination of silviculture treatments, harvest, and prescribed burning (**Appendix B**). Increasing spatial heterogeneity at multiple scales, and disrupting fuel continuity, can alter potential fire behavior (Finney 2001) and may create conditions in which fire can occur without detrimental consequences, reducing impacts to highly valued resources, including timber and wildlife habitat (Jain *et al.* 2012). These conditions may also provide opportunities for effective fire management, including the ability to utilize wildfire for resource benefit in under conditions outlined in Management Direction (**Appendix B**). Particularly in stands that are not currently complex, the creation of small openings and heterogeneous (patchy) stand composition will move vegetation patterns and fuel loadings and arrangements toward conditions comparable to low and mixed severity fire regimes (Agee 2002).

In large part, the lack of difference among alternatives for the dry forest in the interior/south is due to the abundance of acres in the mixed resistance category (**Figure 3-36**), especially in the Late-Successional Reserve (**Figure 3-40**). The mixed fire resistance category has the potential to exhibit the full range of resistance categories (high to low). Particularly in these stands, management involving mechanical treatments and prescribed burning that affects the horizontal and vertical arrangement of canopy, ladder, and surface fuels, can reduce crown fire potential (Agee and Skinner 2005, Scott and Reinhardt 2001, Jain *et al.* 2012). This type of management would trend these mixed resistance stands toward higher relative resistance to replacement fire. The BLM assumed that the restoration approach taken in the Late-Successional Reserve in the dry forest would include stand density reductions, cultivation of large trees with old-growth characteristics, and introductions of heterogeneity into increasingly uniform stands, and treatments to reduce fire risk adjacent to high-value habitat. However, a degree of uncertainty surrounds the implementation of treatments within Late-Successional Reserve, due to potentially conflicting management objectives and management direction.

In summary, all alternatives would reduce the acres of moderate or low fire resistance and increase the acres of high resistance, relative to current conditions across the dry forest in the interior/south. Although the alternatives would differ only slightly across the dry forest, those differences reflect the varied extent and patterns resulting from management within the Harvest Land Base among the alternatives. The effects of some alternatives, evident within the Harvest Land Base, are less evident at the entire extent of the dry forest, due to the small Harvest Land Base relative to a larger Late-Successional Reserve system.

Issue 3

How would the alternatives affect wildfire hazard within close proximity to developed areas?

Summary of Analytical Methods

In this analysis, the BLM evaluated stand-level fire hazard within close proximity to developed areas.

Wildfire risk encompasses the potential for a wildfire to start and have adverse effects to human values (lives, homes, ecosystem services, or ecological functions and attributes). In this analysis, the BLM assumed that a one-mile buffer around the Wide Wildfire Risk Assessment Wildland Development Areas data layer (WWRA 2013) represents the geographic scope of possible immediate risks to the public and firefighter safety within close proximity to communities located within the Wildland Urban Interface

(WUI)[42] across the planning area. The BLM used a one-mile buffer around the Wide Wildfire Risk Assessment Wildland Development Areas data layer as a surrogate for the WUI in this analysis. The Oregon Department of Forestry, on behalf of the Council of Western State Foresters and the Western Forestry Leadership Coalition, completed the West Wide Wildfire Risk Assessment in 2013. This assessment quantified the magnitude of the current wildland fire problem in the west and established a baseline for planning mitigation activities and monitoring change over time. The Wildland Development Areas data layer provides a delineation of where people live in the wildland, classifying a minimum of one structure per 40 acres as a developed area. The magnitude of human-caused ignitions that occur there illustrates the substantial exposure and demand on fire suppression resources within close proximity to developed areas and risk to life and property (**Figure 3-42**).

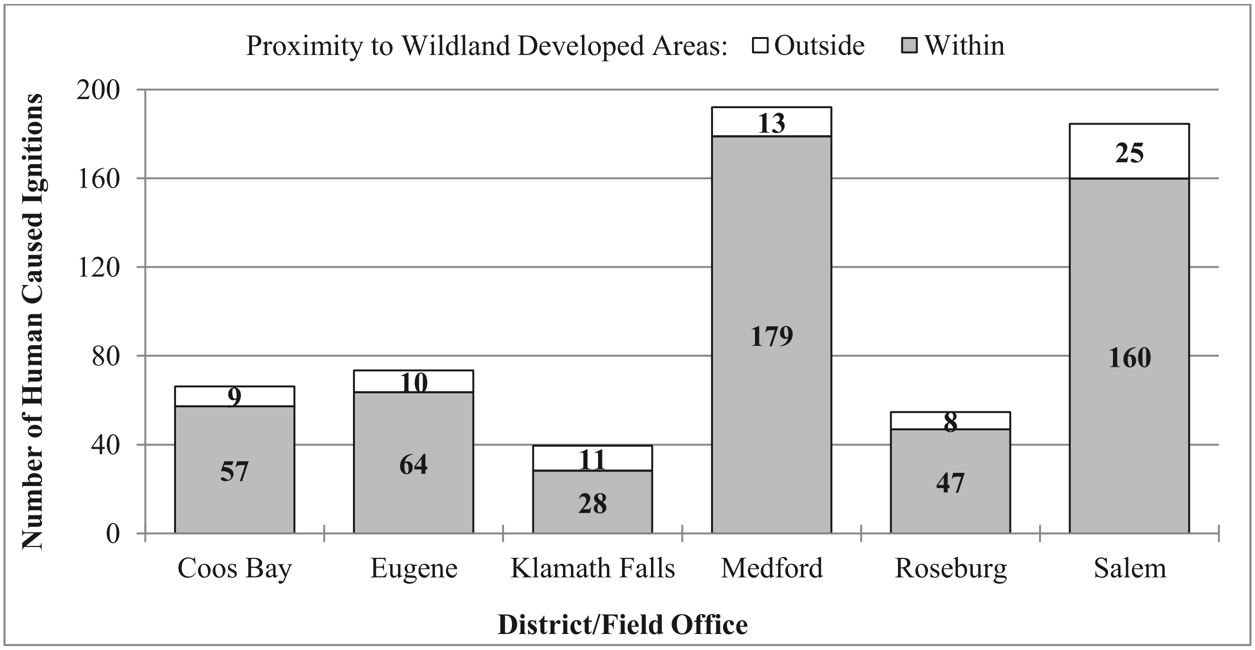


Figure 3-42. Average annual number of human-caused ignitions, 1984-2013.
Source: Oregon Department of Forestry ignition data.

The BLM assigned forest structural stages to a relative ranking of stand-level fire hazard (**Table 3-43**). Wildfire hazard refers to the ease of ignition, potential fire behavior, and resistance to control of the fuel complex, defined by the volume and arrangement of several strata, including surface, ladder, and canopy fuels (Calkin *et al.* 2010).

[42] The Healthy Forest Restoration Act (2003) identifies WUI as an area within or adjacent to structures and other human development that meet or intermingle with undeveloped wildland.

Table 3-43. Stand-level wildfire hazard ratings by structural stage.

Structural Stages	Subdivisions	Wildfire Hazard
Early-successional	With Structural Legacies	Moderate
	Without Structural Legacies	Moderate
Stand Establishment	With Structural Legacies	High
	Without Structural Legacies	High
Young Stands – High Density	With Structural Legacies	High
	Without Structural Legacies	High
Young Stands – Low Density	With Structural Legacies	Moderate
	Without Structural Legacies	Moderate
Mature	Single-Layered Canopy	Low
	Multi-Layered Canopy	Mixed
Structurally-complex	Developed Structurally-complex	Mixed
	Existing Old Forest	Mixed
	Existing Very Old Forest	Mixed

The BLM assumed that broad descriptions of forest vegetation conditions reflect relative stand-level fire hazard, based on general assumptions regarding the fuel profile and the probable fire behavior within that structural stage classification. The primary fuel characteristics associated with potential fire behavior and crown fire potential are canopy base height, canopy bulk density, and surface fuel loading (Scott and Reinhardt 2001, Jain and Graham 2007). Fire behavior has a direct effect on fire severity, mortality, suppression tactics, and the initiation of crown fire, which presents the greatest resistance to control and the greatest potential to threaten wildland urban interfaces (Graham *et al.* 2004). In addition, treatments that reduce surface and ladder fuels may reduce the stand-level fire hazard (Agee and Skinner 2005, Scott and Reinhardt 2001, Jain *et al.* 2012).

Similar to the analytical methods for stand-level fire resistance, this analysis does not account for the complex interaction among fuels (including vertical and horizontal composition and moisture), topography (e.g., slope, topographic position, elevation, and aspect), and weather (e.g., wind, temperature, relative humidity, fuel moisture, and drought) that influence fire behavior, resultant burn severity, and fire effects (Andrews and Rothermel 1982, and Scott and Reindhard 2001).

The BLM quantified the acreage of forested BLM-administered lands in each fire hazard category for each alternative over the course of 50 years within a 1-mile buffer of the Wide Wildfire Risk Assessment Wildland Development Areas data layer (WWRA 2013).

The results of this analysis do not include effects from non-commercial hazardous fuels work, which would contribute toward reducing fire hazard similarly among all alternatives.

Appendix H provides detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales.

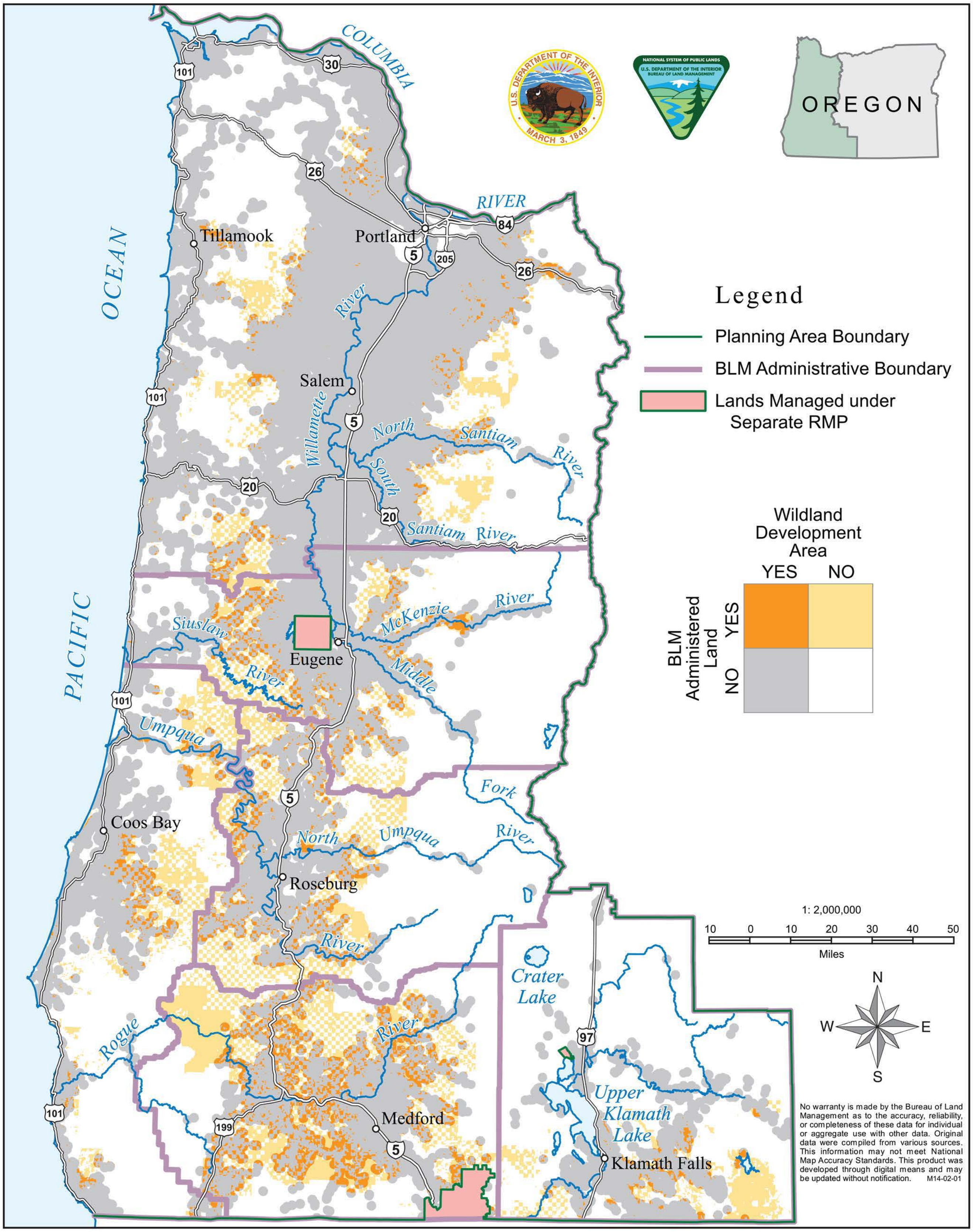
Background

Managing wildfire risk in the western United States is becoming an increasingly complex challenge. Wildland fuels continue to build, drought conditions persist, human development spreads, budgets continue to fluctuate, and wildfire suppression costs increase, particularly given the complex multi-jurisdictional landscape that surround the decision area. New home construction steadily increased within wildland areas in Oregon between 1990 and 2008 (Brown *et al.* 2014, Stein *et al.* 2013), and this trend is likely to continue in the future, given expected increases in Oregon's population (OR OEA 2012).

The Healthy Forest Restoration Act provides the latitude to Community Wildfire Protection Plans (CWPP) to refine their WUI boundary, based on vegetation conditions, topography, and geographic features, including infrastructure, where strategic fuel reduction can reduce risks from large, severe wildfires and promote fire-adapted communities. Additionally, Community Wildfire Protection Plans may incorporate areas near communities that have important economic, social, cultural, visual, and ecological values in the delineation of their WUI boundary (CWPP Handbook 2004). Community Wildfire Protection Plans and collaborating partners use WUI boundaries for local coordination, prioritization, and implementation of landscape-level fuel treatments, the identification of strategically-defensible fuel breaks for wildfire management, and the recognition and protection of local values.

The BLM-administered lands in the planning area are typically located in the foothills and mountains surrounding inhabited valley bottomlands and are closely intermixed with small towns, rural residential areas, and private and industrial forests. Much of the planning area has a checkerboard pattern of ownership, with square mile sections alternating between private land and BLM-administered land. This checkerboard land ownership pattern increases the inherent complexities and difficulties of operational fire management and fuel reduction efforts (OFRI 2014, 2013 fire season observations). The checkerboard ownership pattern also limits the options for managing wildfires for resource benefits because of the risk of affecting neighboring private lands.

Between 21 and 49 percent of BLM-administered lands by office are within 1mile of Wildland Development Areas. The Eugene and Medford Districts have the greatest proportion, 49 and 47 percent, respectively. The Medford District has nearly three times the acreage of any other office within close proximity to developed areas. The Klamath Falls Field Office has the smallest proportion (21 percent) of BLM-administered lands within 1 mile of Wildland Development Areas. Slightly more than 1/3 of BLM-administered lands within Coos Bay (36 percent), Roseburg (38 percent), and Salem (33 percent) are within close proximity to developed areas. For many offices, the footprint of Wildland Development Areas buffered by 1 mile is a considerably smaller extent than the CWPP WUI boundaries (**Map 3-3**).



Map 3-3: Wildland Developed Areas within the Planning Area

The vast majority of BLM-administered lands burned by wildfire are in the interior/south (**Table 3-44**). In the past decade, less than 5 percent of the acres burned in the decision area were in the coastal/north.

Table 3-44. Total acres burned by wildfires within the planning area, 1984-2013.

Region	Acres		
	1984-1993	1994-2003	2004-2013
Coastal/North	23,478	12,938	6,716
Interior/South	138,715	583,749*	163,382

* Includes the 499,945-acre Biscuit wildfire. Source: Oregon Department of Forestry ignition data.

Between 1984 and 2013, human-caused ignitions were the source of most fires for nearly all offices within the planning area (**Figure 3-30**). The vast majority of all human-caused ignitions occurred within close proximity to developed areas (**Figure 3-42**). Increased development of homes in the WUI, trail systems, dispersed campsites, recreation, and major travel corridors all serve to increase the risk of human-caused fires. During this period, the Oregon Department of Forestry has managed fire suppression on BLM-administered lands in the planning area under the Western Oregon Fire Services Protection contract.

Firefighting resources across the planning area have been highly effective at minimizing acres burned for most fires, keeping 96 percent of all ignitions to less than 10 acres in size (**Table 3-39**). However, extreme fire weather conditions still present problems for control. The cost of large wildfires is a growing economic concern, in part prompting The National Cohesive Wildland Fire Management Strategy (Cohesive Fire Strategy or CFS), a comprehensive effort created by the FLAME Act (H.R. 5541). This Act directed the Secretary of Agriculture and the Secretary of the Interior to submit a joint strategy to address major wildland fire issues in the United States through the enhancement and development of fire-adapted communities, effective and efficient wildfire response, and resilient landscapes.

Affected Environment and Environmental Consequences

Currently, almost half of all forested, BLM-administered lands within close proximity to Wildland Developed Areas have High stand-level fire hazard. In the coastal/north, approximately 20 percent of forested, BLM-administered lands within close proximity to Wildland Developed Areas have Low stand-level fire hazard (**Figure 3-43**). In the interior/south, less than 10 percent of forested, BLM-administered lands within close proximity to Wildland Developed Areas have Low stand-level fire hazard (**Figure 3-44**).

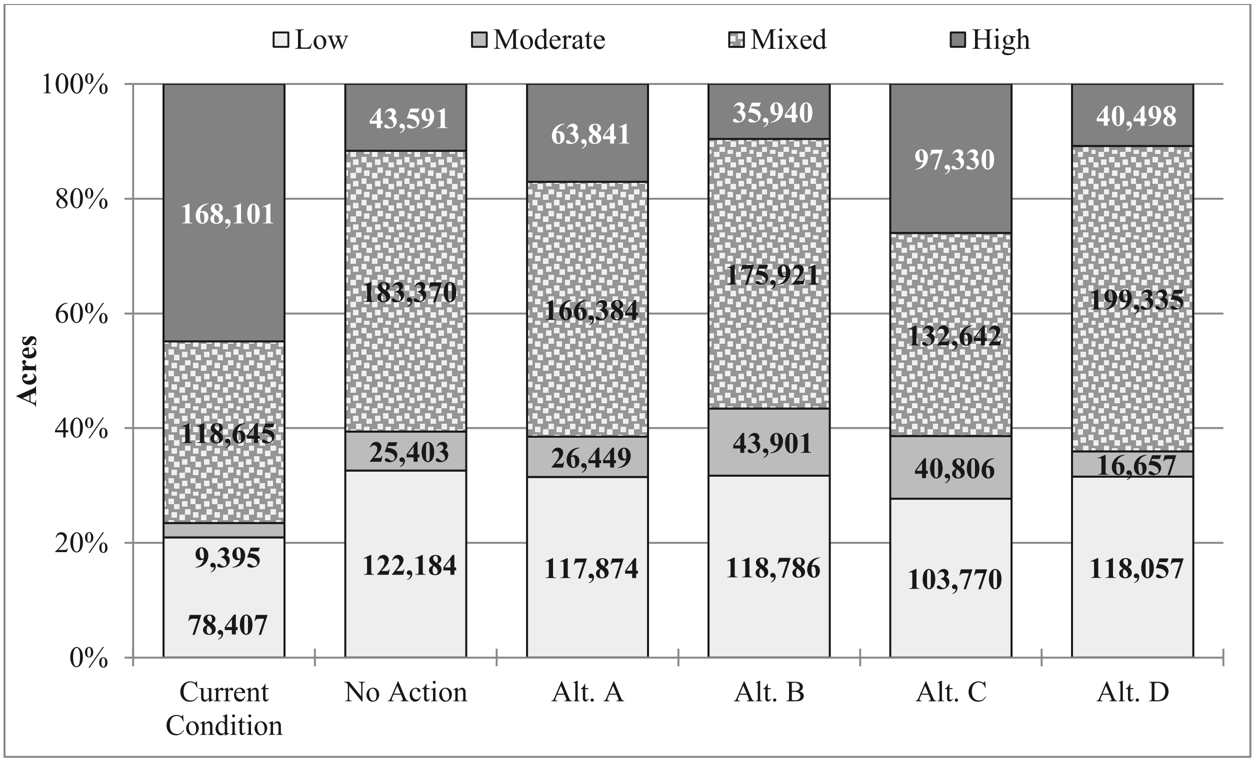


Figure 3-43. Stand-level fire hazard for all BLM-administered lands in the coastal/north within the WUI, current condition, and alternative in 2063.

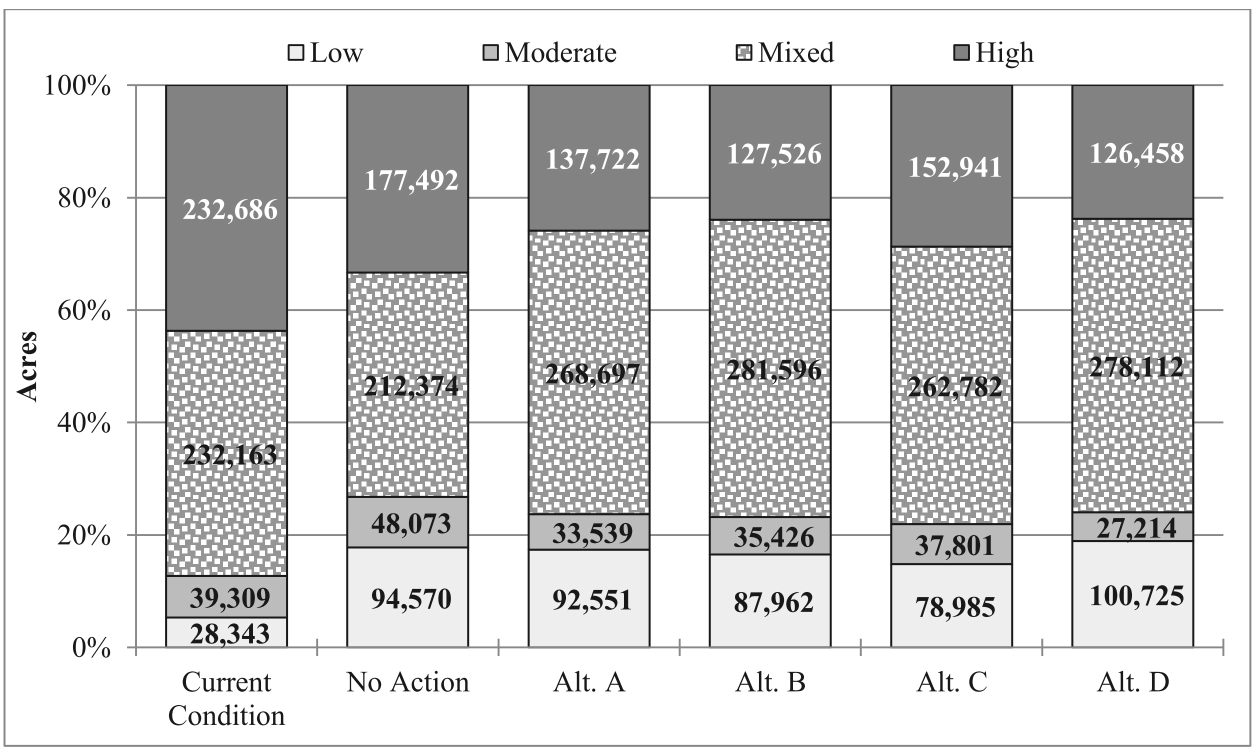


Figure 3-44. Stand-level fire hazard for all BLM-administered lands in the interior/south within the WUI, current condition, and alternative in 2063.

In 50 years, all alternatives would result in a decrease of stand-level fire hazard for the 374,548-forested acres within close proximity to Wildland Developed Areas (WWRA 2013) in the coastal/north (**Figure 3-43**). All alternatives would reduce the acres of Moderate or High fire hazard and increase the acres of Low hazard, relative to current conditions. Alternative C would result in the least reduction of acreage of High or Moderate hazard. The No Action alternative and Alternative D would result in the greatest reduction in the acreage of Moderate or High fire hazard, closely followed by Alternatives A and B. The effects of the alternatives on stand-level fire resistance for individual offices in 50 years would approximate the effects across the entire coastal/north portion of the planning area (**Appendix H**).

In 50 years, all alternatives would result in a decrease in stand-level fire hazard for the 532,500 forested acres within close proximity to developed areas in the interior/south (**Figure 3-44**). All alternatives would reduce the acres of Moderate or High fire hazard and increase the acres of Low hazard, relative to current conditions. The No Action alternative and Alternative C would result in the least reduction of acreage of High or Moderate hazard. Alternatives A, B, and D would result in the greatest reduction in the acreage of Moderate or High fire hazard within close proximity to Wildland Developed Areas (WWRA 2013). The effects of the alternatives on stand-level fire resistance for individual districts in 50 years would approximate the effects across the entire interior/south portion of the planning area (**Appendix H**).

As in Issue 2, the extent of the Harvest Land Base under each alternative and the associated changes in vegetation due to differing management direction would influence the overall patterns in stand-level fire hazard, rather than changes within the reserves. However, the extent of the Harvest Land Base is relatively small, and changes in fire hazard patterns are minimized at the entire Wildland Developed Areas scale.

In addition, as concluded in Issue 2, all alternatives would have similar effects on fire resistance within the Late-Successional Reserve. Similarly, the patterns of change in stand-level fire hazard would not differ within Late-Successional Reserves among alternatives (**Appendix H**).

The alternatives differ in the extent and location of the Harvest Land Base for the coastal/north. However, the current fire hazard conditions are relative similar within close proximity to Wildland Developed Areas among the alternatives (**Figure 3-45**). All alternatives have between 50 and 60 percent of the acreage in High or Moderate fire hazard. Alternative C has the largest acreage of Harvest Land Base within proximity to Wildland Developed Areas (WWRA 2013), closely followed by the No Action alternative. The amount of Harvest Land Base within proximity to Wildland Developed Areas (WWRA 2013) is relatively similar among Alternatives A, B, and D.

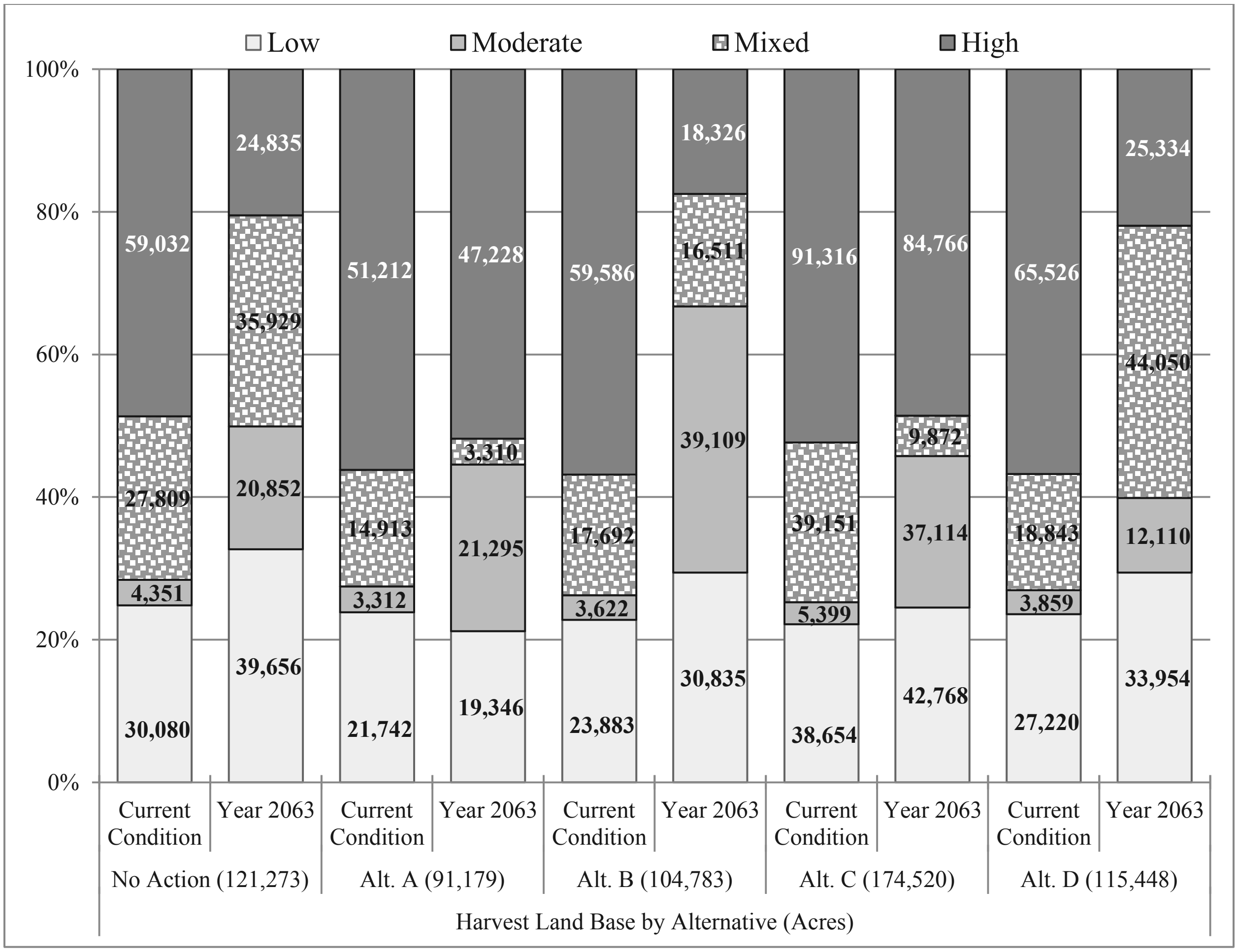


Figure 3-45. Stand-level fire hazard for the Harvest Land Base in the coastal/north within the WUI, current condition, and alternative in 2063.

In 50 years, the No Action alternative and Alternatives B, C and D would slightly increase the proportion of Low hazard acres in the Harvest Land Base, relative to the current condition in the coastal/north (**Figure 3-45).** Alternative D would decrease the proportion of High and Moderate hazard by 28 percent, and the No Action alternative would result in a decrease of 15 percent. Alternative B would decrease the proportion of High hazard by 39 percent, and increase Moderate hazard by 34 percent, resulting in a slight (6 percent) net decrease of acreage in High or Moderate hazard. Alternative A and C would both increase (15 and 14 percent, respectively) the proportion of High or Moderate hazard within close proximity to Wildland Developed Areas.

For the interior/south, the alternatives differ in the extent and location of the Harvest Land Base, and the current conditions of fire hazard differ (**Figure 3-46**). The No Action alternative has the largest Harvest Land Base (i.e., Matrix and Adaptive Management Area; see Chapter 2) and the smallest proportion (53 percent) currently in High or Moderate fire hazard. The size of the Harvest Land Base is relatively similar in Alternatives B, C, and D, and approximately 60 percent of the acreage is in High or Moderate fire hazard. Alternative A has the smallest Harvest Land Base and the largest proportion (75 percent) in High or Moderate fire hazard.

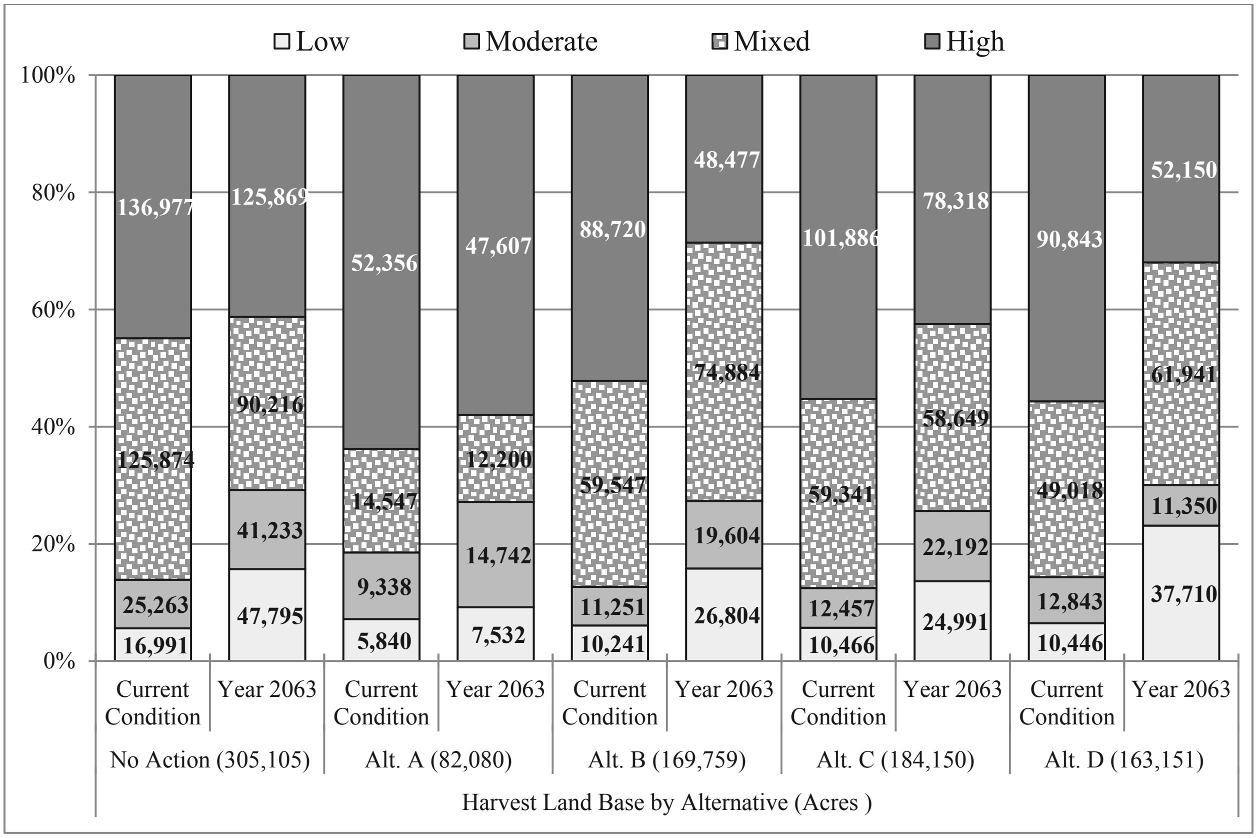


Figure 3-46. Stand-level fire hazard for the Harvest Land Base in the interior/south within the WUI, current condition and by alternative in 2063.

In 50 years, all alternatives would slightly increase the proportion of Low hazard acres, relative to the current condition in the Harvest Land Base in the interior/south (**Figure 3-46**). Alternative D would decrease the proportion of High and Moderate hazard by 35 percent, Alternative B would result in a decrease of 30 percent, and Alternative C would only slightly decrease the proportion of High hazard. The No Action alternative and Alternative A would both result in slight increases of the acreage in High and Moderate hazard within close proximity to Wildland Developed Areas.

In summary, all alternatives would reduce the acres of High or Moderate fire hazard and increase the acres of Low hazard, relative to current conditions, within close proximity to Wildland Developed Areas. The slight differences among the alternatives largely reflect the different extents and varied patterns resulting from management within the Harvest Land Base.

Issue 4

How would the alternatives affect the number of acres at risk from residual activity fuels associated with timber management?

Summary of Analytical Methods

In this analysis, the BLM determined the potential wildfire risk associated with residual activity fuels resulting from timber management activities, treatment locations relative to Wildland Developed Areas (WWRA 2013 explanation in Issue 3), and the Wildland Fire Potential (WFP) (FSIM – USDA 2012) for all BLM-administered lands within the decision area.

Wildfire risk describes the likelihood, susceptibility, and intensity for wildfire and adverse effects to human values. In this analysis, the BLM assumed that Wildland Developed Areas are a highly-valued resource, the Wildland Fire Potential describes the likelihood for fire, and activity fuel loading has the potential to increase fire intensity.

In addition to proximal location of treatments to developed areas, the Wildland Fire Potential (USDA FS FMI 2013) is an important factor in determining the risk from residual fuel loading. The Wildland Fire Potential depicts the relative probability of experiencing extreme fire behavior with torching and crowning, and the potential for wildfire that would be difficult for suppression resources to contain during weather conditions favorable for fire growth. This data is based on past fire occurrence, 2008 fuels data from LANDFIRE, and 2012 estimates of wildfire likelihood and intensity from the large fire simulator (FSim). Within the planning area, the distribution of Wildland Fire Potential closely resembles the proportions of dry and moist forest across the planning area (**Figure 3-47** and **Figure 3-48).** The interior/south has more acreage in the very high and high Wildland Fire Potential categories than the coastal/north.

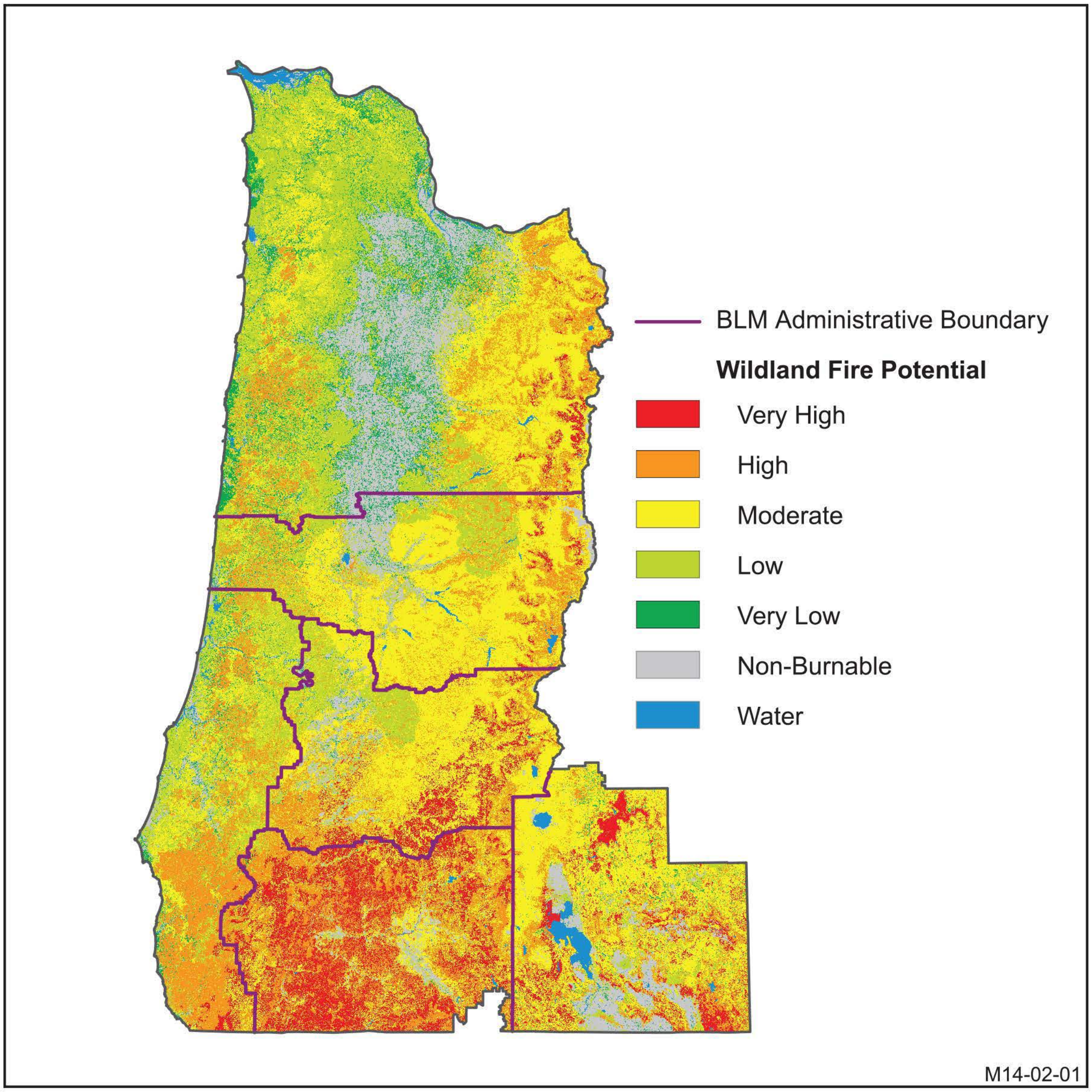


Figure 3-47. Wildland Fire Potential with office boundaries.

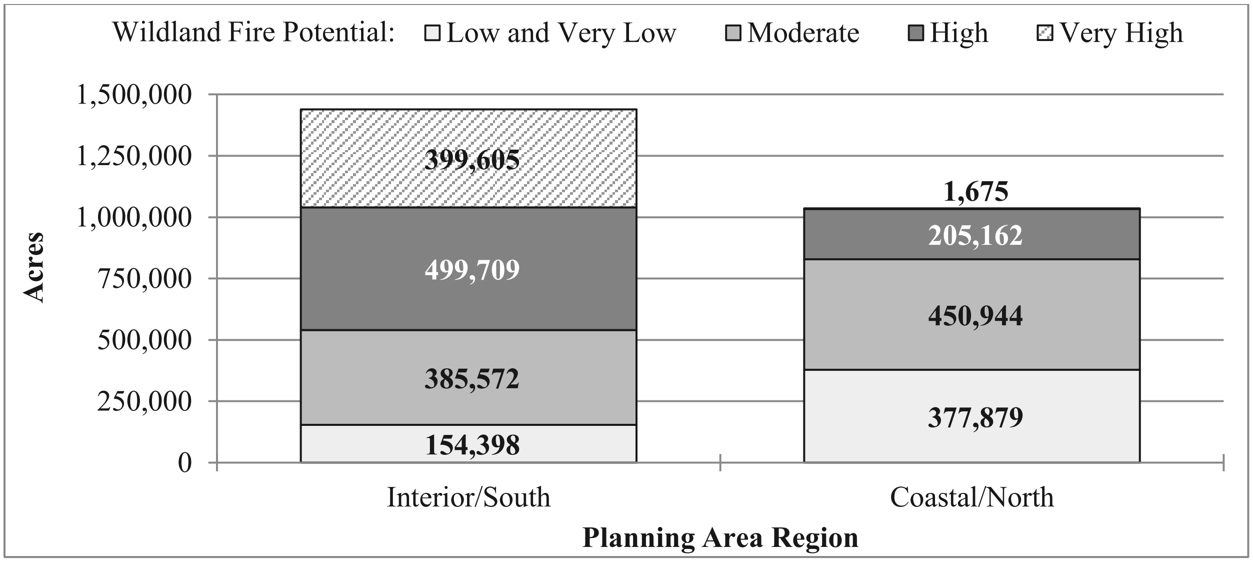


Figure 3-48. Wildland Fire Potential for BLM-administered lands.

In this analysis, the BLM determined a relative weighting of residual activity fuel that would remain following timber management activities (**Table 3-45**), based on the management type and intensity. Timber harvest prescriptions that remove greater basal area from stands leave more surface fuels. This increase in surface fuels has the potential to result in higher rates of spread and greater flame lengths in the event of a wildfire (Weatherspoon and Skinner 1995, North 2012, Raymond and Peterson 2005, Prichard *et al.* 2010), increasing the risk to firefighters and public safety (Graham *et al.* 1999 and 2004). Many different treatments can accomplish surface fuel reduction, including prescribed fire, biomass removal, and mechanical mastication or manipulation.

Table 3-45. Relative weighting of residual surface fuel loading by timber management type and intensity.

Timber Management Type (Intensity)	Residual Fuel Load Weighted Value
Selection (Moderate/Light)	2
Thinning	2
Thinning with No Extraction	3
Selection (Heavy)	3
Pre-Commercial Thinning	3
Two-Age (Light)	3
Clearcut/Two-age (Heavy/Moderate)	4

The weighting represents the probable amount of fuel loading based on the retention associated with the timber management type, where less retention has more residual fuel loading. Clearcut harvest would occur in the HITA in Alternatives A and C. Heavy and moderate two-age regeneration harvest would occur in the Matrix in the No Action alternative and the MITA in Alternatives B and D. Light two-age regeneration harvest would occur in the LITA in Alternative B. Heavy selection harvest would generally occur in the Uneven-Aged Timber Area in all action alternatives. Moderate selection harvest would generally occur in the Owl Habitat Timber Area in Alternative D. Light selection harvest would occur in reserves in all alternatives. Thinning and pre-commercial thinning would occur throughout the Harvest Land Base in all alternatives. These harvest intensities are rough generalizations used as analytical assumptions, but are not intended to replace or supplement management direction in each alternative.

Additional factors influence the need and ability to mitigate residual fuel loading, such as stand structure, yarding method, harvest unit size, biomass utilization, topography, road proximity, soil composition, fuel decomposition rates and compaction, airshed restrictions, and weather conditions. However, the BLM cannot accurately forecast these site-specific and market-driven variables for analysis and modeling at this scale.

The BLM determined the relative risk of residual fuel (**Table 3-46**) based on the weighted combination of Wildland Fire Potential (USDA FS FMI 2013), treatment location relative to the zone within 1 mile of developed areas (WWRA – WDA 2013), and the probable residual activity fuel loading associated with timber management activities. The BLM assigned a weight of 1 to areas beyond 1 mile of developed areas and a weight of 2 to areas within 1 mile of wildland developed areas. Wildland Fire Potential weights followed the classification scheme (e.g., Very Low/Low = 1 and High = 4). The BLM assigned weights to the harvest activities based on probable residual fuel loading relative to proportional basal area removed. The BLM derived a risk matrix by multiplying these weighted variables and grouping them numerically into four categories. The BLM quantified the average decade total acreage within each risk category over 50 years for each of the alternatives. The BLM evaluated the alternative effects on the potential acres in need of treatment to mitigate the hazard and relative risk posed from residual activity fuel loading associated with management activities throughout the decision area.

Table 3-46. Risk category based on predicted residual activity fuel following harvest, proximal location to Wildland Developed Areas, and wildfire potential.

Wildfire Potential	Proximity to Developed Areas (WWRA WDA)	Residual Activity Fuel from Timber Management Activities		
		Low	Moderate	High
Very Low - Low	Outlying	Low	Low	Low
	Within	Low	Low	Low
Moderate	Outlying	Low	Low	Low
	Within	Low	Moderate	Moderate
High	Outlying	Low	Moderate	Moderate
	Within	Moderate	High	High
Very High	Outlying	Low	Moderate	Moderate
	Within	Moderate	High	Very High

*Source: Wildland Developed Areas (WWRA – WDA 2013) and Wildland Fire Potential (USDA FS FMI 2013).

Background

Historically, the BLM has treated a portion of residual activity fuels following timber management activities for both site preparation and hazardous fuels reduction purposes. The BLM incorporated these assumptions into the modeling as a reasonable expectation of future levels of treatments (**Table 3-46**). The treatment of slash from pre-commercial thinning is highly dependent on the residual stand structure, topographic location, and cost/benefit trade-offs of hazard reduction.

Affected Environment and Environmental Consequences

The current wildfire risk, based on Wildfire Potential and proximity to WUI, for BLM-administered lands follows a similar pattern to the moist and dry forest distribution across offices (**Table 3-47**). The coastal/north has over 60 percent of BLM-administered lands in the Low risk category. Most of the remaining acres in the coastal/north are at Moderate risk. In the interior/south, nearly half of all BLM-administered lands are at Moderate risk. Nearly a quarter of this area is in the Very High (10 percent) and High (13 percent) risk categories, while nearly thirty percent is at Low risk.

Table 3-47. Current fire risk for BLM-administered lands.

Planning Area Region	Risk Category (Acres)			
	Low	Moderate	High	Very High
Coastal/North	675,325 (66%)	295,099 (29%)	56,926 (6%)	1,432 (<1%)
Interior/South	407,824 (28%)	684,619 (48%)	192,465 (13%)	147,642 (10%)

Over 50 years, the alternatives would differ substantially in the acreage of timber management activities, and, consequently, the acreage with residual activity fuels. Alternative A would have the fewest average acres of timber management activities per decade in both the coastal/north and interior/south. Alternative C would have the most average acres of timber management activities per decade in the coastal/north, and Alternative B would have the most average acres of timber management activities per decade in the interior/south (**Figures 3-49** and **3-50**).

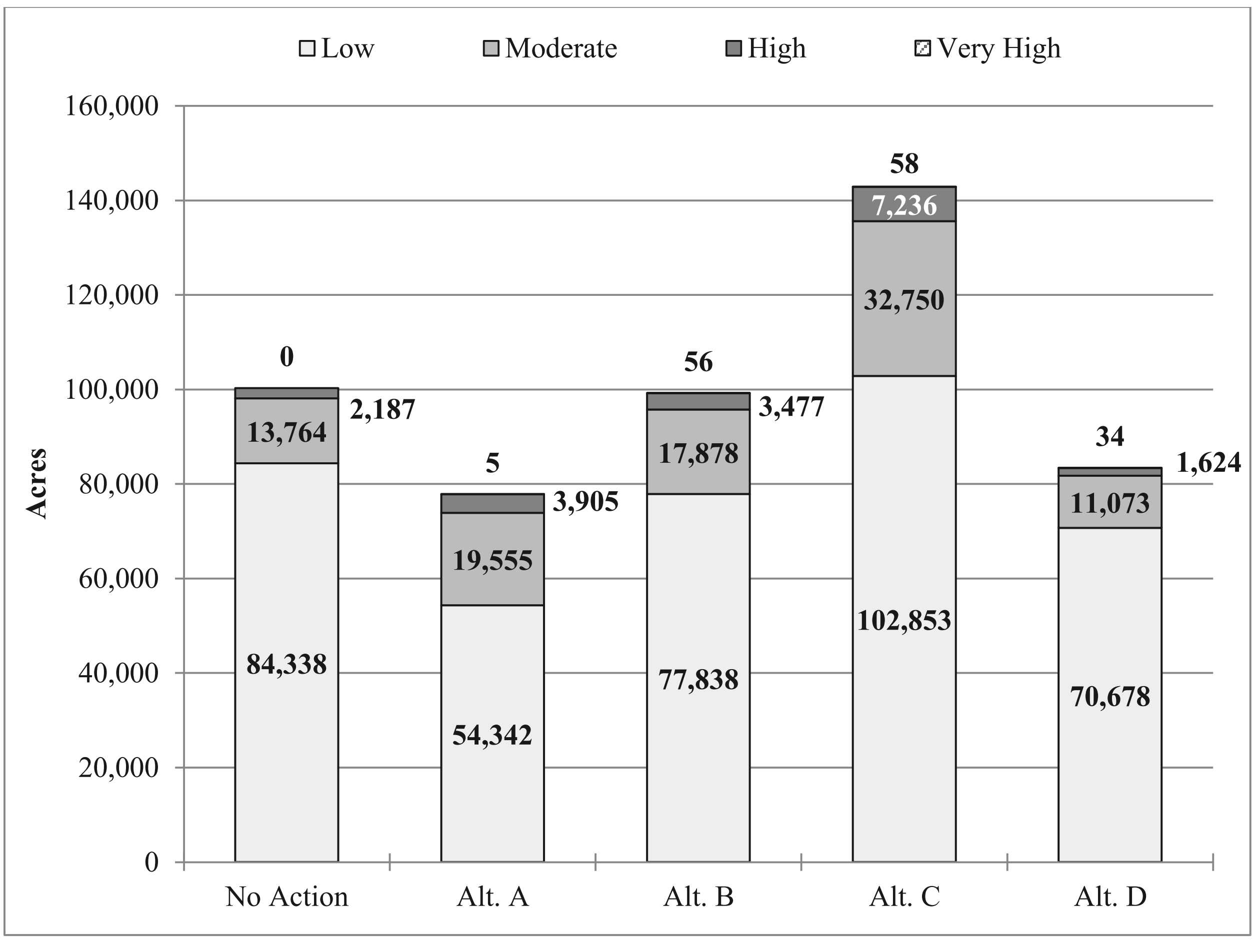


Figure 3-49. Activity fuel risk categories for BLM-administered lands in the coastal/north, decadal average 2013-2063, by alternative.

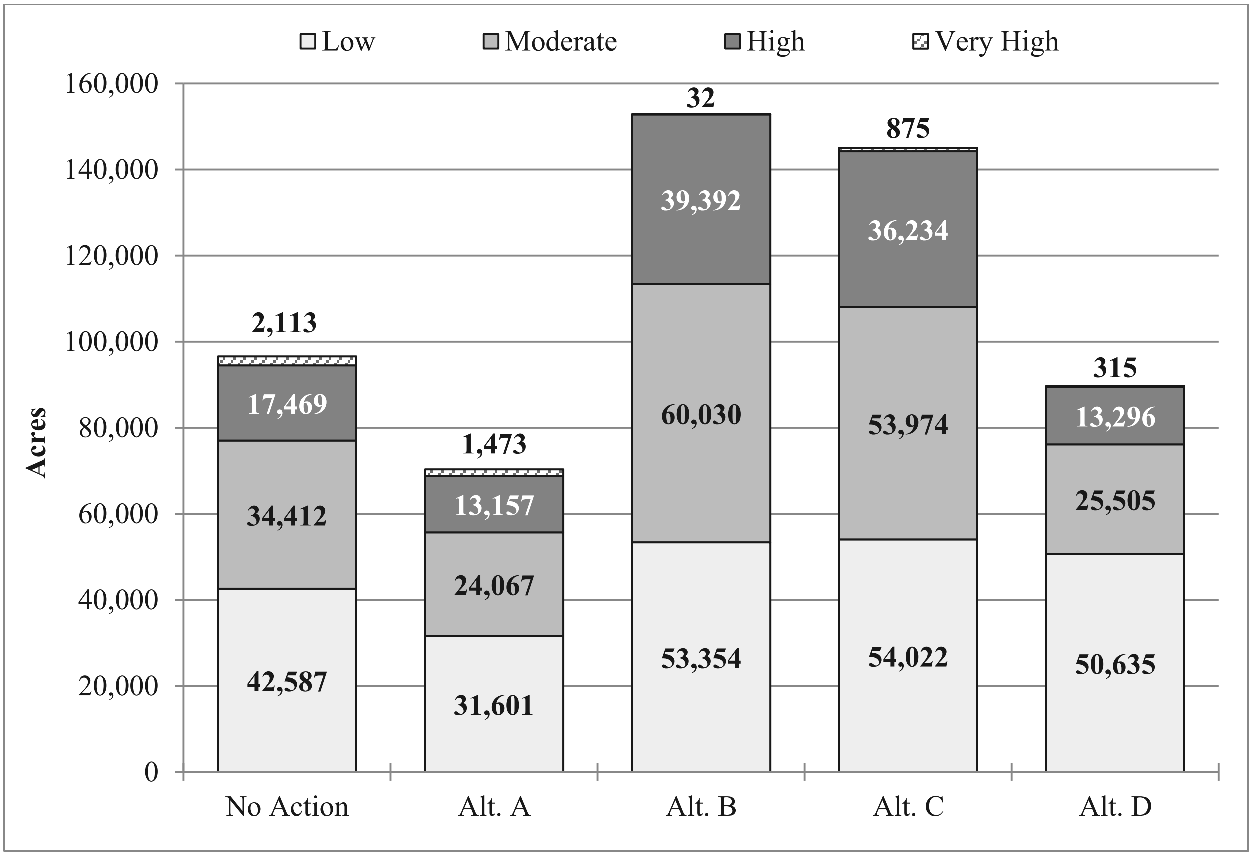


Figure 3-50. Activity fuel risk categories for BLM-administered lands in the interior/south, decadal average 2013-2063, by alternative.

The majority of managed acres in the coastal/north would be at Low risk from residual activity fuel under all alternatives (**Figure 3-49**). Alternative C would result in the most acres of Moderate and High risk for the coastal/north. Alternative D would result in the fewest average acres per decade of Moderate and High residual fuel risk for the coastal/north. Alternative C would result in the greatest amount of Low risk acreage per decade in the coastal/north.

Over the course of 50 years, both Alternatives B and C would result in the most acres of Moderate and High risk for the interior/south. Alternatives A and D would result in the fewest average acres per decade of Moderate and High residual fuel risk (**Figure 3-50**). Alternatives B, C, and D would result in the largest amount of Low risk acreage. The No Action alternative and Alternative A would create a very small acreage of Very High risk.

The size of the Harvest Land Base and the timber management type and intensity are factors influencing the amount of acres in each risk category by alternative. For example, alternatives that would have the greatest amount of timber harvest and pre-commercial thinning per decade would also have the greatest acres in moderate and high risk. This is true of Alternative C in both the coastal/north and interior/south, and Alternative B in the interior/south. Alternative A has the smallest Harvest Land Base, but a larger portion of it is the High Intensity Timber Area. Consequently, Alternative A would have amounts of Moderate and High risk similar to Alternative B in the coastal/north and Alternative D in the interior/south. The Harvest Land Base is larger in both Alternatives B and D, but the harvest intensity would be less.

By generating residual activity fuels, timber management activities would have the potential to add to the current fire risk if not adequately treated (Agee 1993, Weatherspoon and Skinner 1995, Raymond and Peterson 2005). The acres in residual fuel risk categories provide an estimate of potential future work needed to reduce the risk associated with activity fuels. A variety of follow-up treatments could mitigate most residual activity fuel, depending on the risk and amount of remaining fuel. Depending on the residual stand structure, allocating resources to mitigate the activity fuel loading, particularly through prescribed burning, could result in some level of post-treatment mortality to the residual stand. This could have the effects of reducing the risk and developing stand structural diversity. Alternatively, mitigation of activity fuels might not reduce the hazard or could result in unacceptable levels of tree mortality. In some cases, the wildfire potential and wildfire probability would be minor, and treating activity fuels may not be necessary to reduce risk. For example, under Alternative A, trees cut for restoration thinning in the Late-Successional Reserve in the moist forest would remain on-site. This situation would likely result in low risk, as the districts with greater proportions of moist forest tend to have lower Wildfire Potential (**Figures 3-31** and **3-48**).

Coupling the activity fuel risk with stand-level hazard or resistance (Issue 2 and 3) illustrates the costs and benefits of doing the work to mitigate the risk. For example, in the interior/south, Alternatives B and C would result in similar amounts of moderate and high risk residual activity fuel acres. Treatment of activity fuel in Alternative C would clearly reduce a portion of the risk, but the remaining stand structure would be less fire resistant and of higher fire hazard than in Alternative B (see Issues 2 and 3). Treatment of residual activity fuels in Alternative B may provide greater overall benefit at a similar cost. In addition, in the interior/south, Alternative D would have the fewest acres in high/moderate activity fuel risk, as well as improvement in stand-level fire resistance and hazard. This combination might also provide increased stand-level fire resistance and lower risk activity fuel loading. For the coastal/north, Alternative C would also have the greatest residual fuel load risk and the highest relative stand-level hazard. The No Action alternative, and Alternatives B and D would have similar amounts of activity fuel risk and stand-level hazard ratings. Under all alternatives, in the coastal/north, these relationships between stand-level hazard and activity fuel risk are more straightforward.

In summary, the size of the Harvest Land Base and the timber management type and intensity influence the amount of acres in each risk category by alternative. The acreage in activity fuel risk categories provides an estimate of potential future work needed to reduce the risk associated with activity fuels. Coupling the stand-level wildfire hazard and resistance results with the activity fuel risk helps to illustrate the cost/benefit of doing work to mitigate the risk.

Issues Considered but not Analyzed in Detail

How would the alternatives affect the implementation and effectiveness of hazardous fuel treatments?

All of the alternatives have similar management objectives and management direction regarding non-commercial natural hazardous fuel reduction treatments. Therefore, the BLM assumed in this analysis that similar types and amounts of treatments that have occurred over the past decade would continue in the future under any of the alternatives (**Table 3-48**), despite substantial year-to-year variation in acres treated. For example, acres of under-burning may increase and acres of hand pile burning decrease, as programs shift into the maintenance of previously-treated non-commercial hazardous fuel units.

Table 3-48. Non-commercial natural hazardous fuel treatment acres, 2003-2012, by treatment type and BLM district/field office.

District/ Field Office	Biomass Removal (Acres)	Hand Pile and Burn (Acres)	Machine Pile and Burn (Acres)	Mechanical Manual[43] (Acres)	Mechanical Mastication (Acres)	Underburn/ Broadcast Burn (Acres)
Coos Bay	1,161	595	63	122	1,680	1,092
Eugene	-	192	1	10,354	813	15
Klamath Falls	5,443	4,163	17,071	4,592	2,198	9,371
Medford	1,190	62,497	-	15,032	3,161	22,064
Roseburg	-	422	-	2,313	-	3,235
Salem	-	438	-	3,733	280	-

Increasing landscape-level fire resilience and stand-level fire resistance and decreasing stand-level fire hazard would increase the effectiveness of hazardous fuel treatments. To the extent that changes in landscape-level fire resilience, stand-level fire resistance, stand-level fire hazard, and residual activity fuel loading influence the effectiveness of hazardous fuel treatments, the previous issues in this section describe the effects of these factors. However, it is not possible at this scale of analysis with the data available to describe specifically how such changes together would alter the effectiveness of hazardous fuels treatments or to consider how differing combinations of outcomes would alter the effectiveness of hazardous fuels treatments (e.g., increased stand-level fire resistance within a landscape of decreased fire resilience). Therefore, it is not possible to determine any specific change in the effectiveness of hazardous fuel treatments resulting from the alternatives

How would the alternatives affect wildfire response?

There is no accurate way to predict the exact location and timing of wildfires. However, treatments that reduce flame lengths and decrease the probability of crown fire potential would minimize risk to wildland firefighters and the public, and provide more effective fire management opportunities, including safe engagement of suppression resources. These treatments would also increase the potential to utilize all fire management tools, including utilizing wildfires to meet resource objectives. The previous issues in this section describe effects to landscape-level fire resilience, stand-level fire resistance, stand-level fire hazard, and residual activity fuel loading. To the extent that changes in landscape-level fire resilience, stand-level fire resistance, stand-level fire hazard, and residual activity fuel loading potentially influence wildfire response, the previous issues in this section describe the effects ofthese factors. The full range of wildfire response tactics would be available under all alternatives. Maintenance of fire suppression-related infrastructure would not change among alternatives. The ability to conduct salvage harvest for purposes of protecting human health and safety within the dry forest would be available under all alternatives. Because these factors would not differ among the alternatives, there is no reasonable basis on which to identify a difference in the effect of the alternatives on wildfire response at this scale of analysis, beyond the effects to landscape-level fire resilience, stand-level fire resistance, and stand-level fire hazard already described above.

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[43] Mechanical manual includes thinning, mowing, chipping, and lop and scatter, etc. See glossary for additional treatment descriptions.

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Fisheries

Key Points

- All of the alternatives would increase the potential large wood and small functional wood contribution to streams from the current conditions over time.
- Sediment production from road construction and operation would increase by less than 1 percent under all alternatives, and the effects to fish would not differ by alternative. These effects to fish would be short-term and localized and could result from increases in turbidity or deposition of fines in the stream channel substrates affecting habitat in the short term.
- Under the No Action alternative, and Alternatives A and D, less than 0.5 percent of all perennial and fish-bearing stream reaches in the decision area would be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserve based on current conditions. Under Alternative B and C, approximately 5 percent of all perennial and fish-bearing reaches in the decision area would be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserve based on current conditions. Short-term and non-lethal effects from minor increases in stream temperature could include reduced growth rates, a reduction in juvenile survival, or a reduction in reproductive success.

Background

Threatened and endangered anadromous fish species in the planning area include:

- Lower Columbia River Chinook Salmon
- Lower Columbia River Coho Salmon
- Lower Columbia River Steelhead Trout
- Columbia River Chum Salmon
- Upper Willamette River Chinook Salmon
- Upper Willamette River Steelhead Trout
- Southern Oregon/Northern California Coho salmon
- Oregon Coast Coho Salmon
- North American Green Sturgeon
- Pacific Eulachon

The National Marine Fisheries Service designated critical habitat for eight anadromous salmonid species within the planning area (**Table 3-49**). The National Marine Fisheries Service has published recovery plans for Lower Columbia River Chinook, Lower Columbia River Steelhead, Lower Columbia River Coho, Upper Willamette Chinook, Upper Willamette Steelhead, and Southern Oregon Northern California coho salmon (USDC NMFS 2011, 2013, and 2014) and has developed a draft recovery plan for the Oregon Coast coho salmon. The U.S. Fish and Wildlife Service has published recovery plans for bull trout (USDI FWS 2014), Lost River sucker and shortnose sucker (USDI FWS 2012) and Oregon chub (USDI FWS 1998).

Table 3-49. Federal Register notices for listing status, critical habitat designation, and ESA protective regulation for listed anadromous fish in the planning area.

<table>
<tr><th>Species</th><th>Listing Status</th><th>Critical Habitat</th><th>Protective Regulation</th></tr>
<tr><td>Lower Columbia River Chinook Salmon</td><td rowspan="3">06/28/2005;
70 FR 37160</td><td rowspan="5">09/02/2005;
70 FR 52630</td><td rowspan="7">06/28/2005;
70 FR 37160</td></tr>
<tr><td>Upper Willamette River Chinook Salmon</td></tr>
<tr><td>Columbia River Chum Salmon</td></tr>
<tr><td>Lower Columbia River Steelhead Trout</td><td rowspan="2">01/05/2006;
71 FR 834</td></tr>
<tr><td>Upper Willamette River Steelhead Trout</td></tr>
<tr><td>Lower Columbia River Coho Salmon</td><td rowspan="2">06/28/2005;
70 FR 37160</td><td>01/14/2013;
78 FR 2726</td></tr>
<tr><td>Southern Oregon/Northern California Coho Salmon</td><td>05/05/1999;
64 FR 24049</td></tr>
<tr><td>Oregon Coast Coho Salmon</td><td>06/20/2011;
76 FR 35755</td><td colspan="2">02/11/2008; 73 FR 7816</td></tr>
<tr><td>Pacific Eulachon</td><td>03/18/2010;
75 FR 13012</td><td>10/20/2011;
76 FR 65324</td><td>06/28/2005;
70 FR 37160</td></tr>
</table>

Threatened or endangered resident fish species in the planning area include:

- Bull Trout
- Lost River Sucker
- Shortnose Sucker
- Oregon Chub (proposed for delisting)

The amount of critical habitat for non-salmonid fish species or resident salmonid fish species on BLM-administered lands is less than 5 percent of all critical habitat for fish in the decision area (**Table 3-50**). The BLM has very limited ability to affect these non-salmonid and resident salmonid fish species or their critical habitat through forest management, infrastructure maintenance, or habitat manipulations. The analysis contained herein will therefore focus on anadromous salmonids and effects to their habitat.

Table 3-50. Listed fish species with miles and percent of critical habitat on BLM-administered lands.

Species	Miles of Critical Habitat	Miles of Critical Habitat on BLM-administered land in the Planning Area	Percent of all Critical Habitat that is on BLM lands
Bull Trout (*Salvelinus confluentus*)	4,954	3.6	< 0.1
Shortnose sucker (*Chasmistes brevirostris*)	208	9.0	4.3
Lost River sucker (*Deltistes luxatus*)	141	0	0
Pacific eulachon (*Thalyichthys pacificus*)	335	0.1	< 0.1
Green sturgeon (*Acipenser medirostris*)	1,107	0.07	< 0.1

Pacific lamprey (*Entosphenus tridentatus*), though not a Federally-listed species, is an important fish for Tribes within the planning area. The Pacific lamprey was historically an abundant food source and played an important role in the daily lives of Tribal members. Though complete and accurate counts throughout the range do not exist, anecdotal information suggests the population of Pacific lamprey is declining across its range, from Washington to California (Luzier *et al.* 2009). Pacific lamprey life history and habitat usage is sufficiently similar to listed salmonid fish species to allow them to be analyzed together.

Columbia River chum and Oregon chub, although occurring in the planning area, are not present in streams adjacent to BLM-administered lands. The U.S. Fish and Wildlife Service has recently proposed to delist the Oregon chub (79 FR 7136).

Several other non-salmonid species occur in a relatively small percentage of streams on BLM-administered lands (**Table 3-50**). These populations, based on the very low interaction with BLM-administered lands, have very little potential to be affected by BLM management actions.

In 2011, National Marine Fisheries Service conducted a formal status review of Federally-listed anadromous salmon and steelhead. The analysis and summaries of that review are incorporated here by reference (USDC NMFS 2011). Oregon Coast coho salmon and Southern Oregon/Northern California Coho salmon were not included in that analysis. Of the six anadromous salmon and steelhead in the planning area that were analyzed in that review, none warranted a change in the biological risk category from the previous review in 2005. Only the Lower Columbia coho had a biological risk assessment of in danger of extinction with the remaining species likely to become endangered.

Although a wide variety of anadromous and resident salmonid species occur within the planning area, they share similar life histories and habitat requirements. These fish species all spawn in rivers or streams, utilizing clean gravel substrates free of fine sediment, and juveniles spend at least a portion of their lives rearing in pool or off-channel habitat, created primarily by large wood and boulders. For this analysis, the habitat requirements are sufficiently similar to be analyzed together.

Large wood, stream temperature, sediment, and water flow have the greatest influence on aquatic habitat and the ability of aquatic habitat to support fish populations in the planning area. The abundance and survival of salmonids in the planning area is often closely linked to the abundance of large woody debris in stream channels. The Analysis of the Management Situation (USDI BLM 2013, pp. 32-36) and the 2008 RMP/EIS (USDI BLM 2008, pp. 372-390) provide more detailed explanation of the influence of key ecological processes on fish habitat and fish populations, and those discussions are incorporated here by reference.

The BLM has implemented in-stream fish habitat restoration projects on about 230 miles of fish-bearing streams on BLM-administered lands and on adjacent private lands. This accounts for about 7 percent of fish-bearing streams in the decision area and about one percent of all fish-bearing streams in the planning area. The BLM has thinned 17,461 acres forest stands within the Riparian Reserves in the decision area since 1995. This accounts for approximately 2 percent of the 938,467 acres within Riparian Reserves under the 1995 RMPs.

Issue 1

How do the alternatives vary in the contribution of large and small functional wood to fish bearing and non-fish bearing streams?

Summary of Analytical Methods

In this analysis, the BLM evaluated the effects of the alternatives on the potential contribution of large and small functional wood to fish-bearing and non-fish bearing streams at the watershed scale

(Hydrologic Unit Code 10).[44] The BLM conducted this analysis at the watershed scale, because at finer scales (e.g., individual stream reaches), the BLM would not be able to interpret how changes in the amount of wood available for delivery to streams would affect fish habitat or populations. Wood delivery to individual stream reaches is highly variable, episodic, and unpredictable. Additionally, anadromous fish travel through multiple watersheds along their migrations, and the effects on spawning or rearing habitat would only be discernible once fish reach streams suitable in size for spawning or rearing. This generally occurs in streams at the HUC 10 watershed scale.

The BLM analyzed the potential contribution of wood to streams over time, but did not attempt to model actual wood delivery to streams over time under each alternative. Wood delivery to streams is influenced by myriad factors, including riparian stand conditions, individual tree processes, disturbance events, and geomorphic processes. Many of these influential factors are inherently unpredictable, and several would not be affected by the alternatives. Instead, this analysis, like the 2008 RMP/EIS, evaluated the potential contribution of wood to streams by assessing the condition of forest stands that could potentially deliver wood to streams. The alternatives would directly and substantially affect the condition of these forest stands, and the BLM can more accurately forecast changes to forest stand condition than wood delivery to streams under the alternatives.

The BLM analyzed the potential contribution of wood to streams over 100 years to provide a meaningful comparison of the effects of the alternatives on fish habitat. Wood loading in streams is highly variable, and wood delivery is only one component. Breakdown of wood, large floods, and debris flows can alter the amount or effectiveness of large wood in the stream, and these processes can take place over large spatial scales. Therefore, analyzing the potential contribution of wood to streams over a shorter time period would not accurately compare the effects of alternatives in their ability to affect in-stream fish habitat through wood delivery. The effects of land management to the landscape could take up to 100 years to show any discernable change in the amount or quality of fish habitat created by large or small functional wood.

The ability to analyze the effects of the alternatives on potential wood delivery to streams is limited by several factors, including the data available at this scale of analysis on both stream reach and riparian stand conditions, uncertainties about the extent, location, and timing of riparian stand thinning under each alternative, and the indirect connection between riparian stand conditions and wood amounts in streams. For example, data available at this scale of analysis is not sufficiently site-specific and detailed to evaluate whether the trees in a specific riparian stand are of sufficient size to provide stable in-stream habitat structure in the specific adjacent stream reach. Instead, the BLM must make generalizations and assumptions, to describe current riparian stand conditions, future riparian stand conditions, and stream conditions. In addition, riparian stand thinning under each alternative would affect riparian stand conditions and consequently the wood available for delivery to streams. However, forecasting the extent, specific location, and timing of riparian stand thinning required the BLM to make assumptions about a plausible scenario for implementation under each alternative, adding uncertainty to the effects in any specific location. Finally, the analysis addressed the riparian stand conditions, which identified the wood available for delivery to streams, but actual delivery of wood to streams and consequently, the habitat structure in streams, depends on many factors in addition to riparian stand condition, including stochastic processes, which adds an additional layer of uncertainty to the effects in any specific location.

[44] Hydrologic Unit Codes (HUC) are a U.S Geological Survey classification based on a hierarchy of nested watersheds.

In this analysis, the BLM assumed that the analytical results in the 2008 RMP/EIS for potential wood contribution provide an approximation of the effects of the alternatives in this analysis. The 2008 RMP/EIS utilized a spatially explicit GIS model to estimate large and small wood delivery to BLM-administered and non-BLM-administered streams for all HUC-10 watersheds within the planning area. The 2008 RMP/EIS analyzed potential large wood and small functional wood contribution to streams considering the effects of forest management and stand growth over time in portions of the landscape capable of delivering wood to streams. That analysis is incorporated here by reference (USDI BLM 2008, pp. 779-797). The Riparian Reserve land use allocation designs and management direction relevant to potential wood contribution for Alternatives B and C in this analysis are roughly comparable to the Riparian Management Area design and management direction in the 2008 Proposed RMP. The Riparian Reserve land use allocation designs and management direction for Alternatives A and D are intermediate between the No Action alternative and the 2008 Proposed RMP. Thus, the analytical results from the 2008 RMP/EIS for the potential wood contribution of the No Action alternative and the 2008 Proposed RMP bracket the effects that would occur under the alternatives in this analysis.

In this analysis, the BLM evaluated the structural stage condition and several forest stand metrics within one site-potential tree height distance of streams. The BLM used one site-potential tree height distance of streams to approximate the area likely to deliver wood to streams. The BLM evaluated four stand metrics:

- The density of large trees (greater than 20” diameter breast height (DBH))
- The percentage of forest stand canopy cover in hardwoods (e.g., red alder and big leaf maple)
- The quadratic mean diameter (QMD) of trees (a weighted average of the size of trees in the stand)
- The number of trees per acre

These metrics provide broad measures of the potential for forest stands to provide large wood and small functional wood to streams. The BLM used the results of these simpler analyses to validate the assumption that the results from the more complex analysis in the 2008 RMP/EIS for potential wood contribution provides a reasonable approximation of the effects of the alternatives in this analysis.

Background

Woody debris is an important channel-forming component in forested streams in the Pacific Northwest. Wood traps and stores gravel, generates scour that creates pool habitat, provides overhead cover, and protects banks by reducing stream energy. In headwater streams, small wood can retain fine sediment and prevent downstream transport to fish-bearing reaches. Conifer species persist the longest in stream channels. However, hardwood trees, such as red alder and big leaf maple, provide wood as well as leaf litter that serves as a nutrient base for macroinvertebrates, which in turn provide food for anadromous fish.

The size of wood that can provide stable structure and induce habitat change in a stream (i.e., functional wood) varies by channel width. Generally, wider streams require larger pieces of wood (Beechie *et al.* 2000, **Table 3-51**). Smaller pieces of wood can also be functional if the stream channel is narrow or if the smaller wood interacts with larger, stable debris jams. Some small instream wood that is not entrained in a debris jam is flushed from the system during high flows. The remaining large pieces of instream wood are depleted at an average rate of 1.5 percent per year (Murphy and Koski 1989). For most streams in the planning area, a 20” DBH tree can provide functional wood in the stream.

Table 3-51. Diameter of functional wood piece as it relates to width of active stream channel.

Width of Stream Channel (Feet)	Diameter of Functional Wood (Inches)
15	4.5
20	6.0
30	9.0
40	12.0
50	15.0
>50	>20.0

Trees closer to the stream have a higher probability of falling into the stream. Wood is delivered to stream channels generally from distances less than one site-potential tree height[45] in width from edge of the active channel. Beyond a distance of one site-potential tree height from the stream, contribution of wood in the form of whole trees is rare and results from episodic debris flowss and slope failures. These slope failures result from oversaturation of soils or unstable underlying geology, where large wood along with small wood, boulders, and other substrates can be delivered over longer distances. The 2008 RMP/EIS analyzed land management alternatives using a wood model that accounted for the delivery of wood in the form of whole trees from a variety of sources (USDI BLM 2008, pp. 779-799). That analysis identified three primary sources of instream large wood: riparian tree fall, channel migration, and debris flows (USDI BLM 2008, pp. 376-384, 781-797).

In 2013, the interagency Regional Executive Team released a series of technical summaries by a Science Review Team on the issue of the effects of riparian thinning and those analyses and findings are incorporated here by reference (Spies *et al.* 2013). The Science Review Team's findings are a compilation of empirical data, relevant studies, and recently modeled wood input. The Science Review Team found that up to 95 percent of instream wood comes from distances ranging from 48 to 148 feet from the edge of the stream bank (i.e., generally less than one site-potential tree height). The primary near-stream inputs of large wood are from tree mortality and bank erosion, along with landslides and debris flows.

Headwater streams that are prone to debris flow delivery can contribute a large proportion of in-stream wood downstream in fish-bearing stream reaches (Benda *et al.* 2003). In these streams, debris flows will capture wood and sediment from the debris flow area and deliver it to streams. May and Gresswell (2004) estimated debris flow recur at an interval of up to 357 years for headwater basins in the Oregon Coast Range.

Riparian tree mortality and subsequent recruitment to streams can represent the primary contribution of large wood in low-gradient meandering streams, while upslope and debris flow contributions can be greatest in higher gradient streams (Bigelow 2007, Reeves *et al.* 2003).

During the last century, many streams were "cleaned" of large wood to make the downstream transport of harvested logs more efficient. Without large wood to retain gravel and other woody material, many streams were scoured to bedrock and have correspondingly poor habitat for fish. Active restoration to offset the loss of habitat has involved the placement of logs and whole trees in addition to boulders into these bedrock channels. These restorative efforts persist for several decades as riparian stands develop that are capable of supplying long-term sources of wood to streams.

[45] Site-potential tree-heights generally range from 140 feet to 210 feet across the decision area, depending on site productivity.

Past timber harvest of riparian stands has resulted in the replacement of structurally-complex stands (with large diameter trees) to young stands (with small diameter trees). These young riparian stands have a preponderance of smaller diameter trees resulting from high tree densities and competition, limiting the ability of these riparian stands to provide functional wood to streams. These young riparian stands are developing at higher densities than the stand conditions under which the existing structurally-complex stands developed. (Poage and Tappeiner 2002, Tappeiner *et al.* 1997). The 2008 RMP/EIS described the effects of past harvest on forest stands across the landscape and riparian forest stands specifically (USDI BLM 2008, pp. 202-212, 375-376), and those discussions are incorporated here by reference.

Monitoring results conclude that the ecological condition of approximately two-thirds of the watersheds in the Northwest Forest Plan area have improved in condition in the past two decades. One of the primary factors responsible for this improvement has been the increase in the number of large trees (greater than 20” DBH) within the Riparian Reserves (Lanigan *et al.* 2012, Reeves *et al.* 2006).

Affected Environment and Environmental Consequences

Currently, riparian stands that are within one site-potential tree height of streams average about 316 trees per acre, of which 19 trees per acre are greater than 20” DBH (**Figure 3-51**). Conifers in riparian stands have an average diameter of 8” quadratic mean diameter (QMD). Hardwood trees provide approximately 20 percent of riparian canopy cover. In general, current riparian stand conditions are more dense, with smaller diameter trees, than riparian stands historically.

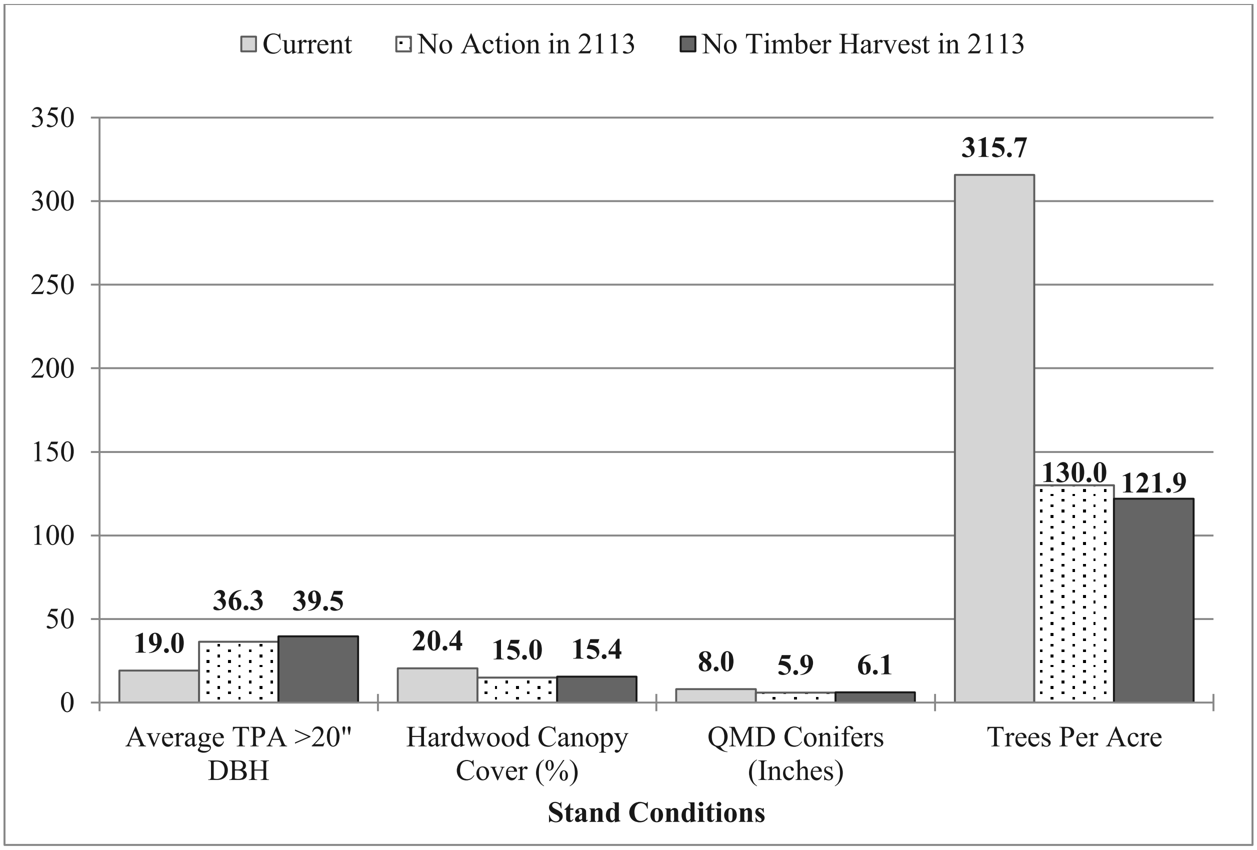

Figure 3-51. Stand conditions within one site-potential tree height; current condition, the No Action in 2013 and 2113, and the No Timber Harvest Reference Analysis in 2113.

Stands within one site-potential tree height currently have a relatively even distribution of structural stages with early-successional having the least (**Table 3-52**, **Figure 3-52**). Over the next 100 years, the No Action alternative and the No Timber Harvest Reference Analysis would have a very similar distribution of young, mature, and structurally-complex stand types.

Table 3-52. Acres in each structural stage for stands within one site-potential tree height from all streams for the current condition and all alternatives in 2113.

Alternative	Early-successional (Acres)	Stand Establishment (Acres)	Young (Acres)	Mature (Acres)	Structurally-complex (Acres)
Current Condition	10,325	140,353	232,064	179,570	210,061
No Action	2	988	39,508	340,841	391,034
Alt. A	-	988	38,807	332,580	399,998
Alt. B	20,800	988	61,785	314,877	373,923
Alt. C	32,570	36,353	74,360	291,095	337,996
Alt. D	-	988	38,420	333,200	399,765
No Timber Harvest	-	-	39,354	332,784	400,620

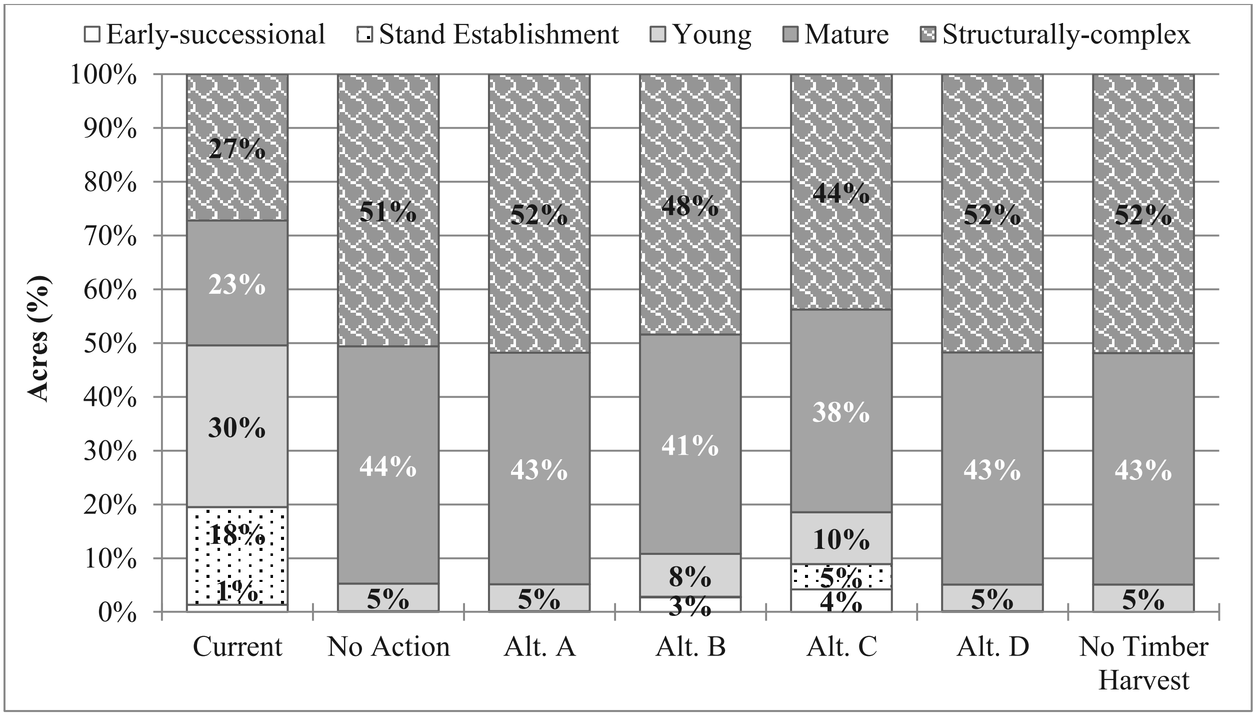

Figure 3-52. Relative proportion of structural stage acres under each alternative for stands within one site-potential tree height from all streams; current condition and all alternatives in 2113.

All of the alternatives would increase the potential large wood and small functional wood contribution to streams from the current conditions. There is no meaningful difference discernible at this scale of analysis among the alternatives in their effect on potential wood contribution. The BLM based this conclusion on the analytical results in the 2008 RMP/EIS for potential wood contribution, which provide an approximation of the effects of the alternatives in this analysis, as discussed above under analytical methods. The 2008 RMP/EIS found that the No Action alternative and 2008 Proposed RMP would have nearly identical effects on potential large wood and small functional wood contribution, and that the potential wood contribution would be only slightly lower than the No Timber Harvest Reference Analysis. Because the analytical results from the 2008 RMP/EIS for the No Action alternative and the 2008 Proposed RMP bracket the effects that would occur under the alternatives in this analysis, and the No Action alternative and 2008 Proposed RMP had indistinguishable effects on potential wood contribution, the alternatives in this analysis would all have the same effects on potential wood contribution as those identified in the 2008 RMP/EIS for the No Action and 2008 Proposed RMP.

The relative proportion of structural stages within one site-potential tree height would be similar over time across alternatives (**Figure 3-52**, **Table 3-52**). The similar proportion of structural stages over time under all alternatives is consistent with the analytical conclusion that the overall potential wood contribution from the alternatives would be similar. Under Alternative B and C a higher proportion of those stands within one site-potential tree height would be early-successional and stand establishment. Alternative C has the least acres in the mature and structurally-complex stand types (i.e., those stands with the most capability to grow and deliver large wood to streams).

All alternatives would increase the number of trees per acre greater than 20” DBH near streams from the current condition (**Figure 3-53**). Alternatives A and D would result in a similar increase in the number of large trees near streams, slightly greater than the other alternatives, and only very slightly less than the No Timber Harvest Reference Analysis. The No Action alternative and Alternative B and C would result in a smaller increase in the number of large trees near streams. In 20 years, the No Action alternative would result in the least increase in the number of large trees near streams, barely above current levels. In 100 years, Alternative C would result in the least increase in the number of large trees near streams (**Figure 3-54**).

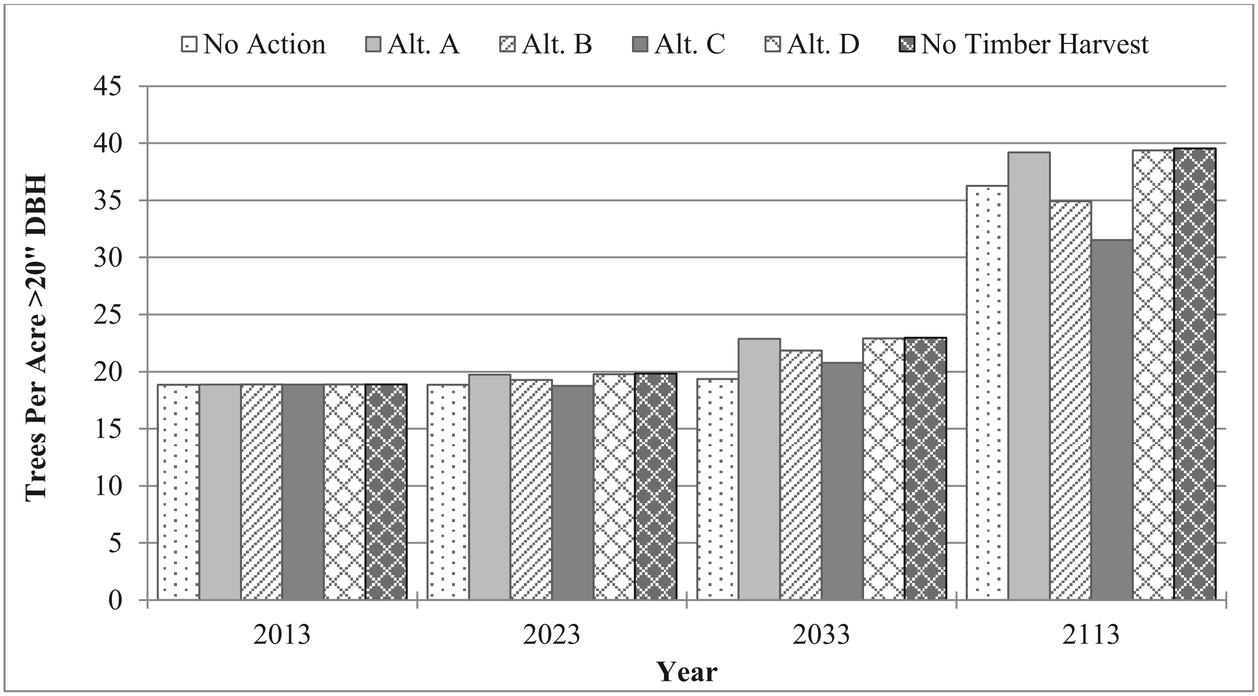

Figure 3-53. Trees per acre greater than 20" DBH within one site-potential tree height over time.

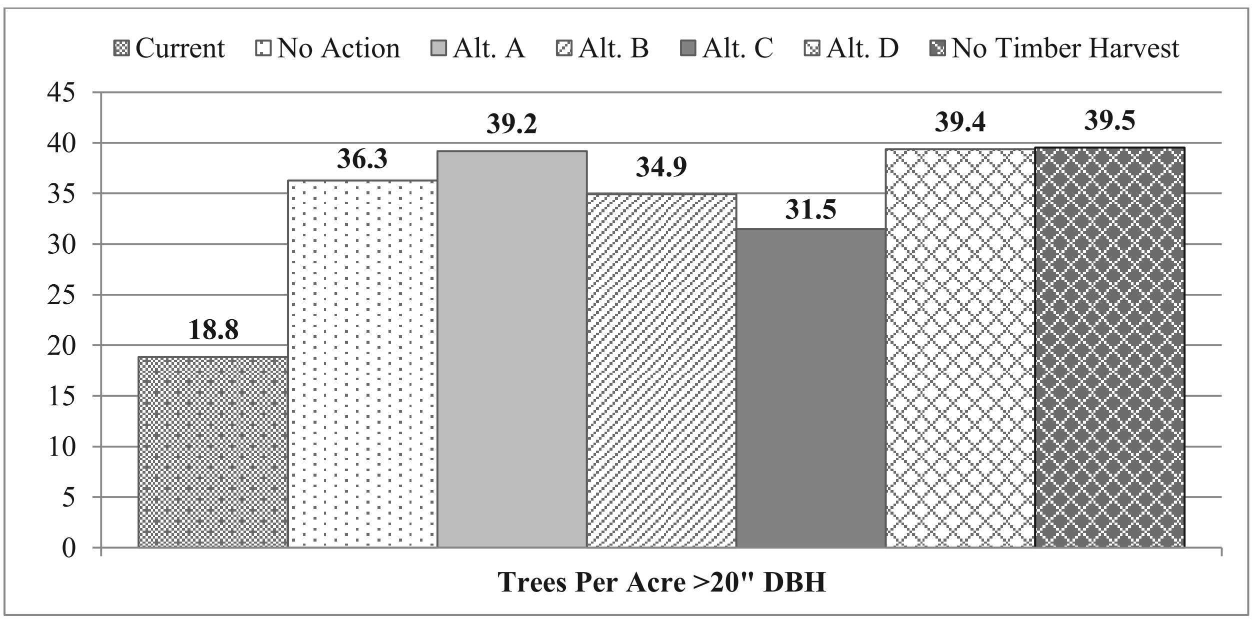

Figure 3-54. Trees per acre greater than 20" DBH for stands within one site-potential tree height of streams; current conditions and all alternatives in 2113.

All alternatives would result in a similar decrease in the percentage of canopy cover in hardwoods (**Figure 3-55**).

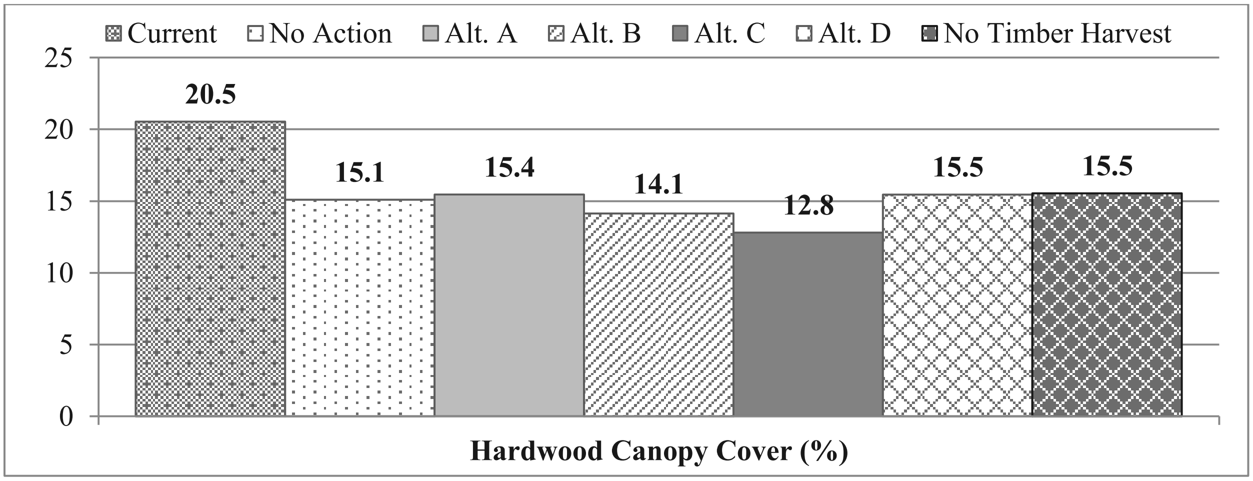

Figure 3-55. Percent hardwood canopy cover for stands within one site-potential tree height of streams; current conditions and all alternatives in 2113.

All alternatives would increase the average diameter of trees in stands within one site-potential tree height of streams (**Figure 3-56**); that increase would be similar under the No Action alternative, and Alternatives A and D, and would be only very slightly less than the increase under the No Timber Harvest reference analysis. Alternative C and Alternative B would result in a smaller increase in the average diameter of trees in stands within one site-potential tree height of streams, reflecting the influence of timber harvest in portions of the Harvest Land Base that are outside of the Riparian Reserve along non-fish-bearing intermittent streams, but within one site-potential tree height of streams.

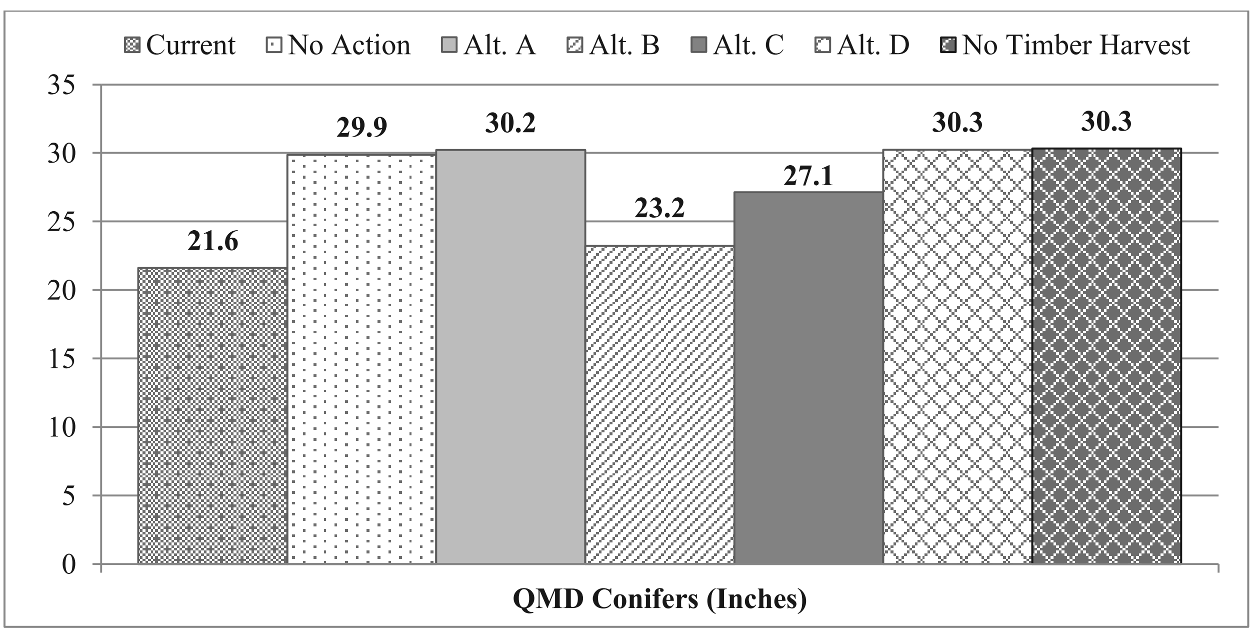

Figure 3-56. Quadratic mean diameter (QMD) of conifers for stands within one site-potential tree height of streams; current conditions and all alternatives in 2113.

The trees per acre within one site-potential tree height of streams would decrease substantially from current conditions under all alternatives (**Figure 3-57**); that decrease would be similar under Alternatives A and D, and would be only very slightly less than the decrease under the No Timber Harvest Reference

Analysis. The No Action alternative and Alternatives B and C would result in slightly less decrease in the density of trees in stands within one site-potential tree height of streams. The similar trends for these stand metrics within one site-potential tree height of streams over time under all alternatives is generally consistent with the analytical conclusion that the overall potential wood contribution from the alternatives would be similar, but reveals some specific differences among the alternatives in the potential to provide wood to streams.

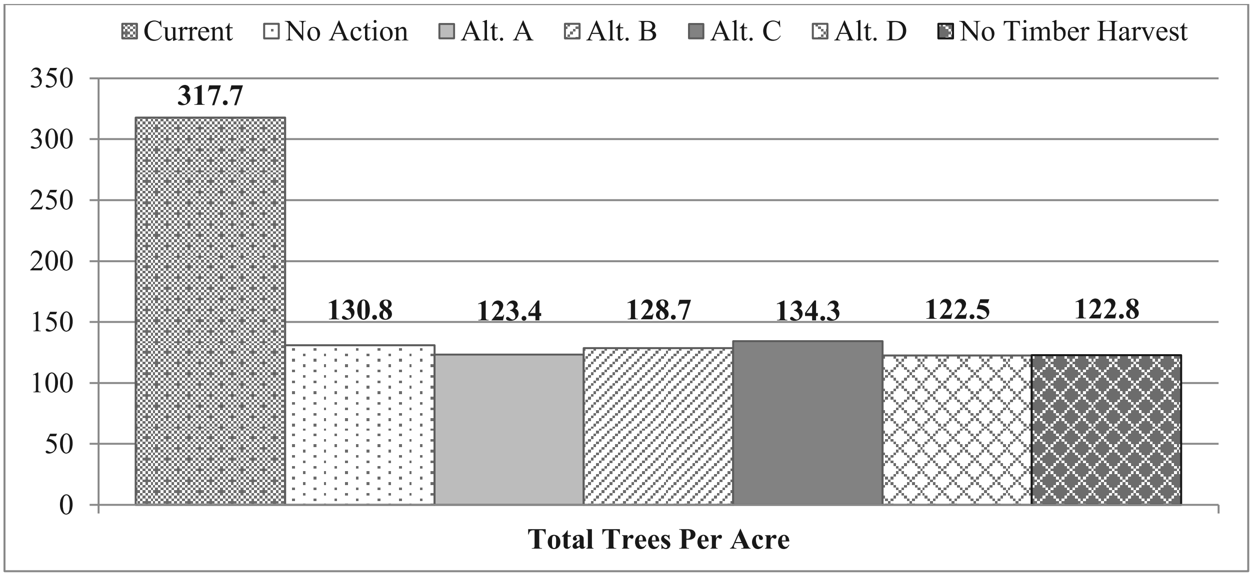

Figure 3-57. Total trees per acre for stands within one site-potential tree height of streams; current conditions and all alternatives in 2113.

There are differences in the design of the alternatives that may have differential effects on potential wood contribution that the BLM cannot quantitatively evaluate at this scale of analysis. Notably, the alternatives differ in Riparian Reserve widths, inner zone widths, and management direction for Riparian Reserve thinning.

Riparian Reserve Width

The No Action alternative has wider Riparian Reserve widths on fish-bearing streams than all action alternatives. The No Action alternative and Alternatives A and D have wider Riparian Reserve widths on non-fish-bearing intermittent streams than Alternatives B and C. As a result, the No Action alternative and Alternatives A and D would include within the Riparian Reserve the largest proportion of the landscape capable of delivering wood to the stream. Alternative B would explicitly provide debris-flow prone non-fish-bearing intermittent streams with a wider Riparian Reserve than other non-fish-bearing intermittent streams. The Riparian Reserve on these debris-flow prone streams under Alternative B would be narrower than the Riparian Reserve under the No Action alternative and Alternatives A and D, but wider than under Alternative C. In the various metrics shown above, these differences among the alternatives in Riparian Reserve width result in only modest differences in potential wood contribution. It is possible that there would be circumstances in which there could be differences in wood delivery to streams not revealed by this analysis. For example:

- Substantial channel migration could move the stream closer to harvested stands outside of the Riparian Reserve. Under the action alternatives, this could reduce the potential wood contribution to the stream.

- Tree fall on extremely steep slopes could result in delivery of wood to non-fish-bearing streams from beyond 50’ from the stream. Under Alternatives B and C, this could result in fewer trees and smaller diameter wood delivered to some streams if the upslope area includes recently harvested stands outside the Riparian Reserve.
- Debris flows could exceed 100’ in width. Under Alternative C, this could result in fewer trees and smaller diameter wood delivered to streams if the debris flow area includes recently harvested stands outside the Riparian Reserve.

These examples represent exceptional or low-probability circumstances. Furthermore, actual wood loading on streams results from multiple factors, and wood delivery from multiple sources, further lowering the probability that any of these exceptional circumstances would result in any discernible difference in actual wood loading in streams at the watershed scale.

Inner Zone Widths

All action alternatives delineate an inner zone near streams in which stand thinning would not occur. Alternatives B and C delineate a smaller inner zone than Alternatives A and D. The No Action alternative does not specific any such inner zone. The vegetation modeling of the No Action alternative in this analysis did make assumptions based on recent projects that Riparian Reserve stand thinning would not occur near streams. However, such assumptions about thinning under the No Action alternative are more uncertain than under the action alternatives, given the absence of specific management direction for an inner zone under the No Action alternative. Over time, the wider inner zone under Alternatives A and D could result in some stands capable of delivering wood to streams developing without thinning and thus providing smaller wood available for delivery to streams. Alternatively, the narrower inner zone under Alternatives B and C could result in some stands capable of delivering wood to streams being thinned and having fewer trees available for delivery to streams. Identifying any such differences in the influence of differing inner zone widths on potential wood contribution would require stand-specific and stream-specific data coupled with modeling of a specific thinning prescription, which is not possible at this scale of analysis. Nevertheless, using the generalized stand and stream data available, and the modeling assumptions about the extent, location, and prescriptions for thinning, this analysis identified only modest differences in the effect of differing inner zone widths on potential wood contribution to streams.

Management Direction for Riparian Reserve Thinning

The No Action alternative would include thinning for a variety of broad-based ecological purposes, including the nine Aquatic Conservation Strategy objectives. Alternatives B and C would direct thinning in the outer zone for a differing set of purposes, including increasing the diversity of riparian species and developing structurally-complex stands. Alternatives B and C would also direct that a portion of the trees in stand thinning in the outer zone be directionally felled to the stream. Alternatives A and D would direct thinning in the outer zone as needed for the purpose of ensuring that stands are able to provide stable wood to the stream. Alternative A would generally limit this thinning to non-commercial treatments (i.e., all cut trees would be left in the stand), except in the dry forest, where thinning would also occur as needed for fuels treatments. As with inner zone widths, the management direction under Alternatives A and D could result in some stands capable of delivering wood to streams developing without thinning and thus providing smaller wood available for delivery to streams. On the other hand, over time, the management direction under the No Action alternative and Alternatives B and C could result in some stands capable of delivering wood to streams being thinned and having fewer trees available for delivery to streams. As with inner zone widths, identifying any such differences in the influence of differing management direction for riparian thinning on potential wood contribution would require stand-specific and stream-specific data coupled with modeling of a specific thinning prescription, which is not possible at this scale of analysis. Nevertheless, using the generalized stand and stream data available, and the modeling assumptions about the extent, location, and prescriptions for thinning, this analysis identified only modest differences in the effect of differing management direction for thinning on potential wood contribution to streams.

In summary, the analysis demonstrates only modest differences among the alternatives in the potential wood delivery to streams over time. To the extent that this analysis is able to predict accurately the potential wood contribution, all alternatives would increase the large wood and small functional wood contribution to streams over time. This analytical conclusion is based on high-quality information using robust analytical methodology and provides an accurate, albeit generalized, description of the effects of the alternatives across the decision area and a sound basis for comparing the alternatives. However, because of the limitations on available data and analytical methodologies and the uncertainties described above, there may be more substantial differences among the alternatives on wood delivery to streams than is apparent in this analysis in some locations and under some circumstances. Such circumstances are exceptional or not conducive to analysis at this scale with the data available. Where such circumstances would be relevant, the BLM would address these site-specific effects on potential wood delivery more fully in the analysis for specific implementation actions.

Issue 2

How would delivery of sediment to fish bearing and non-fish bearing streams affect fish under the alternatives?

Analytical Approach

The delivery of sediment to fish-bearing and non-fish-bearing streams is presented in the Hydrology section. That analysis describes the amount of new road construction and use within a 200-foot delivery distance to streams to estimate the contribution of fine sediment to stream channels.

In this analysis, the BLM assumed that every 1 percent increase in fine sediment from management activities would result in a 3.4 percent decrease in fish survival, and that increases in fine sediment less than 1 percent would not result in measurable or meaningful effects on fish survival. The 2008 RMP/EIS summarized the effects of sediment on fish and aquatic habitat and that summary is incorporated here by reference (USDI BLM 2008, pp. 385-388, 799-800). Thresholds for lethal and sub-lethal effects on fish from increases in sediment delivery have not been well established at the scale of this analysis. Cederholm (1981) concluded that there was a 2 percent decrease of egg to emergence survival of salmonids for each 1 percent increase in fine sediment over natural levels at the watershed scale. Suttle *et al.* (2004) suggest there is no threshold below which fine sediment is harmless to fish, and the deposition of fine sediment in the stream channel (even at low concentrations) can decrease the growth of salmonids. Such sub-lethal effects on individual fish would occur under every alternative from timber harvest activities, broadcast burning, grazing, culvert replacements, and other management activities, but it is not possible to describe quantitative changes in sub-lethal effects under the alternatives over time at this scale of analysis. Therefore, this analysis focuses on the sediment levels that would affect fish survival.

Background

Sediment occurs naturally in stream systems and can affect fish directly by increasing turbidity and inhibiting foraging and breathing functions, or indirectly by embedding in stream substrates thereby reducing macroinvertebrate productivity or smothering eggs and fry. Fine sediment in streams can affect fish habitat by filling interstitial spaces in gravel substrate, reducing oxygen flow to incubating eggs, and by physically preventing newly-hatched fish from emerging. In suspension, fine sediment reduces visibility, reduces foraging ability, and impairs oxygen uptake in gill membranes (Waters 1995).

Affected Environment

In 2009, the Oregon Department of Environmental Quality published an assessment of water quality indicators for forested lands in Western Oregon (ODEQ 2009). The ODEQ modeled sediment using the PREDATOR model, which uses known preferences and tolerances of aquatic macroinvertebrates to predict stream sediment and other water quality indicators. The model showed that over two-thirds of sites on all Federal lands had less than 10 percent fines, which would be considered ideal for salmonids. Federal lands had the highest percentage of sites in excellent water quality condition, higher than either State or private forestlands (ODEQ 2009).

The ODEQ report summarized conditions by ownership and grouped BLM-administered lands and Forest Service lands into a single category of Federal lands; therefore, conditions may not precisely reflect BLM-administered lands independently. The Willamette region has the highest percent of sites in excellent condition (less than 10 percent fines) with 92 percent, followed by the South Coast with 81 percent, and the North Coast with 69 percent. Although the ODEQ report did not break down the Lower Columbia region by ownership, 81 percent of sites in that region are in excellent condition across all ownerships (ODEQ 2009).

In 2012, the Aquatic and Riparian Effectiveness Monitoring Program, a joint monitoring program through the BLM and Forest Service released their 15-year monitoring summary and the analysis and findings contained are incorporated here by reference (Lanigan *et al.* 2012). That monitoring summary evaluated habitat on Federal lands and found that a majority of watersheds showed an increase in Watershed Condition Scores. In-channel substrate showed an overall positive score indicating that conditions are not only improving but also are trending toward more historical conditions. Substrate scores take into account percent fine sediment, median substrate size, and presence of macroinvertebrates.

Environmental Consequences

Under each of the alternatives, the estimated amount of additional sediment delivered to streams channels from roads in the first decade would be less than a 1 percent increase from the current amounts. At this level, there would be no detectable effect to fish or stream channels from additional sediment. At the site scale, small accumulations of fine sediment could begin to fill pool-tails, or these fines become embedded in gravel substrates used for spawning. These sediments would be flushed during subsequent high flows and dispersed downstream where no discernable effect would be detected. Under all alternatives, the increase in fine sediment delivery to streams would not increase more than 1 percent above the current conditions, and would therefore be below the threshold for measurable effects on fish survival at this scale of analysis.

As sediments are flushed from road surfaces, there could be some short-term increases in in-stream turbidity that would be dispersed within about 500 feet downstream from the source. This would result in a short-term and localized effect to fish that would elicit non-lethal stress or physical movement out of the stream reach until turbidity levels return to ambient levels.

Pacific lamprey require sediment accumulations in slow water habitat to complete juvenile rearing. Juvenile lamprey bury themselves in thick sediment deposits where they rear for up to 7 years while filter feeding (Luzier *et al.* 2009). Since none of the alternatives would increase sediment contribution above the site level, there are no anticipated effects from any of the alternatives on Pacific lamprey.

Watershed restoration actions, such as log and boulder placement and fish passage improvements that are beneficial to fish habitat, would also result in short-term increases in sediment delivery to stream channels. Removal of culverts and other in-stream structures like blockages would cause stream channel disturbance during summer in-stream operating periods (ODFW 2008). Juvenile fish rearing in these reaches would be displaced either moving upstream or downstream during the time of elevated turbidity and these juveniles would return shortly after disturbance. This could be up to 8 hours in duration and the elevated turbidity could extend up to 500 feet downstream from the site of the disturbance. Application of BMPs (Best Management Practices, **Appendix I**) would help meet ODEQ water quality standards and further reduce the effects of elevated turbidity on juvenile fish. Additionally, because the BLM does not anticipate any difference among the alternatives in watershed restoration actions, there would be no difference among the alternatives in turbidity because of restoration actions.

Under all of the alternatives, including the No Action alternative, the effect on stream sediment from grazing would remain the same or decrease. As discussed under Livestock Grazing, under all of the action alternatives, livestock grazing (acres for grazing, number of allotments, animal unit months, and permittees/lessees) would remain the same or decrease. Grazing allotments would either be discontinued (Alternative D) or would make progress toward meeting rangeland health standards.

Where grazing decreases or is eliminated, there would be some recovery of stream-side vegetation that would result in a reduction of stream bank erosion and sediment contribution to streams. This would result in improved spawning substrate for fish through a reduction in fine sediment in gravels. However, at the scale of the planning area, there would be no discernable difference among any of the alternatives including the No Action in the effects to fish from grazing.

Issue 3

How would the alternatives vary in maintaining stream temperatures for fish and non-fish bearing streams?

Background

The 2008 RMP/EIS described the effects of temperature to fish and that discussion is incorporated here by reference (USDI BLM 2008, pp. 388-389). Salmon and steelhead require relatively narrow ranges of temperature at multiple life stages for optimal migration, growth, and reproduction. The Oregon Department of Environmental Quality has defined those ranges in their cold-water protection standards (**Table 3-53**).

Table 3-53. State of Oregon cold-water protection criteria for trout, salmon, and steelhead.

Salmonid Beneficial Use	Criteria
Salmon and Steelhead Spawning	55.4 °F
Core Coldwater Habitat	60.8 °F
Salmon and Trout Rearing and Migration	64.4 °F
Salmon and Steelhead Migration Corridor	68.0 °F
Lahontan Cutthroat Trout or Redband Trout	68.0 °F
Bull Trout Spawning and Juvenile Rearing	53.6 °F

Affected Environment and Environmental Consequences

As stated in Hydrology, the riparian management strategies under the No Action and Alternatives A and D would be highly protective of stream shade and would have little risk of increasing stream temperatures. Under these alternatives, less than 0.5 percent of all perennial and fish-bearing reaches in the decision area would be susceptible to shade reductions that could affect stream temperature if the

BLM applies thinning in the outer zone of the Riparian Reserve, based on the current condition. However, this limited stream mileage reflects areas with currently low canopy cover in the inner zone, which are the riparian stands least likely to be thinned under the management direction of the No Action alternative, and Alternatives A and D. As discussed in the Hydrology section, this result does not reflect an actual reduction in stream shading, but a susceptibility to such a reduction in stream shading if the BLM thins the outer zone along these streams. If the BLM does not thin the stand in the outer zone, no reduction in stream shading would occur. This limited stream mileage susceptible to shade reductions would decrease over time as the stands in the inner zone increase in canopy cover. The stream mileage susceptible to shade reductions would decrease to almost zero in 20 years under Alternatives A and D, and in 30 years under the No Action alternative.

Under Alternatives B and C, approximately 5 percent of fish-bearing and perennial streams would be susceptible to shade reductions that could affect stream temperature if the BLM applied thinning in the outer zone of the Riparian Reserve, based on the current condition. This larger stream mileage does not reflect greater effects of thinning under Alternatives B and C, but a greater susceptibility to shade reductions because of the combination of the current condition of low canopy cover in the inner zone along these streams, combined with the narrower inner zone width under Alternatives B and C. As noted above, areas with low canopy cover in the inner zone are the riparian stands least likely to be thinned under the management direction of Alternatives B and C. Even if the outer zone adjacent to inner zone with low canopy cover was thinned, not all of the susceptible reaches would be treated in a given year. In addition, as some stream reaches are treated other stream reaches would recover, reducing the overall effect of canopy removal. The stream mileage susceptible to shade reductions would decline within the first 20 years under Alternatives B and C, and then would remain relatively constant.

At the reach scale, a loss in stream shade that would result in stream heating could induce non-lethal heat stress on juvenile salmonids rearing where stream temperatures already exceede ODEQ standards for fish use. This could include lowered disease resistance and reduced growth rates. Effects from canopy removal would be most noticeable in smaller headwater perennial streams that have a continuous canopy over the channel. Shade reductions on intermittent streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

Larger order channels would have a sufficient buffer to temperature increases from the large volume of water that the overall effect on salmonids would be negligible. Additionally, larger streams have more open canopy over the center of the channel and a small reduction in shade would represent a relatively small change in the overall amount of sunlight reaching the steam.

Issues considered but not analyzed in detail

How would peak streamflows affect fish habitat?

The Hydrology section identifies watersheds that would be susceptible to peak flow increases from rain-on-snow events and evaluated how each of the alternatives would affect the potential for peak flow increases. Atypically high stream flows can modify stream channels by scouring banks and substrate, altering fish habitat. The 2008 RMP/EIS provided a summary of the potential effects of stream flow and peak flows on fish habitat. That discussion is incorporated here by reference (USDI BLM 2008, pp. 390, 800-801). The Hydrology section contains the conclusion that a very small acreage of BLM-administered land in the planning area would be susceptible to peak streamflow increases under any alternative. Consistent with the conclusions in the 2008 RMP/EIS, there would be no identifiable difference among the alternatives in the effects on fish from peak flow increases for the following two reasons: 1) there is no methodology for detecting differences in effects on fish habitat at this scale of analysis, given the small acreage susceptible to peak flow increases and the relatively small difference in peak flow susceptibility among the alternatives; and 2) the causal connection between watershed susceptibility to increases in peak flow and fish habitat is too speculative and tenuous to describe direct or indirect effects that would differ among the alternatives.

How would stream productivity resulting from nutrient and sunlight influences vary between the alternatives?

In addition to primary productivity, there are other sources of nutrient input and food web stimulus into small fish-bearing streams. Opening the riparian overstory and increasing the available light that reaches the stream can increase primary productivity (Hill *et al.* 1995), hasten breakdown of litter and leaf material (Lagrue *et al.* 2011) and translate to increases in macroinvertebrate and fish biomass (Kiffney *et al.* 2014, Wootton 2012). Fish-bearing stream reaches can receive nutrient influxes from headwater reaches. Both invertebrates and detritus can be exported downstream from non-fish-bearing, headwater reaches year-round and, in turn, support large numbers of juvenile fish (Wifpli and Gregovich 2002). Thinning riparian stands, especially near streams, could potentially increase the primary productivity in streams by increasing sunlight to streams and altering the litter fall composition. All action alternatives would limit near-stream thinning to maintain stream shading; however, Alternatives B and C, which could partially reduce stream-side shade, could result in increased primary productivity and growth rates of juvenile salmonids. However, as described above under stream shading, such effects under Alternative B and C are uncertain, and it is not possible to identify any specific change in stream productivity under any of the alternatives.

Historic salmon runs would have also added a large nutrient component to headwater streams that could be utilized by macroinvertebrates and juvenile fish. The ODFW has added spent hatchery carcasses to streams since salmon carcasses could potentially increase growth and abundance of macroinvertebrates that provide forage for juvenile salmonids (Chaloner and Wifpli 2002, Kiffney *et al.* 2014). The addition of salmon carcasses by ODFW could happen under all of the alternatives, and there is no basis for identifying any difference among the alternatives in nutrient inputs to streams.

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Forest Management

Key Points

- Even-aged systems with clear-cutting would produce more uniform stands in a mix of age classes without structural legacies. Two-aged systems with variable-retention regeneration harvesting would produce stands in a mix of age classes with legacy structures and multiple canopy layers. Uneven-aged management systems with selection harvesting regimes would produce mostly older, structurally-complex stand,s and mature forests with multiple canopy layers.
- The allowable sale quantity (ASQ) under the alternatives would range from 120 million board feet per years under Sub-alternative B to 486 million board feet per year under Alternative C. The ASQ is primarily determined by the size of the Harvest Land Base, the intensity of forest management practices, and restrictions on timber harvest.
- Non-ASQ timber harvest volumes in the first decade would range from 4 million board feet per year under Alternative D to 122 million board feet per year under the No Action alternative.
- The proportion of harvest volume coming from large logs would be lowest under Sub-alternative C, at 5 percent of total harvest volume, and highest under the No Action alternative and Alternative C, at 14 percent of total harvest volume.

Issue 1

How would the age classes, structural stages, and inventory of merchantable timber volumes in forest stands change among alternatives in the Harvest Land Base and reserve land use allocations?

Summary of Analytical Methods

The BLM used Current Vegetation Survey plots and the Forest Operations Inventory to create a data set representing the current condition of the forest. The BLM then modeled a variety of silvicultural treatments, stand growth, and forest development through time using Organon growth and yield model in conjunction with the Yield Table Generator (YTG Tools) and the Woodstock model. The BLM modeled silvicultural treatments to simulate the management that would occur under the various alternatives, based on the management direction found in Appendix B.

In this analysis, the BLM evaluated the development of the forest categorized by structural stages (**Table 3-54**). The Vegetation Modeling section has a more thorough discussion of the structural stage classification system.

Table 3-54. Structural stage classification generalized definitions.

Code	Structural Stage Classification Label
ES-WSL	Early-successional; with structural legacies
ES-WOSL	Early-successional; without structural legacies
SE-WSL	Stand establishment; with structural legacies
SE-WOSL	Stand establishment; without structural legacies
YHD-WSL	Young high density; with structural legacies
YHD-WOSL	Young high density; without structural legacies
YLD-WSL	Young low density; with structural legacies
YLD-WOSL	Young low density; without structural legacies
M-SINGLE	Mature; single-layered canopy
M-MULTI	Mature; multi-layered canopy
SC-OF	Structurally-complex; existing old forest
SC-VOF	Structurally-complex; existing very old forest
SC-DEV	Structurally-complex, developed structurally-complex

For several aspects of this analysis, the BLM categorized the decision area into the "coastal/north" areas (the Salem, Coos Bay, and Eugene Districts) and the "interior/south" areas (the Medford and Roseburg Districts, and the Klamath Falls Field Office). This division represents a general divide in forest productivity and the current stand conditions within the decision area. The interior/south currently contains a higher proportion of lower productivity/fire-prone dry forests than the coastal/north areas.

For other aspects of this analysis, the BLM categorized the decision area into moist and dry forest areas. This division of the decision area is consistent with the discussion of moist and dry forest in the Fire and Fuels section in this chapter.

The BLM analyzed changes in age classes, structural stages, and standing inventory over 200 years to provide a meaningful comparison of the effects of the alternatives. This long period of analysis is necessary given the varying and sometimes long periods between forest management treatments and long periods of forest structural development. The combined effects of forest management and forest growth across the landscape would take long periods to show meaningful changes in forest condition.

Acreage summaries in this section do not include Eastside Management Lands, non-forest areas, or other areas not given an age or structural stage classification in the Forest Operations Inventory.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which are incorporated here by reference (USDI BLM 2014, pp. 56-61).

Background

A wide variety of forest conditions exist within the decision area, which includes a variety of forest types, ages, structural stages, and productive capacity for timber production. While the forest conditions in many areas are the result of past fires and other natural disturbances, the BLM has altered much of the landscape through a variety of management activities and harvest. Timber harvest levels in the decision area have fluctuated substantially over the past 80 years, with a generally flat trend over the past two decades (**Figure 3-58**).

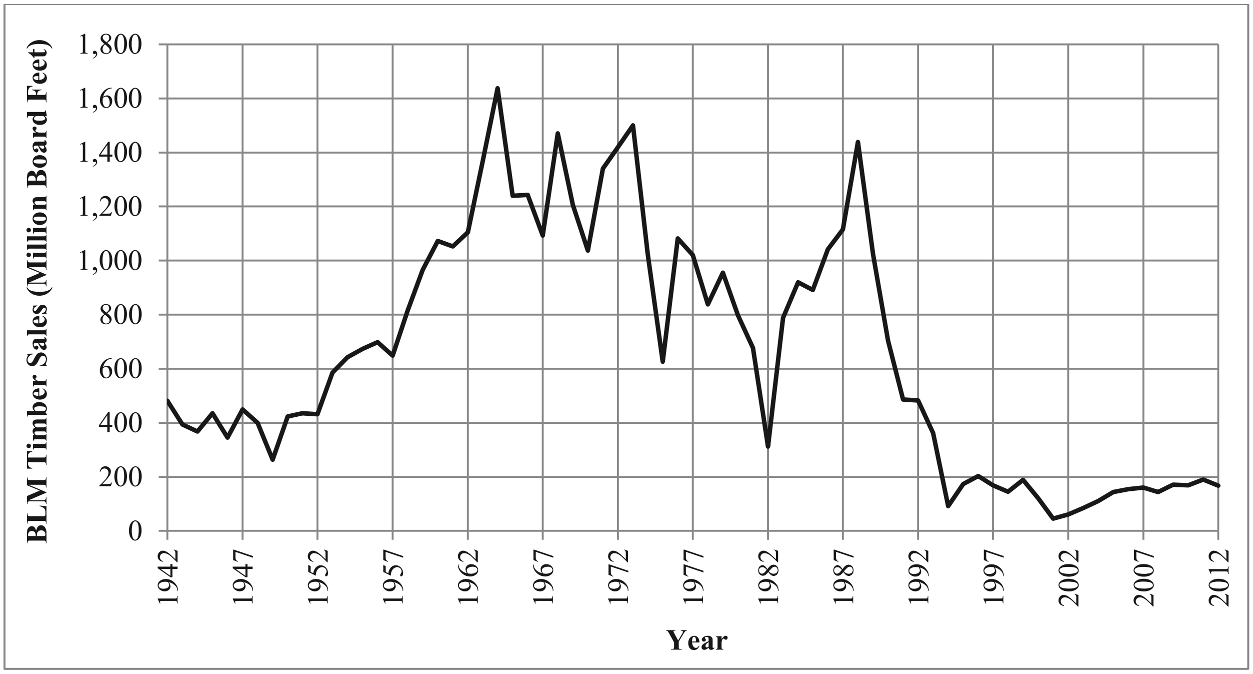


Figure 3-58. BLM historical timber sales; 1942-1961 data represents volume sold while 1962-2012 data represents volume harvested.

Between 1962 and 1994, the BLM timber harvest from the planning area was 16 percent of western Oregon totals and averaged 980 million board feet per year. Since adoption of the 1995 RMPs, the BLM contribution has been less than 5 percent of western Oregon totals and has averaged 144 million board feet per year (**Figure 3-59**).

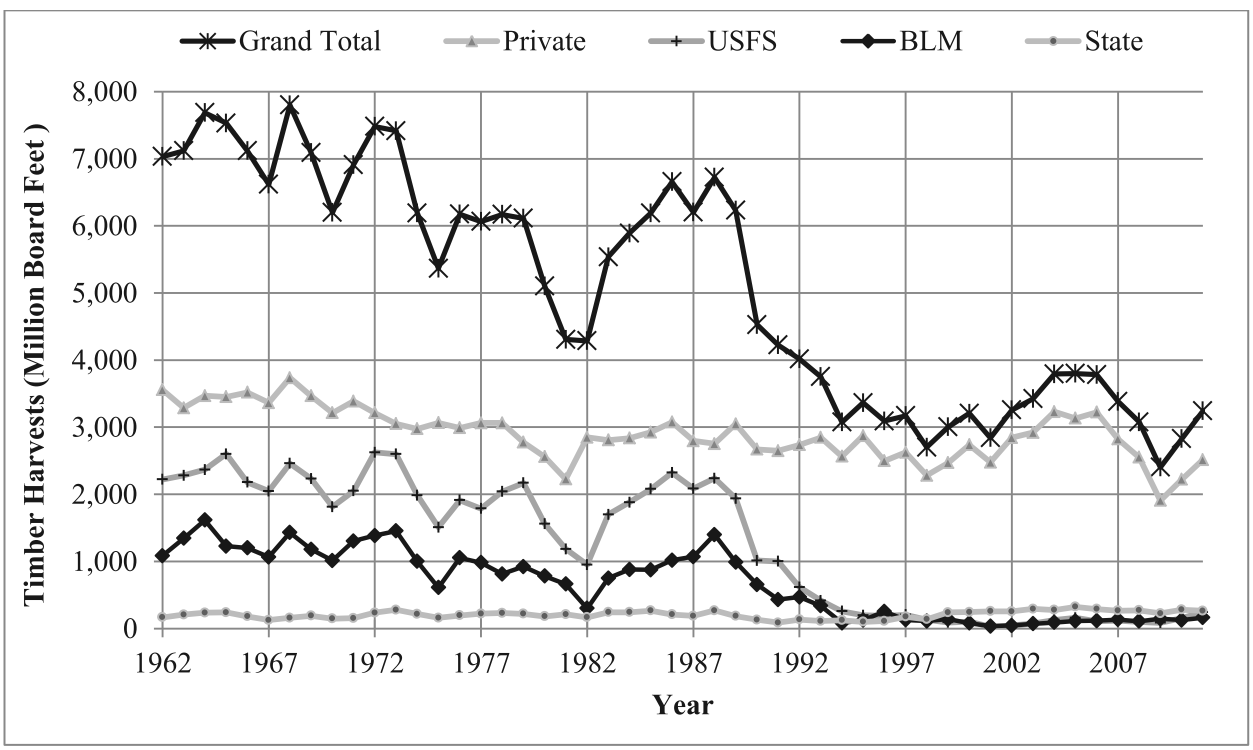


Figure 3-59. Western Oregon timber harvests by landowner, 1962-2011 (Tuchman and Davis 2013).

Affected Environment and Environmental Consequences

Age Classes

The natural disturbance and management history of the decision area has resulted in a mix of stand ages. The current age class distribution of forested lands in the decision areas is shown in **Figure 3-60**.

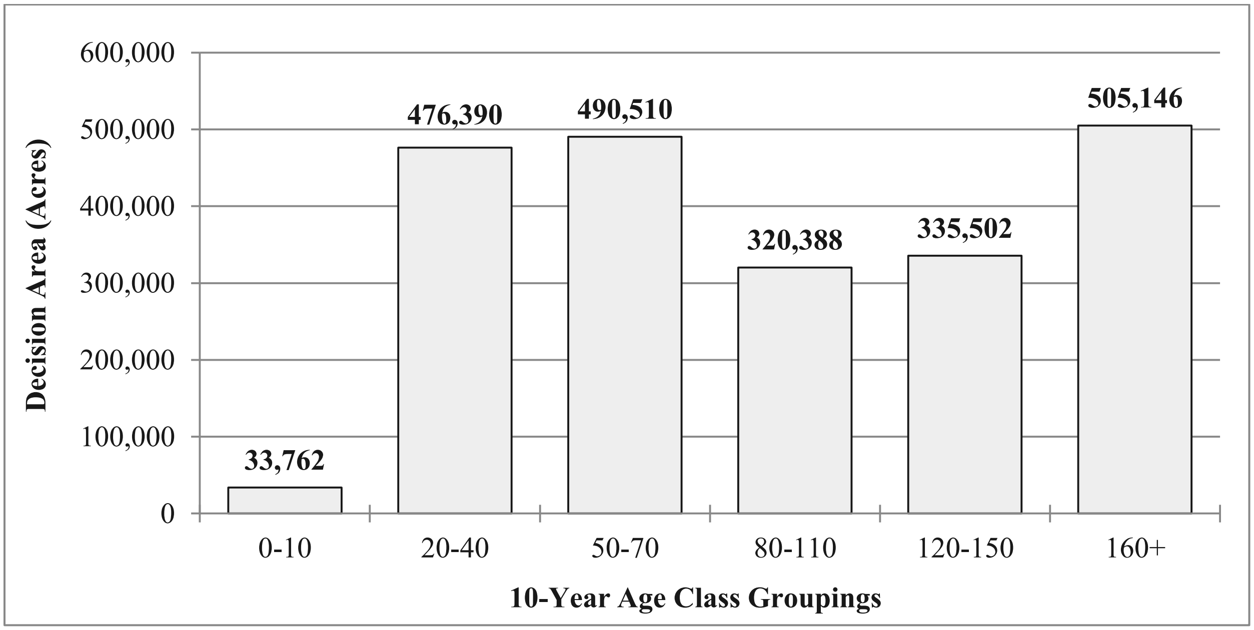


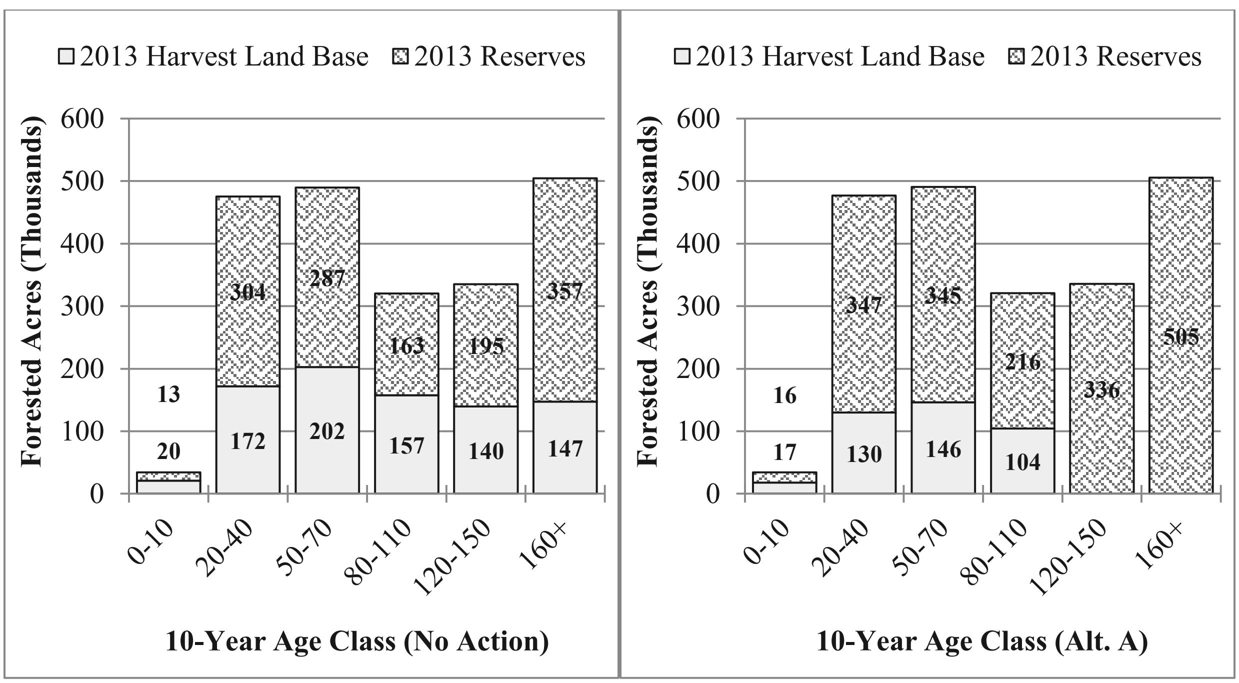
Figure 3-60. 2013 age class distribution for forested acres within the decision area.

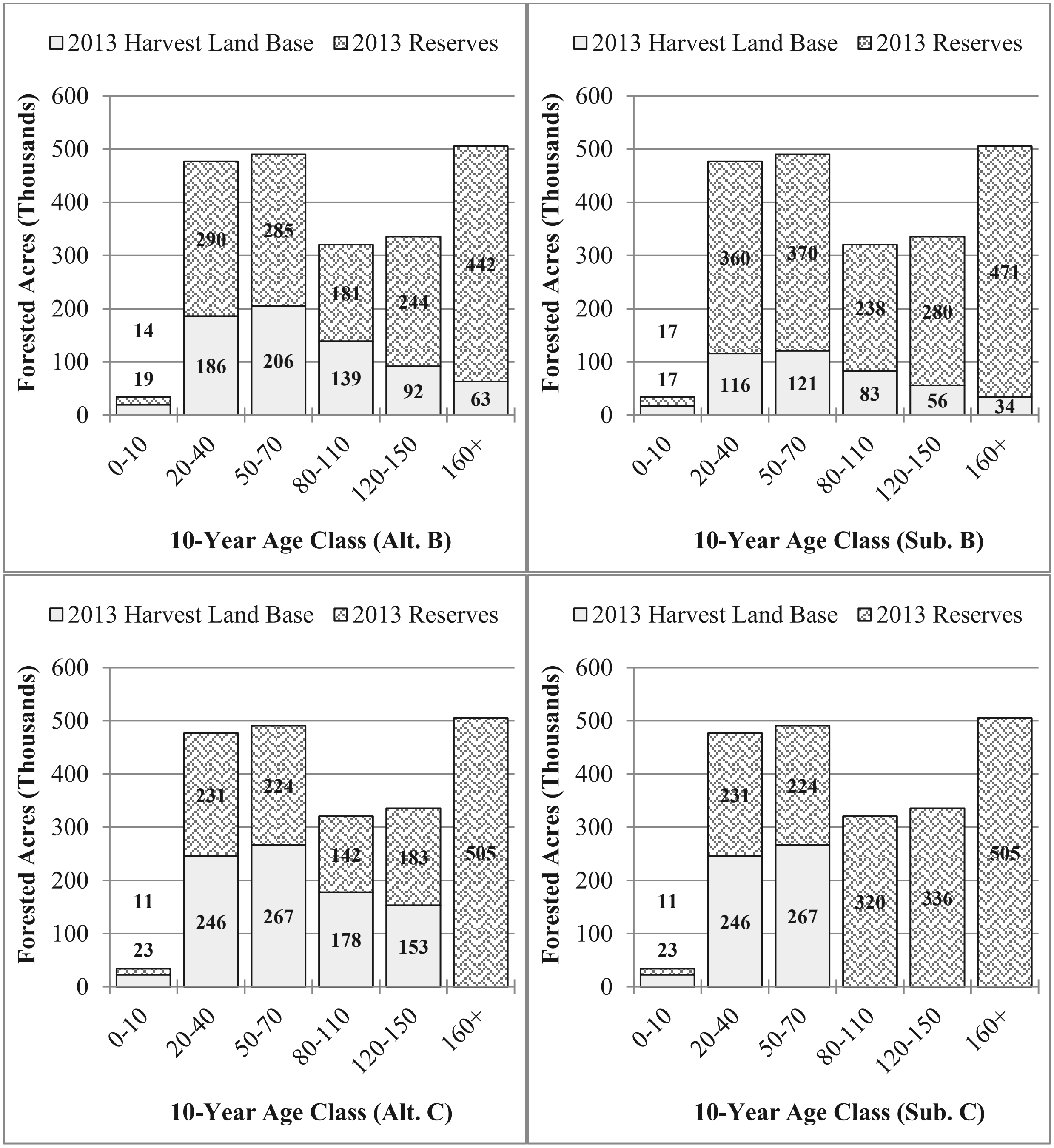
The Coos Bay, Medford, and Roseburg Districts currently have the highest proportion of stands 160-years-old and older with 24 percent, 29 percent, and 34 percent respectively. The Salem District has the lowest proportion of stands 160-years-old and older with 9 percent. With the exception of the Klamath Falls Field Office, the districts only have 1-2 percent of their forested lands in the 10-year age class (**Table 3-55**). This is mostly due to the low levels of regeneration harvesting that the BLM has implemented since 1994 (**Figure 3-71**).

Table 3-55. 2013 age class distribution; forested acres and percent by district/field office.

District/Field Office		10	20-40	50-70	80-110	120-150	≥ 160	Grand Total
Coos Bay	Acres	3,288	91,747	79,527	21,370	34,978	73,119	**304,137**
	%	1%	30%	26%	7%	12%	24%	
Eugene	Acres	2,669	78,887	112,471	41,556	17,022	44,617	**297,222**
	%	1%	27%	38%	14%	6%	15%	
Klamath Falls	Acres	4,656	3,636	8,321	18,105	6,965	5,090	**48,011**
	%	10%	8%	17%	38%	15%	11%	
Medford	Acres	17,555	106,119	92,706	139,498	166,057	218,184	**740,119**
	%	2%	14%	13%	19%	22%	29%	
Roseburg	Acres	3,187	106,920	74,160	35,108	50,838	128,950	**399,163**
	%	1%	27%	19%	9%	13%	32%	
Salem	Acres	2,406	89,082	123,325	64,751	59,641	35,186	**374,541**
	%	1%	24%	33%	17%	16%	9%	
Totals	**Acres**	**33,762**	**476,390**	**490,510**	**320,388**	**335,502**	**505,146**	**2,163,193**
	%	**2%**	**22%**	**23%**	**15%**	**16%**	**23%**	

The alternatives vary in their approach to protection of older, more structurally-complex forest, affecting the distribution of older forests among the reserves and the Harvest Land Base. The No Action alternative allocates the largest acreage of forests older than 80 years to the Harvest Land Base, while Sub-alternative C allocates the least (**Figure 3-61**). Of the forests older than 80 years in the Harvest Land Base in Alternative B, 73 percent of the acreage is in the dry forest portion of the decision area.




2013 Harvest Land Base
2013 Reserves
Forested Acres (Thousands)
600
500
400
300
200
100
0
0-10
20-40
50-70
80-110
120-150
160+
10-Year Age Class (Alt. B)
14
19
290
186
285
206
181
139
244
92
442
63
10-Year Age Class (Sub. B)
17
17
360
116
370
121
238
83
280
56
471
34
10-Year Age Class (Alt. C)
11
23
231
246
224
267
142
178
183
153
505
10-Year Age Class (Sub. C)
11
23
231
246
224
267
320
336
505

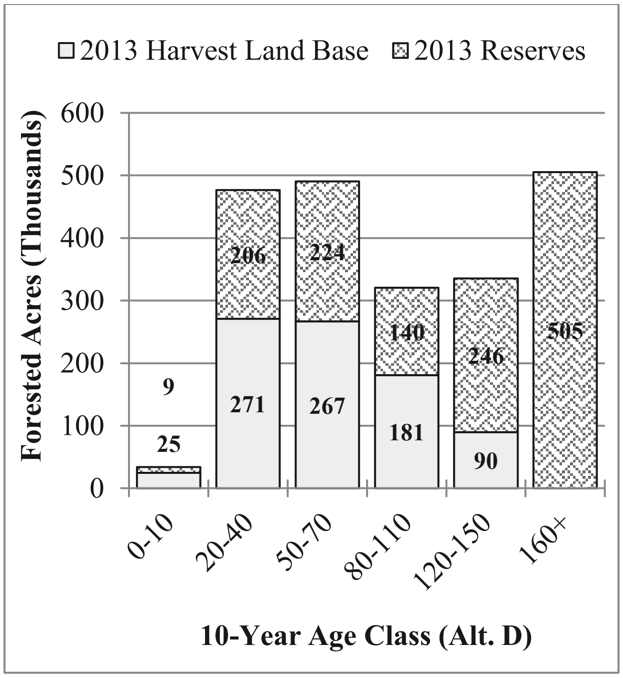
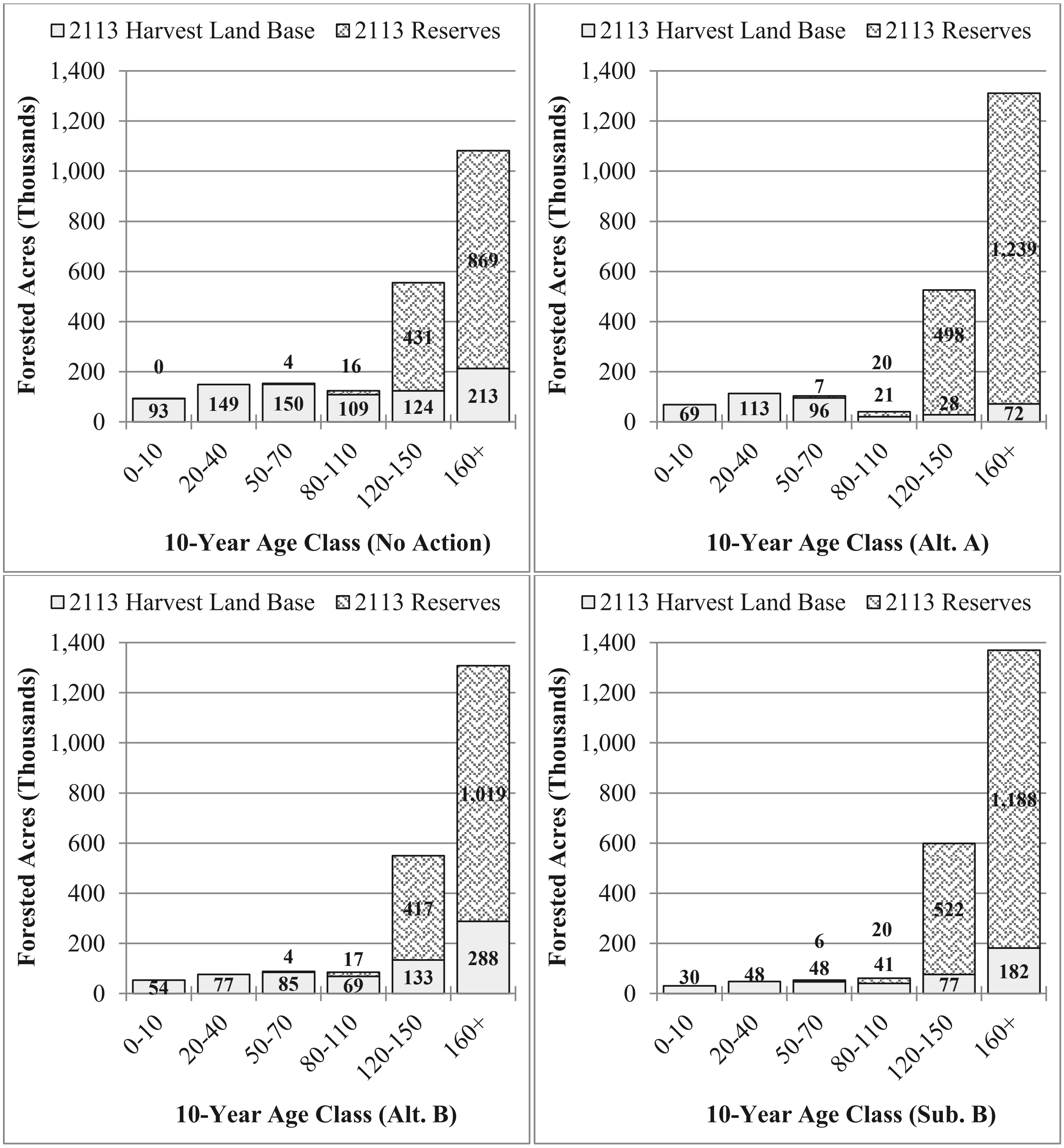


Figure 3-61. 2013 Age class distribution; by 10-year age class grouping by alternative, the Harvest Land Base, and Reserves.

Dry forests typically are the product of relatively frequent low- to mixed-severity fire, which produces stands with multiple cohorts of trees of varying ages (Franklin and Johnson 2012, Sensenig *et al.* 2013). Therefore, the concept of stand age in these forests is less useful to approximate structural complexity or northern spotted owl habitat value. The BLM's approach to the protection of older, more structurally-complex forests in Alternative B is based on district-defined maps, rather than stand age, which explains why Alternative B would allocate some older stands, especially in the dry forest, to the Harvest Land Base (**Figure 3-53**).

Over time, the age class distribution in the decision area would represent the product of management under the different alternatives. In 100 years, the forest stands in Reserve land use allocations would be mostly greater than 120-years-old, since the harvest types employed would not result in an alteration of stand structure sufficient to cause a reset of stand age. The BLM expects that wildfire would also play a role in shaping the future age class distribution of the decision area, but it would be a relatively limited role. The BLM did not simulate other natural disturbances including wind-throw or insect and disease epidemics in the vegetation modeling.

The BLM's simulations of wildfire impacts on the decision area reveal that a relatively small number of acres of BLM-administered lands are forecasted to experience high-severity wildfire per decade. On average, roughly 150 acres of BLM-administered lands in the coastal/north area and 2,950 acres in the interior/south area are forecasted to experience high-severity wildfire per decade. **Appendix H** contains more details of wildfire modeling on these simulations. In the absence of timber harvest, these and other natural disturbances would create the only areas in reserve land use allocations containing young forests. In the Harvest Land Base, the future age class distribution would be determined by the harvest intensity and cutting cycle under each alternative (**Figure 3-62**).


2113 Harvest Land Base
2113 Reserves
Forested Acres (Thousands)
1,400
1,200
1,000
800
600
400
200
0
0-10
20-40
50-70
80-110
120-150
160+
93
149
150
109
124
213
0
4
16
431
869
10-Year Age Class (No Action)
2113 Harvest Land Base
2113 Reserves
69
113
96
21
28
72
7
20
498
1,239
10-Year Age Class (Alt. A)
2113 Harvest Land Base
2113 Reserves
54
77
85
69
133
288
4
17
417
1,019
10-Year Age Class (Alt. B)
2113 Harvest Land Base
2113 Reserves
30
48
48
41
77
182
6
20
522
1,188
10-Year Age Class (Sub. B)

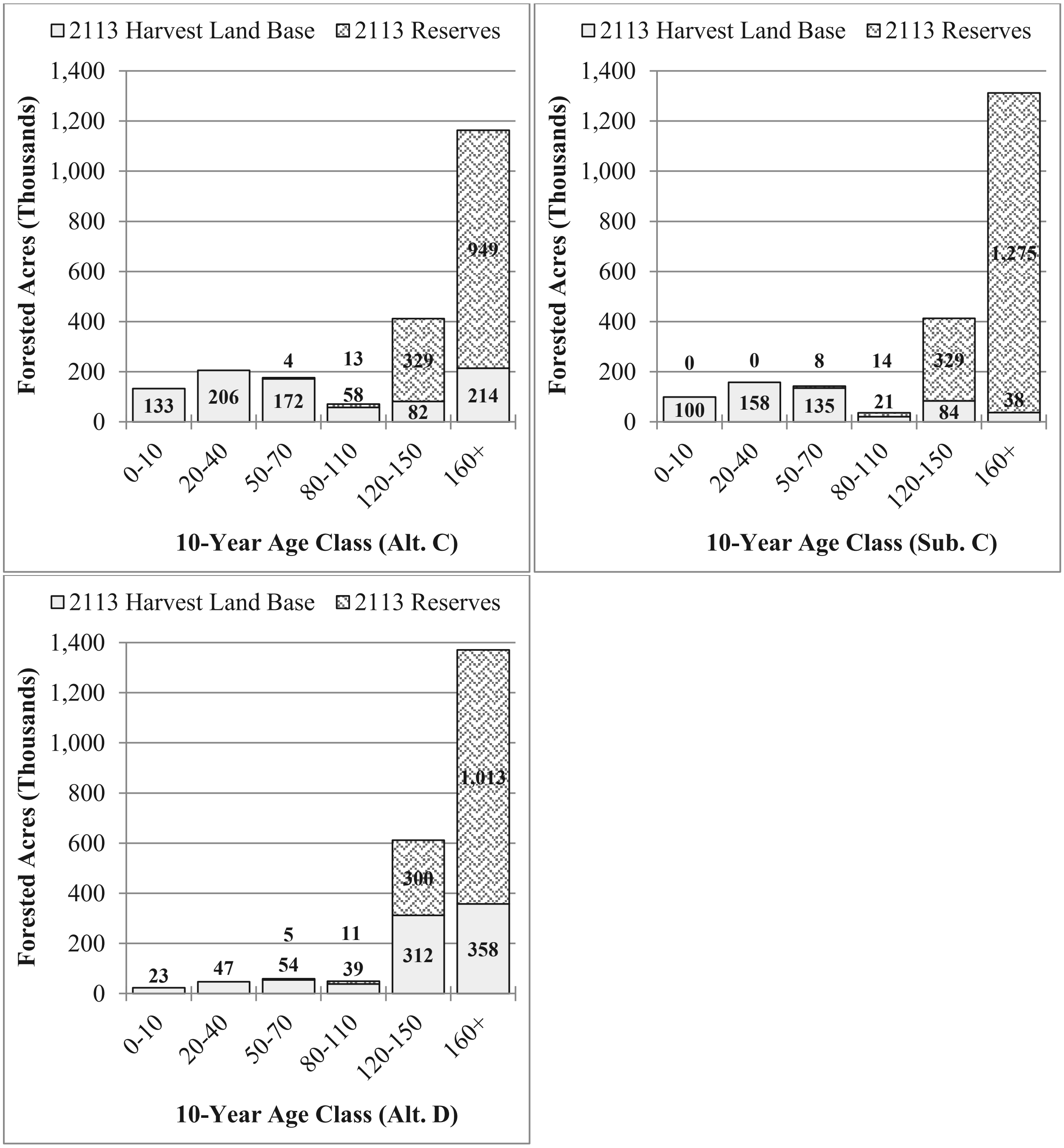


Figure 3-62. 2113 age class distribution; by 10-year age class grouping by alternative, broken out between the Harvest Land Base and Reserves.

In the long-term, the age class distribution in the Harvest Land Base in the No Action alternative (the Matrix and the Adaptive Management Areas) would approach forest regulation (i.e., an equal number of acres in each age class grouping). This would be the result of long-rotation, two-aged management on the entire Harvest Land Base. The portions of the Harvest Land Base in Alternatives A and C in the High Intensity Timber Area (HITA) would trend towards regulation in age classes 0-70 years, which would be the product of relatively short-rotation, even-aged management. In Alternatives B and D, the portions of the Harvest Land Base in the Moderate Intensity Timber Area (MITA) and Low Intensity Timber Area

(LITA) would generally trend towards regulation in age classes 0-140 years in the dry forest, and 0-100 years in the moist forest.

The portions of the Harvest Land Base in the Uneven-aged Timber Area (UTA) in all action alternatives and the Owl Habitat Timber Area (OHTA) in Alternative D would tend to get older at a similar rate as stands within reserve land use allocations, because stands in the UTA and OHTA would be partially cut on a perpetual re-entry cycle. Stands partially cut under uneven-aged management regimes would never be reset to stand age zero by stand-wide regeneration harvest. These stands would transition to multi-aged, multi-cohort stands. The following table shows the percentage of the Harvest Land Base in each land use allocation category grouped in a way that is relevant to impacts on the future age class distribution (**Table 3-56**).

Table 3-56. Percentage of Harvest Land Base in each land use allocation category.

Alternative	Long Rotation Two-aged; GFMA, NGFMA, SGFMA, CONN, AMA, LITA, MITA (Percent)	Short Rotation Even-aged; HITA (Percent)	Uneven-aged; UTA, OHTA (Percent)
No Action	100%	-	-
Alt. A	-	84%	16%
Alt. B	51%	-	49%
Sub. B	54%	-	46%
Alt. C	-	75%	25%
Sub. C	-	81%	19%
Alt. D	25%	-	75%

In summary, progression of the age class distribution of the decision area through time would be dictated by the harvesting practices directed in each land use allocation. Reserves and allocations dedicated to uneven-aged management regimes and associated selection harvesting, the UTA and OHTA, would continue to age since the stand age would never be reset to zero, barring an intense natural disturbance event. The relatively short rotation even-aged management regimes and associated clear-cutting in the HITA land use allocation in Alternatives A and C would result in roughly an equal number of acres in each age class up to the 70-year class.

The emphasis on longer rotation two-aged management regimes and associated variable-retention regeneration harvesting (VRH) in the No Action alternative, in the MITA and LITA in Alternative B and Sub-alternative B, and in the MITA in Alternative D would result in roughly an equal number of acres in each 10-year age class up to the 100-year age class in moist, higher productivity forest, and up to the 140-year age class in drier, lower productivity forests. The more clear-cutting and variable-retention regeneration harvesting[46] in an alternative, the more acres would be in the younger age classes in 100 years. Therefore, the overall age class distribution in Alternative C would contain the most acres in stands less than or equal to 40-years-old in 100 years (**Figures 3-61** and **3-62**).

Structural Stages

The natural disturbance and management history of the decision area has affected the mix of structural stages similarly to age classes. The decision area is currently comprised predominately of stand

[46] The BLM uses the term variable-retention regeneration harvest in this analysis to describe regeneration harvest practices in the No Action alternative. The 1995 RMPs require retention of green trees in regeneration harvests based on a range of trees per acre.

establishment without structural legacies, young without structural legacies, mature, and structurally-complex forest (**Figure 3-63**). **Table 3-54** lists the structural stage classifications.

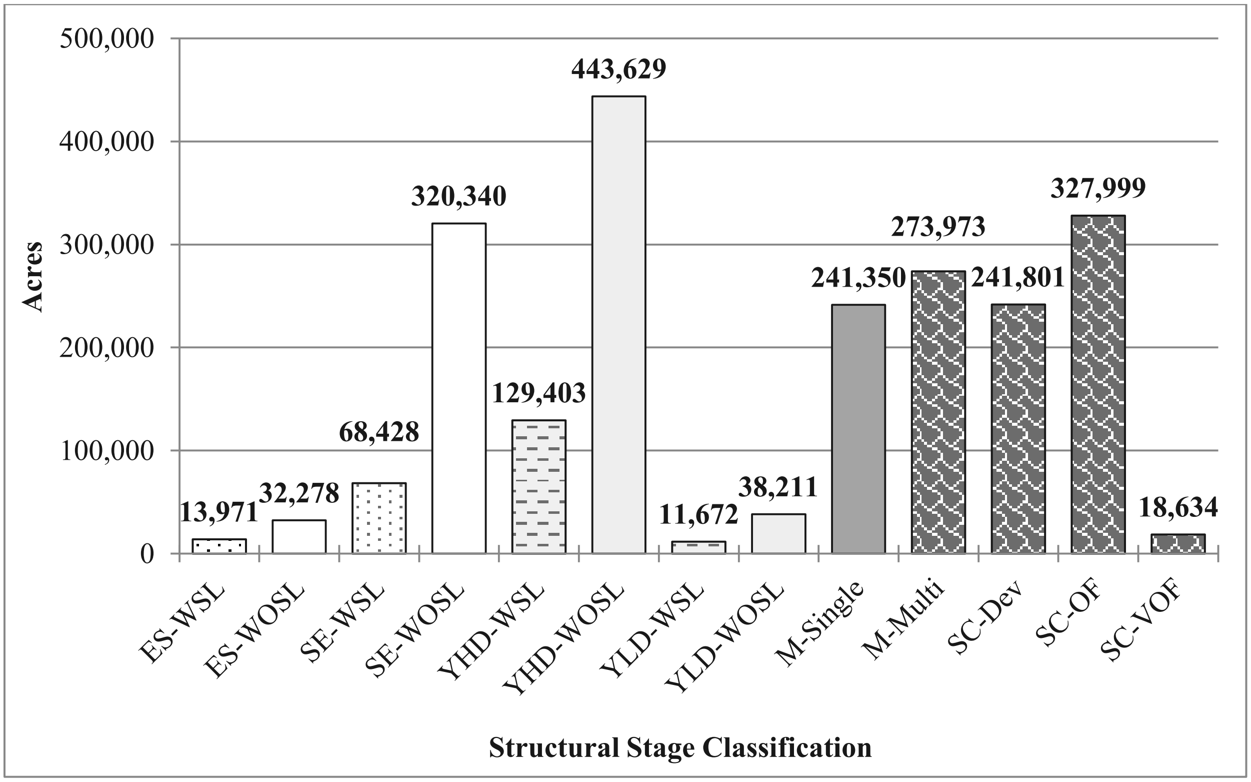
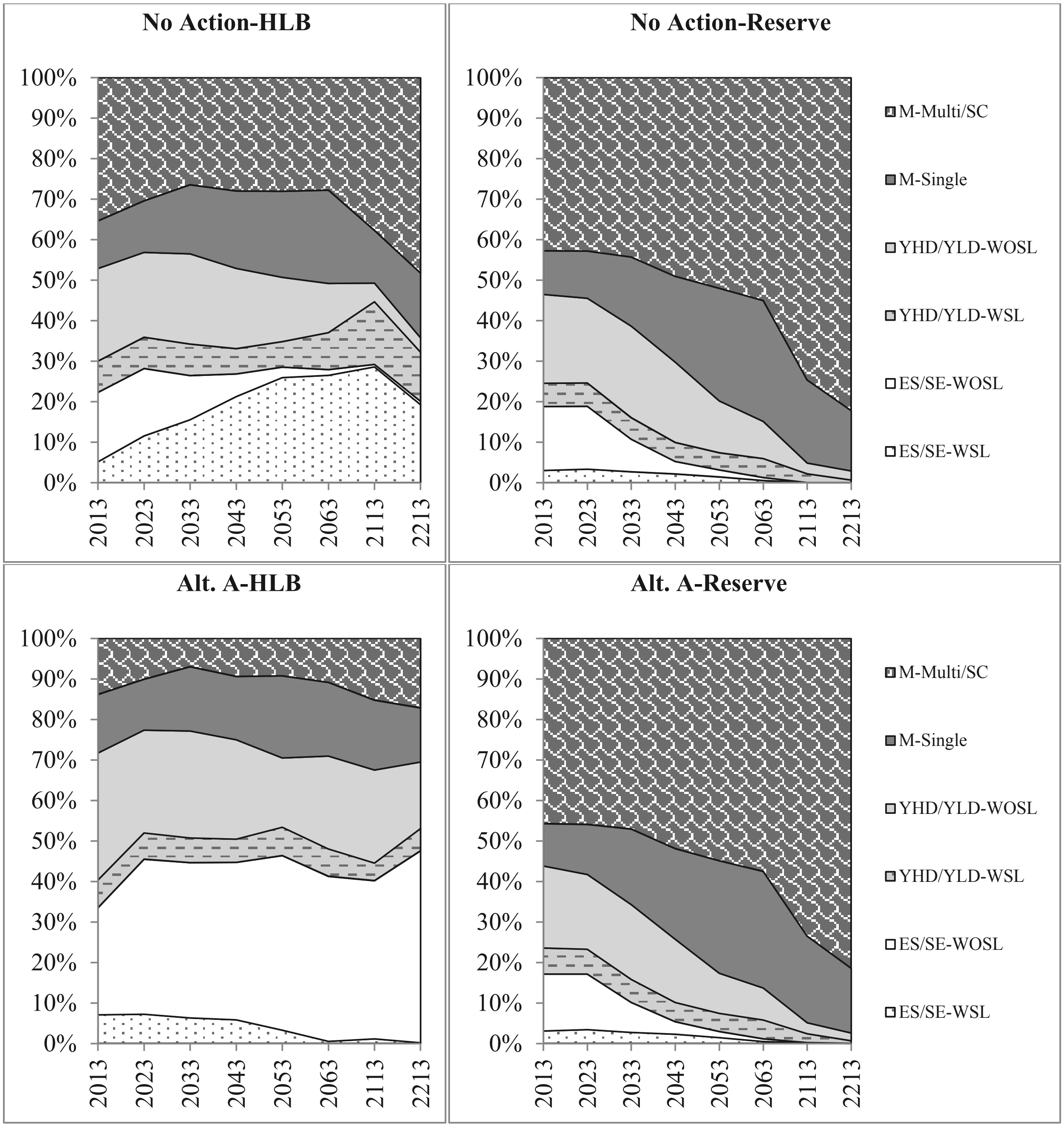


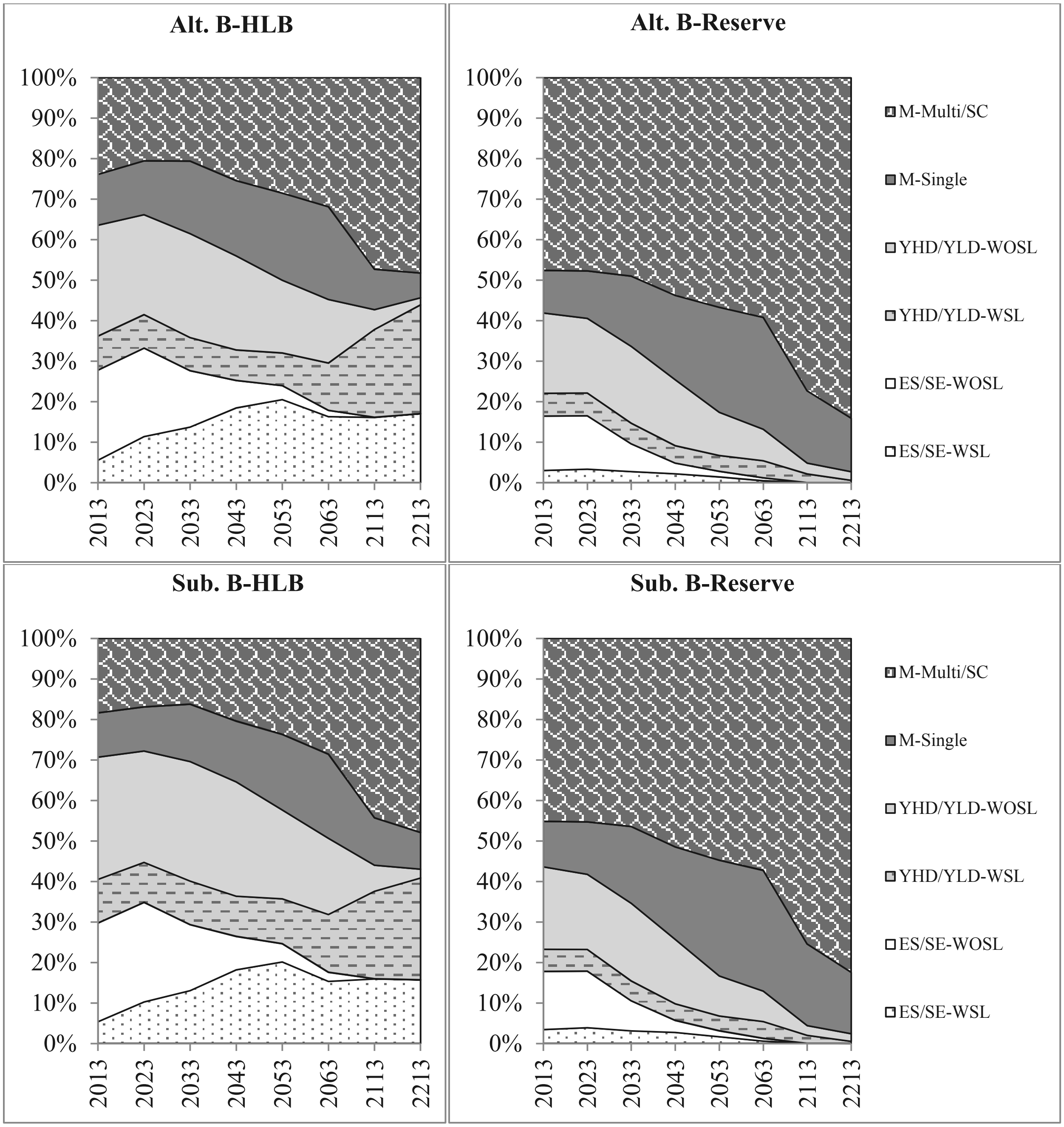
Figure 3-63. Current structural stage distribution for decision area.

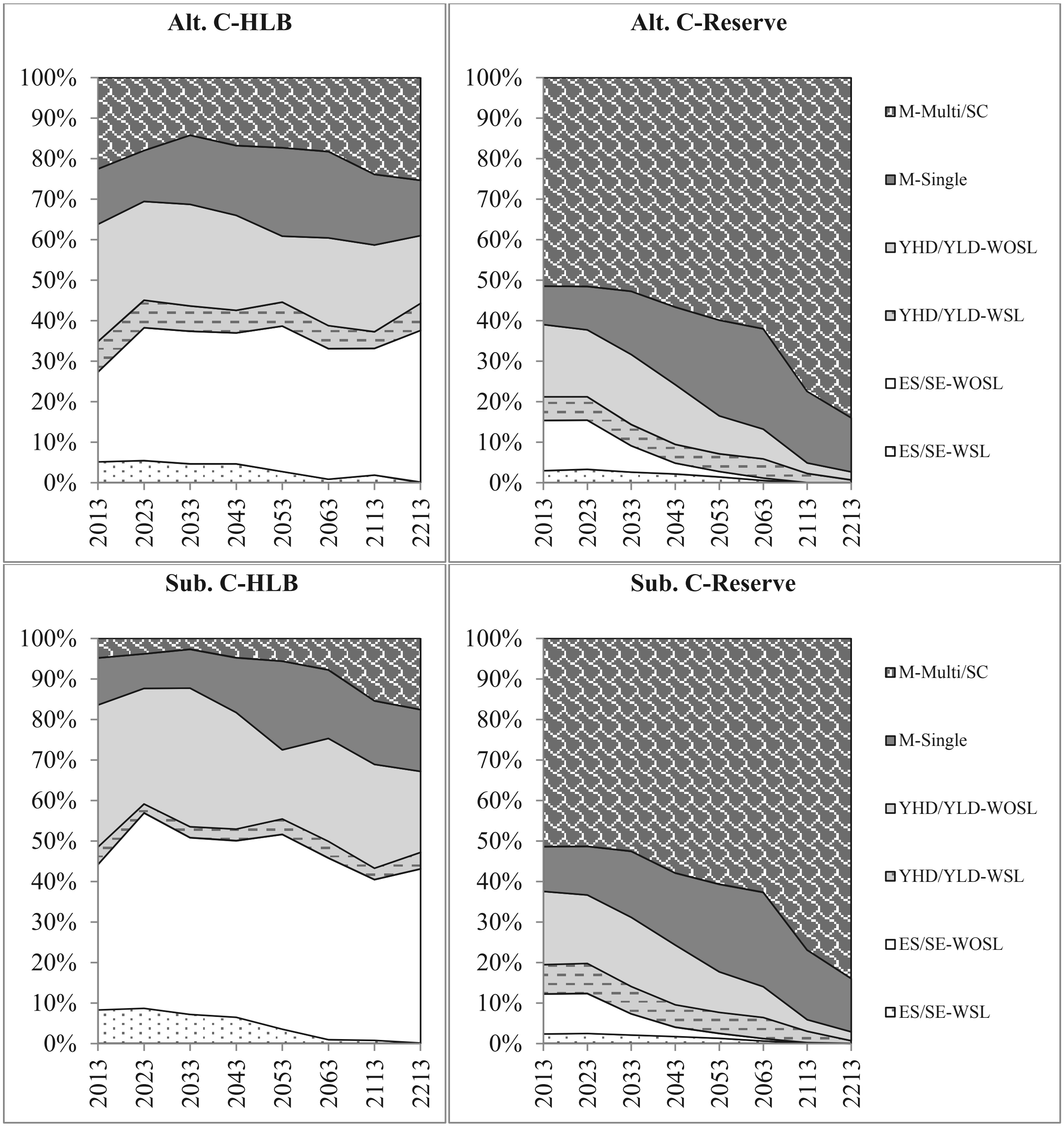
The BLM management has the potential to cause significant changes to the structural stage distribution of forested lands in the decision area over time. The 2008 RMP/EIS contains a robust spatial and temporal analysis regarding Forest Structure and Spatial Pattern compared to historic condition, which is incorporated here by reference (USDI BLM 2008, pp. 501-536).

The structural stage progression in the reserves would represent the majority of the forested land in the decision area, because the BLM would allocate no more than 30 percent of the decision area to the Harvest Land Base in any alternative. Since the majority of forested land resides in reserve land use allocations in all alternatives, structural stage differences between alternatives are muted when the Harvest Land Base and Reserves are combined, therefore they will be shown broken out. **Figures 3-61** and **3-62** highlight the structural stage progression through time for each alternative, grouped into similar categories, and broken out by Harvest Land Base and reserves.

The proportion of the Harvest Land Base composed of mature multiple canopy and structurally-complex forests in 2013 in each alternative would be mostly driven by the alternative-specific approach to the protection of older, more structurally-complex forests. The BLM has grouped mature multiple canopy forests with structurally-complex forests in the following figures and discussion due to their similarities related to northern spotted owl habitat quality (**Figure 3-64**).


No Action-HLB
No Action-Reserve
Alt. A-HLB
Alt. A-Reserve
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2013
2023
2033
2043
2053
2063
2113
2213
M-Multi/SC
M-Single
YHD/YLD-WOSL
YHD/YLD-WSL
ES/SE-WOSL
ES/SE-WSL


Alt. B-HLB
Alt. B-Reserve
Sub. B-HLB
Sub. B-Reserve
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2013
2023
2033
2043
2053
2063
2113
2213
M-Multi/SC
M-Single
YHD/YLD-WOSL
YHD/YLD-WSL
ES/SE-WOSL
ES/SE-WSL


Alt. C-HLB
Alt. C-Reserve
Sub. C-HLB
Sub. C-Reserve
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2013
2023
2033
2043
2053
2063
2113
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M-Multi/SC
M-Single
YHD/YLD-WOSL
YHD/YLD-WSL
ES/SE-WOSL
ES/SE-WSL

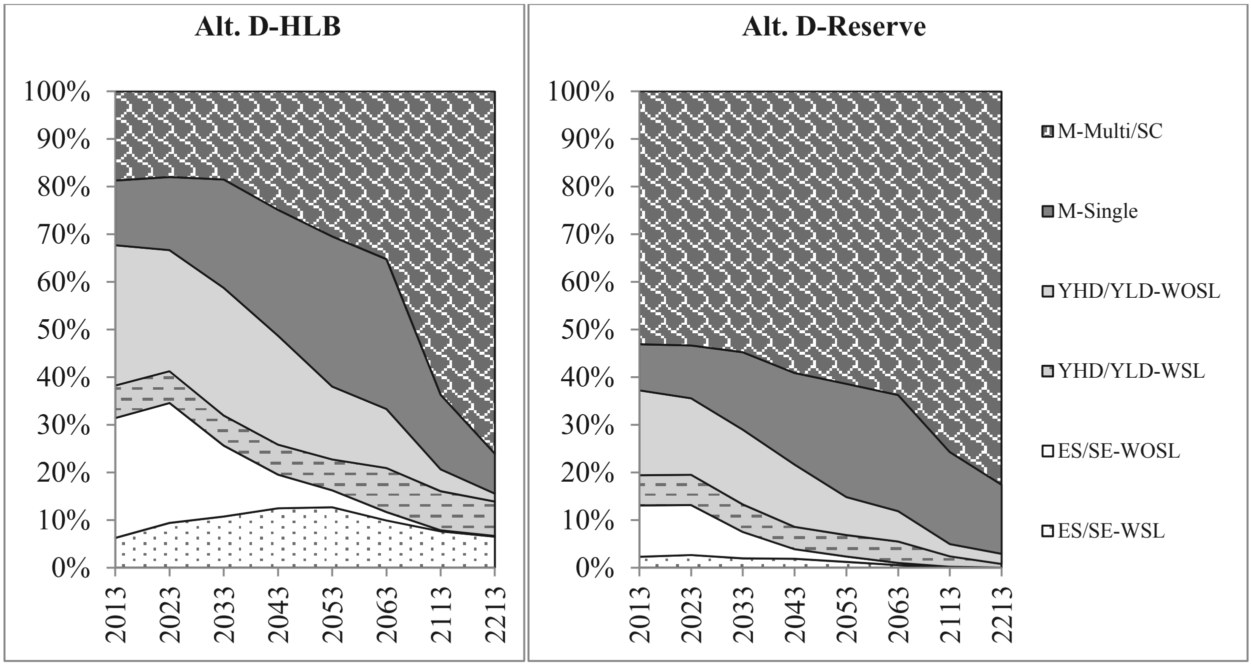

Figure 3-64. Structural stage progression over 200 years in the Harvest Land Base and reserves.

The No Action alternative contains the highest proportion of the Harvest Land Base in mature, multiple canopy and structurally-complex structural stages (35 percent). Sub-alternative C contains the smallest proportion of these forests in the Harvest Land Base, with approximately 5 percent, since the BLM would reserve all stands greater than 80-years-old in this alternative. It is notable that although close to 25 percent of the Harvest Land Base is in this category in Alternative B, 75 percent of those acres are in dry forests, which the BLM would allocate to the UTA in this alternative. Alternative B includes a district-defined designation of older, more structurally-complex forests. See Chapter 2 for a more thorough explanation of the varying approaches to older forest protection.

In the Harvest Land Base, the patterns of structural stage progressions would follow three distinct patterns (**Figures 3-65** and **3-66**). In Alternatives A and C, the Harvest Land Base would mostly trend towards single-story stands and structural stages without structural legacies, in almost equal parts of early-successional, stand establishment, young, mature, and structurally-complex in 100 years. In the No Action alternative and Alternative B, the Harvest Land Base would mostly trend towards multi-storied stands and structural stages with structural legacies, with mature and structurally-complex stands occupying around 50 percent of the area in 100 years. In Alternative D, in which 75 percent of the Harvest Land Base would be managed using uneven-aged management regimes (**Table 3-56**), the majority of the Harvest Land Base would develop into mature or structurally-complex forest in 100 years.

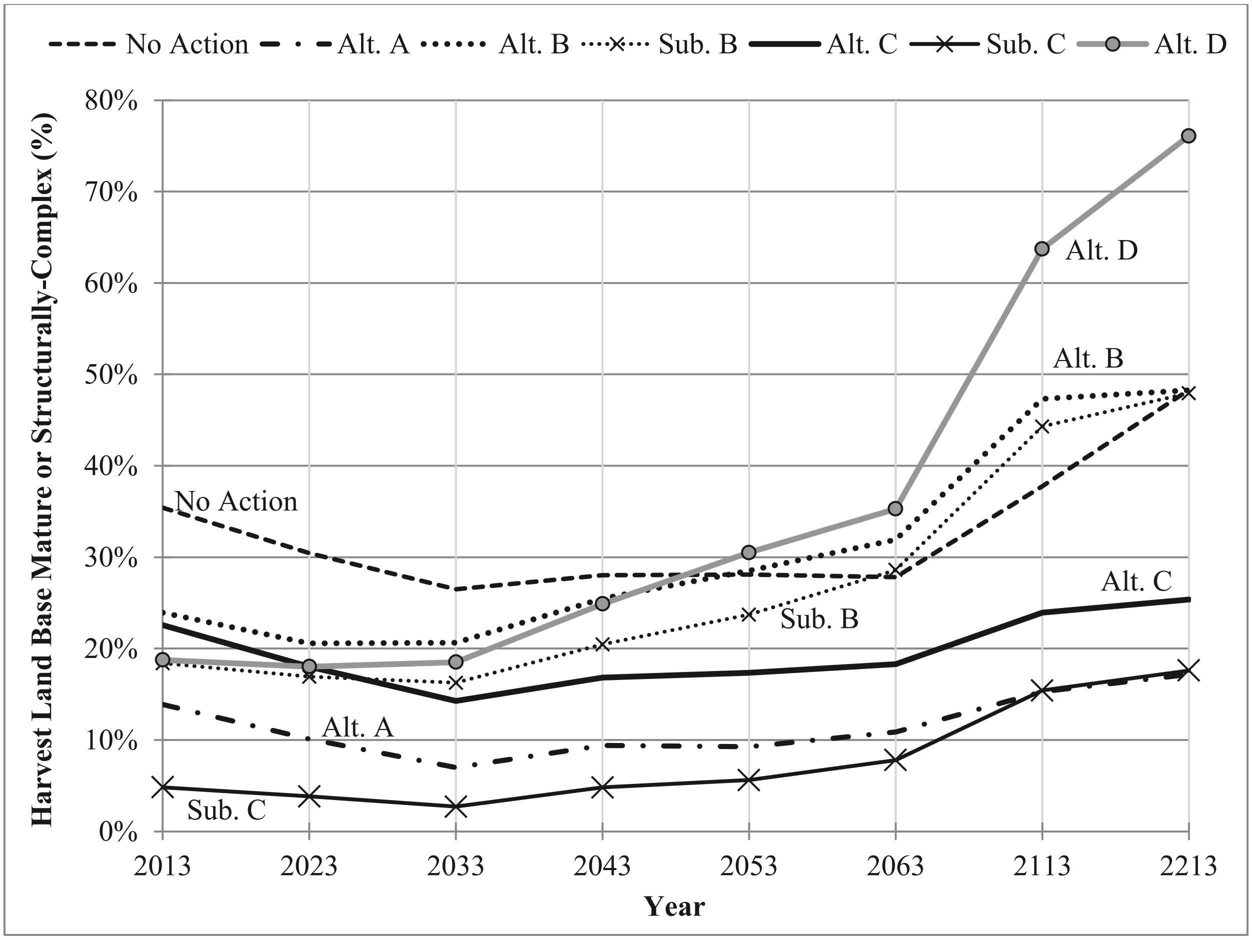

Figure 3-65. Proportion of the Harvest Land Base as mature or structurally-complex.

Under Alternatives A and C, clear-cutting in the HITA would produce relatively uniform, single–story stands, with little to no structural legacies. In contrast, the variable-retention regeneration harvesting in the No Action alternative and Alternatives B and D would produce heterogeneous, multi-layered stands with structural legacies (**Figure 3-66**). This is consistent with the analytical conclusions about the effect of different regeneration harvest approaches on structural stage development in the 2008 RMP/EIS (USDI BLM 2008, pp. 505-506, 508-513, 517) and recent publications on retention forestry (Gustafsson *et al.* 2012).

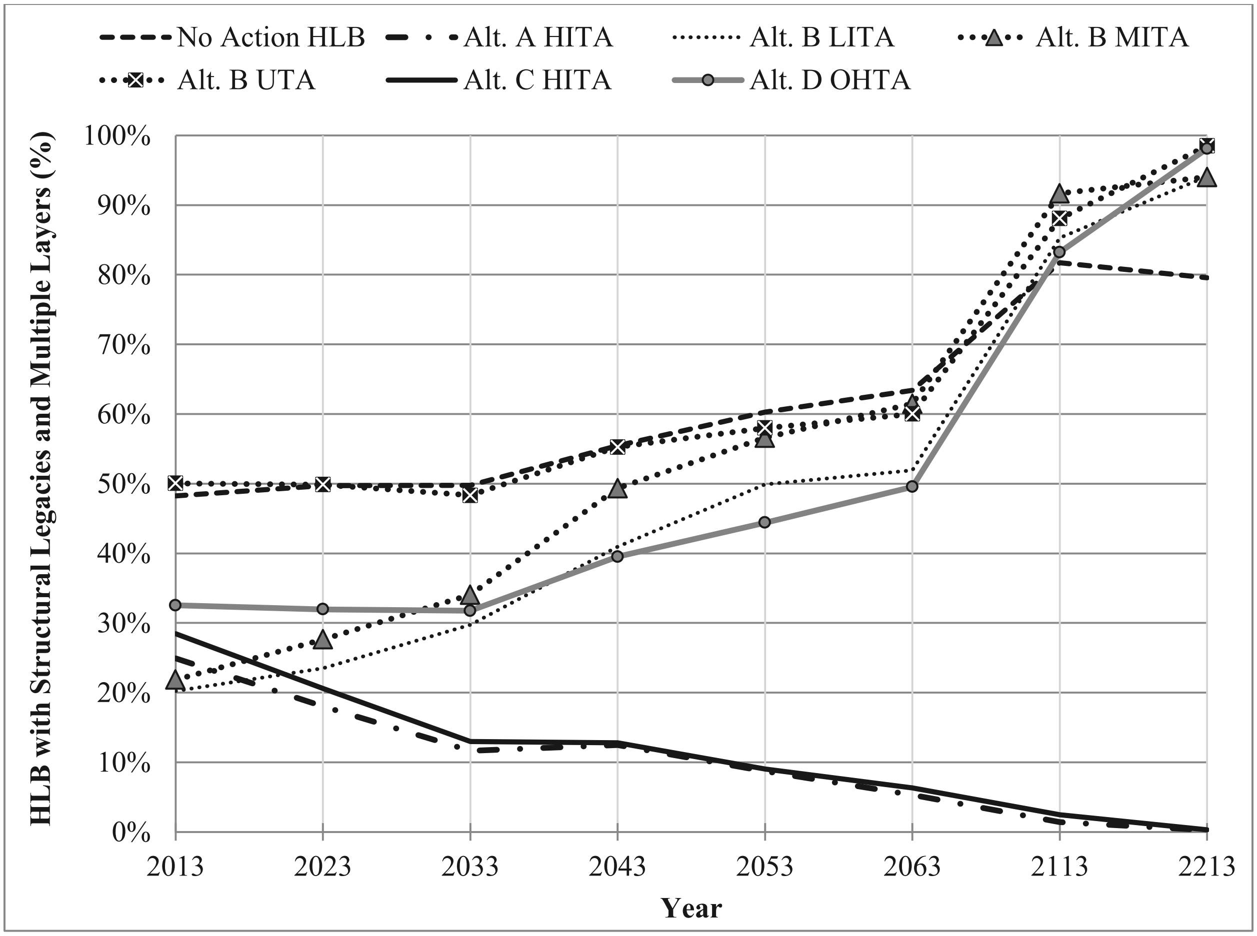

Figure 3-66. Proportion of the Harvest Land Base with structural legacies or multiple layers.
The data is not shown for Alt. D MITA, Alt. A, C, and D UTA since the land use allocation development trends are nearly identical between alternatives.

Clear-cutting under Alternatives A and C would produce different post-harvest conditions than variable-retention regeneration harvesting under the No Action alternative and Alternatives B and D. Alternative C would produce the most early-successional conditions of any alternative, while Alternative B would produce the most early-successional with structural legacies (**Figure 3-67**).

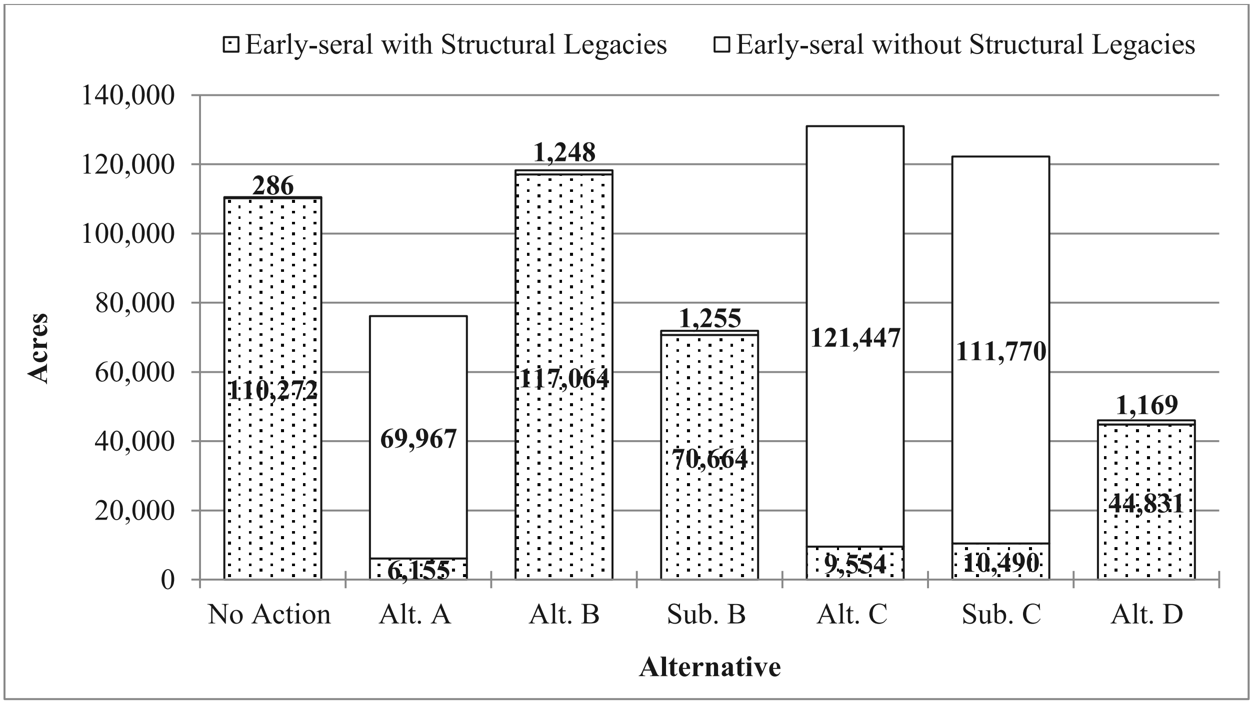

Figure 3-67. Structural complexity and abundance of early-seral structural stage in 2063.

In the Reserves, the pattern of structural stage development would vary little among the alternatives, because the BLM would implement silvicultural treatments in the reserve land use allocations only for restoration purposes under all alternatives. Under all alternatives, stands in the Reserve land use allocations would generally trend towards mature and structurally-complex conditions, while early-successional, stand establishment, and young stands would mostly disappear over time.

Natural disturbances, especially wildfire, would create some areas of early-successional forest, regardless of land use allocation designation. Because the acreage of Reserve allocations would vary by alternative, the acreage of reserve allocations that would be affected by wildfire would vary by alternative as well. Based on wildfire simulation, on average, between 41-115 acres of reserve land use allocations on BLM-administered lands in the coastal/north area and between 911-2,317 acres of Reserve land use allocations on BLM-administered lands in the interior/south area would experience high-severity wildfire per decade. Assuming burned stands remain in an early-successional condition for three decades. This would only yield up to 345 acres of early-successional forest in the coastal/north areas, and 6,951 acres of early-successional forests in the interior/south areas in any given decade. The BLM did not simulate the impacts of other natural disturbances including wind-throw or insect and disease outbreaks in the vegetation modeling.

Management direction for stand treatments within the Late-Successional Reserve would vary by alternative. The No Action alternative and Alternatives B and C would include timber harvesting as a tool for attainment of Late-Successional Reserve management objectives. Alternative A would achieve these management objectives in moist forest Late-Successional Reserves through non-commercial management (i.e., cutting trees but not removing them from the stand). In Alternative D, the Late-Successional Reserve is comprised of older, more structurally-complex forest and thus would not require the same treatments to attain Late-Successional Reserve management objectives. However, the OHTA within the Harvest Land Base in Alternative D includes management direction to apply selection harvesting to speed the development of and then maintain northern spotted owl habitat, similar to the management direction within the Late-Successional Reserve in other action alternatives. Therefore, the outcomes for the OHTA in Alternative D provide a relevant comparison to the outcomes for portions of the Late-Successional Reserve under other alternatives.

The following figure (**Figure 3-68**) illustrates the differences in the proportion of forested acres in mature multiple canopy and structurally-complex conditions in 2013 and 2213. The BLM grouped the mature multiple canopy and structurally-complex structural stages because they generally represent the highest quality spotted owl habitat. The difference in structural conditions in the moist forest Late-Successional Reserve managed using commercial thinning is indistinguishable from structural conditions in the Late-Successional Reserve using non-commercial thinning only (Alternative A). However, 98 percent of stands develop into mature multiple canopy and structurally-complex forest in response to the uneven-aged management prescriptions in the OHTA in the Harvest Land Base in Alternative D.

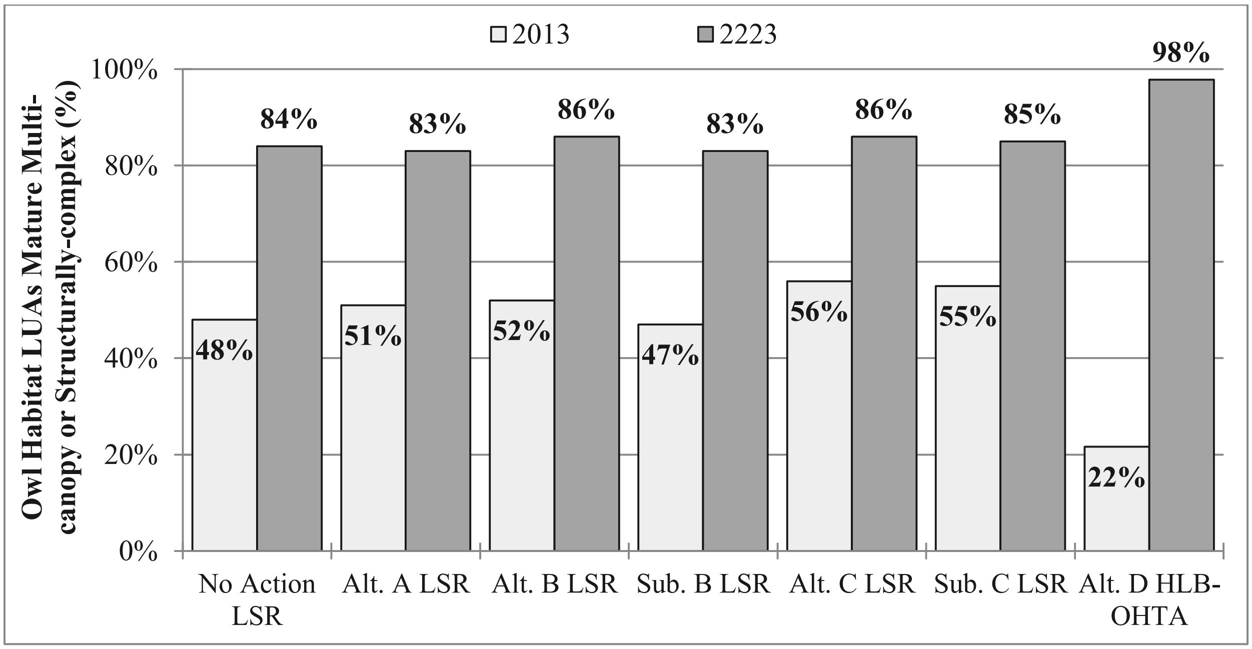

Figure 3-68. Proportions of owl habitat management land use allocations in mature multiple canopy or structurally-complex structural stages in 2013 and 2223 by alternative.

Figure 3-69 shows that the proportions of acres in mature multiple canopy and structurally-complex conditions in the Late-Successional Reserves, the UTA, and the OHTA would range between 60 percent and 81 percent in 100 years. In the HITA under Alternatives A and C, the acreage of mature multiple canopy and structurally-complex forest would decline to zero in 100 years due to the emphasis on relatively short-rotation clear-cutting harvest practices. The LITA and MITA would achieve moderately higher proportions in mature multiple canopy and structurally-complex forest than the HITA under Alternatives A and C, with around 10 percent, due the trend towards longer rotation lengths and variable-retention regeneration harvest practices.

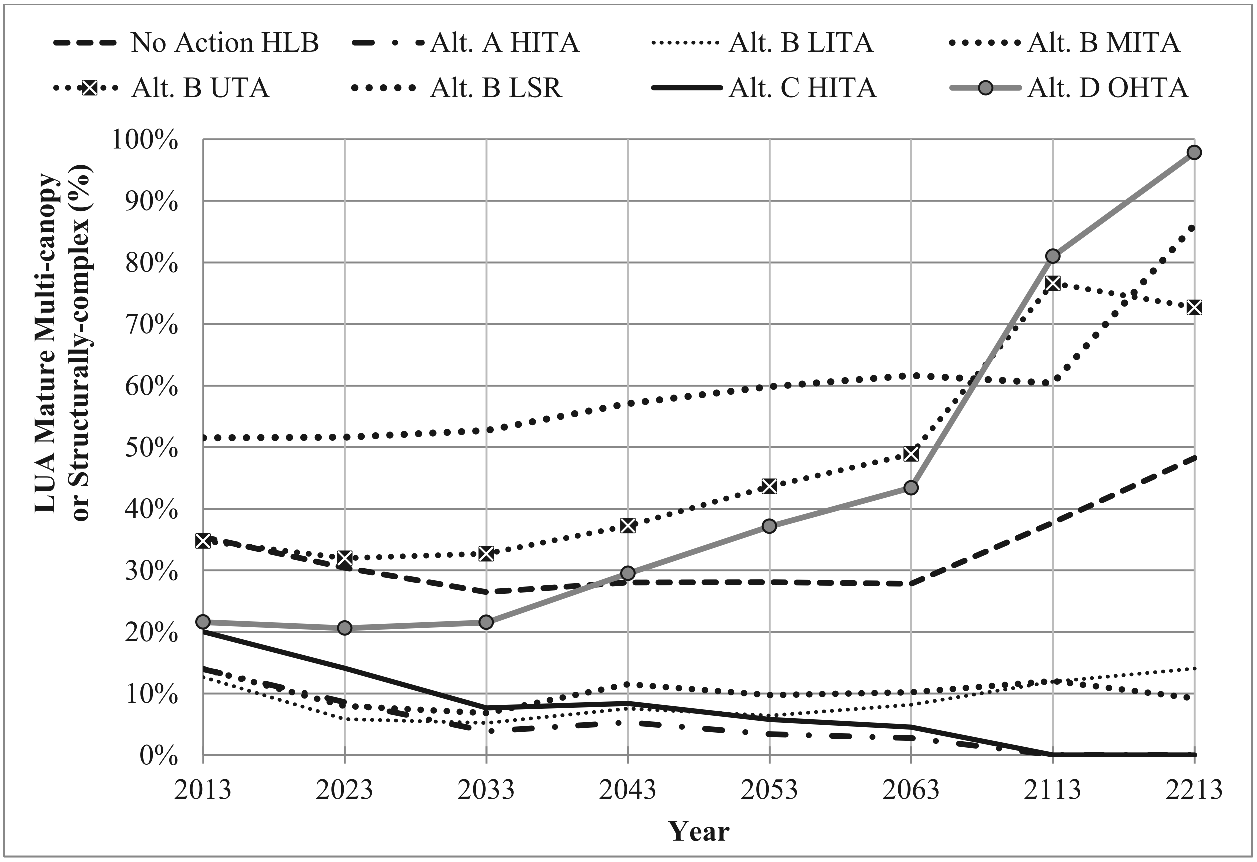

Figure 3-69. Proportions of land use allocations in mature multiple canopy or structurally-complex structural stages through time. LSR, UTA, MITA, and LITA are only shown for alternative B since developmental trajectory within land use allocations is nearly identical between alternatives.

The Harvest Land Base in the No Action alternative would contain 38 percent in these structural stage conditions within 100 years. This is due to the interaction between starting age class distribution and minimum rotation age assumptions in the vegetation modeling for the Harvest Land Base in the No Action alternative. Having a substantial acreage of stands beyond the culmination of mean annual increment (CMAI) of net timber volume in land use allocations dedicated to two-aged management regimes would allow the BLM to implement long rotations right away. Reserving older forests in the action alternatives would force the BLM to harvest stands less than 80-years-old for up to 100 years before transitioning completely to longer rotations.

In summary, the mix of silvicultural systems and harvesting practices applied within the decision area will determine the future of the structural stage distribution the decision area. Wildfire is projected to play a relatively small role in the creation of early-seral structural stages when compared to timber harvest, especially in the coastal/north areas. Early-successional forests in the HITA in Alternatives A and C would not contain structural legacies. There is a substantial difference in the structural complexity of most future forests when comparing the even-aged management (which includes clear-cutting) practices in the HITA in Alternatives A and C to the two-aged practices (which include variable retention-regeneration harvest) in the No Action alternative, and the LITA and MITA in Alternatives B and Sub-alternative B, and the MITA in Alternative D.

Even-aged management with clear-cutting would result in relatively simple structured forests lacking legacy structures, while two-aged harvesting would produce forests with multiple layered canopies and legacy structures. Land use allocations dedicated to uneven-aged management regimes, the UTA and OHTA, would eventually produce mature multiple canopy forests and structurally-complex forests in proportions equal to or greater than Late-Successional Reserve management. The structural stage development of moist LSRs would be similar among all alternatives. Retention of cut trees in Alternative A versus commercial removal in other alternatives would not result in differences in structural stage development. Land use allocations implementing regeneration harvest in the action alternatives would contribute a relatively small proportion of acres to these older and more structurally-complex structural stage classifications. The Harvest Land Base in the No Action alternative would contribute a substantially higher proportion of mature multiple canopy and structurally-complex forests to the decision area. This is because the inclusion of substantial acreages of stands beyond CMAI of net timber volume in the Harvest Land Base would allow the BLM to implement long rotations right away, rather than the gradual trend towards longer rotations that would be required in the MITA and LITA in Alternative B and Sub-alternative B, and in the MITA in Alternative D.

Inventory of Merchantable Timber

The inventory of merchantable timber volume in the decision area has increased since 1940 (**Table 3-57**).

Table 3-57. The standing net timber inventory at each re-measurement period.

Historic Estimates	1940	1960	1970	1980	1990	2006
Timber Volume MMbf (million board feet)	46,000	49,100	50,300	46,900	49,900	73,300
Acres Considered in Calculation	2,165,900	2,145,072	2,391,172	1,771,657	1,794,420	2,197,000

A combination of factors caused the large increase between the 1990 and 2006 inventory of timber volumes. These include:

- The increase in acres included in the determination of volume
- The increase in growth and volume resulting from the increase in faster growing, younger stands
- Harvest levels below the maximum potential annual productive capacity (**Tables 3-60** and **3-61**).

Although these inventories were conducted using different inventory systems, different assumptions, and different portions of the BLM-administered lands, the inventories provide the basis for broad comparisons and general trends. These historical records of timber inventories show that overall growth on the BLM-administered lands has exceeded harvest levels, especially in the last two decades. Current standing timber inventory based on 2013 data is roughly consistent with the 2006 estimate (**Table 3-58**).

Table 3-58. 2013 Scribner 16' scale standing timber volume MMbf and forested acres by district or field office.

District/Field Office	Total BLM (Acres)	Net Inventory (MMbf)	Gross Inventory (MMbf)
Coos Bay	304,137	13,456	15,519
Eugene	297,222	13,735	16,623
Klamath Falls	48,011	757	930
Medford	740,119	15,345	20,003
Roseburg	399,163	12,270	15,590
Salem	374,541	16,569	20,739
Totals	**2,163,193**	**72,132**	**89,404**

The amount of current timber inventory within the Harvest Land Base varies primarily with the extent of the Harvest Land Base under each alternative. Alternative C contains the highest timber inventory within the Harvest Land Base of any alternative, with approximately 24 billion board feet. Sub-alternative B has the lowest timber inventory within the Harvest Land Base, with approximately 9 billion board feet. The current timber volume in the Harvest Land Base ranges from 13-33 percent of total timber inventory in the decision area among the alternatives. Conversely, reserve land use allocations in the alternatives contain between 66-87 percent of total timber inventory among the alternatives (**Figure 3-70**).

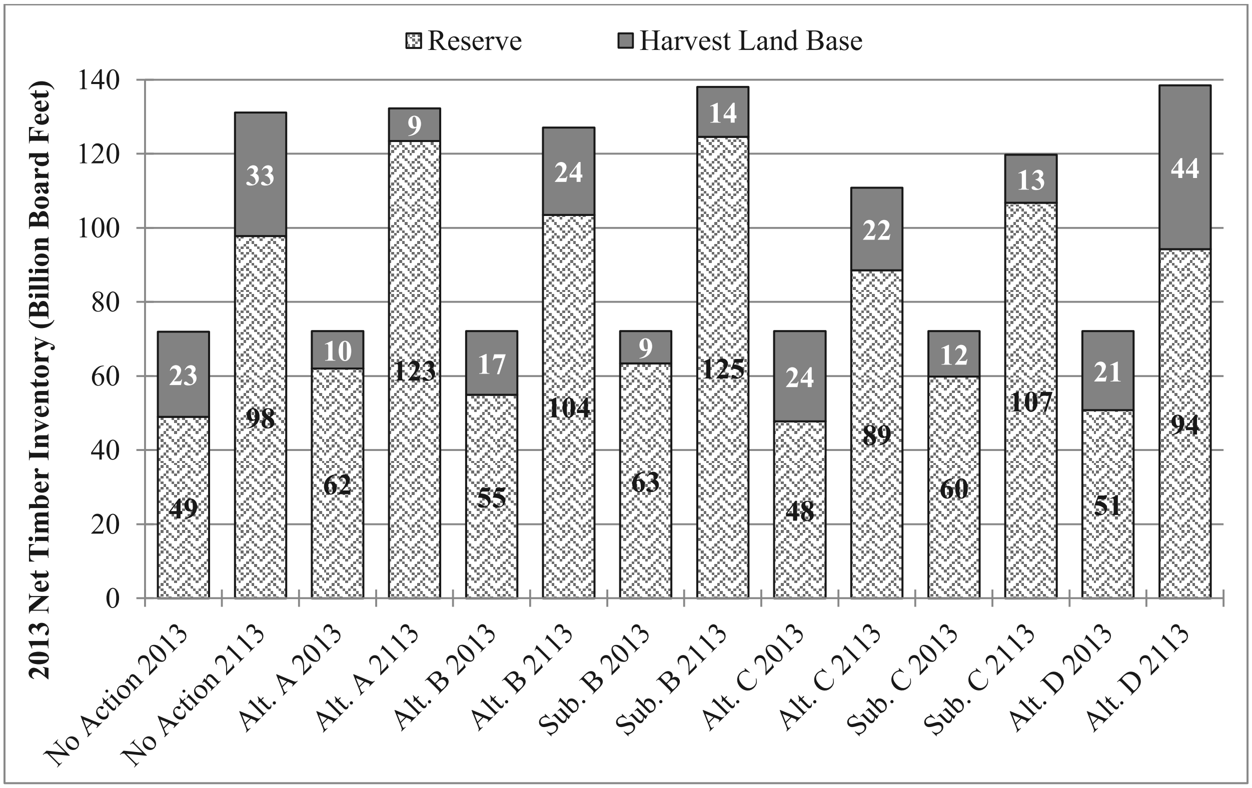

Figure 3-70. 2013 net inventory broken out between Harvest Land Base and reserves by alternative.

The timber inventory would increase under all alternatives. This is mostly due to timber volume accumulation in the reserve land use allocations. Timber volume would increase between 78-100 percent in the reserve over the next 100 years, since the BLM would only be harvesting timber to achieve restoration goals (**Table 3-59**).

Table 3-59. Percent change in inventory between 2013 and 2113 broken out between Harvest Land Base and reserves. Positive numbers indicate inventory increase, while negative numbers indicate inventory decrease.

Inventory	No Action	Alt. A	Alt. B	Sub. B	Alt. C	Sub. C	Alt. D
Reserve	100%	99%	88%	96%	86%	78%	86%
Harvest Land Base	45%	-13%	37%	56%	-9%	6%	108%
Overall	**82%**	**83%**	**76%**	**91%**	**54%**	**66%**	**92%**

The timber inventories in the Harvest Land Base would slightly decline in Alternatives A and C, and remain relatively stable in Sub-alternative C, because of shorter rotations and even-aged timber harvest in the majority of the Harvest Land Base. In these alternatives, the BLM would convert sub-optimal timber production stands in the HITA into fully-stocked stands near the maximum timber production potential for the land. The BLM would only hold the minimum inventory on the Harvest Land Base to ensure long-term sustainability of the timber harvest regime (**Table 3-59** and **Figure 3-70**).

Timber inventory would increase in the Harvest Land Base under the No Action alternative, Alternative B, Sub-alternative B, and, to the greatest extent, Alternative D. For the No Action alternative, the modeling assumptions scheduling regeneration harvest at the CMAI of net harvest volume would interact with the modeling assumption for non-declining even flow to cause inventories to substantially increase on some districts. The Harvest Land Base inventory increases in Alternatives B, Sub B, and D, is partly explained by the modeling assumptions guiding the transition to longer rotations on a relatively young Harvest Land Base, which would require an increase in the standing inventory on those stands as they age into the desired age classes for regeneration harvest. **Appendix C** contains more information on the modeling assumptions used for each alternative.

Another contributing factor leading to the inventory increase in the Harvest Land Base in these alternatives is the implementation of uneven-aged management regimes The BLM would implement selection harvesting to achieve desired stand conditions in the UTA in all the action alternatives and in the OHTA in Alternative D. Volume accumulation would outpace harvest until the desired conditions were reached, which could take 100 years or more, and then the inventory would flatten out as those conditions are maintained, where from that point forward timber harvest would equal growth. Since 75 percent of the Harvest Land Base would be in land use allocations dedicated to uneven-aged management regimes in Alternative D, this net inventory would increase more than any other alternative with 108 percent increase in net timber inventory in the next 100 years (**Table 3-59** and **Figure 3-70**).

In summary, all alternatives would result in an overall increase in net timber inventory of between 54 percent (Alternative C), and 92 percent (Alternative D) in the next 100 years. The net timber inventory in reserve land use allocations would increase more than 78 percent in all alternatives. Net timber inventories in the Harvest Land Base in Alternatives A and C would remain stable or slightly decrease in the next 100 years as the HITA land use allocation would transition into a fully regulated relatively short-rotation forest. Net timber inventories in the Harvest Land Base in the No Action alternative, Alternatives A, B, Sub-alternative B, and Alternative D would increase between 37 percent (Alternative B) and 108 percent (Alternative D). The increase in net timber inventories is due to the combination of the modeling assumptions guiding the transition of younger forests to long rotations and the implementation of uneven-aged management regimes in the action alternatives. The increase in inventory in the No Action alternative's Harvest Land Base is explained primarily by the combination of the non-declining timber flow modeling assumption with the assumption that stands meet CMAI of net timber volume prior to implementing regeneration harvest, which causes inventories on some districts to increase substantially.

Issue 2

What would be the annual productive capacity for sustained-yield timber production under each alternative? How would different intensities of forest management and restrictions on timber harvest in the Harvest Land Base influence the annual productive capacity?

Analytical Methods

Through the RMPs, the BLM will determine and declare the annual productive capacity for sustained-yield timber production or allowable sale quantity (ASQ).[47] The ASQ is the timber volume that a forest can produce continuously under the intensity of management described in each alternative for those lands

[47] The terms "annual productive capacity," "annual sustained yield capacity," and "allowable sale quantity" are synonymous.

allocated for sustained-yield timber production (i.e., the Harvest Land Base). The calculation of the ASQ for each alternative is a direct output from the vegetation modeling analysis for each alternative and would vary based on the timing and intensity of timber harvest, silvicultural practices, and restrictions on timber harvest in the Harvest Land Base under each alternative. Because the ASQ volume reflects the capacity for sustained-yield timber production, it would not decline over time.

In contrast to the ASQ volume, timber volume produced as a by-product of silvicultural treatments in reserve land use allocations (i.e., non-ASQ volume) would change over time and eventually decline in moist forest areas. The calculation of the non-ASQ volume for each alternative is also a direct output from the vegetation modeling, but reflects modeling assumptions about the intensity and extent of thinning or selection harvesting needed to achieve the management objectives of the Reserve land use allocations.

The BLM calculated the ASQ and non-ASQ volume for each of the six sustained yield units, which match the five western Oregon BLM district boundaries and the western portion of the Klamath Falls Field Office.

The vegetation modeling included forecasting future marbled murrelet sites and North Coast Distinct Population Segment (DPS) red tree vole sites, which, in some alternatives, would be removed from the Harvest Land Base and would therefore not be available for sustained-yield timber harvest. See the Wildlife section in this chapter for more detail on site management. The forecasting of future marbled murrelet sites required slightly different methodologies for the No Action alternative and the action alternatives and inherently includes substantial uncertainty. The BLM did not quantitatively forecast the loss of Harvest Land Base area to future red tree vole sites in the vegetation modeling for the No Action Alternative, and therefore likely overestimates the ASQ for this alternative. There is substantial variability in the detection rates of red tree voles and management requirements for detected red tree vole sites, which complicate any attempt to forecast the effects of future red tree vole sites on the ASQ under the No Action alternative. This analysis uses decision area-wide detection rates based on protocol surveys between 2000 and 2012 on BLM-administered lands irrespective of habitat condition outside of vegetation modeling. Detection rates range from 16.7 percent in the Salem District to 76.1 percent in the Coos Bay District, with an average of 42.1 percent for the decision area. The BLM uses the assumption that 40 percent of stands with red tree vole detections would be unavailable for long-term sustained yield timber harvest, in order to bracket the potential effects of red tree vole site management on the ASQ for the No Action alternative. This estimate is shown in **Table 3-62**.

The modeling of future marbled murrelet sites in the No Action alternative assumed that all stands currently 120-years-old and older in Matrix and Adaptive Management Areas within 35 miles of the coast would be occupied by marbled murrelets and would be reserved from timber harvest. The modeling assumed that stands in the Matrix and Adaptive Management Area that are currently less than 120-years-old would not be occupied by marbled murrelets, even those stands that would become 120-years-old or older during the modeling period. The modeling also assumed that no stands greater than 35 miles from the coast would be occupied by marbled murrelets. The assumption that all stands currently 120-years-old and older within 35 miles of the coast would be occupied by marbled murrelets is likely an overestimation, and the assumption that no stands currently less than 120-years-old and no stands greater than 35 miles from the coast would be occupied by marbled murrelets is likely an underestimation. Overall, the forecasting of future marbled murrelet sites for the No Action alternative likely underestimates the acres that would be reserved from timber harvest and consequently overestimates the ASQ. However, the BLM lacks sufficient data at this time to refine these assumptions about the No Action alternative or quantitatively describe the overestimation of ASQ. The BLM used this age-based assumption for future occupancy for the No Action alternative, because the No Action alternative, in contrast to all of the action alternatives, includes harvest of older, more structurally-complex forest, which provides the highest quality marbled murrelet nesting habitat.

Because all of the action alternatives would reserve older, more structurally-complex forest, which provides the highest quality marbled murrelet nesting habitat, the forecasting of future marbled murrelet sites within the Harvest Land Base focused on younger stands than the No Action alternative. Therefore, this analysis used a different methodology for the action alternatives, which was based on extrapolating from previous marbled murrelet survey results using the proportion of survey stations that had marbled murrelet occupancy. This approach has the advantage of using consistent data that is currently available across the entire decision area. The station-based methodology provided an estimation of marbled murrelet sites based on the existing BLM corporate data, from the perspective of analyzing the effects on marbled murrelets. This methodology may underestimate the acres that would be reserved from timber harvest under an action alternative that would survey for marbled murrelet sites and reserve occupied sites. Estimating the acres of occupied marbled murrelet habitat is not the same as estimating the acres that would be reserved from timber harvest around an occupied site. Much of the difficulty in developing an effective methodology for analysis is in translating a positive survey result into an estimation of acres reserved from timber harvest. The station-based methodology provides an estimation for the purpose of analyzing the effects on marbled murrelets, but may underestimate the effects on timber harvest. However, the BLM lacks sufficient data at this time to describe quantitatively the overestimation of ASQ in the alternatives that would require protection of future marbled murrelet sites.

In order to calculate estimated reductions to ASQ levels from predictions of red tree vole in the action alternatives and marbled murrelet site occupancy and protection in all alternatives, the number of acres where timber harvest was precluded was determined using Geographic Information System (GIS) analysis. GIS analysis was then performed to determine which Harvest Land Base land use allocation those acres of forested land would have been in had the BLM not predicted occupancy. The BLM then multiplied those acres by the expected board feet per acre ASQ contribution estimated for that land use allocation and region based on values derived for **Figure 3-72**. This methodology produced an estimated ASQ reduction for each alternative for predictions of site protection associated with red tree voles and marbled murrelets reported in **Table 3-62**.

A similar methodology was also used to determine the ASQ reductions associated with northern spotted owl site protection in Alternative D, where areas were mapped as OHTA or LSR where needed to maintain spotted owl habitat around known, historic, and alternate sites. GIS analysis was used to determine how many acres of OHTA or LSR were mapped due to proximity of northern spotted owl sites, and the BLM estimated how many acres would have otherwise been mapped as either UTA or MITA. The difference in productive contribution of those acres were used to calculate the estimated ASQ reduction associated with northern spotted owl site management in Alternative D, reported in **Table 3-62**. In Sub-alternative B, the impacts to ASQ from northern spotted owl site protection were reported directly, since this was the single difference between this sub-alternative and Alternative B. Since the BLM made these deductions to the Harvest Land Base in the vegetation modeling, ASQ values reported in **Table 3-62** include them, with the exception of red tree vole management in the No Action Alternative.

The BLM also made deductions to long-term yields based on area lost to road construction and detrimental soil disturbances, insects and disease, defect and breakage, snag and downed wood requirements, and other factors. The Vegetation Modeling section earlier in this chapter provides more information on the calculations of ASQ and non-ASQ timber volume.

Background

The BLM has implemented timber harvest levels and a mix of harvest types that has differed from those anticipated in the 1995 RMPs. Specifically; the BLM has implemented less regeneration harvest and more commercial thinning (**Figure 3-71**). In 2012, the BLM conducted an evaluation of the 1995 RMPs in accordance with its planning regulations, and concluded that continuation of these trends in timber harvest practices is not sustainable at the declared ASQ level. Implementation of timber harvest since the adoption of the 1995 RMPs is described in detail in the BLM plan evaluations and is incorporated here by reference (USDI BLM 2012, pp. 6-12, and Appendices 3-8)

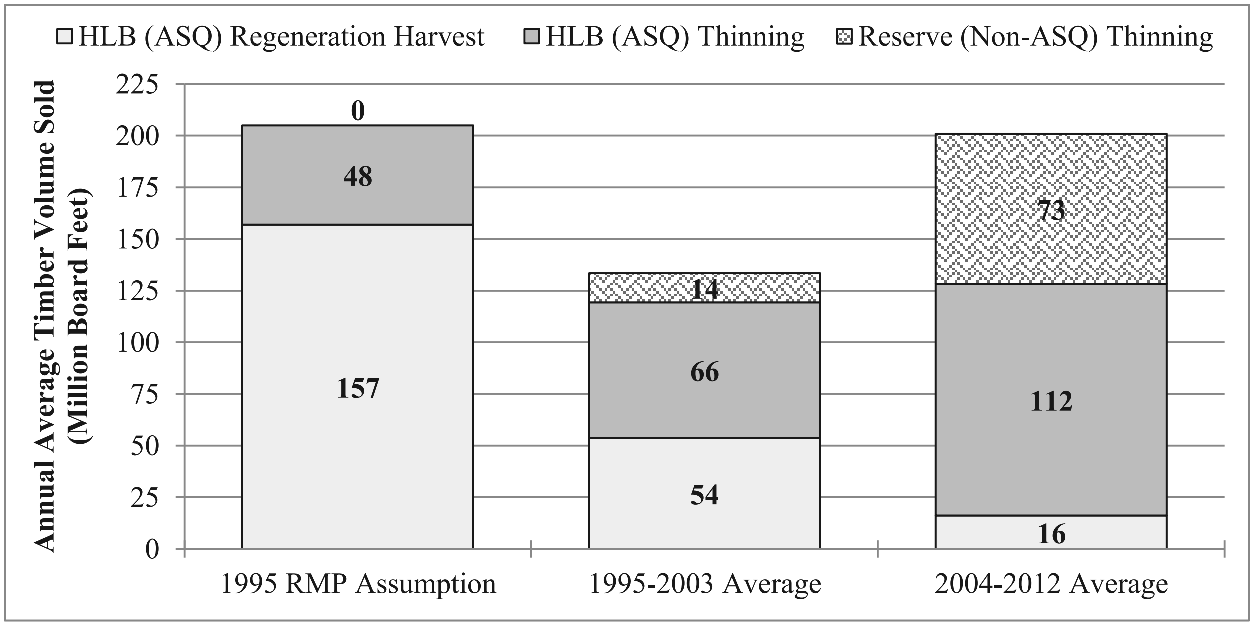

Figure 3-71. Assumed vs. implemented annual average sold timber volume (MMbf) levels and mix of harvest types, 1995 through 2012.

The 1995 through 2010 data in **Figure 3-71** comes from district data requests for the 2012 Resource Management Plan Evaluation Report. 2011 and 2012 data was generated from Forest Resource Information System (FRIS) data entered through 10-23-2014. Due to continual updates and data correction in FRIS, these estimates may be different from other estimates generated at different times or from different sources.

Affected Environment and Environmental Consequences

The BLM performed a reference analysis of "Manage most commercial lands for maximizing timber production" in the 2008 RMP/EIS (USDI BLM 2008, pp. 573-574) and that analysis is incorporated here by reference. This reference analysis evaluated the outcomes if all BLM-administered lands in the planning area capable of producing a long-term flow of commercial timber volume would be managed under intensive forest management, without regard for the requirements of other laws or the purpose and need for action. The results of this reference analysis concluded that the BLM-administered lands in the planning area are capable of producing approximately 1.2 billion board feet per year (**Table 3-60**). Although there have been some changes in the decision area that would slightly alter these calculations, as a result of timber harvest and growth since the calculations in the 2008 RMP/EIS, these results provide an approximate outcome that is still relevant for the decision area.

Table 3-60. Reference analysis; “Manage Most Commercial Lands for Maximizing Timber Production,” ASQ by district or field office. 1995 RMP declared ASQ.

District/Field Office	Scribner 16’ scale (MMbf Per Year)	
	Reference Analysis ASQ	1995 RMP Declared ASQ
Coos Bay	257	27
Eugene	273	33
Klamath Falls	10	6
Medford	174	57
Roseburg	198	45
Salem	289	35
Totals	**1,201**	**203**

The 1995 RMPs declared ASQ levels for each of the sustained-yield units (**Table 3-60**). The ASQ for the No Action alternative calculated here (277 MMbf) is substantially higher than the ASQ declared in the 1995 RMPs (203 MMbf) because of improvements in data and changes in forest conditions since 1995. Improved field validation and mapping of stream classification and fish presence has revealed that the analysis for the 1995 RMPs overestimated the extent of the Riparian Reserves and thereby underestimated the extent of the area available for sustained-yield timber production. In addition, new inventory data, revised growth and yield information, and increases in timber inventory in the decision area since 1995 have increased the calculation of the ASQ under the No Action alternative. This is consistent with the conclusion in the 2008 RMP/EIS, which calculated the ASQ for the No Action alternatives to be 268 MMbf (USDI BLM 2008, p. 575), and that discussion is incorporated here by reference.

Alternative C would have the highest ASQ among the alternatives, followed by Sub-alternative C, and the No Action alternative (**Table 3-61**). Major factors determining the ASQ under a given alternative are the size of the Harvest Land Base, the intensity of forest management practices, and restrictions on timber harvest (e.g., wildlife site protection, visual resource management, and recreation management).

Table 3-61. First decade ASQ timber harvest (MMbf/year Scribner 16’ Scale).[48]

District/Field Office	No Action	Alt. A	Alt. B	Sub. B	Alt. C	Sub. C	Alt. D
Coos Bay	46	46	23	14	82	66	22
Eugene	58	63	56	25	138	103	45
Klamath Falls	8	3	7	4	10	3	5
Medford	73	27	42	15	54	24	28
Roseburg	55	25	35	14	78	51	22
Salem	37	71	71	47	124	85	54
Totals	**277**[49]	**234**	**234**	**120**	**486**	**332**	**176**

Size of the Harvest Land Base

The size of the Harvest Land Base is dependent on a number of factors including Riparian Reserve widths, the size of the Late-Successional Reserve, including the threshold for protection of older, more structurally-complex forest, and the protection of future sites for some wildlife species under some of the

[48] Reported ASQ volumes are rounded to the nearest MMbf, so there are minor errors associated with rounding.
[49] The BLM has made no deduction in the vegetation modeling for reductions due to management of future Survey & Manage sites. This and other issues place uncertainty around the expression of ASQ for the No Action alternative.

alternatives. Chapter 2 contains a description of the design of each alternative and a description of the acreage in each land use allocation. The Harvest Land Base under Alternative C would be the largest among the alternatives (30 percent of the decision area) and smallest under Sub-alternative B (12 percent of the decision area).

Sub-alternative B would be identical to Alternative B, except that it would include protection of habitat within the home ranges of all northern spotted owl known, alternate, and historic sites that would be within the Harvest Land Base in Alternative B. This single change in design reduces the Harvest Land Base from 22 to 12 percent of the decision area, which is smaller than any other alternative. This difference in the size of the Harvest Land Base reduces the ASQ in Sub-alternative B by 114 million board feet per year from the ASQ in Alternative B.

Although the size of the Harvest Land Base has an important influence on the ASQ, it does not entirely determine the ASQ. For example, Alternatives A and B have almost identical ASQ levels, but the size of the Harvest Land Base would differ substantially (14 percent and 22 percent, respectively). Nevertheless, the size of the Harvest Land Base determines the number of acres of eligible forest stands that would be available for harvesting to meet the declared ASQ. Therefore, all other things held equal, the larger the Harvest Land Base, the higher the ASQ.

Intensity of Forest Management Practices

The more intensive the forest management practices applied, the more timber volume would be produced on a given acre of ground within a fixed unit of time. **Figure 3-72** shows a breakdown of calculated timber production rates by management intensity for the coastal/north areas, which generally have higher productivity lands, and the interior/south areas, which generally have lower productivity lands.

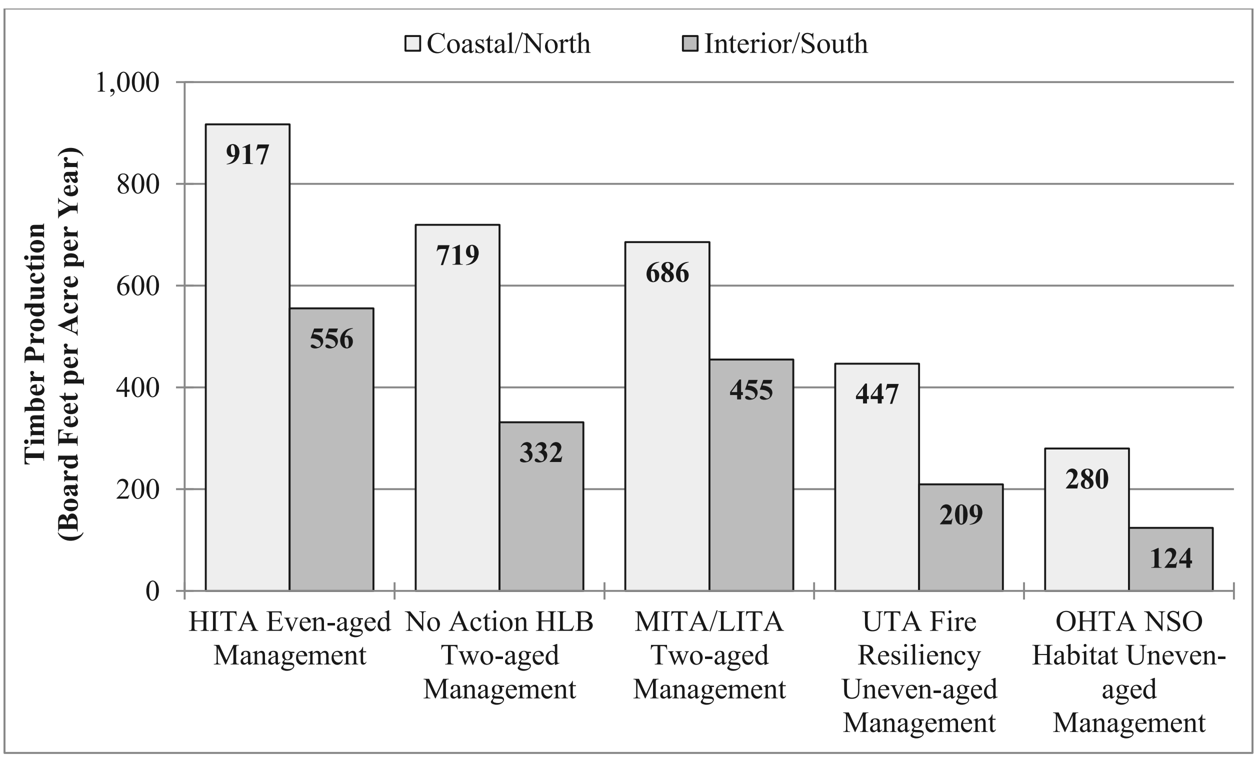

Figure 3-72. Timber production rates by management intensity (board feet per acre per year), broken out between coastal/north and interior/south areas.

The highest timber yields per acre would come from the HITA, because of even-aged management regimes including relatively short rotations, clear-cutting, rapid reforestation, fertilization, and control of competing vegetation. For every acre of HITA in the Harvest Land Base, the ASQ contribution would be approximately 917 board feet per year in the coastal/north area, or 556 board feet per year in the interior/south areas.

The second-highest timber yields per acre would come from lands managed under two-aged management regimes, which includes variable-retention regeneration harvesting. This category includes the Matrix[50] and Adaptive Management Areas in the No Action alternative, the MITA in Alternatives B and D, and the LITA in Alternative B. The reduction in timber yield per acre in these land use allocations compared to the HITA would result from the retention of a portion of the stand during regeneration harvest and the trend towards longer rotations (Birch and Johnson 1992, Long and Roberts 1992). The overstory retention in these land use allocations would also suppress the growth rates of regenerated trees compared the HITA, but this effect would be highly variable, and in part dependent on the arrangement of retention trees (Di Lucca *et al.* 2004, Temesgen *et al.* 2006, Urgenson *et al.* 2013). It is not possible at this scale of analysis with the data available to quantify the effects of varying levels of retention on the growth of the regenerating stand. The effects of varying retention levels in these land use allocations would also influence the timber yield per acre somewhat.

Nevertheless, for every acre one of these land use allocations is in the Harvest Land Base in the action alternatives, the ASQ contribution would average 686 board feet per year in the coastal/north area, or 455 board feet in the interior/south. For the No Action alternative, the ASQ contributions would be 719 board feet per acre per year in the coastal/north area, and 332 board feet per year in the interior/south. The reason the contribution from the interior/south is lower in the No Action alternative when compared to the action alternatives is that dry forest stands in the Harvest Land Base in the action alternatives would be managed using uneven-aged management in the UTA, while these dry forest stands are contained in lands dedicated to regeneration harvesting regimes in the No Action alternative. The dry forests tend to be lower productivity, thereby pulling the average production rate down in the interior/south in the No Action alternative.

Alternative B includes different reforestation practices after regeneration harvest than the other alternatives. In the MITA in Alternative B, the BLM would delay canopy closure for at least three decades after regeneration harvest, in order to prolong and enhance the early-successional stage of forest development. In the LITA in Alternative B, the BLM would rely on natural reforestation after regeneration harvest (i.e., natural seeding rather than planting). In all other alternatives, the BLM would ensure rapid reforestation following regeneration harvest, consistent with current practices. There is no apparent difference in timber yields between delayed canopy closure in the MITA in Alternative B and prompt canopy closure in the other alternatives, including the MITA in Alternative D. The average delay in canopy closure in the MITA in Alternative B would be 10 to 15 years beyond what would typically occur with standard reforestation practices. This delay would theoretically delay attainment of timber merchantability and thereby reduce overall timber yield per acre (Miller *et al.* 1993). However, any effect of delaying timber harvest in the MITA would be diluted by the trend towards longer rotation lengths that would occur in the MITA. Additionally, there are so many factors affecting the varying timber yield per acre among alternatives that it is not possible to isolate the effect of this single factor.

[50] The Matrix in the No Action alternative includes the General Forest Management Area, and Connectivity/Diversity Blocks, which identify differing levels of tree retention and other practices in regeneration harvest.

The LITA would produce an average of 18 percent less timber yield per acre than the MITA in Alternative B, because of the higher level of retention and projected reforestation failures after regeneration harvest. Based on evaluation of past natural reforestation, the BLM concludes that an average of 10 percent of each regeneration harvest unit in the LITA would fail to reforest, 30 percent would reforest at very low levels of stocking, and 60 percent would reforest at target stocking levels. Appendix C contains more details about assumptions related to reforestation rates. Reforestation failures would eliminate future timber harvest opportunities; reforestation at very low levels of stocking would preclude commercial thinning opportunities. In addition to reductions in timber yield from reforestation failures in the LITA, the reliance on natural reforestation would limit the ability to manage the species composition of the regenerating stand. This would also preclude replanting stands with disease-resistant trees, such as rust-resistant sugar pine or root disease-resistant Port-Orford-cedar. This reliance on natural reforestation would also preclude the ability of the BLM to shift tree species composition or tree genotypes within stands to adapt to changing climate conditions (see the Climate Change section in this chapter).

The third-highest timber yields per acre would come from the uneven-aged management in the UTA, which is included in all action alternatives. In this land use allocation, the continuous retention of substantial portions of the stand would reduce the timber yields compared to the yields under regeneration harvest. For every acre of UTA in the Harvest Land Base, the ASQ contribution would be approximately 447 board feet per year in the coastal/north area, or 209 board feet in the interior/south area.

The lowest timber yields per acre would come from uneven-aged management in the OHTA in Alternative D. In this land use allocation, the continuous retention of substantial portions of the stand would reduce the timber yields, as in the UTA. However, timber harvest would be further limited in the OHTA to meet direction to develop and then maintain northern spotted owl habitat function at the stand level, limiting the intensity of harvest and the size of openings, further reducing timber yield compared to the UTA. Appendix B contains more details on objectives and direction for each land use allocation. For every acre of OHTA, the ASQ contribution would be approximately 280 board feet per year in the coastal/north area, or 124 board feet in the interior/south area.

The varying timber yield per acre of the different land use allocations demonstrates the influence the intensity of forest management practices has on the ASQ. This influence on the ASQ can be as important as the size of the Harvest Land Base. For example, Alternative A has almost the same ASQ as Alternative B even though it has a much smaller Harvest Land Base because of the more intensive forest management practices in Alternative A. Alternative D, which has a larger Harvest Land Base than Alternatives A and B, has a lower ASQ because forest management practices would be less intensive.

Restrictions on Timber Harvest

The alternatives contain various potential restrictions on timber harvest in the Harvest Land Base that could influence the calculation of the ASQ. The restrictions in the action alternatives include site protection for northern spotted owls, protection of future marbled murrelet sites, protection of future North Coast DPS red tree vole sites, management of Wild and Scenic Rivers, visual resource management, and recreation management. The calculation of the ASQ in this analysis predicted the quantitative effects of some these potential restrictions. However, other potential restrictions are too uncertain to incorporate into the calculation of the ASQ. As a result, there are varying levels of uncertainty about the calculation of the ASQ among the alternatives because of these potential restrictions on timber harvest, as detailed below.

The No Action alternative includes a variety of restrictions on timber harvest in the Matrix and Adaptive Management Areas, including protection of known spotted owl activity centers, protection of future marbled murrelet sites, Survey & Manage protections, and the retention of old-growth fragments in watersheds where little remains. The effects of implementation of these restrictions on timber harvest levels are difficult to forecast, especially the Survey and Manage protections. The 2004 Final Supplemental EIS to Remove of Modify the Survey & Manage Mitigation Measure Guidelines discussed the difficulties in evaluating the effect of the Survey and Manage protections on timber harvest and provided estimates (USDA FS and USDI BLM 2000, pp. 428-438), and those discussions are incorporated here by reference. Because of the difficulty in forecasting future site abundances and locations for Survey and Manage species and the uncertainty of specific site management approaches, the BLM did not attempt to forecast restrictions on timber harvest within the Matrix and Adaptive Management Areas in the vegetation modeling. Red tree vole detection rates across the decision area between 2000 and 2012 irrespective of habitat condition are 42.1 percent. Assuming that 40 percent of stands in the Harvest Land Base where red tree voles are found become unavailable for long-term sustained yield timber production, this indicates that ASQ levels in **Table 3-61** for the No Action Alternative are 16.8 percent, or 47 MMbf/year too high (**Table 3-62**). Since the BLM did not include this assumption in vegetation modeling for the No Action Alternative, the BLM believes that the ASQ predictions in **Table 3-61** for the No Action Alternative are likely an overestimate. For the Adaptive Management Areas, the 1995 RMPs specifically directed developing and testing unspecified approaches to timber harvest and restrictions on timber harvest, lending considerable uncertainty to timber harvest levels within the Adaptive Management Areas. For the Adaptive Management Areas, the 1995 RMPs specifically directed developing and testing unspecified approaches to timber harvest and restrictions on timber harvest, lending considerable uncertainty to timber harvest levels within the Adaptive Management Areas.

Table 3-62. Estimated reductions to ASQ from wildlife surveys and site protection, million board feet per year.

Alternative	Marbled Murrelet	Red Tree Vole	Northern Spotted Owl Site Management	Survey and Manage	Totals
No Action	4	47[51]	-	Unknown	**> 51[20]**
Alt. A	-	-	-	-	**-**
Alt. B	6	6	-	-	**12**
Sub. B	6	6	115	-	**127**
Alt. C	2	-	-	-	**2**
Sub. C	-	-	-	-	**-**
Alt. D	29	4	57	-	**90**

The BLM deducted the values from the expression of ASQ in **Table 3-62**, with the exception of red tree vole management in the No Action Alternative. Potential reductions to ASQ in the No Action Alternative due to the management of future red tree vole sites were not included in the vegetation modeling.

Sub-alternative B includes protection of habitat within the home ranges of all northern spotted owl known and historic sites that would be within the Harvest Land Base in Alternative B, as described above. This would reduce the ASQ by approximately 115 million board feet per year. Alternative D includes protection of habitat within the nest patch of all northern spotted owl known and historic sites, and sets thresholds for habitat within core areas and home ranges of all known and historic sites, limiting timber harvest. The BLM estimates that the combination of these two approaches to site management in Alternative D reduces the ASQ by 57 million board feet (**Table 3-62**). None of the other alternatives

[51] The potential 47 MMbf per year reduction in ASQ for the No Action Alternative due to future red tree vole site management shown in **Table 3-62** was not deducted from the estimate of ASQ in **Table 3-61**.

would require specific site management for known or historic northern spotted owl sites in the Harvest Land Base.

All alternatives except Alternative A and Sub-alternative C require marbled murrelet surveys prior to habitat disturbing activities and site protection for newly-discovered sites in a portion or the entirety of the range of the marbled murrelet in the decision area. The effect of protection of future marbled murrelet sites on the ASQ would vary with the extent of the Harvest Land Base subject to surveys and the extent of protection around newly-discovered sites. Marbled murrelet surveys and site protection would have the greatest effect on the ASQ in Alternative D, which would require surveys in marbled murrelet Zones 1 and 2 and protection of habitat within ½ mile around newly-discovered occupied sites, with an estimated ASQ reduction of 29 million board feet per year (**Table 3-62**). The effect of protection of future marbled murrelet sites on the ASQ is predicted to be relatively small in Alternative B, Sub-alternative B, and Alternative C, because these alternatives would require surveys in a smaller area and a protect a smaller amount of habitat around newly discovered sites than Alternative D. The small reduction in ASQ projections in the No Action alternative relative to the action alternatives is due, in part, to the difference in modeling methodology used, as discussed above.

Alternative B, Sub-alternative B, and Alternative D require surveys prior to habitat-disturbing activities and site protection for newly-discovered sites for the North Coast DPS red tree vole. This site protection in these alternatives would reduce the acres in the Harvest Land Base, thereby reducing the ASQ. Protection around newly-discovered North Coast DPS red tree vole sites would reduce the ASQ in Alternative B and Sub-alternative B by 6 million board feet per year, and in Alternative D by 4 million board feet per year. Red tree vole surveys and protection are required across the decision area in the No Action alternative under Survey and Manage protections and the potential reductions to the ASQ were not built into the vegetation modeling (**Table 3-62**).

The alternatives vary in the protection of wilderness characteristics outside of designated Wilderness Areas. However, the alternatives do not include the protection of wilderness characteristics in the Harvest Land Base on O&C lands, as discussed in the section on the O&C Act and the FLPMA in Chapter 1. Therefore, there is no influence on the protection of wilderness characteristics on the calculation of the ASQ in any of the alternatives.

The corridors of rivers that are suitable for Wild and Scenic River designation overlap the Harvest Land Base in all alternatives, but in widely varying amounts: 18 acres in the No Action alternative, 4,140 acres in Alternative A, 9,215 acres in Alternative B, 11,317 acres in Alternative C, and 8,595 acres in Alternative D. In all alternatives, the inner portion of each river corridor would be within the Riparian Reserves. Which river segments would be recommended for inclusion in the Wild and Scenic River system varies by alternative, and the degree to which management in the outer portion of the river corridor (outside of the Riparian Reserve) would conflict with Harvest Land Base management would vary by alternative. The calculation of the ASQ did not attempt to account for restrictions in timber harvest in the outer portion of the corridors of rivers that would be recommended for inclusion in the Wild and Scenic River System. These restrictions would likely reduce but not preclude sustained-yield timber harvest contribution from these areas. Therefore, potential restrictions on timber harvest in the outer portion of corridors of rivers that would be recommended for inclusion in the Wild and Scenic River System adds some uncertainty to the ASQ calculations. In Alternative A, there would be no potential restrictions on timber harvest, because none of the eligible river segments would be recommended for inclusion. In Alternatives B and D, the harvest practices may be reconciled with river corridor management by modifying the arrangement, location, and target level of retention trees. The greatest potential for restrictions on timber harvest in the river corridors would be in Alternative C, because of the greatest acreage of overlap with the Harvest Land Base and difficulty of reconciling clear-cutting in the HITA with river corridor management. Potential mitigation measures, such as adjusting timber harvest practices to include or increase retention levels in regeneration harvests in these overlapping areas could reduce or avoid this conflict.

Visual Resource Management (VRM) areas in Alternatives C and D would identify areas of VRM II or VRM III within the Harvest Land Base, which may limit intensity of timber harvest. In Alternatives A and B, all lands in the Harvest Land Base would be managed as VRM IV, which would not limit the intensity of timber harvest. In the UTA in Alternative C or D or in the OHTA in Alternative D, timber harvest may be reconciled with visual resource management in areas managed as VRM II or VRM III. In the MITA in Alternative D, timber harvest may be reconciled with visual resource management in areas managed as VRM III. However, there may be restrictions on timber harvest in the HITA in Alternative C in areas managed as VRM II or VRM III and in the MITA in Alternative D in areas managed as VRM II (**Table 3-63**). The calculation of the ASQ did not attempt to account for restrictions in timber harvest in these areas in Alternatives C and D. These restrictions would likely reduce but not preclude sustained-yield timber harvest contribution from these areas. Potential mitigation measures, such as adjusting timber harvest practices to include or increase retention levels in regeneration harvests in these overlapping areas could reduce or avoid this conflict. Nevertheless, potential restrictions on timber harvest in these areas add some uncertainty to the ASQ calculations for Alternatives C and D.

Table 3-63. Compatibility of sustained-yield management regimes with VRM classifications.

Classification*	HITA (Even-aged Management)	LITA/MITA/No Action (Two-aged Management)	OHTA/UTA (Uneven-aged Management)
VRM I			
VRM II			
VRM III			
VRM IV			

*Dark grey boxes indicate that the management regime would generally be incompatible.
Cross-hatched boxes indicate that the management regime may be compatible.
Light grey boxes indicate that the management regime would generally be compatible.

Within Special Recreation Management Areas (SRMA), the BLM would manage and protect specific recreation opportunities and recreation setting characteristics on a long-term basis. This recreation management may restrict timber harvest where SRMAs overlap with the Harvest Land Base, which occurs in all alternatives in widely varying amounts: 168,968 acres in the No Action alternative, 29,065 acres in Alternative A, 24,972 acres in Alternative B, 59,046 acres in Alternative C, and 86,693 acres in Alternative D. In these areas of overlap, the BLM would not preclude sustained yield timber harvest, but management for recreational values could condition or reduce it. The calculation of the ASQ did not attempt to account for restrictions in timber harvest in these areas. In some areas of overlap, timber harvest under the alternatives may be compatible with recreation management. Where incompatible, recreation management would restrict timber harvest, but not preclude it. Potential mitigation measures, such as adjusting timber harvest practices to include or increase retention levels in regeneration harvests in these overlapping areas could reduce or avoid this conflict. Nevertheless, this potential restriction on timber harvest presents an unquantified level of uncertainty in the ASQ calculations for all alternatives.

In summary, restrictions on timber harvest in the Harvest Land Base would have varying levels of influence on the ASQ and would present varying levels of uncertainty about the ASQ calculation among the alternatives. The quantified effects on the ASQ would be substantial for protection of future marbled murrelet sites in Alternative D, and the management of known and historic northern spotted owl sites in Sub-alternative B and Alternative D. Although the effect is quantified here, the potential restrictions related to future marbled murrelet sites in the No Action alternative, Alternative B, Sub-alternative B, and Alternatives C and D present uncertainty, and the effects on timber harvest are likely underestimated here.

Unquantified potential restrictions on timber harvest would present substantial uncertainty in the ASQ calculation for the No Action alternative, especially related to implementation of Survey and Manage protections and forest management within Adaptive Management Areas. Areas of overlapping designations could result in potential restrictions on timber harvest in some alternatives, most notably where the HITA in Alternative C would overlap with designations for Wild and Scenic Rivers, VRM II, VRM III, or SRMAs.

Issue 3

What would be the total timber harvest volume, including timber harvested from the reserve land use allocations, under each alternative?

Summary of Analytical Methods

In addition to the calculation of the ASQ described above, the Woodstock model also provided calculations of timber volume produced from reserve land use allocations. In contrast to the ASQ volume, timber volume that would be produced as a by-product of silvicultural treatments in reserve land use allocations (i.e., non-ASQ volume) would change over time and eventually decline in moist forest areas. Therefore, the volume from reserve land use allocations does not constitute sustained-yield timber production and does not contribute to the ASQ. The calculation of the non-ASQ volume for each alternative was also a direct output from the vegetation modeling, but reflected modeling assumptions about the intensity and extent of thinning needed to achieve the management objectives of the reserve land use allocations.

Background

The management direction in the 1995 RMPs directed thinning in the Late-Successional Reserves and Riparian Reserves to attain the management objectives of those land use allocations and permitted timber salvage after disturbance under certain conditions. However, as noted in the BLM plan evaluations, the analysis for the 1995 RMPs did not include an assessment of the potential harvest volume from the reserve allocations, hardwood conversion, or reserve salvage harvest (USDI BLM 2012, p. 11).

Affected Environment and Environmental Consequences

Between 1995 and 2012, the BLM has sold an average of 167 million board feet of timber annually in the decision area, including both ASQ and non-ASQ volume. Between 2004 and 2012, the BLM sold an average of 73 million board feet of non-ASQ timber annually, out of an average total timber volume sold of 201 million board feet. In 2011 and 2012, non-ASQ volume averaged 38 percent of total timber volume sold in the decision area (**Figure 3-73**).

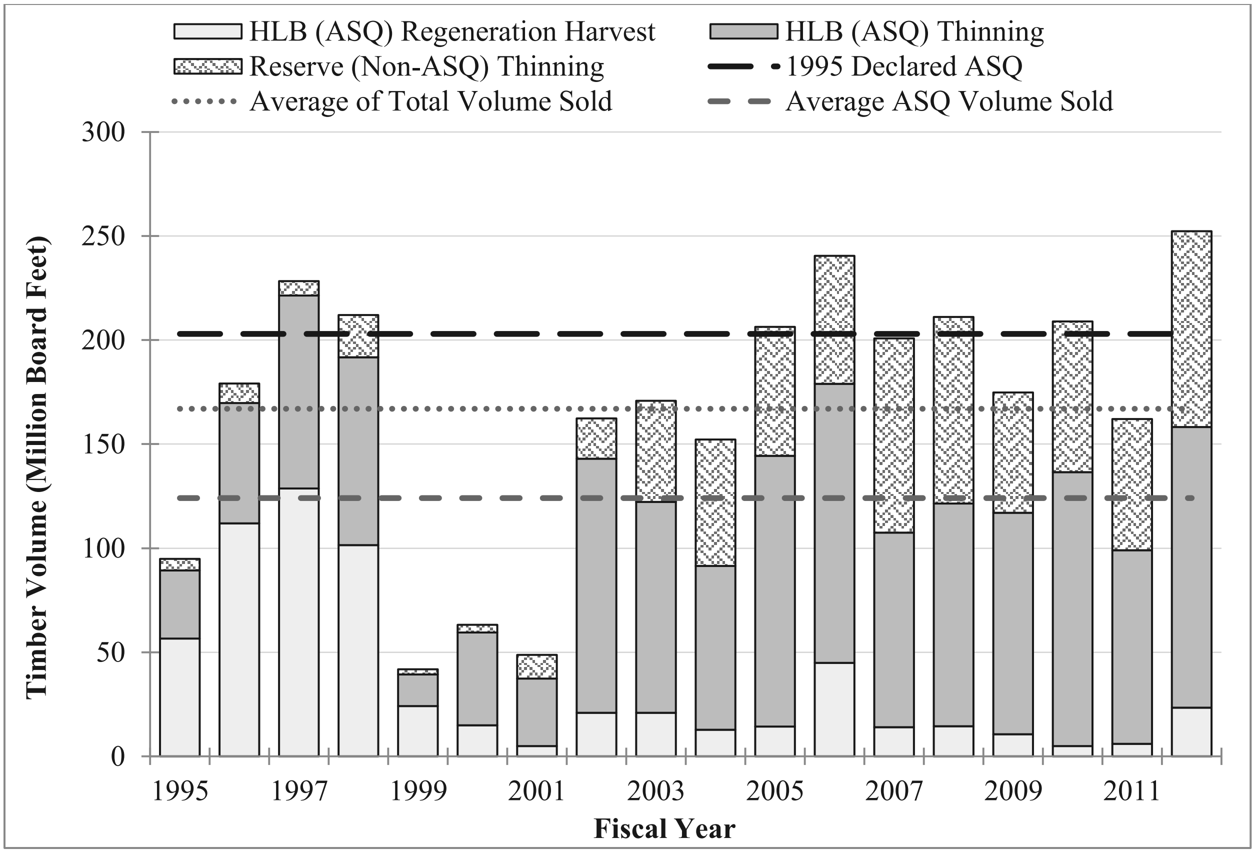

Figure 3-73. Total ASQ vs. Non-ASQ timber volume sold in the decision area between 1995 and 2012.

In **Figure 3-73**, the 1995 through 2010 data comes from office data requests for the 2012 Resource Management Plan Evaluation Report. 2011 and 2012 data was generated from Forest Resource Information System (FRIS) data entered through 10-23-2014. Due to continual updates and data correction in FRIS, these estimates may be different from other estimates generated at different times or from different sources.

Alternative C would have the highest total harvest volume at 555 million board feet per year during the first decade, while Alternative D would have the least, with 180 million board feet per year (**Figure 3-74** and **Table 3-64**).[52] The No Action alternative would provide the most non-ASQ volume in the first decade, followed by Alternative B and Sub-alternative B. Alternatives A and D would provide the least non-ASQ volume. The amount of non-ASQ volume under the alternatives would be heavily influenced by management direction for reserve thinning and the forest conditions within the reserve.

[52] Both **Figure 3-74** and **Table 3-64** contain minor errors associated with rounding.

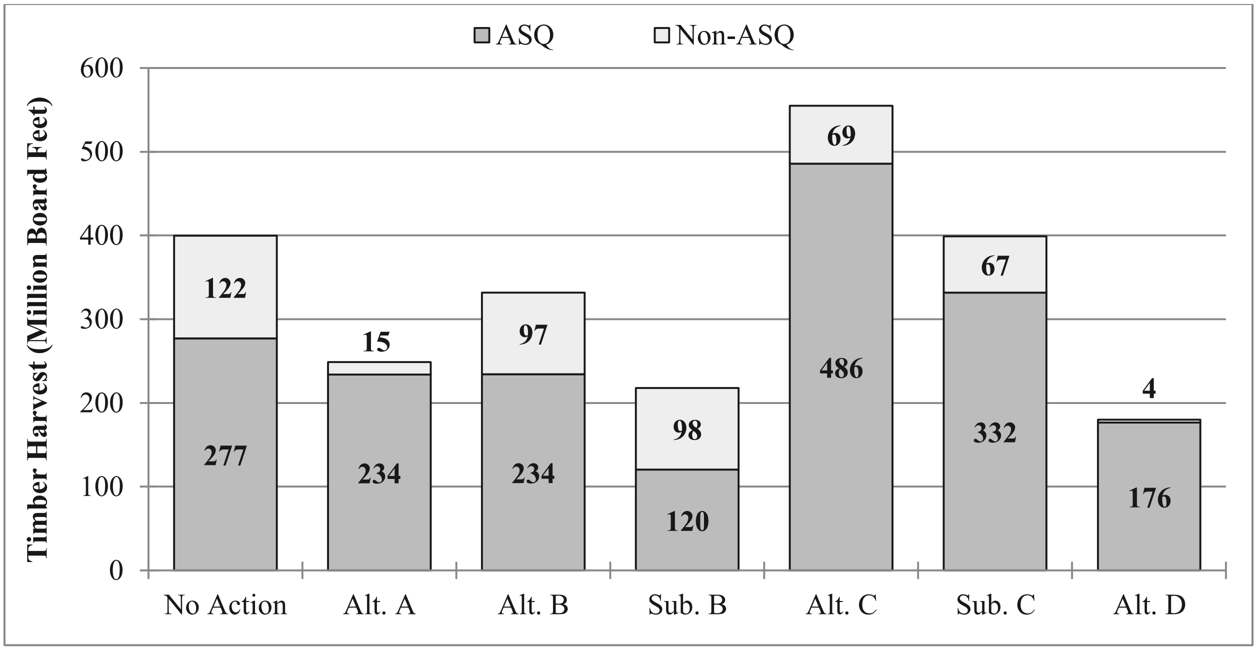

Figure 3-74. Total annual timber harvest for the first decade by alternative (MMbf), broken out between ASQ and non-ASQ sources.

Table 3-64. First decade total annual timber harvest volume by district (MMbf) broken out between ASQ and non-ASQ sources.

Alternative	Coos Bay		Eugene		Klamath Falls		Medford		Roseburg		Salem		Totals (MMbf)
	ASQ (MMbf)	Non-ASQ (MMbf)	ASQ (MMbf)	Non-ASQ (MMbf)	ASQ (MMbf)	Non-ASQ (MMbf)	ASQ (MMbf)	Non-ASQ (MMbf)	ASQ (MMbf)	Non-ASQ (MMbf)	ASQ (MMbf)	Non-ASQ (MMbf)	
No Action	46	22	58	31	8	-	73	12	55	17	37	41	**400**
Alt. A	46	-	63	-	3	1	27	11	25	3	71	-	**249**
Alt. B	23	24	56	26	7	-	42	16	35	12	71	19	**332**
Sub. B	14	24	25	26	4	-	15	16	14	12	47	19	**218**
Alt. C	82	15	138	17	10	-	54	12	78	10	124	15	**555**
Sub. C	66	15	103	17	3	-	24	10	51	9	85	15	**399**
Alt. D	22	-	45	1	5	-	28	1	22	1	54	1	**180**

The non-ASQ timber volume under Alternative D would be very low (4 million board feet per year during the first decade), because few if any stands allocated to the Late-Successional Reserve would require silvicultural treatments. Most timber harvesting in Reserves in this alternative would be restricted to a small outer zone in the Riparian Reserve. This Riparian Reserve thinning would provide almost all of the non-ASQ volume under Alternative D.

The non-ASQ timber volume under Alternative A would be low (15 million board feet per year during the first decade), because Alternative A would employ non-commercial silvicultural treatments in moist forest reserves. The small non-ASQ volume in Alternative A would be produced almost entirely in the interior/south areas where removal of cut trees would be needed to manage fuels and promote forest resiliency.

The No Action alternative generally precludes management of stands over 80-years-old in reserves. In the Late-Successional Reserve and Riparian Reserve in the dry forest, none of the action alternatives specify an age limit for determining treatment eligibility. Alternative B and Sub-alternative B limit timber harvest in Late-Successional Reserves in the moist forest to stands no more than 120-years-old. None of the other action alternatives would specify an age limit for silvicultural treatments in the reserve land use allocations in the moist forest. Instead, treatment eligibility for Reserves in the action alternatives would generally be based on habitat evaluations, rather than specific age limits. Regardless of the variation in age limits prescribed in the management direction, the BLM assumed that the majority of reserve treatments would occur in stands less than 80-years-old in moist forests, and would not occur within older, more structurally-complex forests, as defined in that alternative in dry forests.

The non-ASQ volume would decline in future decades, as fewer moist forest stands would need silvicultural treatments to achieve reserve land use allocation management objectives. This decline would be more pronounced in the coastal/north area than in the interior/south due to the higher proportion of dry forest reserves in the south. Under the action alternatives, the BLM assumed that management in the Late-Successional Reserve in the dry forest would include stand density reductions, cultivation, release of large trees with old-growth characteristics, and introductions of heterogeneity into increasingly uniform stands. As described in more detail in the Fire and Fuels section, the BLM assumed that mechanical treatments would be necessary to both restore dry forest stands and maintain them in a restored condition in order to increase stand resiliency to fire, disease, and the potential, yet unknown effects from climate change. This would involve selection harvest on a variable, but perpetual, re-entry cycle to keep stands from becoming overstocked. As a result, the non-ASQ volume associated with silvicultural treatments of Late-Successional Reserves would not taper off to zero in any alternatives except the No Action alternative and Alternative D (**Table 3-65**).

Table 3-65. Annual non-ASQ timber harvest by decade: coastal/north vs. interior/south.

Alternative	Area	2023 (MMbf)	2033 (MMbf)	2043 (MMbf)	2053 (MMbf)	2063 (MMbf)	2113* (MMbf)
No Action	Coastal/North	94	87	76	63	46	-
	Interior/South	29	28	28	25	18	-
Alt. A	Coastal/North	0.1	0.1	0.2	0.8	0.3	0.3
	Interior/South	15	10	11	10	17	19
Alt. B	Coastal/North	70	66	57	47	33	-
	Interior/South	27	22	22	20	23	18
Sub. B	Coastal/North	70	66	57	47	33	-
	Interior/South	27	22	22	20	23	18
Alt. C	Coastal/North	47	45	38	31	22	-
	Interior/South	22	18	17	16	16	11
Sub. C	Coastal/North	48	45	38	31	22	-
	Interior/South	20	13	12	11	19	2
Alt. D	Coastal/North	2.6	2.4	2.0	1.6	0.9	-
	Interior/South	1.1	1.0	1.0	0.9	0.6	-

* This table has minor errors associated with rounding

In summary, all alternatives would result in higher total harvest volumes in the first decade than the average annual timber sale volumes from the decision area since 1995. Although Sub-alternative B has the lowest ASQ volume out of any alternative, the total harvest volume would be 218 million board feet per year compared to 180 million board feet per year under Alternative D. Alternative C would have the highest total annual harvest in the first decade with 555 million board feet per year followed by the No Action alternative with 400 million board feet per year. Non-ASQ timber harvest volumes would decline and eventually disappear in the moist forest Late-Successional Reserve, while non-ASQ timber harvest from dry Late-Successional Reserve would generally continue in future decades.

Issue 4

What log sizes would be harvested under each alternative?

Summary of Analytical Methods

The outputs from the Woodstock model grouped harvested timber volume into four generalized size/quality groups (**Table 3-66**). The BLM based these groupings on small end diameter inside bark from harvest tables, including taper assumptions by species group.

Table 3-66. Log size groups by diameter class.

Size Group	Timber Diameter Class (Inches)
1	>20”
2	12” to 20”
3	8” to 11”
4	<8”

Affected Environment and Environmental Consequences

Because the vast majority of BLM timber harvesting in the past decade has come from thinning stands less than 80-years-old, most of the timber volume has been coming from log size groups 2 through 4, with relatively little timber volume being produced in log size group 1 (logs greater than 20").

The percentage of timber harvested in log size groups 2, 3, and 4 would differ only slightly among the alternatives. However, the alternatives would differ more substantially in the percentage of timber harvested in log size group 1. Log size is generally smaller in younger stands, and taking older, more structurally-complex forests out of the Harvest Land Base would increase the reliance on timber harvest in younger stands. The percentage of timber in log size group 1 would be lowest in Sub-alternative C, at 5 percent of total volume; because Sub-alternative C would reserve all stands currently older than 80-years-old. The percentage of timber in log size group 1 would be highest in the No Action alternative, which does not specifically reserve older, more structurally-complex forest, and in Alternative C, which would reserve all stands currently older than 160 years (**Table 3-67**).

Table 3-67. Percentage of total timber harvest volume by log size group; first 5 decades.

Log Size Group	No Action (% Harvest Volume)	Alt. A (% Harvest Volume)	Alt. B (% Harvest Volume)	Sub. B (% Harvest Volume)	Alt. C (% Harvest Volume)	Sub. C (% Harvest Volume)	Alt. D (% Harvest Volume)
1	14%	10%	10%	9%	14%	5%	11%
2	50%	52%	50%	48%	51%	47%	47%
3	22%	23%	23%	24%	21%	28%	24%
4	15%	16%	16%	18%	14%	20%	18%

Issue 5

What harvest types and silvicultural practices would the BLM apply under each alternative?

Summary of Analytical Methods

In the vegetation modeling, the BLM made assumptions for harvest types consistent with the management direction for each alternative (Appendix C). These harvest types fall into the following five categories:

- Commercial thinning
- Selection harvest
- Variable-retention regeneration harvest
- Clear-cutting
- Salvage

Non-commercial thinning in the Late-Successional Reserve in Alternative A would generally not include timber harvest, as the BLM would fell the timber and leave it on site. Non-commercial thinning it is not reported in the timber harvest categories, but it is included in the report on silvicultural treatments (**Table 3-68**). Timber harvest implemented in the Late-Successional Reserve in the dry forest is categorized as selection harvest in the action alternatives, but as thinning in the No Action alternative, because of differences in management direction. Variable-retention regeneration harvesting would include all regeneration harvest practices in the Matrix and Adaptive Management Area in the No Action alternative, regeneration harvest in the MITA and LITA in Alternative B and Sub-alternative B, and regeneration harvest in the MITA in Alternative D. All timber harvesting in the UTA in all action alternatives and in the OHTA in Alternative D is in the selection harvest category, with the exception of salvage.

The Woodstock model predicted the acreage of silvicultural treatments associated with timber harvest for each decade under each alternative. These silvicultural treatments include fuels reduction, site preparation, planting, stand maintenance and protection, pruning, stand conversion, pre-commercial thinning, and fertilization. The extent of many silvicultural treatments is linked directly to the amount and type of regeneration harvest implemented. For example, following a regeneration harvest, the BLM would typically implement site preparation, tree planting, and stand maintenance. The BLM assumed that no fertilization would be implemented under Alternative B, Sub-alternative B, and Alternative D, because of the forest management practices in those alternatives. Modeling assumptions about post-fire timber salvage are used to approximate the management direction for salvaging after natural disturbances included in Appendix B by land use allocation. For the Harvest Land Base in all alternatives, except for the OHTA in Alternative D, the BLM assumed that timber salvage would occur after high- and moderate-severity fire events. In the OHTA in Alternative D, and the Late-Successional Reserve in Alternative C, the BLM assumed that timber salvage would occur only after high-severity fire events. Alternative C is the only alternative in which the BLM modeled timber salvage volume from Reserves. The BLM did not simulate the occurrence of other natural disturbance in the vegetation modeling including insect and disease outbreaks or wind-throw; however, the management direction in **Appendix B** provides salvage guidance for all natural disturbances.

Affected Environment and Environmental Consequences

The 1995 RMPs estimated levels of silvicultural treatments that would occur because of implementation of the plan, but the BLM has generally not achieved these levels of treatments. The BLM plan evaluations concluded that implementation of the timber management program was departing substantially from the outcomes predicted in the 1995 RMPs (USDI BLM 2012). On average, implementation of regeneration harvests has been 26 percent of levels anticipated in the 1995 RMPs, varying from 9 percent to 36 percent among districts. Commercial thinning has averaged 137 percent of levels anticipated in the 1995 RMPs, varying from 95 percent to 569 percent among districts. With the exception of commercial thinning, the levels of silvicultural activities within the decision area (**Table 3-68**) have been substantially less than anticipated in the 1995 RMPs. Average decadal accomplishments in the decision area since 1995 include 14,275 regeneration harvest acres sold and 122,245 acres of thinning sold. For this calculation, timber salvage is lumped into either the regeneration harvest category where it is the most similar. The levels of reforestation treatments have been directly affected by the timber harvest activities that the BLM implemented. The lack of anticipated regeneration harvest levels and the shift to commercial thinning reduced the extent of reforestation activities since 1995.

Table 3-68. Average decadal silvicultural treatment accomplishment acres 1996-2012.

Silvicultural Treatment	Coos Bay (Acres)	Eugene (Acres)	Klamath Falls (Acres)	Medford (Acres)	Roseburg (Acres)	Salem (Acres)	Totals (Acres)
Fertilization	14,213	1,511	-	1,389	3,440	2,903	**23,456**
Pre-commercial Thinning	18,135	21,374	10,352	26,423	36,428	27,082	**139,793**
Pruning	8,786	4,174	406	6,079	5,791	2,723	**27,960**
Slash Disposal and Site Preparation	2,928	2,759	30,727	129,829	4,573	6,522	**177,338**
Stand Conversion	489	-	92	-	-	121	**703**
Stand Maintenance and Protection	25,552	13,032	2,053	17,860	12,958	22,330	**93,784**
Tree Planting	5,170	4,243	2,236	22,156	4,726	4,851	**43,383**

Alternative C would have the largest acreage of clear-cutting of any alternatives and the largest acreage of regeneration harvest overall. The No Action alternative would have the largest acreage of variable retention-regeneration harvest. Alternative D would have the largest acreage of selection harvest. Based on simulations of wildfire occurrence and subsequent salvage harvest, salvage harvest would occur on a small acreage under all alternatives (359 acres per year or less). Alternative C would have the largest salvage harvest acreage of all alternatives, in part because Alternative C would direct the salvage in the Late-Successional Reserve after natural disturbances to recover economic value (**Figure 3-75**). Since the BLM did not simulate the occurrence of other natural disturbances besides wildfire in the vegetation modeling, these salvage figures are likely an underestimate.

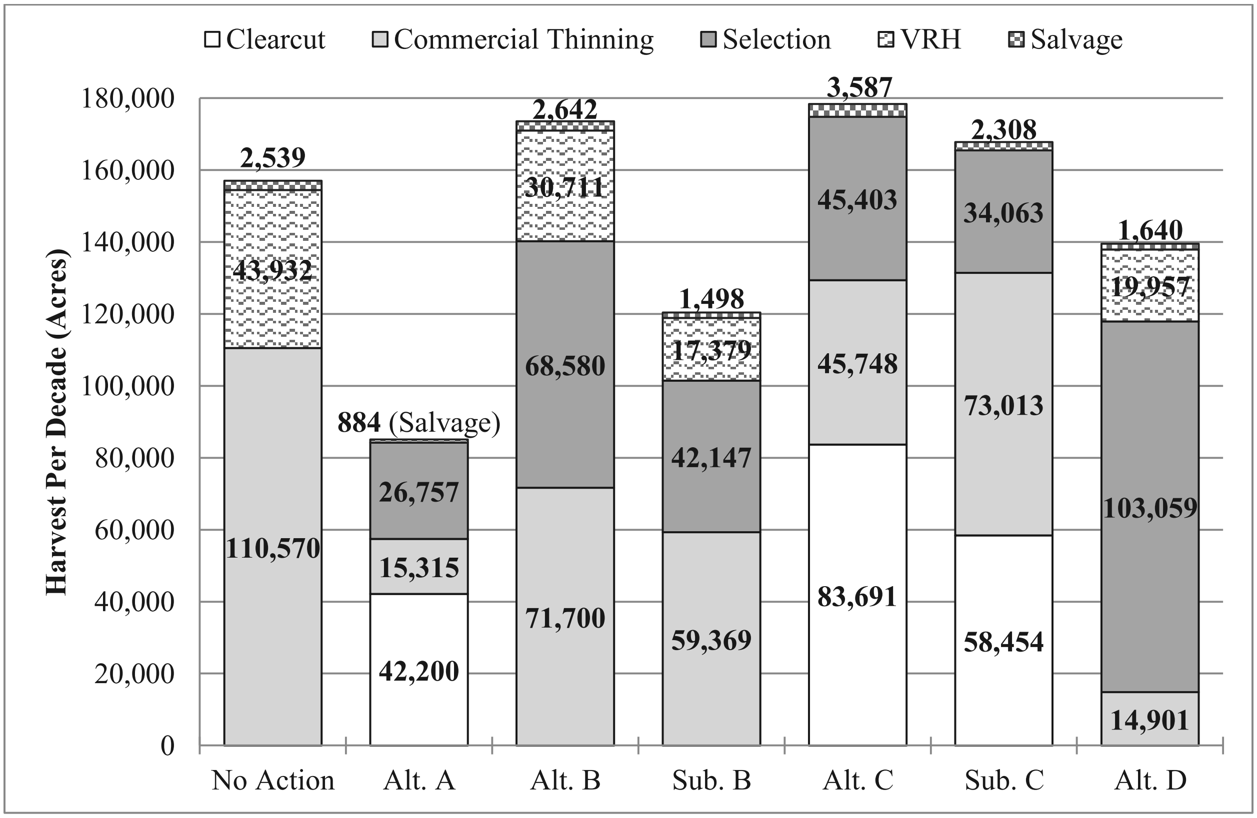

Figure 3-75. Harvest acres per decade by harvest type and by alternative; average of the first two decades.

The acreage of timber harvest would not mirror the volume of timber harvest, as discussed above in the issue on the annual productive capacity. The dramatic difference in the timber volume per acre among the harvest types, results in different patterns in acres that would be harvested and timber volume among the alternatives (**Figures 3-76** and **3-77**). For example, Alternative A would harvest the fewest total acres of all alternatives, but would harvest the fifth-highest timber volume out of the seven alternatives presented. Alternative B would harvest the second-largest acreage, but would harvest the fourth-highest timber volume. Alternative D would harvest the fifth-highest acreage, but would harvest the least timber volume. These relationships are explained by the average timber volume per acre removed, which varies by harvest type, and is influenced by the log size class of timber eligible for harvest.

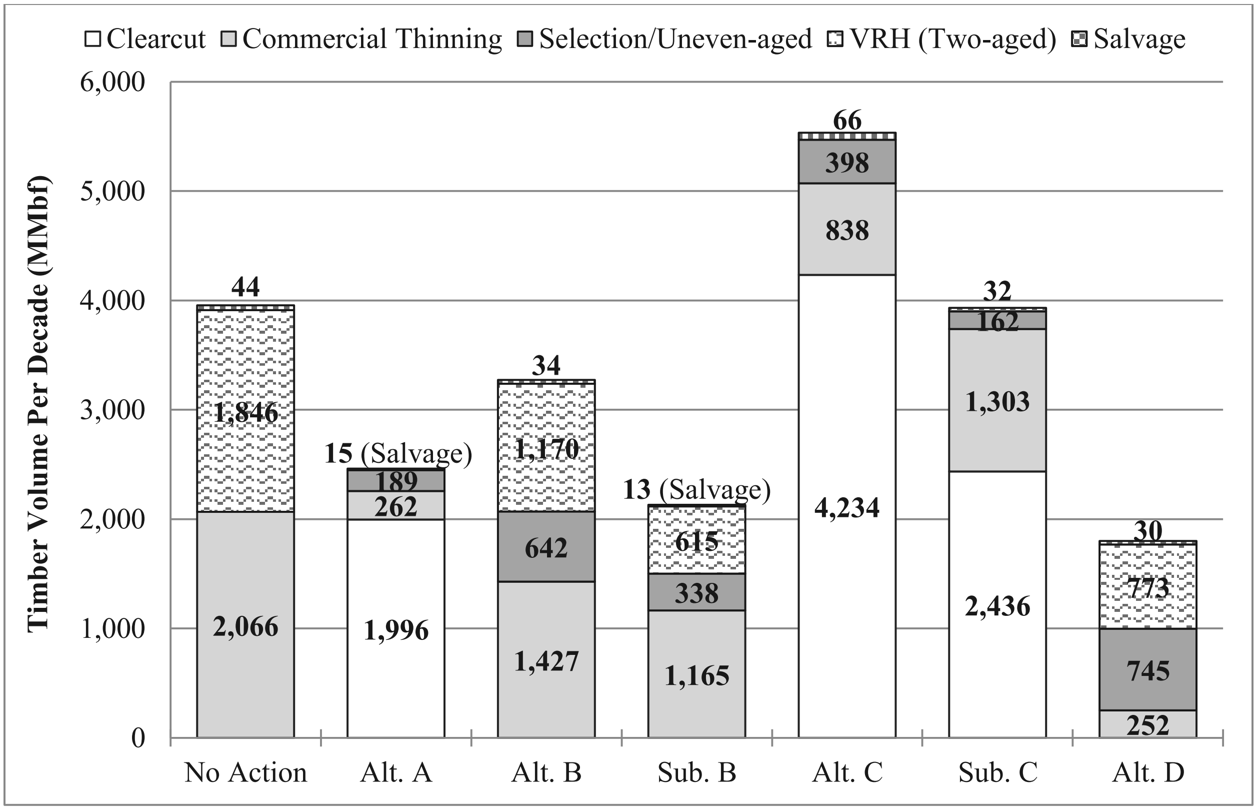

Figure 3-76. Harvested timber volume (MMbf) per decade by harvest type and by alternative; average of the first two decades.

Average timber harvest volume per acre also varies between the coastal/north and interior/south areas. Total annual timber harvest acreage is higher in the coastal/north area in the No Action alternative and Alternative C, and higher in the interior/south area in Alternative B. Total annual harvest acreage in the other alternatives is relatively comparable between the coastal/north and the interior/south (**Figure 3-77**). However, total harvested timber volume per year is substantially higher in the coastal/north area than the interior/south in all alternatives (**Figure 3-78**).

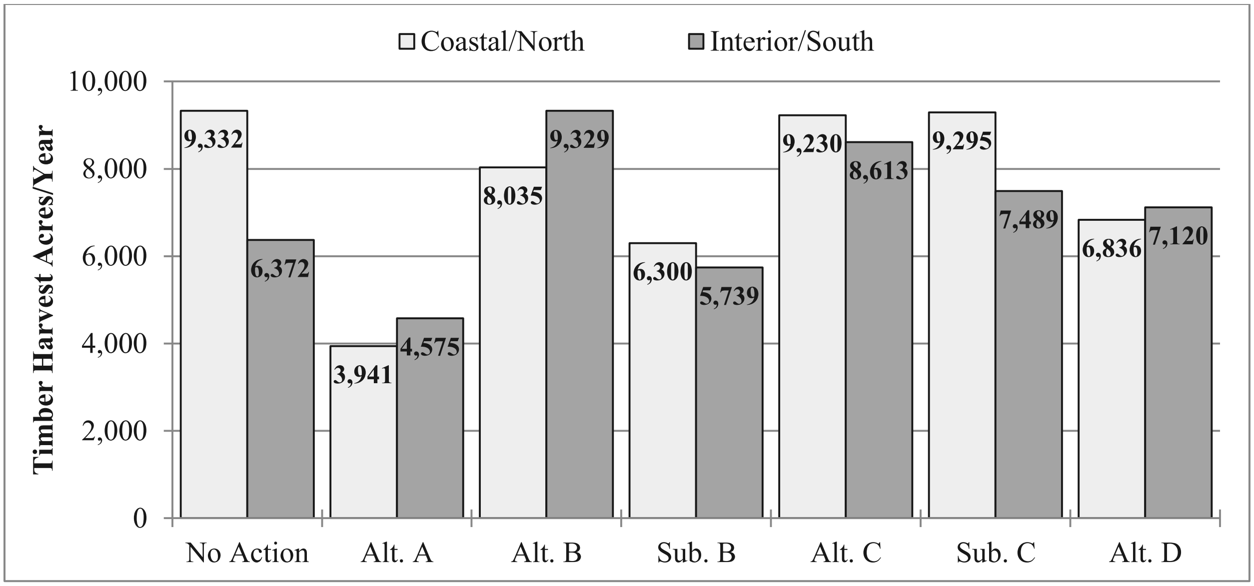

Figure 3-77. Total timber harvest acreage per year; average of first two decades, broken out between coastal/north and interior/south areas.

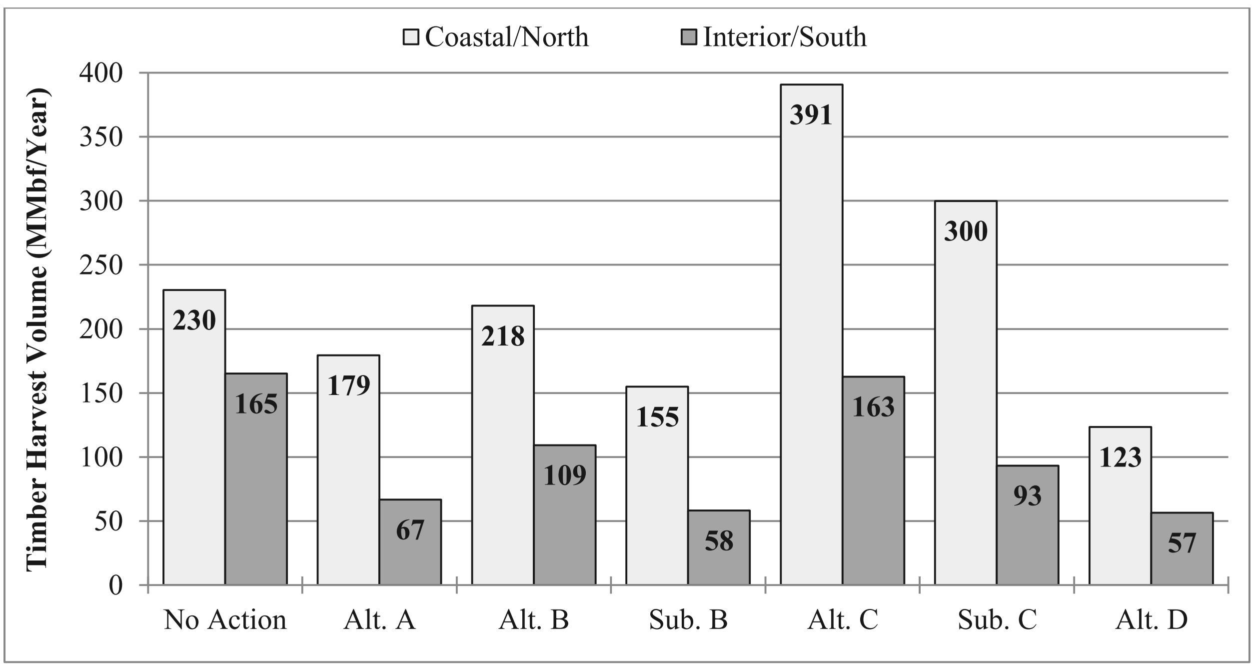

Figure 3-78. Total timber harvest volume (MMbf) per year; average of first two decades, broken out between coastal/north and interior/south areas.

The acreage of most silvicultural treatments, especially reforestation, site preparation, and stand maintenance activities that would occur under the alternatives is correlated with the acreage of regeneration harvest (i.e., clear-cutting and variable-regeneration retention harvest). Uneven-aged management regimes would also require reforestation, site preparation, and stand maintenance activities, but these activities would only be undertaken on a portion of the treatment acres in a given decade. Alternative C would have the highest acreage of most silvicultural treatments and Alternative D would have the least acreage (**Table 3-69**).

Table 3-69. Treatment acreages per decade by alternative; average of first two decades.

Treatment Type	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Sub. B (Acres)	Alt. C (Acres)	Sub. C (Acres)	Alt. D (Acres)
Non-Commercial Thinning	-	12,957	-	-	-	-	-
Under Burn	8,907	16,760	16,571	9,871	33,152	23,792	10,410
Hand Pile and Burn	24,734	23,309	35,349	21,950	45,751	36,590	25,822
Landing Pile and Burn	5,402	3,089	6,313	3,926	6,479	7,158	4,955
Machine Pile and Burn	14,780	7,429	13,353	9,874	17,907	17,197	10,313
Slash and Scatter	20,201	14,231	30,092	18,390	27,437	22,248	22,280
Mastication	3,010	4,669	3,902	2,129	10,664	7,488	2,352
Planting	55,999	57,223	44,750	27,154	117,004	82,669	38,064
Stand Maintenance and Protection	82,573	89,061	77,213	45,432	181,801	130,114	60,578
Pre-commercial Thinning	54,366	49,570	43,778	25,429	97,420	69,758	26,148
Fertilization	10,989	15,606	-	-	19,139	36,222	-
Pruning	3,498	4,362	3,878	2,119	9,474	6,516	2,740
Stand Conversion	114	295	216	164	555	436	139
Totals	**284,573**	**298,561**	**4,094**	**2,283**	**566,783**	**440,188**	**2,879**

In summary, Alternative C would have the most acres of clear-cutting per decade, followed by Sub-alternative C and Alternative A. The No Action alternative would have the most acres per decade of variable-retention regeneration harvesting, followed by Alternative B. Alternative D would have the most acres of selection harvest followed by Alternative B. Silvicultural treatments acres would be correlated most strongly to the number of acres of clear-cutting and variable-retention regeneration harvesting, although other harvest types would also require silvicultural treatments to a lesser degree. Annual acreage of timber harvests is relatively comparable between the coastal/north and the interior/south areas in the alternatives, with the exception of the No Action alternative, Sub-alternative C, and Alternative B. However, total annual timber harvest is substantially higher in the coastal/north areas in all alternatives.

Issue 6

How would each alternative affect the availability of special forest products?

Summary of Analytical Methods

In this analysis, the BLM divided special forest products into two broad categories:[53]

- Category I- disturbance-associated special forest products- Christmas trees, wood products, some transplants (manzanita), some edibles and medicinals (huckleberries), some floral and greenery (beargrass), some seeds and seed cones (pine cones), and some mushrooms (morels)
- Category II- disturbance-averse special forest products- some transplants (ferns), some edibles and medicinals (wild ginger), some floral and greenery (mosses), some seeds and seed cones (hemlock cones), some mushrooms (chanterelles), coniferous boughs, and burls

[53] These categories are not a formal designation and are simply labeled here for the purpose of analysis.

The BLM assumed for the analysis that disturbances such as timber harvesting, prescribed fire, and wildfire would produce the conditions that would support Category I special forest products, and areas that did not experience these disturbances would support Category II special forest products. The BLM assumed that less intensive treatments such as pre-commercial thinning, fuel reduction, and fertilization, would have no effect on conditions for either category of special forest products. The more acres that would be disturbed by timber harvest, prescribed fire, and wildfire in the decision area, the more acres would be available for harvest of Category I species. The more acres that would be undisturbed in the decision area, the more acres would be available for harvest of Category II special forest products.

In this analysis, the BLM considered acres that received no timber harvest, prescribed fire, or wildfire within the previous 20 years as undisturbed and therefore supporting Category II special forest products. The BLM used outputs from the Woodstock model to estimate future disturbed and undisturbed areas, in order to compare special forest product availability between the alternatives.

This analysis only addresses broad characterizations of the supply of special forest products. The BLM lacks information on the extent to which supply would affect the collection of special forest products or other factors that would affect collection. The number of available acres suitable for the collection of these products does not forecast future demand or sustainable harvest levels for each of these products. The BLM also assumed that public access was available to all lands that would be available to special forest products harvesting. Finally, each specific product has fine-scale associations by aspect, plant association, and other unique site-level factors beyond disturbance history. The BLM does not have sufficient product-specific, species-specific, or site-specific information at this scale of analysis to refine this analysis beyond the broad categories of special forest products and the broad characterizations of disturbance.

Background

Special forest products is a term used to describe some of the vegetative material found on public lands that can be harvested for recreation, personal use, or as a source of income. They include grasses, seeds, roots, bark, berries, mosses, greenery (e.g., fern fronds, salal, and huckleberry), edible mushrooms, boughs, tree seedlings, transplants, poles, posts, and firewood. Trees or logs that contain saw timber are not considered SFP.

Management of special forest products (SFP) is an important component of resource management in Oregon/Washington BLM. SFPs are commonly referred to as "minor forest products" and are restricted to vegetative material. The SFP program benefits the Oregon/Washington BLM and the public in many ways. Some of these benefits are to contribute to the economic stability in local communities, provide critical cultural and subsistence benefits, support of a variety of cottage industries, form partnerships with groups concerned with the harvest of management of these products, and provide educational opportunities regarding the value of our natural, renewable resources.

Commercial, personal, and incidental uses are distinct categories for public users on BLM-administered lands, although the boundaries between personal and incidental use blend. Commercial use of special forest products requires a permit and harvesters generally search for and harvest high value products from patches in a systematic and thorough method for high resale value. Many individuals enjoy harvesting or collecting special forest products for their own personal use and tend to harvest smaller quantities, searching less systematically and less thoroughly and at a smaller spatial scale. Some personal use special forest products also require permits, such as Christmas trees and firewood. Incidental use includes collection and gathering of berries and mushrooms for immediate use and firewood for campfires. Although most commercial harvesters in the Pacific Northwest do not rely on special forest products for their sole source of income these products do provide important supplemental or seasonal sources of income that contribute to household economies (Charnley 2006).

Permits for commercial use and some types of personal use for special forest products may include restrictions to help meet ecological and renewable resource standards and to protect other sensitive resource values. Permits may restrict the type of species, quantity harvested, harvest or collection method, location, access and season.

Field inventories of special forest products that include distribution and abundance, harvest areas, and actual harvest amounts on BLM-administered lands are lacking.

Affected Environment and Environmental Effects

Currently, 11 percent of the forested lands in the coastal/north area are suitable for the collection of Category I special forest products, while 16 percent of forested lands in the interior/south area are currently available for collection of these products. Conversely, almost 89 percent of the coastal/north area and 84 percent of the interior/southern area are currently suitable for the collection of disturbance-averse special forest products. Based on this analysis, the availability of Category I special forest products are more limited than Category II special forest products in the decision area.

Under all alternatives, the interior/south area would consistently have a higher proportion of the forested land available for the harvesting of Category I special forest products than the coastal/north area (**Figures 3-79** and **3-80**).

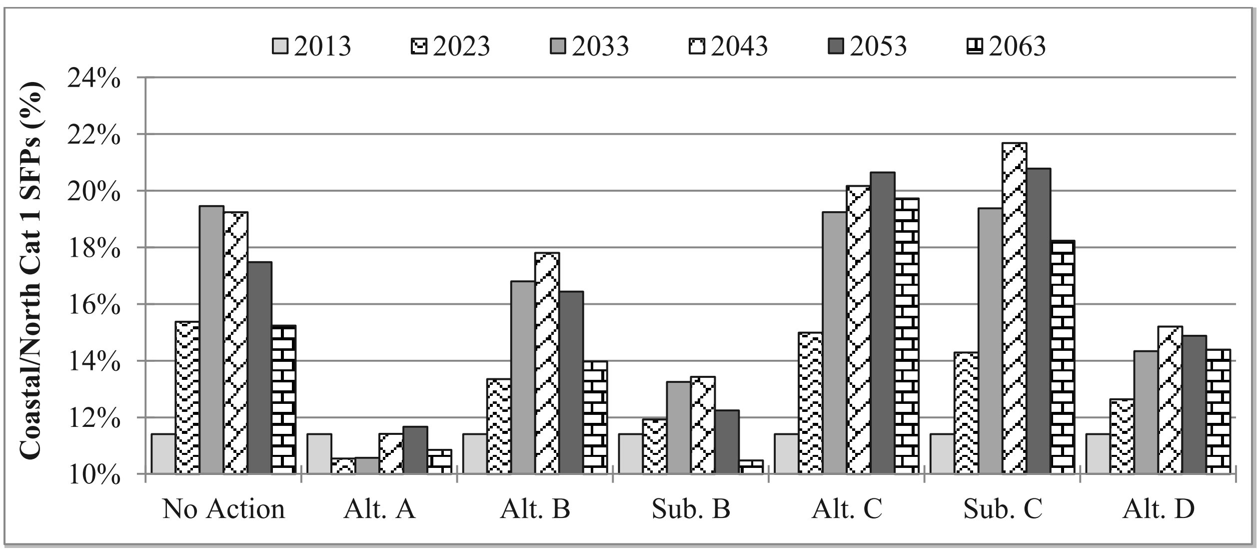

Figure 3-79. Percentage of forested acres suitable for the collection of Category I special forest products; coastal/north area.

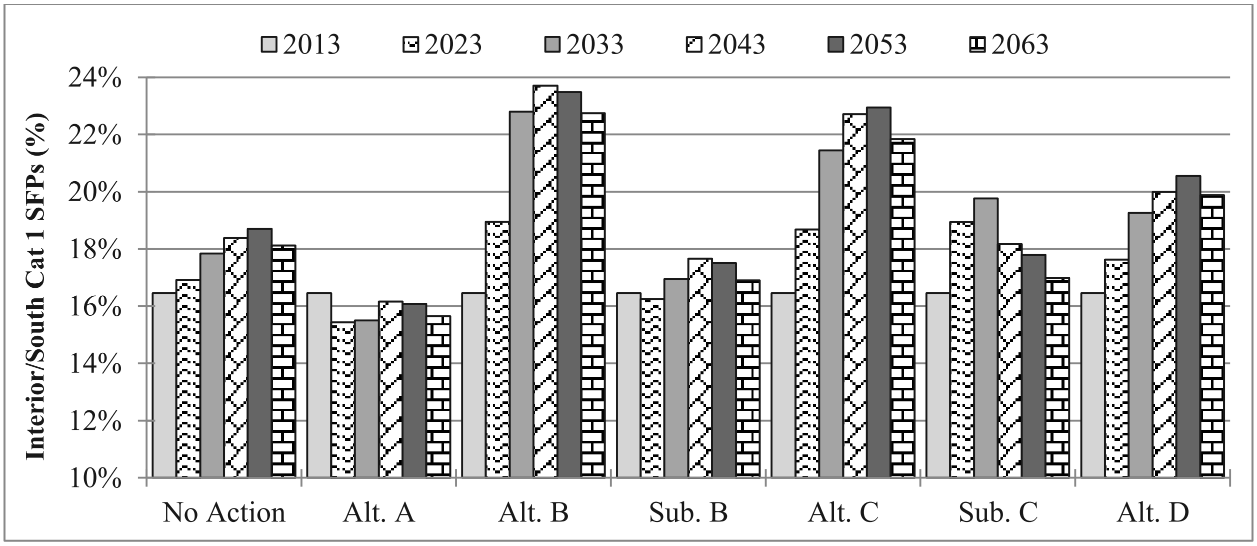

Figure 3-80. Percentage of forested acres suitable for the collection of Category I special forest products; interior/south area.

In the coastal/north, Alternatives C and Sub-alternative C would have the largest acreage available for harvest of Category I special forest products, followed by the No Action alternative and Alternative B. Alternative A would have the smallest acreage suitable for these disturbance-related products. In fact, the acreage available for harvesting Category I special forest products would decline in the coastal/north in the first two decades from current conditions under Alternative A (**Figure 3-79**).

In the interior/south, Alternative B would have the largest acreage suitable for the collection of Category I special forest products, followed by Alternative C and Alternative D. As in the coastal/north, Alternative A would have the smallest acreage suitable for the harvesting of these products. The acreage available for harvesting Category I special forest products in the interior/south would decline in the first five decades from current conditions under Alternative A (**Figure 3-80**).

Conversely, the coastal/north would consistently have more acreage available for the collection of Category II special forest products. Regardless of alternative, decade, or region, the proportion of the forested area available for the collection of Category II special forest products would be above 75 percent of forested acres in the decision area (**Figures 3-81** and **3-82**).

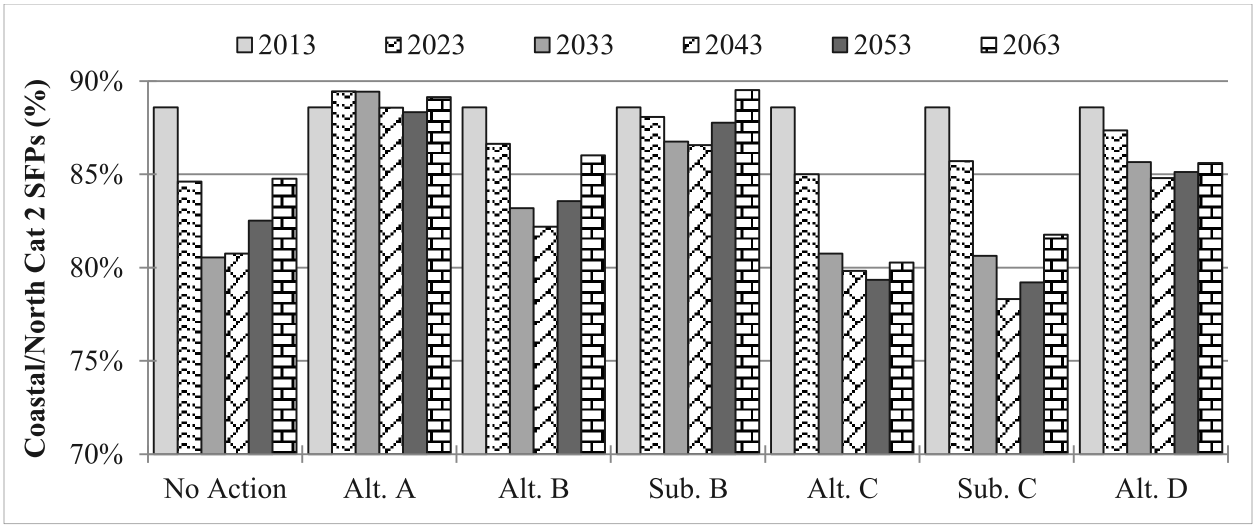

Figure 3-81. Percentage of forested acres suitable for the collection of Category II special forest products; coastal/north area.

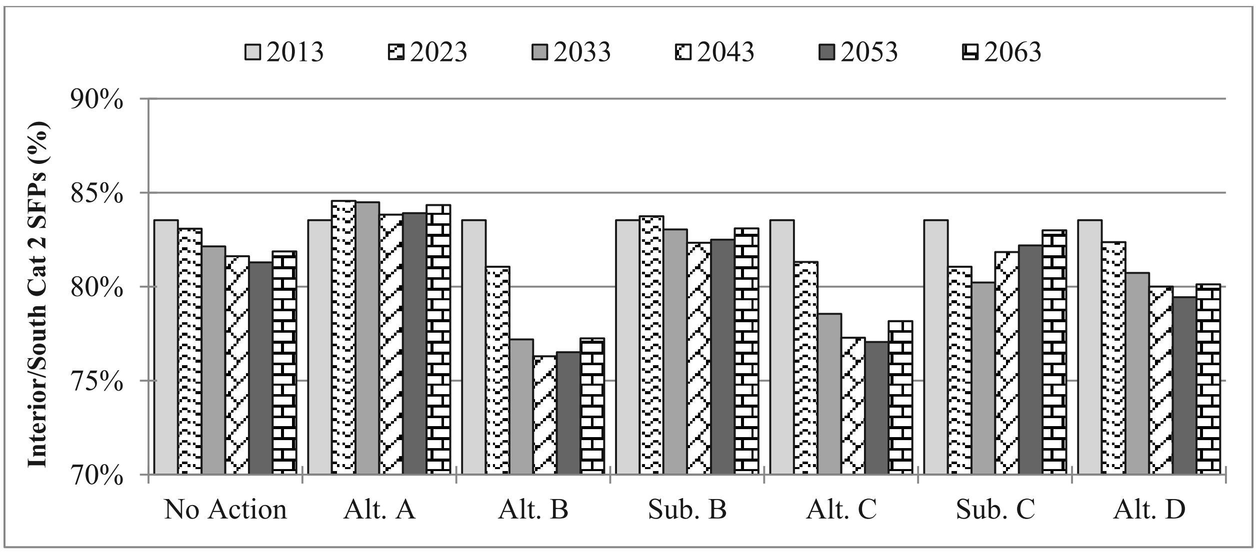

Figure 3-82. Percentage of forested acres suitable for the collection of Category II special forest products; interior/south area.

In summary, the acreage of forests available for the harvesting of Category II (disturbance-averse) special forest products would remain abundant in all alternatives, especially in the coastal/north areas. The acreage of forests available for the harvesting of Category I (disturbance associated) special forest products would be more limiting than Category II special forest products, and consistently higher in the interior/south than the coastal/north due to disturbed acres associated with both prescribed fire and wildfire. Availability of these forest conditions in the coastal/north areas would be almost completely dependent on harvesting practices. Therefore, the alternatives that include the most timber harvest acreage would also produce the largest number of acres available for the collection of Category I special forest products. In the coastal/north, Alternative C and Sub-alternative C would have the largest acreage available for harvest of Category I special forest products, followed by the No Action alternative and Alternative B. In the interior/south, Alternative B would have the largest acreage suitable for the collection of Category I special forest products, followed by Alternatives C and D.

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Hydrology

Key Points

- The BLM analyzed stream shading using two methods. By one method, all alternatives would avoid any measurable increases in stream temperature. The other method identified a small percentage of streams where forest management in the outer Riparian Reserve under Alternatives B and C would potentially affect stream temperature.
- Less than 2 percent of the decision area would susceptible to peak flow increases over time under any alternative. The No Action alternative and Alternatives A and D would result in slight decreases and Alternatives B and C would result in slight increases in the number of sub-watersheds susceptible to peak flow increases over time.
- Less than 1 percent of the Harvest Land Base would be have susceptibility to landsliding with the potential to deliver sediment to streams over time under any alternative. Alternative C would have the highest acreage of regeneration harvest in areas with susceptibility to landsliding, and Alternative D would have the lowest acreage.
- Under all alternatives, potential sediment delivery to streams from new road construction would constitute less than a one percent increase above current levels of fine sediment delivery from existing roads.

Issue 1

To what extent would each alternative maintain effective shade along streams?

Summary of Analytical Methods

This analysis addresses stream shading along each side of fish-bearing and perennial streams on BLM-administered lands. This analysis evaluates existing and projected forest vegetation that provides shade and maintains cool stream temperatures. Primary components of shade (forest tree height, canopy density, and Riparian Reserve width) form the basis of the analysis, rather than measuring stream temperature variation along watercourses directly. The physics of stream temperature gain or loss within forest streams is highly correlated to the extent and quality of shading vegetation (see Background section).

Each action alternative defines overall Riparian Reserve widths, divided into an inner zone and an outer zone. Management direction for the inner and outer zones addresses a variety of actions and varies by action alternative. This analysis assumed that the defined inner zone would be maintained unthinned and that restoration thinning would occur in outer zones under all action alternatives. In light of the differences in management direction for the outer zone, the analysis assumed that riparian restoration thinning would occur over a greater percentage of stands suitable for thinning and would thin stands to a lower density in Alternatives B and C than in Alternatives A and D.

The No Action alternative defined interim Riparian Reserve widths that could be modified after watershed analysis. For this analysis, the BLM assumed that Riparian Reserves under the No Action would remain at the interim widths, two site-potential tree heights for fish-bearing streams and one site-potential tree height for perennial streams. Under the No Action alternative, riparian thinning is allowed anywhere in the Riparian Reserve with no specific retention requirements. However, activities must meet the Aquatic Conservation Strategy objectives, which are often difficult to interpret at the site scale. Although not explicitly stated in the 1995 RMPs, this analysis assumed that an inner zone 60-foot width along each side of a stream would be retained unthinned under the No Action alternative because of any combination of: stream temperature concerns and maintenance of streamside shade, large and small wood recruitment needs over time, sediment filtering and channel stability where steep and unstable inner gorges must be protected to prevent landsliding. This analysis assumed that where young forest stands in the Riparian Reserves are overstocked, thinning would occur in the outer portion of the Riparian Reserves for a variety of restoration objectives.

In this analysis, the BLM used two different methodologies to evaluate stream shade. Method A determines the width of Riparian Reserves by empirical relationships necessary to provide 80 percent effective shade and relies upon previous work in the 2008 RMP/EIS (USDI BLM 2008). Effective shade is the percentage of sun blocking by topography, forest trees, and vegetation during a solar day. Effective shade reaches an upper limit in the 80 to 90 percent range for normally-stocked young to mature forest stands (USDA FS and USDI BLM 2012). During daylight hours in the summer months when stream heating is a concern, the sun's altitude (vertical zenith angle) and horizontal position (azimuth) change constantly directing solar radiation down to the earth's surface. Solar radiation intensity at the water surface varies with the sun's altitude, azimuth, and cloud cover, diminishing with blocking by topography and reflection or adsorption by forest tree crowns (Brazier and Brown 1972, Boyd 1996). The sun's path length through vegetation decreases transmissivity, particularly where leaf area is high (DeWalle 2010). Where the solar angle exceeds the forest shade angle from the tallest trees, solar radiation will reach the water body (Boyd 1996). When varying angular canopy density is summed for the primary daytime hours and weighted for the proportion of incoming solar radiation blocked for each time period, an estimate of effective shade is obtained. Angular canopy density is the sun-blocking vegetation in the path of the sun from 10 a.m. to 2 p.m. (Brazier and Brown 1972). For normally stocked young to mature forest stands, forest shade tends to reach a maximum near 80 percent effective shade, where increasing the width of the Riparian Reserve further only marginally improves effective shade. Gaps in forest vegetation as well as the quality of shade from needles, leaves, tree-branches and boles, even in mature forest stands, prevent much higher measures of effective shade. There is always some solar radiation transmissivity to the water surface through needles and leaves and over the tallest trees, especially near solar noon.

Method A compares the Riparian Reserve allocations in the alternatives to a 60-foot width inner area and 50 percent canopy closure zone to one site-potential tree height width[54] (USDI BLM 2008, Appendix I – Water, pp. 250-253) along each side of perennial and fish-bearing streams. Analytical conclusions determine the miles of perennial and fish-bearing streams that are not substantially similar by HUC 12 watershed. Streamside forests reach a shade limit in the range of 60- to 100-feet width. Wider Riparian Reserves would provide no further shade benefit, because the solar path lengths through forest vegetation are sufficiently long, where direct beam solar radiation has already been extinguished (DeWalle 2010). A disadvantage of Method A is that it considers a uniform management prescription in the outer zone. The empirical relationships in Method A do not consider angular canopy density that blocks sunlight outside the 10 a.m. to 2 p.m. daily period. However, this design has a negligible effect on decreasing effective shade, because incoming solar radiation intensity is significantly lower during early morning and late afternoon hours, mountainous topography provides shade at these hours, and longer solar path lengths through the sides of forest trees are extinguishing available solar radiation (Boyd 1996, DeWalle 2010). Method A basis does not crosswalk with water quality studies and models to determine if temperature changes are occurring from before-after management activities. Rather, Method A uses an approach that establishes effective shade that is near potential natural shade, based on empirical relationships by Brazier and Brown (1972) and Steinblums *et al.* (1984).

Method B, proposed by the Environmental Protection Agency, presents a mechanistic modeling approach that uses the ODEQ shade model to develop shade loss tables for each alternative Riparian Reserve design. The rationale uses a before-after-control-impact design, where observed changes in stream

[54] Site-potential tree height generally varies from 140 to 240 feet width in the planning area.

temperature are due to the difference between pre-harvest and post-harvest monitoring (Groom *et al.* 2011). The EPA methodology considers whether various widths and canopy cover densities in inner and outer zones of the Riparian Reserve would result in shade loss associated with management that would increase stream temperature. Although Groom *et al.* (2011) determined that levels less than six percent shade loss would have no statistical effect on raising stream temperatures, the EPA has proposed an analytical threshold of no greater than three percent shade loss level, to allow for a factor of safety. In this analysis, shade loss levels greater than three percent would represent a risk of stream temperature increases. This analytical threshold does not represent a specific requirement for management, but an analytical tool for interpreting the results of this analysis.

BLM cross-walked shade density from the ODEQ shade model to canopy cover in the Woodstock model to provide a common attribute in addition to riparian area width to evaluate the alternatives using the EPA shade loss tables. The change is necessary because modeled canopy cover measures have removed tree-to-tree overlap that influences canopy density and shade. Results from modeled canopy density underestimate field measured canopy cover. Fiala *et al.* (2006) found that modeled canopy cover is consistently lower when compared to field measurement of canopy cover and suggest that a regression equation is best to compare measurements of canopy cover. McIntosh *et al.* (2012) compared modeled canopy cover results with a ground-based estimate of canopy cover and reported that equations underestimated cover by 17 percent on average at high cover levels (greater than 70 percent) in wet conifer and wet hardwood stands. Using this approach, the BLM used field measured canopy cover along selected streams from western Oregon districts to form a regression equation (**Figure 3-83**) between pre-harvest vegetation density (shown in the EPA shade loss tables) and canopy cover. The EPA reviewed this regression equation, and provided field measured studies that support the interpretations. This is a modification of the analytical methodology described in the Planning Criteria (USDI BLM 2014, pp. 68-72).

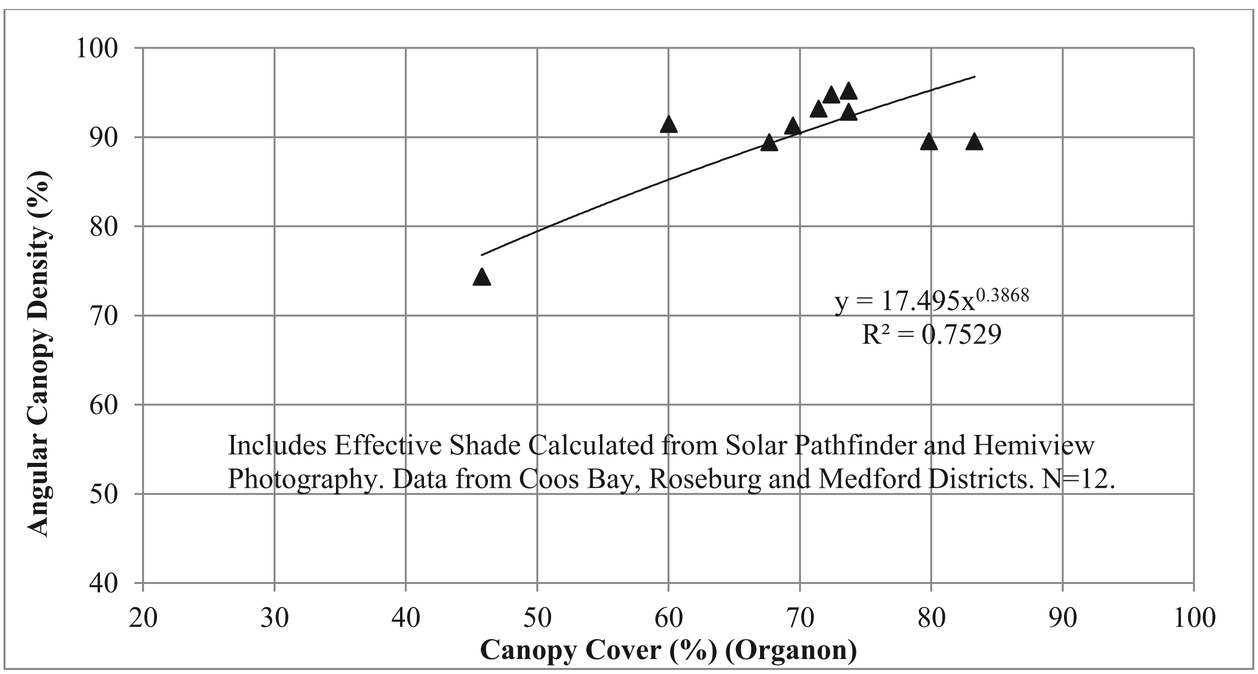

Figure 3-83. Canopy cover and angular canopy density in forest stands.

In this analysis, the BLM and EPA calculated shade lost from the combination of the existing canopy density of the inner zone and the outer zone with an alternative's management direction to retain a specific threshold of canopy cover (**Table 3-70**). In this analysis, the BLM and EPA divided fish-bearing and perennial streams into 0.25-mile segments and then merged with the Woodstock model canopy cover by decade until 2063 for each alternative's Riparian Reserve design. This methodology ignores the small amount of canopy cover overlap at stream segment nodes and at stream junctions. To apply these shade loss tables spatially, the BLM tracked the changing inner zone canopy cover, along each side of fish-bearing and perennial streams for each decade until 2063, and applied the outer zone canopy cover for purposes of reading the EPA shade loss tables. In this way, the BLM calculated the miles of fish-bearing and perennial streams that would exceed 3 percent shade loss until 2063 for each alternative. This is modification of the analytical methodology described in the Planning Criteria (USDI BLM 2014, pp. 73-75).

Table 3-70. Modeled shade loss for a 150-foot-wide Riparian Reserve, with a 60-foot inner no harvest zone, at various thinning intensities and initial canopy conditions (EPA 2014).

Scenario (Two Sided Treatments)	Stream Aspect			
	North South	NW/SE	East West	Average
Pre-harvest Condition - 80% Canopy Cover				
30 ft Clearcut / 90 ft - Outer Thinning Zone 70CC / 60ft - Inner Zone 80CC / Stream	1.3	1.1	0.9	1.1
30 ft Clearcut / 90 ft - Outer Thinning Zone 50CC / 60ft - Inner Zone 80CC / Stream	2.6	1.9	1.3	1.9
30 ft Clearcut / 90 ft - Outer Thinning Zone 30CC / 60ft - Inner Zone 80CC / Stream	4.4	3.0	1.6	3.0
Pre-harvest Condition - 60% Canopy Cover				
30 ft Clearcut / 90 ft - Outer Thinning Zone 50CC / 60ft - Inner Zone 60CC / Stream	5.7	4.9	5.6	5.4
30 ft Clearcut / 90 ft - Outer Thinning Zone 30CC / 60ft - Inner Zone 60CC / Stream	9.7	7.7	6.9	8.1
Pre-harvest Condition - 40% Canopy Cover				
30 ft Clearcut / 90 ft - Outer Thinning Zone 30CC / 60ft - Inner Zone 40CC / Stream	13.8	12.7	16.2	14.2

Modeling design and constraints over a large plan area prevent varying of certain factors known to influence shade. With either method, assumptions about tree heights cannot vary spatially. The BLM calibrated Method A with tree heights for mature to old-growth forest stands. The BLM and EPA calibrated Method B with tree heights for forest stands 50- to 70-years-old. Neither method considers terrain slope and the positive effect of topographic shade during early morning and late afternoon hours. Method A ignores solar radiation outside of 10 a.m.to 2 p.m. In contrast, Method B may overestimate shade loss by not considering topographic shade. Method B tracks stream orientation in shade loss outputs, while Method A does not. However, Method A provides a design that averages all stream orientations where solar radiation can vary in the path of the sun. Both methods do not consider tree set back distance from the stream that may increase solar radiation or the shading effects of understory brush or stream incision. Method A uses a uniform Riparian Reserve design, emphasizing greater than 80 percent effective shade where there is at least a 60-foot inner zone, without any particular prescription constraints in the outer zone. Method B accounts for variable management actions and variable canopy cover density in the inner and outer zone. Method B does not identify an actual reduction in stream shading, but a susceptibility to such a reduction in stream shading if the BLM were to thin the outer zone along certain streams.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 65-75).

Background

Most of the streams on BLM-administered lands are intermittent streams, as evidenced by the distribution of lands in mountainous headwaters, and the correspondingly high ratio (2:1) of intermittent to perennial streams as viewed in **Table 3-71.** The proportion of intermittent to perennial streams on other lands in the planning area is likely similar to the 2:1 ratio on BLM-administered lands. However, the data shown here yields a ratio of 1.5:1 and the difference is likely due to differences in the mapping methods of other landowners.

Table 3-71. Miles of streams with BLM ownership within the planning area.

Stream Periodicity	Planning Area Streams (Miles)	BLM Streams (Miles)	BLM Stream Miles (Percent)
Perennial[a]	57,893	6,711	12%
Intermittent[b]	86,990	13,311	15%
Totals	**144,884**	**20,023**	**14%**

[a] Perennial streams have varying but continuous discharge year round. Their base level is at, or below, the water table.
[b] Intermittent streams are a nonpermanent drainage feature with a dry period, normally for three months or more. Flowing water forms a channel feature with well-defined bed and banks, and bed-forms showing annual scour or deposition, within a continuous channel network.

Stream temperature variation depends upon a number of natural and management factors, including topography, forest vegetation, channel characteristics, streamflow, and climate (Caissie 2006). Water volume and stream width are important as mechanisms by which stream temperatures can fluctuate (Kibler 2007). As stream discharge increases, a fixed amount of solar energy is diluted and the resultant temperature change is decreased. As streams widen, the wetted surface area increases, which results in a higher absorption per unit volume of stream with a corresponding temperature rise.

The interactions controlling stream temperature in mountainous-forested landscapes are complex because simultaneous daily fluxes are occurring over a varying topography with steadily declining streamflow into summer. The temporal area of interest for this analysis is July to August, when clear sky days and solar radiation approach maximum levels. Direct solar radiation is the most important source of the energy budget affecting stream temperature gain at the water and streambed surfaces (Brown 1969, Beschta 1997, Moore and Wondzell 2005, Caissie 2006). During July to August, the sun’s altitude is high (following the second horizontal green line from the top), as only the portion of forest canopy to the south in line with the suns daily path is involved. Sun blocking by stream banks or hill slopes in the path of the sun as well as understory brush and forest trees with varying canopy layers and densities produce shade for most daylight hours. There may be a few gaps where sunlight can reach the stream during the morning or afternoon hours, depending on the specific stand characteristics. However, at mid-day when the sun is near its zenith, solar radiation may reach the stream through overhead canopy gaps in the forest or overtop the highest trees shade angle, depending on tree height, setback distance, angular canopy density, and stream width. Small streams are well-shaded because the tree-to-tree spacing is close and canopies spread over the channel. As watershed area increases and streams widen to rivers with floodplains, linear gaps appear over the stream channel.

There are important interactions simultaneously occurring among stream direction (azimuth), topography, tree height, and density in blocking solar radiation. The natural environment poses an array of possibilities in assessing the transmission of solar radiation to the stream. Shade-blocking forest vegetation involves duration and quality. The duration of shade depends upon shade-producing vegetation in the path of the sun at any given time during the day as the sun's path and altitude changes. The quality of shade depends upon solar radiation transmission through forest canopies, where solar radiation decreases as leaf area index and forest density increases.

The 2008 RMP/EIS provides additional detailed background information on the effects of riparian forests on stream shading and is incorporated here by reference (USDI BLM 2008, pp. 336-34; Appendix I-Water, pp. 250-252).

Affected Environment

Proportions of riparian forests in the decision area by structural stage within 100-feet of fish-bearing and perennial streams are shown in **Figure 3-84**.[55]

[55] USDI BLM FEIS 2008 Ch. 3-341

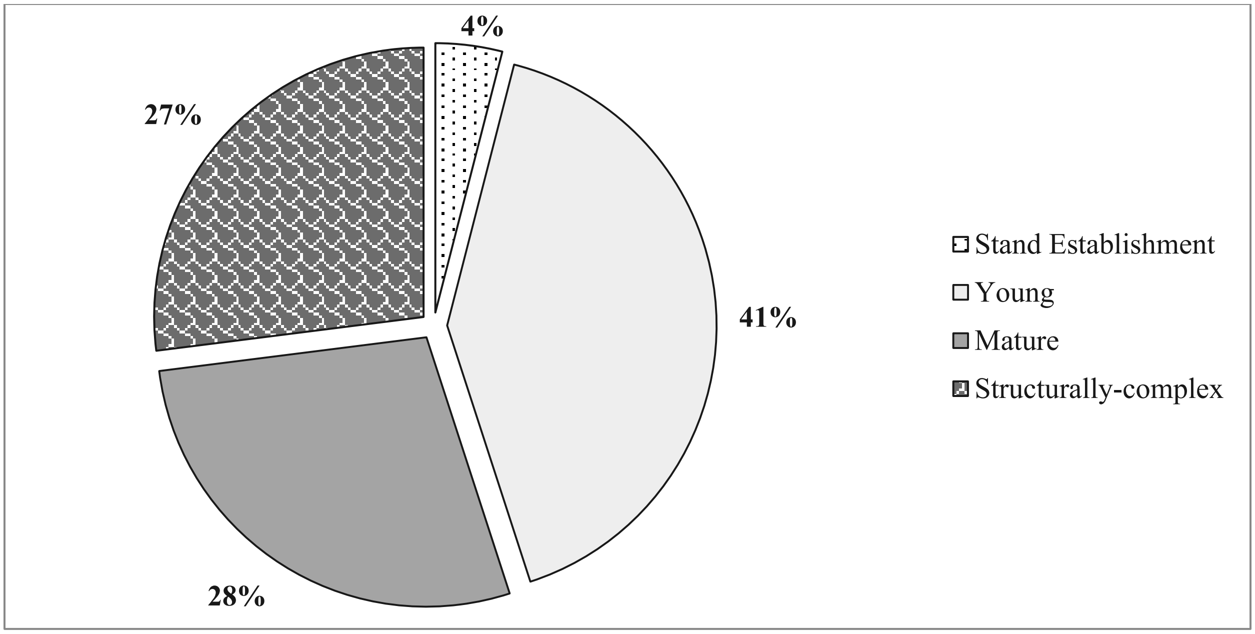

Figure 3-84. Proportions of riparian forests within 100-feet of fish-bearing and perennial streams in the decision area.

More than half of the near-stream riparian forest is currently mature or structurally-complex conifer. There has been very limited regeneration harvest within 100 feet of perennial and fish-bearing streams in the last 30 years, leading to a decline in the early-successional and stand establishment structural stages to four percent. Some portion of the early-successional and stand establishment forest near streams has resulted from natural perturbations, such as wildfire, flood, or disease. Under the 1995 RMPs, the BLM has thinned in the Riparian Reserve in young forest stands along fish-bearing and perennial streams, but often has left a 50- to 60-foot unthinned zone along each side of the stream channel.

Figure 3-85 shows the proportions of the current full width Riparian Reserve forest by structural stage that includes the 100-foot inner stream zone. The forest structural stage patterns are similar to the 100-foot inner stream zone, except there is more area in early-successional and stand establishment forests more than 100 feet to the edge of streams.[56]

[56] This assumed that the No Data 8 percent area does not skew the current structural stage proportions.

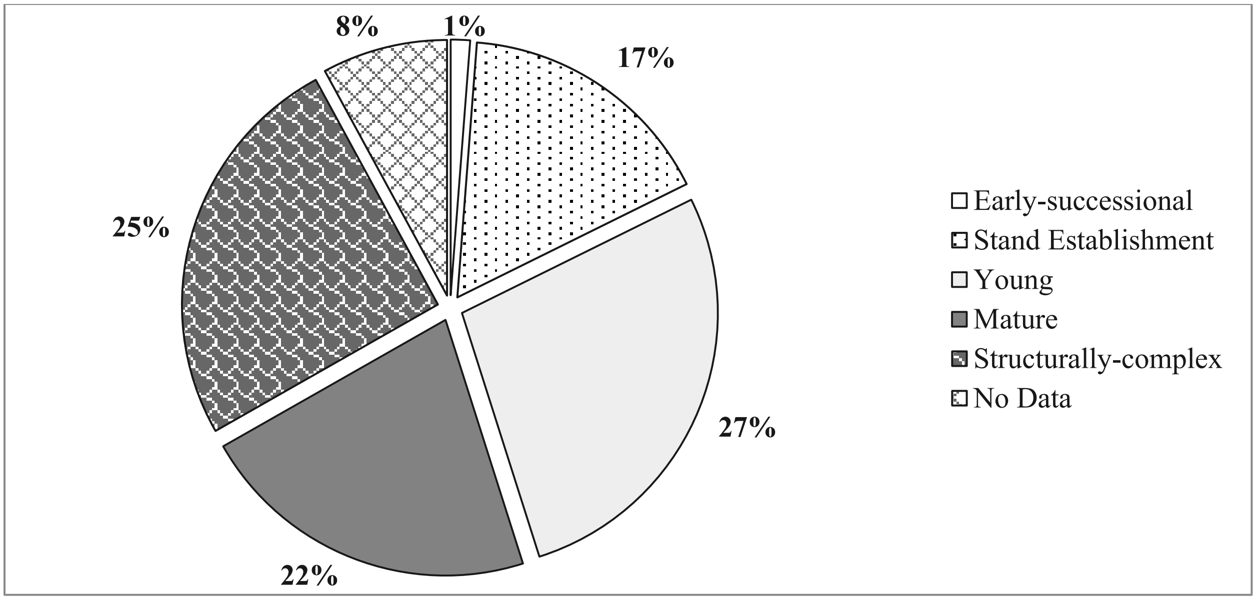

Figure 3-85. Proportion of Riparian Reserve by structural stage.

Monitoring results have documented a decrease in average maximum stream temperatures in the last 20 years. Varying atmospheric conditions and antecedent precipitation result in substantial year-to-year variation in stream temperatures. However, as shown in **Figure 3-86**, average maximum summertime stream temperatures are clearly declining by as much as 4 °F in a coastal Oregon stream. Similar patterns are observed on other districts such as Roseburg shown in **Figure 3-87**.

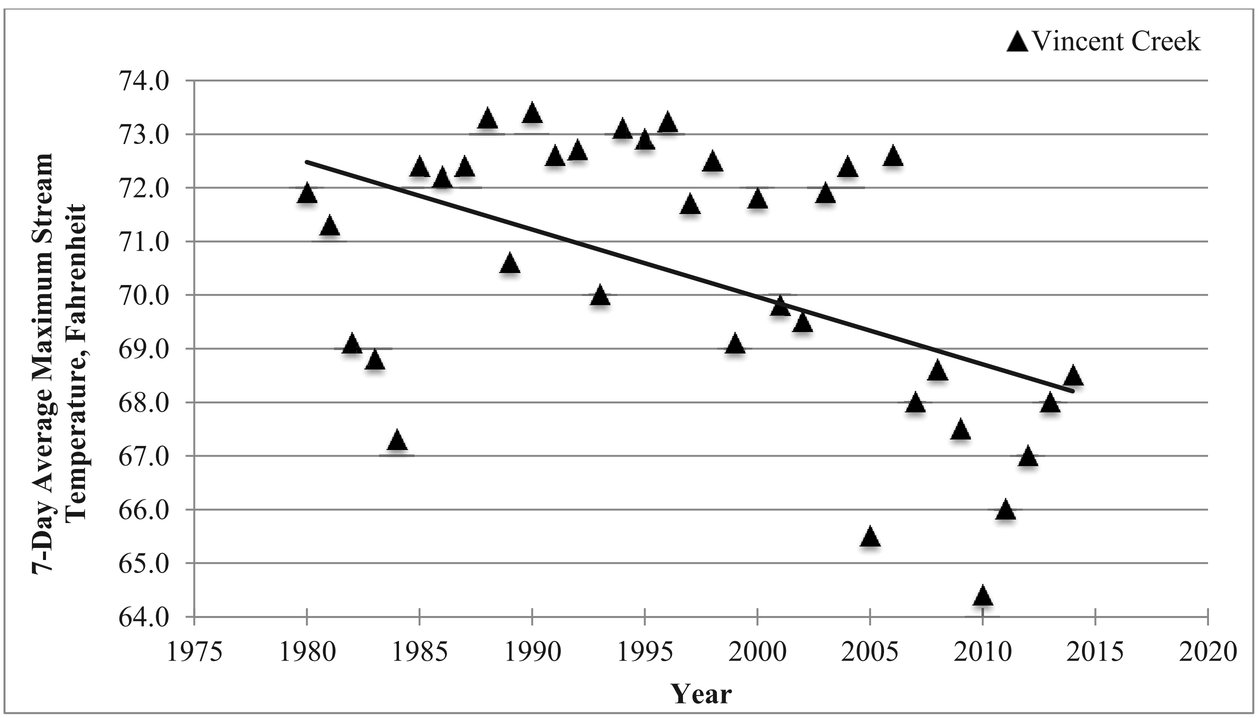

Figure 3-86. Seven day average maximum stream temperatures (°F) Vincent Creek Gaging Station, Coos Bay District, for years 1990-2013.

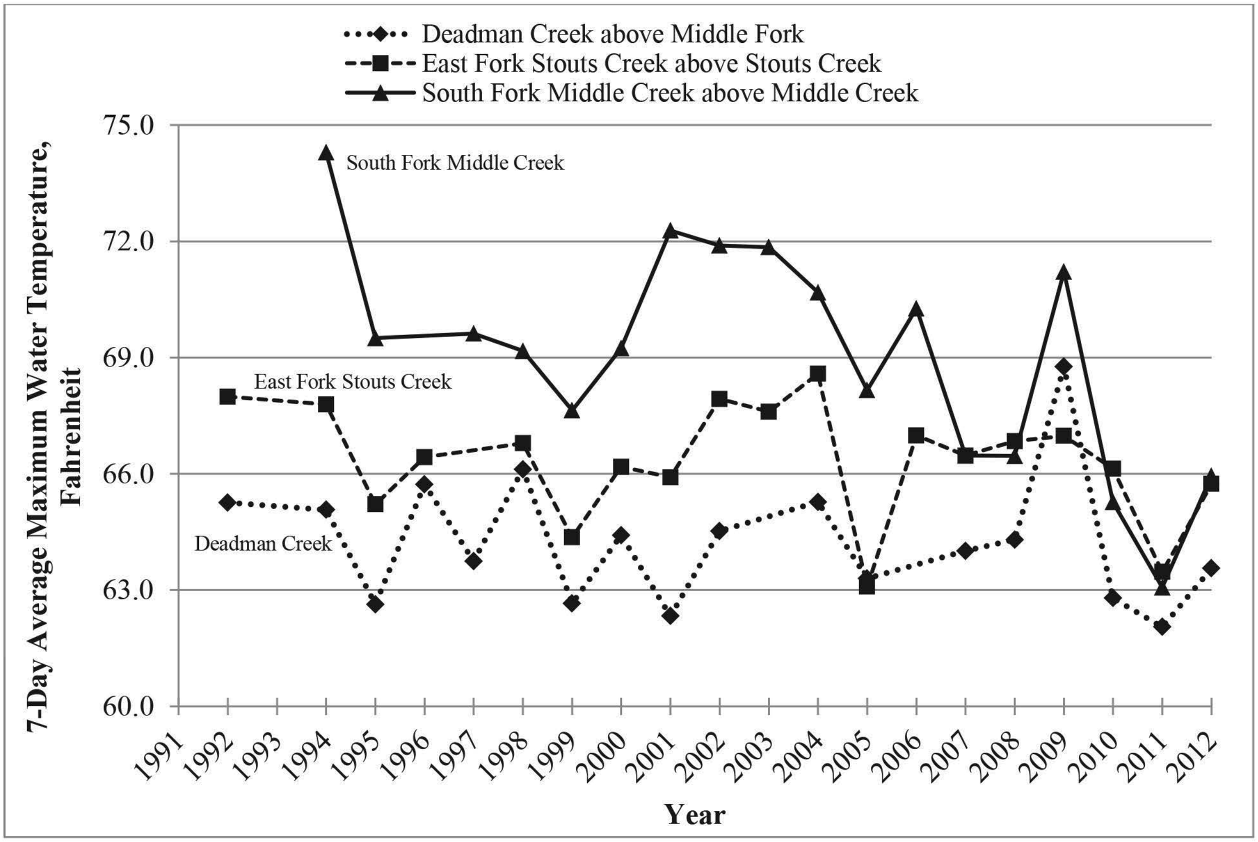

Figure 3-87. Seven day average maximum stream temperatures (°F) at Deadman Creek, East Fork Stouts Creek and South Fork Middle Creek, Roseburg District, for years 1992-2012.

Other studies have shown that the near-stream riparian forests on BLM-administered lands are maintaining high measures of shade, even where forest thinning is undertaken. As part of a forest Density Management Study in cooperation with the U.S. Forest Service, the BLM took hemispherical photography in the field at stream centers along small perennial steams with mature mixed conifer/hardwood riparian stands, for five stream reaches in four BLM districts. These data were analyzed with Hemiview™ solar physics software. Preliminary results shows percent visible sky (openness) at stream center average from 3.0 percent to 5.9 percent, indicating relatively closed forest canopies. As well, shade values ranged from 91 percent to 95 percent.[57] Data from these sites further suggest maximum shading at low solar angles and increased variability towards noon when radiation loads are higher (P. D. Anderson, USFS Forestry Sciences Laboratory, personal communication, 2014).

Environmental Effects

Figure 3-88 displays the total forest acres of the Riparian Reserve Allocation by alternative, and the forest acres of Riparian Reserve bordering fish-bearing and perennial streams.

[57] From Hemiview™ software, using 1-Global Solar Fraction (below canopy radiation/above canopy radiation) as a measure of shade.

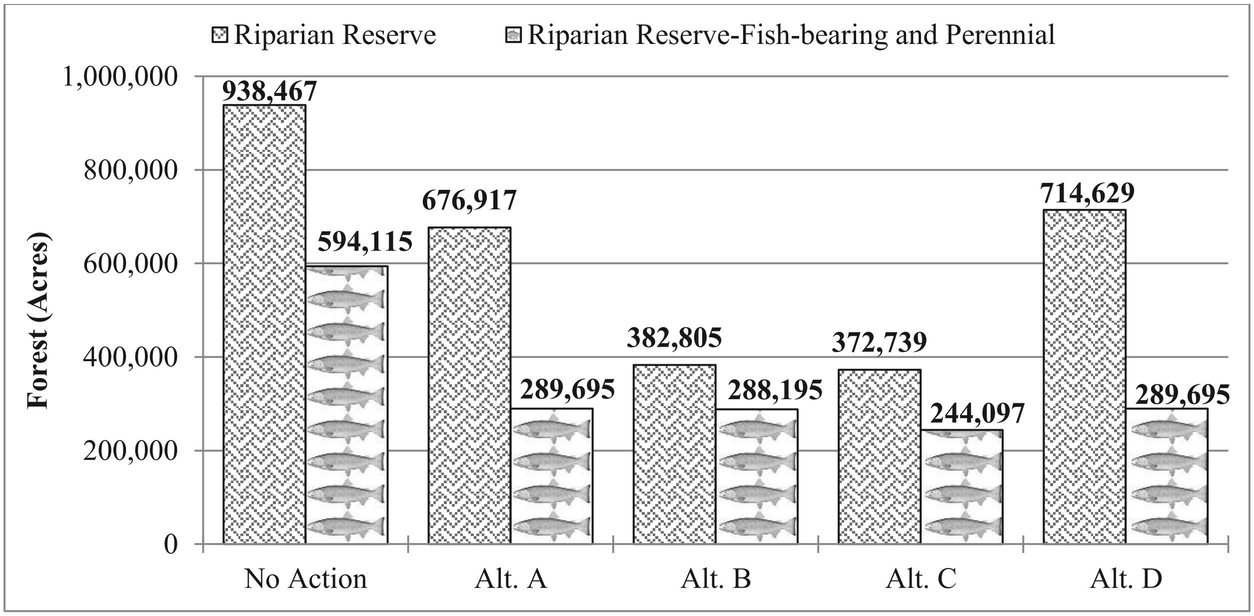

Figure 3-88. Total acres of the Riparian Reserve by alternative compared to total acres of the Riparian Reserve along fish-bearing and perennial streams.

There are 6,970 miles of fish-bearing and perennial streams, where forest management in the outer Riparian Reserve would potentially affect stream temperature. On fish-bearing and perennial streams, the outer management zone width varies from two site-potential tree heights under the No Action alternative (i.e., the entirety of the Riparian Reserve), between 120 feet and one site-potential tree height under Alternatives A and D, between 60 feet and one site-potential tree height under Alternative B, and between 60 feet and 150 feet under Alternative C.

Method A

Alternatives A and D and Alternatives B and C would be very similar in shading effects and are grouped together for discussion.

Alternatives A and D would maintain an unthinned 120-foot width inner zone. This 120-foot width would overlay the primary shade zone and the secondary shade zone plus an additional 20-foot retention. The inner zone alone would be sufficient to avoid reduction in stream shading under Method A. Nevertheless, Alternatives A and D also include an outer zone to one site-potential tree height in which any thinning would maintain at least 30 percent canopy cover and 60 trees per acre. The outer zone would provide a high protection to the inner zone for blowdown at the edge of the Riparian Reserve.

Alternative B and C Riparian Reserve design involves an unthinned 60-foot width inner zone, which would match the primary shade zone. This is the minimum width found necessary to maintain high levels of shade quality, when taken together with an outer managed (secondary) zone to 100-feet with 50 percent canopy cover. Alternatives B and C would maintain at least 50 percent canopy cover and 80 trees per acre in the outer zone, out to a distance of one site-potential tree height for Alternative B and 150 feet for Alternative C. These outer zone widths exceed the secondary shade zone under Method A by 50 feet for Alternative C and an average of 80 feet for Alternative B. Therefore, Alternatives B and C would maintain stream shading sufficient to avoid increases in stream temperature under Method A.

The No Action alternative would meet Method A criteria for stream shading, based on the Riparian Reserve width and assumptions about management actions described in analytical methods. However, there is an element of uncertainty related to stream shading under the No Action alternative compared to the action alternatives. As explained in analytical methods above, riparian thinning under the No Action alternative is allowed anywhere in the Riparian Reserve with no specific retention requirements. However, activities must meet the Aquatic Conservation Strategy objectives, which are often difficult to interpret at the site scale. Nevertheless, the 1995 RMPs do not define a "no-thinning" inner zone, which makes the effects on stream shading less certain than under the action alternatives.

In summary, all alternatives exceed Method A criteria for stream shading and are substantially similar in their ability to provide high quality shade and would avoid any measurable increases in stream temperature at this scale of analysis.

Method B

As in Method A, the results are clustered: No Action and Alternatives A and D would have similar effects on stream shading, and Alternatives B and C would have similar effects on stream shading (**Figure 3-89**). For the No Action alternative and Alternatives A and D, there would be three to 33 miles of fish-bearing and perennial streams that would currently be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves. This is less than 0.5 percent of the total fish-bearing and perennial stream miles as shown in **Figure 3-90**. This limited stream mileage reflects areas with currently low canopy cover in the inner zone, which are the riparian stands least likely to be thinned under the management direction of the No Action alternative and Alternatives A and D. This result does not reflect an actual reduction in stream shading, but a susceptibility to such a reduction in stream shading if the BLM thins the outer zone along these streams. If the BLM does not thin the stand in the outer zone, no reduction in stream shading would occur. This limited stream mileage susceptible to shade reductions would decline over time as the stands in the inner zone increase in canopy cover over time. The stream mileage susceptible to shade reductions would decline to almost zero in 20 years under Alternatives A and D and in 30 years under the No Action alternative.

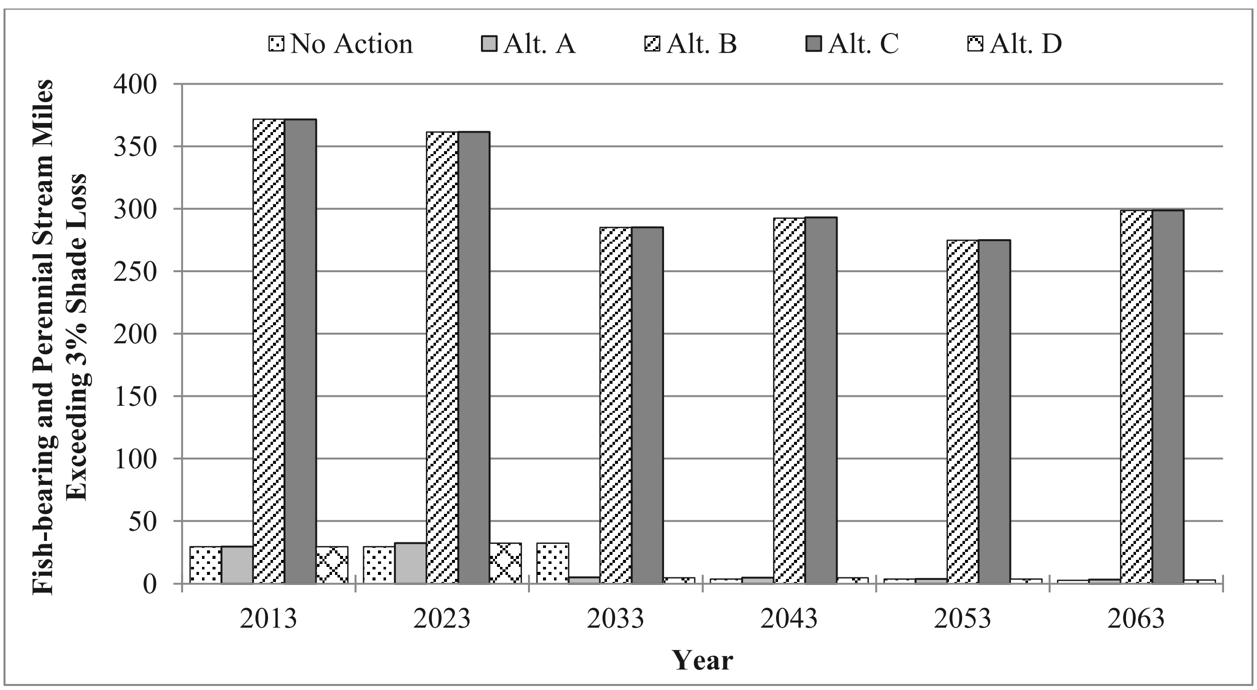

Figure 3-89. Fish-bearing and perennial stream miles exceeding 3 percent shade loss.

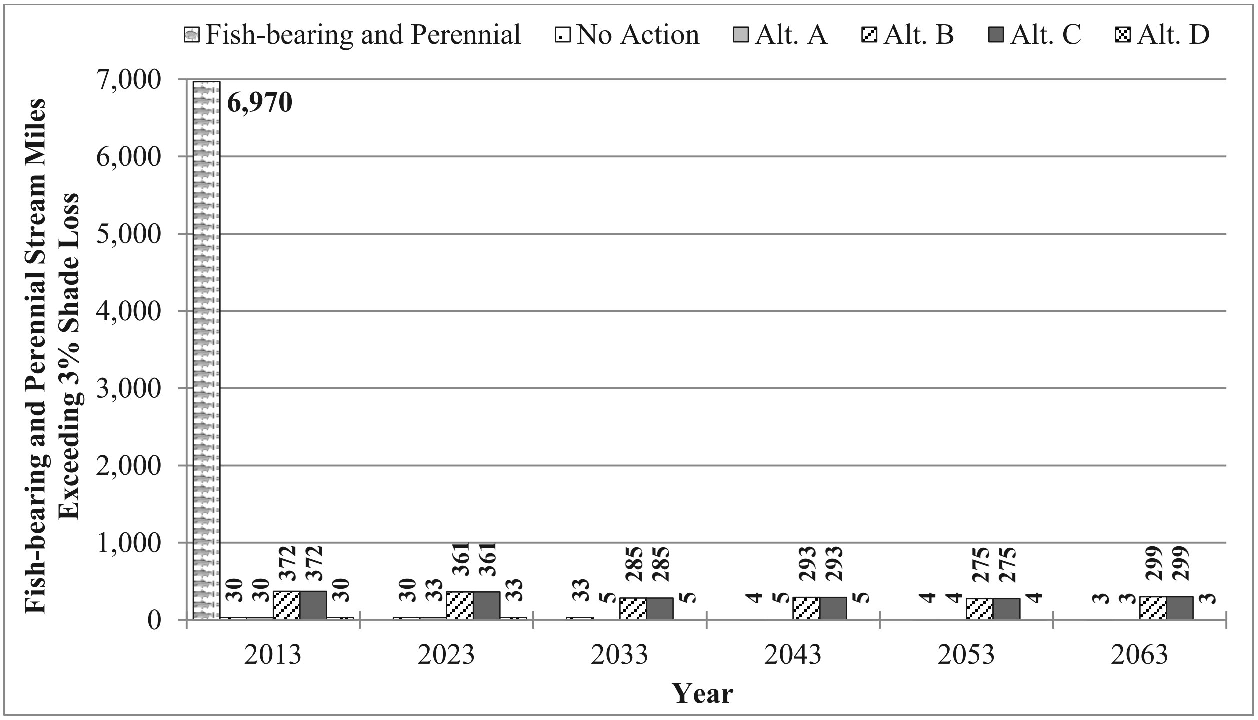

Figure 3-90. Fish-bearing and perennial stream miles in the decision area compared to fish-bearing and perennial stream miles exceeding 3 percent shade loss.

For Alternatives B and C, there would be 275 to 372 miles of fish-bearing and perennial streams that would currently be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves, amounting to approximately 5 percent of the total fish-bearing and perennial stream miles. The No Action alternative is very similar to Alternatives A and D, with the exception of a slight difference in the 2033 period.

Using Method B, the shade loss thresholds are exceeded most frequently where the forest canopy density is < 60 percent in the 60-foot no harvest zone under Alternative B and C, and where the forest canopy density is < 40 percent in the 120-foot no harvest zone under Alternative A and D. If forest treatments do not occur in the outer zone in the relatively few miles of low canopy density forests under Alternatives B and C, then all alternatives would be substantially similar in their effect on stream shading. Even if the outer zone adjacent to inner zone with low canopy cover were to be thinned, not all of the susceptible reaches would be treated in a given year and as some reaches are treated other reaches would recover, reducing the overall effect of canopy removal. The stream mileage susceptible to shade reductions would decline within the first 20 years under Alternatives B and C, and then would remain relatively constant in future decades.

Method A and Method B yield generally similar results about the effects of the alternatives on stream shading, though they show some slight difference concerning Alternatives B and C. While all alternatives would be beneficial in maintaining shade quality along fish-bearing and perennial streams, the No Action alternative and Alternatives A and D would provide slightly better stream shading, in part as a result of wider inner zones for Alternatives A and D and management direction for forest management activities in the outer zone. However, the difference among the alternatives in areas that provide sufficient stream shading would be small when considered as a percentage of the total miles of fish-bearing and perennial streams on BLM-administered lands.

Issue 2

How would timber harvest and road construction under the alternatives affect peak stream flows within the rain-on-snow dominated hydro-region?

Summary of Analytical Methods

Peak stream flows occur infrequently in the planning area, normally from November and February, but carry the majority of the sediment load with high stream energies that may erode and change channel form (Cooper 2005). Peak flows from storm events with a return interval of 1 year or greater have the capacity to mobilize sediment and bed load transport (Andrews 1983 and 1984). Timber harvesting and associated activities alter the amount and timing of peak flows by changing site-level hydrologic processes (e.g., surface flow, sediment movement) (Keppeler and Ziemer 1990, LaMarche and Lettenmaier 1998, Wemple and Jones 2003, Wright *et al.* 1990). Grant *et al.* (2008) concluded that field reviews do not provide evidence that timber harvesting increases peak flows for storms with return intervals longer than 6 years, because the storm event is strong enough that forest management is not an influencing factor in peak flows. Therefore, peak flow storms with 1- to 6-year return intervals reflect the range for measuring the impacts on peak flows from timber harvest.

Hydroregions are a classification of landscapes based on the precipitation type and longevity. These are shown in **Figure 3-91** for the planning area. Hydroregions in western Oregon distinguish predominant precipitation type during the winter months that generally correspond to elevation and latitude. Within the planning area, there are three hydroregions: rain, rain-on-snow (or transient snow zone), or snow hydroregions. The rain hydroregion is generally below 2,000 feet in elevation in the Coast Range. This hydroregion includes valleys up to 1,200-3,600 feet in elevation from north to south along the western Cascades, from the Columbia River to the California border. The rain-on-snow hydroregion, where shallow snow accumulations come and go several times each winter, are 1,200-3,600 feet in elevation in the northern Oregon Cascades, gradually rising to 2,500-5,000 feet in elevation in the southern Oregon Cascades. The snow hydroregion is generally above 3,600 feet in elevation, and it is centered along the Cascades crest.

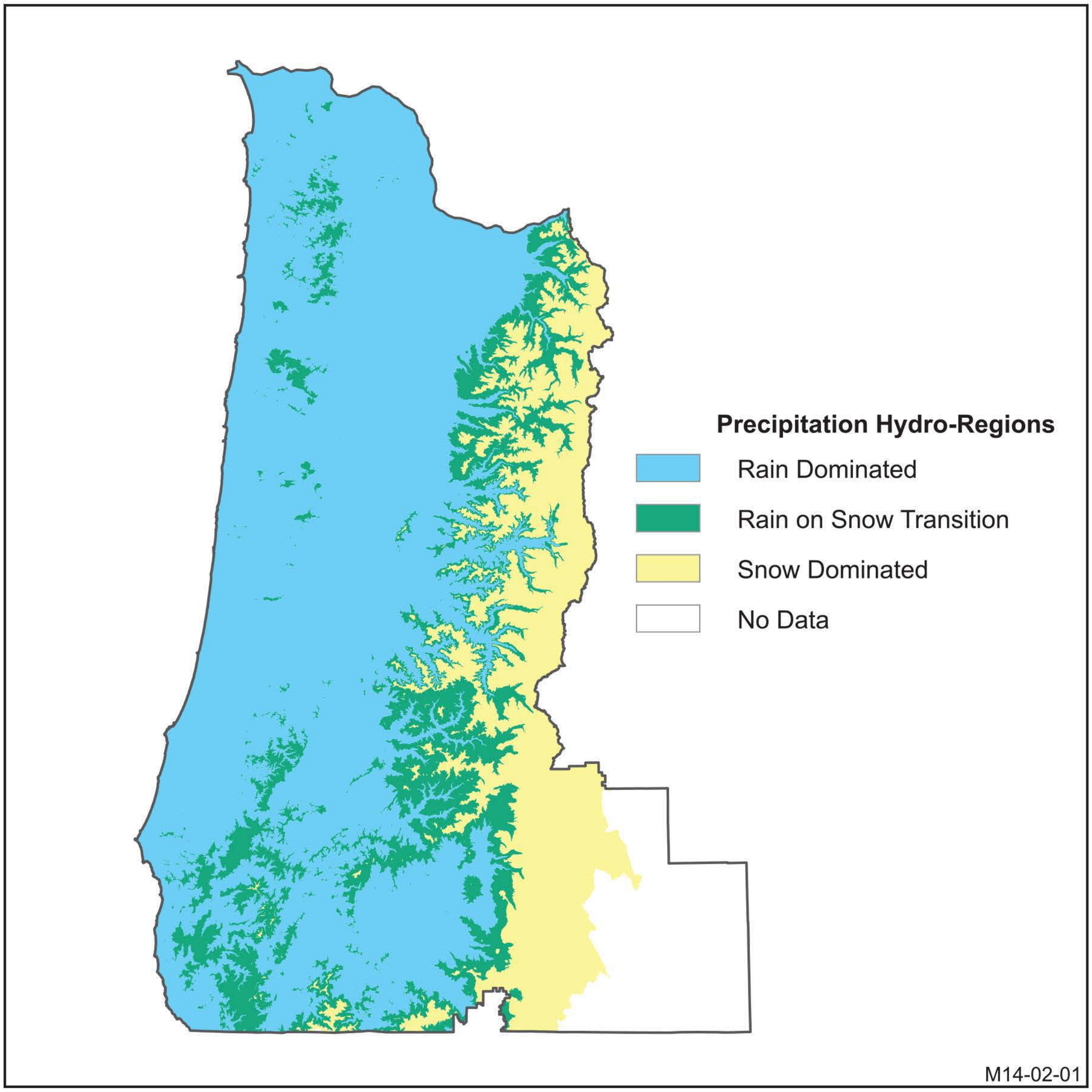

Figure 3-91. Hydroregions within the planning area.

This issue presents an analysis of the cumulative effects on peak stream flows of past, present, and reasonably foreseeable future actions, including both land management on BLM-administered lands and non-BLM-administered lands.

In this analysis, the BLM addressed effects on peak flows in the rain-on-snow hydroregion only, because there is little evidence that the forest harvest activities can elevate peak flows in the rain hydroregion or snow hydroregion (Grant *et al.* 2008). The 2008 RMP/EIS includes a more detailed discussion of the effects of timber harvesting in the rain-dominated watersheds (USDI BLM 2008, pp. 352-354), which is incorporated here by reference.

The BLM addressed effects on peak flows at the subwatershed level (Hydrologic Unit Code 12, previously termed "sixth-field" watershed).[58] Subwatersheds are generally 10,000-40,000 acres in size and have a single outlet. The BLM selected the subwatershed scale for this analysis, because it better captures the BLM forested land pattern at closer to a site scale. The subwatershed scale is more sensitive to vegetation and runoff-related changes. In this analysis, the BLM addresses subwatersheds that meet the following three criteria:

- BLM-administered lands are more than 1 percent of the subwatershed;
- The subwatershed has more than 100 acres of BLM-administered lands in the rain-on-snow hydroregion; and
- More than 60 percent of the subwatershed is in the rain-on-snow hydroregion.

In this analysis, the BLM calculated the total open area from forest harvest and roads for all lands in rain-on-snow subwatersheds as a percent of the total subwatershed area by decade for the alternatives. The BLM then refined open area percentage by factoring harvest unit opening percentages based on treatment type in these rain-on-snow hydroregion and compared these to the response curve (Grant *et al.* 2008). Total open area in this analysis was comprised of—

- Early-successional structural stage from the Woodstock model for BLM-administered lands,
- Early-successional forest from the Landscape, Ecology, Modeling, Mapping and Analysis (LEMMA) for non-BLM-administered lands
- Road area for all lands

The BLM has made three modifications from the analytical methodology described in the Planning Criteria.

First, the BLM only addressed subwatersheds that are predominately rain-on-snow, with more than 60 percent of the subwatershed in the rain-on-snow zone. This is a change from Step 1 of the Analytical Methods in the Planning Criteria, which included all subwatersheds with any amount of the rain-on-snow hydroregion. Only subwatersheds that are predominately rain-on-snow are appropriately compared to the Grant *et al.* (2008) response curve.

Second, the BLM used change detection methods rather than rule set described in Step 3 in the Planning Criteria to calculate the early-successional forest on non-BLM-administered lands. Using the Landscape, Ecology, Modeling, Mapping, and Analysis (LEMMA) satellite imagery and vegetation classification the BLM identified new regeneration harvest areas on non-BLM-administered lands for the base period with available imagery, 1996 to 2006, for each identified rain-on-snow subwatershed. The BLM projected this rate of regeneration harvest forward in 10-year increments for 50 years.

Third, the BLM added the acres of roads in rain-on-snow sub-watersheds to the acres of early-successional forest for BLM-administered lands and non-BLM-administered lands. The BLM calculated the area of roads from GIS spatial data for each subwatershed by assuming an average road cut of 15 feet, road width of 15 feet, and road fill of 15 feet, and multiplying that width by the total road length. Including the area of roads allows a direct comparison with the Grant *et al.* (2008) response curve of reported percentage change in peak flow with percent area harvested in the rain-on-snow hydroregion. This is an addition to Step 4 described in the Planning Criteria.

[58] Hydrologic Unit Codes are a U.S Geological Survey classification based on a national standard to define systems through hierarchy.

The BLM compared the total open area for each rain-on-snow subwatershed for each alternative and time period to the rain-on-snow response curve from Grant *et al.* (2008) that were constructed from data at the site scale (few to hundreds of acres). Response curves for the rain-on-snow hydroregion developed by Grant *et al.* (2008) indicate that a mean of 19 percent of a watershed area with roads would need to be harvested to detect a change in peak flow response.

Interpretation of measured peak flow increases at the site scale to larger scales, including the subwatershed scale, poses a scale problem. Changes in peak streamflow are influenced by harvest, but also by the age and pattern of forest stands within a larger watershed, location, and extent of roads, area extent of riparian areas and watershed condition. Very few studies, such as Jones and Grant (1996) and Bowling and Lettenmaier (2001), address peak flow response in larger watersheds, or the effects of a varying suite of forest management. These studies have shown that peak flow increase from forest harvest decreases with increasing watershed area. Proceeding downstream, flood peaks become flattened due to channel resistance, transmission losses, floodplain storage, and storm size variation over the watershed. Further, timing of tributary inputs typically desynchronizes peak flows causing reductions in unit stream flows of 50 percent or greater (Woltemade and Potter 1994). Jones and Grant (1996) describe that, in larger watersheds (15,000 to 150,000 acres), peak flow increases in adjoining watersheds with different forest stand structural stages were less than the year-to-year natural variability of stream flows. This suggests that stream channels are already adjusted to a range of peak flows that is greater than a land use variation.

Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 76-80).

Background

There is an ongoing and abundant supply of available moisture for rainfall over western Oregon in winter as greatly moderated maritime air masses move across the Pacific Ocean toward the Pacific Northwest. At times, continental air masses displace the warm fronts producing snow in the higher elevations. Ongoing low intensity storms are common in the planning area, but occasional intense storms will produce a storm depth of more than 6 inches of precipitation in 24 hours (NOAA 1973). These storms generate peak flows that may overflow banks and cause channel changes, with a return frequency of 2 to 100 years.

Experimental subwatershed studies in hydrology demonstrate elevated peak flows during flood-producing storms when a high proportion of timber basal area has been removed by forest harvest (**Figure 3-92**), particularly within rain-on-snow watersheds (Grant *et al.* 2008). As the proportion of forest stand harvest increases within a watershed, evapotranspiration, direct interception, and potential for fog drip declines, while the potential for snow accumulation and melt increases. Snow accumulates faster in openings, but is also susceptible to elevated snowmelt rates compared to a forest (Harr 1981, Harr and Coffin 1992). Storm flow causes runoff along road surfaces into drainage ditches or upon fills, while subsurface routes may be day-lighted in road cuts or flow paths cut off or modified under the road surface. This can result in quicker runoff into stream channels during storms where ditch lines connect, compared to slower subsurface flow routes (Harr 1976, Harr *et al*. 1979, Megahan *et al.* 1992, Wemple *et al.* 1996). As storm intensity increases, runoff would more fully synchronize, contributing to peakflows (Megahan and Kidd 1972, LaMarche and Lettenmaier 2001, Luce 2002, Wemple and Jones 2003).

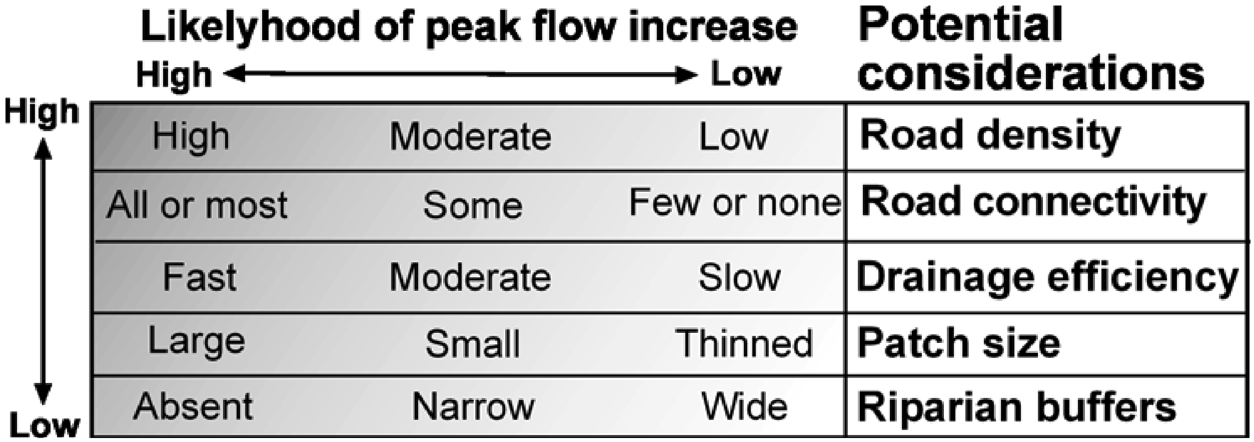

Figure 3-92. Site conditions and treatments for risk of peak flow increase.
Source: Grant *et al*. 2008 PNW-GTR-760 p. 40.

There has been a long debate regarding the magnitude of peak flows resulting from timber harvesting and road building. The 2008 RMP/EIS contained a review of the research and debate over peak flows (USDI BLM 2008, pp. 357-359), which is incorporated here by reference.

There are 1,203 subwatersheds within the planning area. When separated by hydroregion, 679 subwatersheds are predominately rain-dominated, 96 subwatersheds are predominately rain-on-snow-dominated (38 with BLM-administered lands), 163 subwatersheds are predominately snow-dominated and 265 subwatersheds have proportions of each hydroregion. **Figure 3-93** shows the proportion of subwatersheds by hydroregions in the planning area.

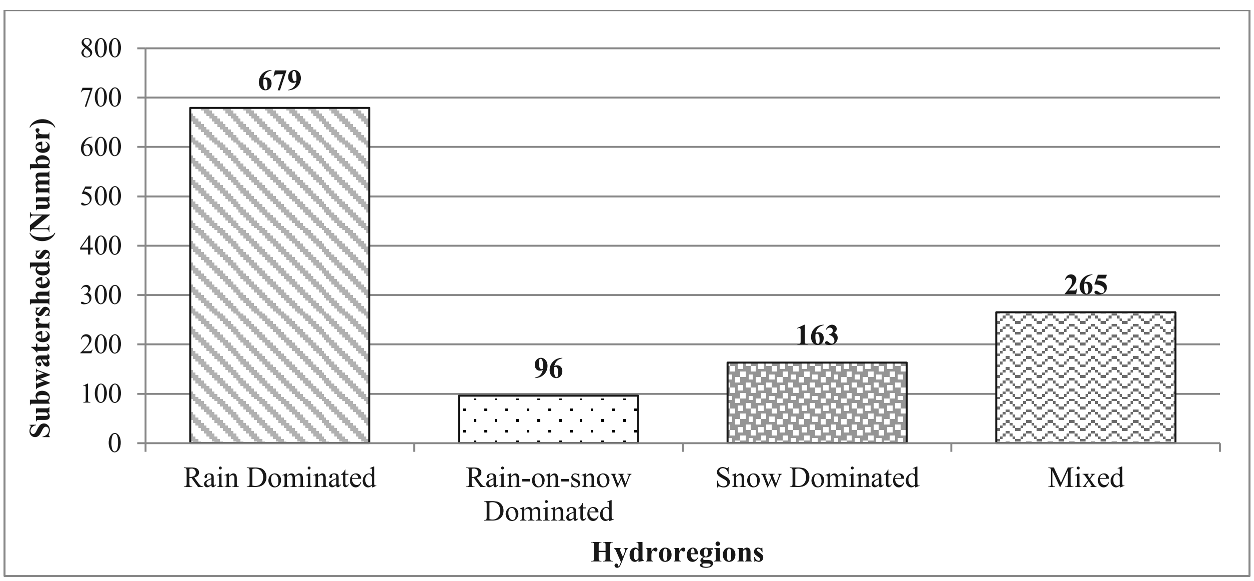

Figure 3-93. Proportions of hydroregions in the planning area.

Gravel bed channel types with a 1 to 2 percent gradient are most likely to be affected for any detected peak flow increase from forest management and roads shown in **Figure 3-94**. Generally, these gravel bed stream types are a small proportion of total stream miles (less than 10 percent) in any subwatershed in the decision area. Most streams in the decision area are cascade or step-pool channel types. The predominance of cascade or step-pool channel types and the general absence of sand-bed channel types in the decision area reduces the likelihood that any peak flow increases would result in changes to channel structure in the decision area.

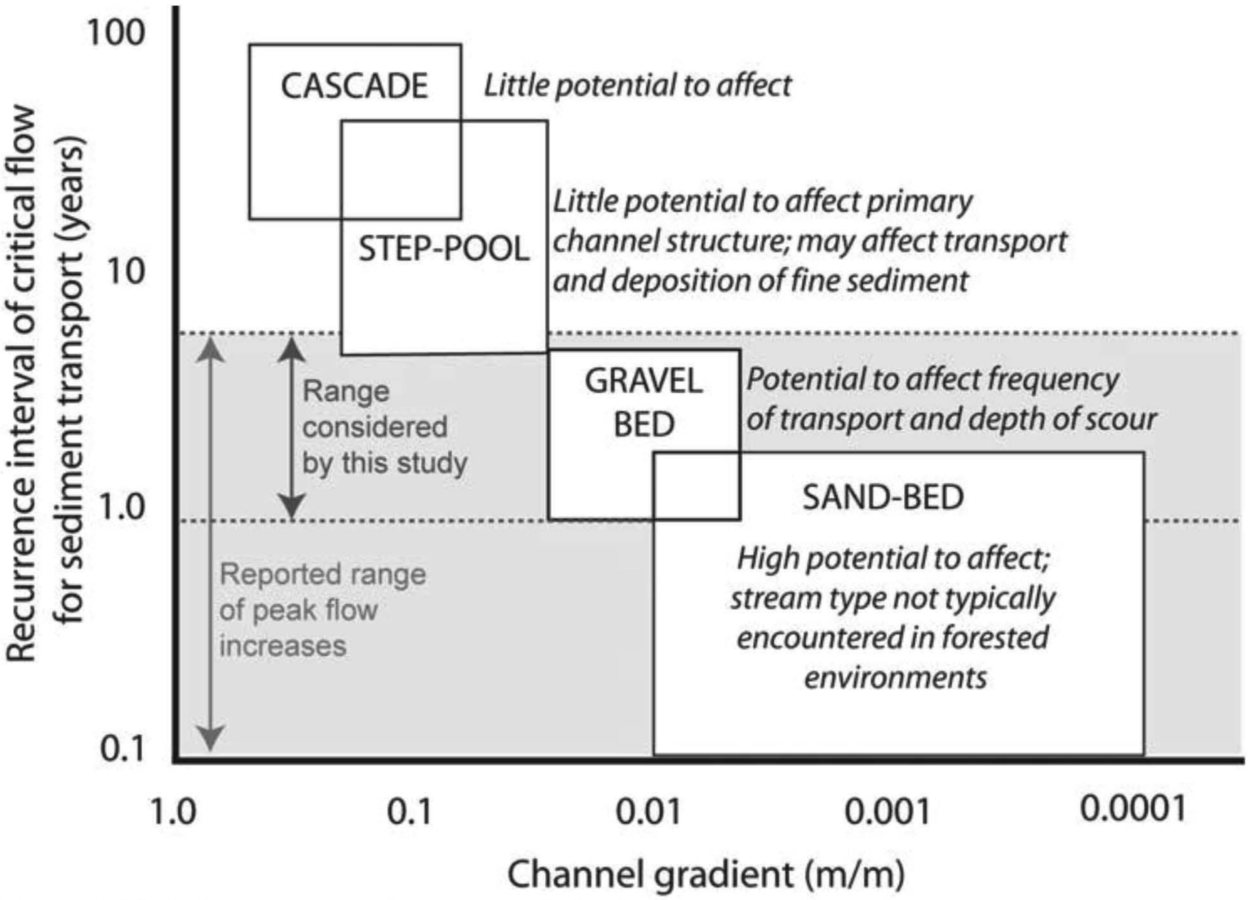

Figure 3-94. Sediment transport by return period and stream type.
Source: Grant *et al*. 2008 PNW-GTR-760 p. 43.

Figure 3-94. shows the potential sediment transport and channel scour by channel gradient and stream type for 1-6 year recurrence interval peak flows from forest management and roads. Notice that 1-2 percent gravel bed streams have the highest potential for effects.

Affected Environment and Environmental Effects

Ninety-six subwatersheds (3 percent) in the decision area are rain-on-snow dominated (**Figure 3-95**). From this selected set of subwatersheds, 38 include BLM-administered lands, for 197,709 BLM-administered acres. These intermediate elevations in rain-on-snow subwatersheds are analyzed with the methodologies presented in the Planning Criteria and they range in area from 3,300-27,400 acres, with a mean size of 15,500 acres and an area of 591,626 acres. **Figure 3-96** displays the rain-on-snow subwatersheds with BLM-administered lands by decade across the range of alternatives. Also shown are 7 subwatersheds out of 38 with BLM-administered lands (8780 acres) where more than 19 percent of the subwatershed is currently in an open condition with regeneration harvest units and roads. According to Grant *et al.* (2008), these 7 subwatersheds would be susceptible to detectable change in peak flow response.

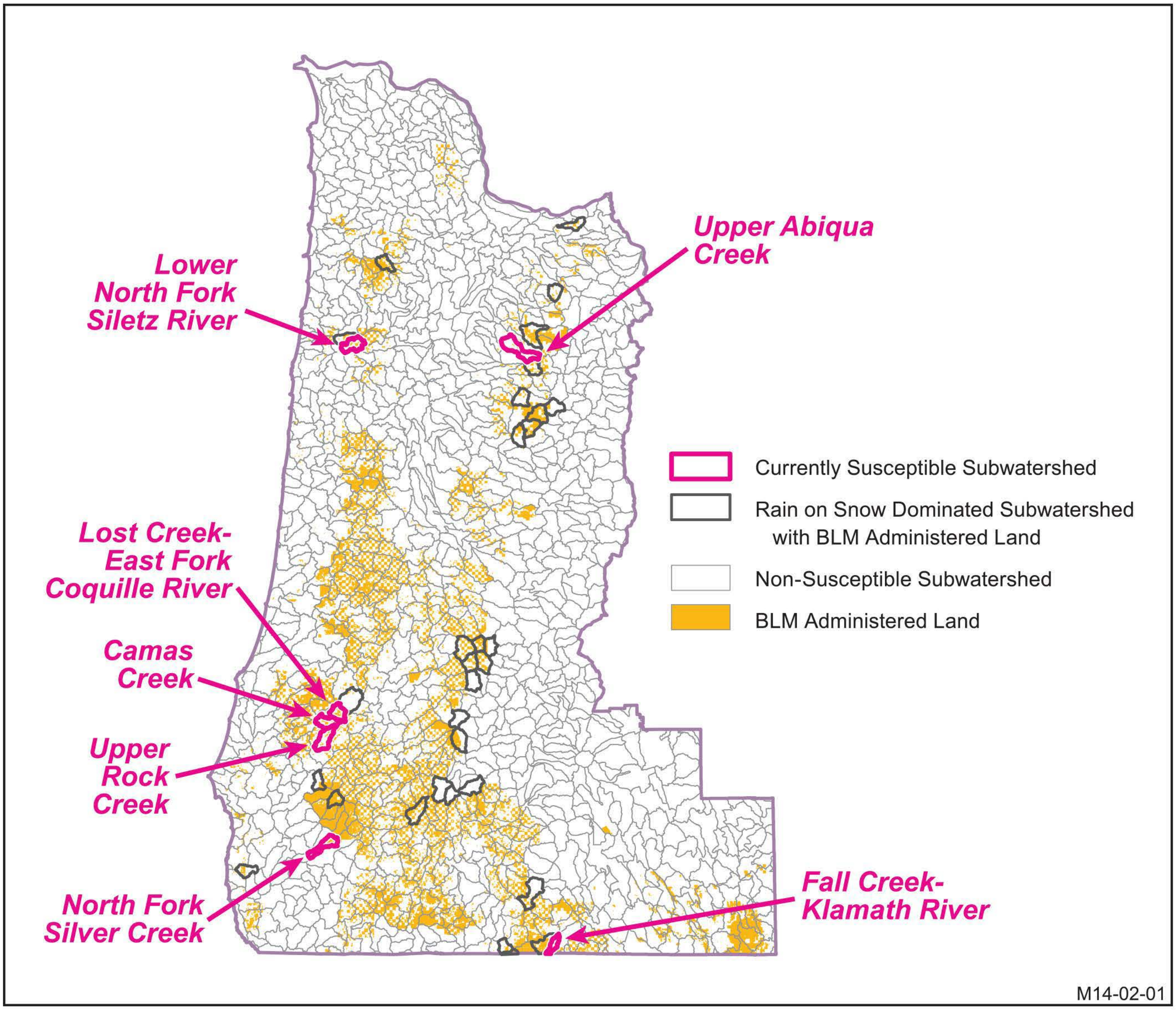

Figure 3-95. Rain-on-snow dominated subwatersheds and subwatersheds currently susceptible to a peak flow increase.

Under all alternatives, the number of subwatersheds with BLM-administered lands that would have more than 19 percent of the subwatershed in regeneration harvest units and roads and be susceptible to a peak flow increase would vary from 6 to 10 in any period to 2063. In future decades, the No Action alternative, Alternative A, and Alternative D would result in slight decreases in the number of subwatersheds susceptible to peak flow increases (in more than 19 percent open condition). In contrast, Alternatives B and C would result in slight increases in the number of subwatersheds susceptible to peak flow increases over the next 50 years. In those subwatersheds susceptible to peak flow increases, the open area from regeneration harvest units and roads would vary from 19 to 29 percent of the subwatershed among all ownerships. The affected BLM-administered lands would increase through 2033, with the smallest increase under Alternative D and the largest increase under Alternative C as shown in **Figure 3-96**. **Figure 3-97** shows a slightly different picture of peak flow susceptibility in the rain-on-snow subwatersheds that would have more than 19 percent of the subwatershed in harvest units and roads when all ownerships are analyzed together. All alternatives would increase the open area in recent harvest areas and roads through 2023 and decrease slowly until 2063, although a near constant 35,000 acres would continue to be susceptible to peak flow increases. Generally, Alternative B would have the highest peak flow susceptibility and Alternative D the lowest peak flow susceptibility through 2063. Less than 2 percent of the entire decision area would exceed the Grant *et al.* (2008) screen that would be susceptible to a peak flow increase under any alternative through 2063.

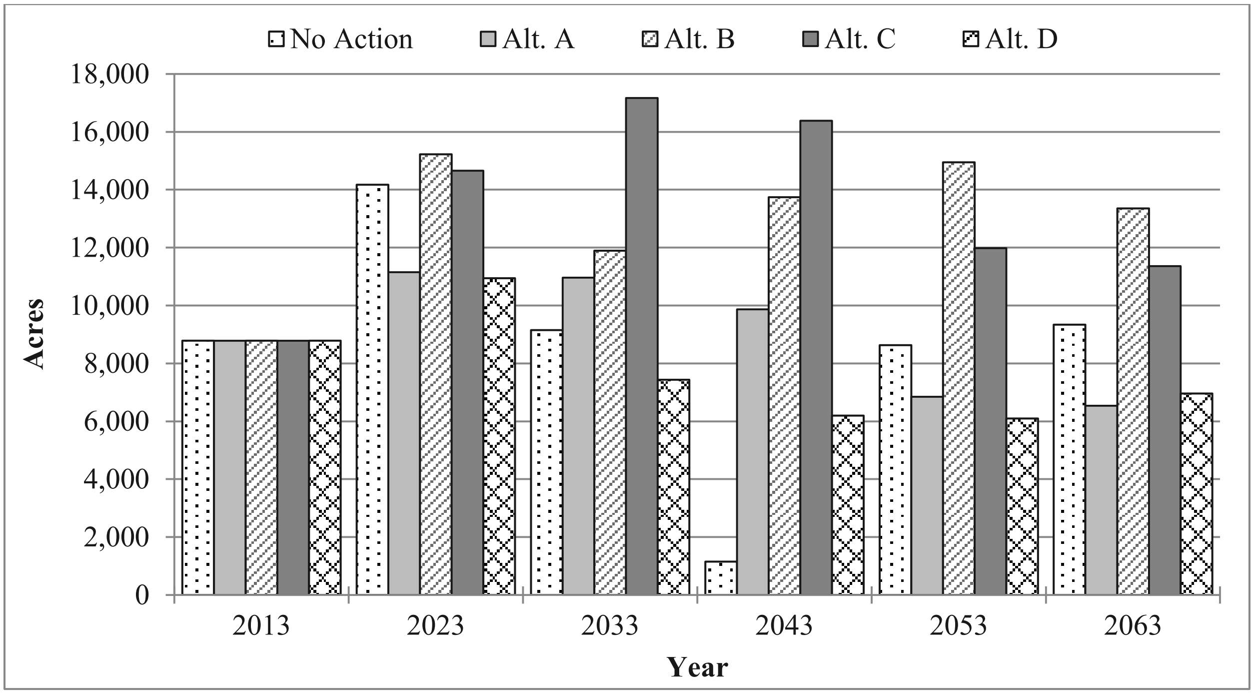

Figure 3-96. Subwatershed area (acres) on BLM susceptible to peak flow increases by decade by alternative.

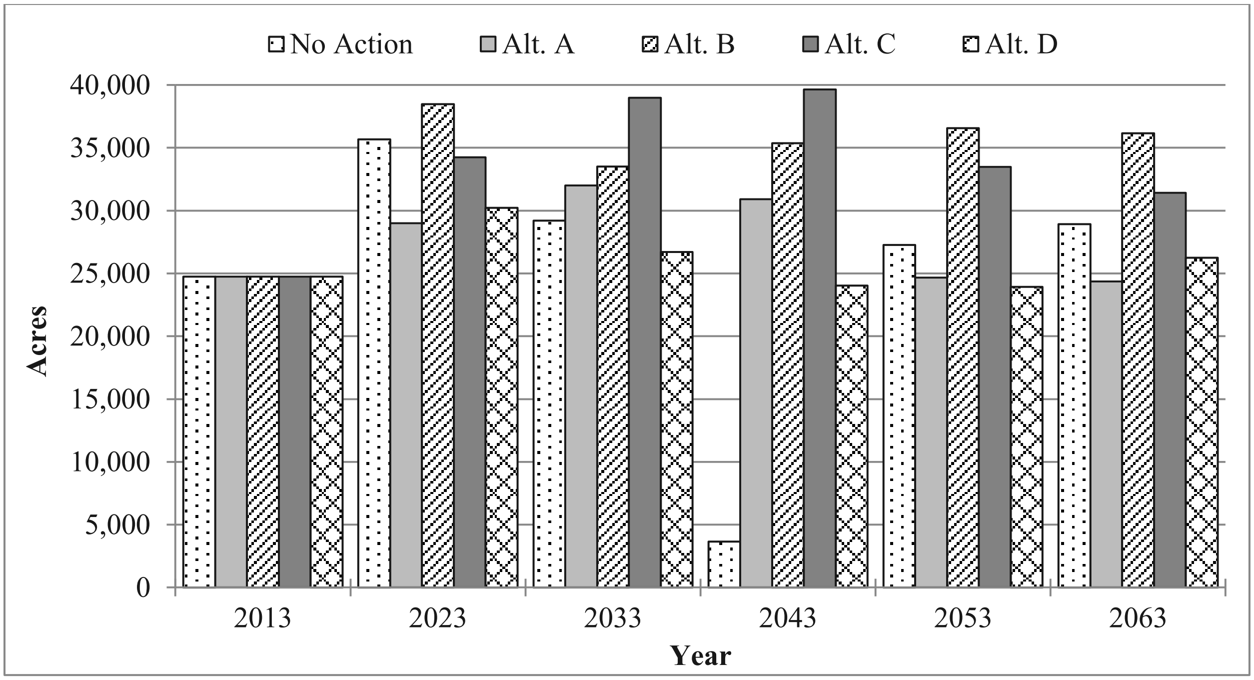

Figure 3-97. Subwatershed area (acres) for all lands susceptible to peak flow increases by alternative.

The affected harvest area on BLM-administered lands varies from 1,180 to 10,173 acres under any alternative and time period, which is less than 0.4 percent of the BLM-administered lands in the decision area and less than 1 percent of the Harvest Land Base under any alternative.

Issue 3

How would timber harvest affect the risk of landslides that would deliver to stream channels under the alternatives?

Summary of Analytical Methods

Shallow translational landslide initiation normally requires some combination of steep and convergent slopes, shallow soils overlying semi-impervious bedrock, and heavy or prolonged precipitation. Removing forest cover can elevate susceptibility to landsliding. Because of the multiple factors affecting landslide occurrence, including stochastic factors, it is not possible for the BLM predict landslide occurrence. Instead, this analysis presents a depiction of risk and the effect of timber harvest under the alternatives on that risk.

In this analysis, the BLM evaluated the risk of landslides by measuring relative landslide density using the geographic information system mass wasting hazard model within NetMap (Miller 2003, Miller and Benda 2005, and Miller and Burnett 2007a). The NetMap model produces a naturally occurring landslide susceptibility from geologic and landform factors, but independent of vegetation factors. The modeling is based on landslide inventories from the Coast Range, Western Cascades, and Klamath Provinces. The model produces a spatially distributed estimate of landslide density by mathematically matching observed landslide locations with topographic attributes including slope, convergence (bowl-shaped landforms), and watershed area, using a digital elevation model. BLM used the channelized mass wasting delivery model in NetMap to determine susceptible areas from the hill slope relative landslide density that could deliver to any stream channel.

The BLM calibrated this modeling for heavy precipitation represented by the 1996 storms (70- to 100-year return period). Extreme storms are highly correlated with increased rates of landsliding on susceptible sites. For the 1996 storms, observed landslide densities and size in the Coast Range were the highest for forest stands less than 10 years old, lower for mature forests, and lowest for forested areas between 10 to 100 years (Miller and Burnett 2007a, Robison *et al*. 1999).

The BLM added forecasts of future timber harvest under each alternative to the NetMap model outputs. In this analysis, the BLM assumed that regeneration harvest would increase the relative landslide density. After regeneration harvest, cut trees root strength rapidly declines and shallow soils lose mechanical strength. Landslide susceptibility lowers substantially 10 years after regeneration harvest and becomes similar to mixed forests or hardwood stands (Ziemer 1981, Miller and Burnett 2007b). In this analysis, the BLM assumed that commercial thinning would not affect landslide risk. After thinning, residual live trees with intertwined roots promote slope stability. Live trees also transpire water, which helps to lower soil water, a causative factor in slope failures. In this analysis, the BLM grouped together various regeneration harvest methods: clearcuts in the HITA in Alternatives A and C, and variable retention harvests in the Matrix and Adaptive Management Areas in No Action alternative, in the MITA and LITA in Alternative B, and in the MITA in Alternative D. It is possible that retention trees in variable retention harvests would reduce the effect of regeneration harvest on landslide risk compared to clearcuts. However, the BLM cannot distinguish this potential effect of retention trees on landslide risk at this scale of analysis. The BLM derived spatial locations of modeled regeneration harvest under each alternative from the Woodstock model outputs. The Vegetation Modeling section earlier in this chapter contains a discussion of the vegetation modeling.

The BLM evaluated relative landslide density only within the Harvest Land Base under each alternative, because the BLM would implement regeneration harvest only within the Harvest Land Base. This is a change from the methodology described in the Planning Criteria and streamlines the analytical procedure to focus on the areas where timber harvest may have a measureable effect on the naturally occurring landslide density. The BLM did not account for the continuing effect of regeneration harvests that the BLM has conducted within the past ten years. As described in the Forest Management section in this chapter, the BLM has conducted only a very small acreage of regeneration harvests in the past ten years.

This analysis within the Harvest Land Base does not account for areas that the BLM has identified or will identify through the timber production capability classification system as unsuitable for sustained yield timber production, such as low-productivity woodlands, unstable landforms, rock bands, talus slopes, meadows, and water-logged soils (USDI BLM 1986). This inventory is ongoing, and the BLM reviews each proposed timber harvest area during interdisciplinary project planning. The BLM will periodically add additional areas to those areas reserved through updates to the timber production capability classification system, when examinations indicate that an area meets the criteria for reservation. Because this modeling does not account for these areas, it overestimates the potential effect of timber harvest on relative landslide risk in these areas. However, these areas unsuitable for sustained-yield timber production would be identified and reserved similarly under all alternatives, and the failure of the modeling to account for these areas would not alter the relative outcomes for the alternatives.

In regeneration harvest areas under each alternative, the BLM multiplied the naturally occurring landslide density by factor of three, to represent the additive risk from regeneration harvest. The BLM derived this factor from the relationship of observed landslides in varying forest age classes on the Siuslaw National Forest during the 1996 storms; the landslide density in stands less than 10 years old was approximately three times the average of stands over 10 years old (Miller and Burnett 2007a).

The BLM did not include potential increases to relative landslide risk from new road construction in this analysis. This is a change from the methodology described in the Planning Criteria (USDI BLM 2014, p.

81). Roads do have the potential to increase landslide risk (Miller and Burnett 2007a, Weaver and Hagans 1996). However, under all alternatives, the BLM would construct few miles of new roads relative to the existing road system (see Trails and Travel Management in this chapter). Furthermore, most new roads under all alternatives would be built on stable areas such as ridge top locations, and would mostly be short spurs to the existing collector roads.

The BLM evaluated the effects of timber harvest on relative landslide density over 50 years. This long period is appropriate, given the importance of stochastic events with long return-intervals (i.e., heavy precipitation) to the underlying landslide risk. Furthermore, this long period is necessary in the analysis to distinguish differences in timber harvest implementation under the alternatives and provide basis for meaningful comparison of the effects of the alternatives.

The BLM used combined landslide density and delivery models in NetMap to calculate the relative susceptibility for direct debris-flow impacts to all stream channels. The BLM classified traversal proportion grid in NetMap to determine the top 80 percent of debris flow risk that would transverse stream segments, based on the cumulative distribution of values. The BLM intersected the regeneration harvest projected in the Woodstock model by alternative and decade with the debris flow risk proportions data layer from NetMap. From this intersection, the BLM determined the potential area of debris flow susceptibility by alternative and decade that may be further elevated by regeneration harvest.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 80-82).

Background

Mountainous topography in western Oregon includes steep slopes, shallow soils, and underlying rock types that may trigger shallow rapid landsliding under high rainfall conditions. Observed differences in the spatial density of landslides are explained in part by variations in geology, topography, and vegetation (Dragovich *et al.*1993). Forests on steep slopes provide partial stability by roots spreading providing mechanical strength and binding of the soil. The important distribution of roots is in the lateral-horizontal direction. Vertical distribution of roots is less important for shallow landslides, because few roots cross the shear plane of the landslides (Schwarz *et al.* 2012). The density of tree roots, especially coarse roots and branching, is important in maintaining slope stability. Tree to tree root grafting further improves slope stability for selective harvest types. Eis (1972) found that 45 percent of selectively cut Douglas-fir trees were root grafted, and approximately half of the stumps from cut trees were still alive 22 years later.

Not all landslides result in effects on streams: from 30 to 70 percent of landslides deliver sediment and other material to streams (Miller and Burnett 2007a). A channelized debris flow (also called debris torrent or sluice-out) is a rapidly moving slurry of soil, rock, vegetation debris and water that can travel long distances from an initiation site through steeply confined mountain channels. Travel distance of stream debris flows depends upon slope gradient, valley width, and high angle tributary junctions encountered. As debris flows move downhill, they entrain additional sediment and organic debris that can expand the original volume by 1,000 percent or more, being more destructive with distance traveled (Benda and Cundy 1990). Debris flows lose energy and terminate at high angle stream tributary junctions and low gradient valley floors.

Affected Environment and Environmental Effects

Figure 3-98 shows the proportion of slopes that are greater than 70 percent by alternative in the Harvest Land Base. These steep slopes occur on 2.5 to 5.5 percent of the Harvest Land Base (14,000 to 42,000 acres) among the alternatives. Not all steep slopes are at high risk of landslides, as discussed above under Analytical Methods and Background.

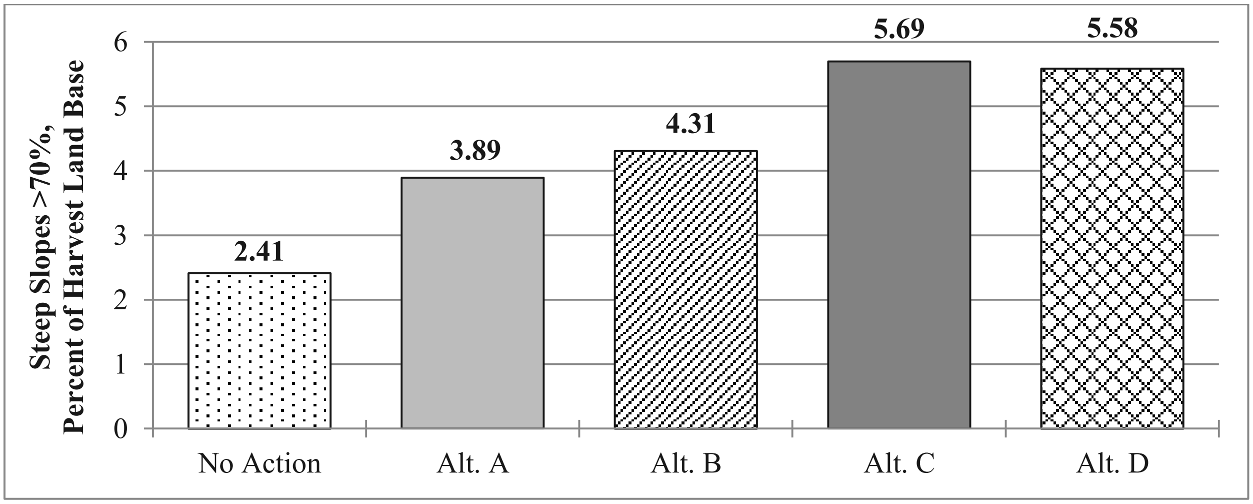

Figure 3-98. Proportion of the Harvest Land Base with steep slopes, > 70%.

The naturally occurring relative landslide density within the Harvest Land Base is similar among the alternatives, although not identical (**Figure 3-99**). The differences are a result of the alternatives allocating different portions of the decision area to the Harvest Land Base. Among all alternatives, almost half of the Harvest Land Base would have a relative landslide density of zero, meaning there would effectively be no risk of landslides. Alternative A would have a slightly higher percentage of the Harvest Land Base with a relative landslide density of zero, compared to the other alternatives. The alternatives would all have a similar percentage of the Harvest Land Base, approximately 2 percent, with the highest relative landslide density (greater than 1 per square mile). As noted in the 2008 RMP/EIS, the Harvest Land Base under the No Action alternative (i.e., Matrix and Adaptive Management Areas) is the portion of the decision area with the lower naturally occurring landslide density. In contrast, the Riparian Reserve, Late-Successional Reserve, and non-forest land use allocations have more than twice the area where modeled naturally occurring landslides exceed 1 per square mile (USDI BLM 2008, p. 349).

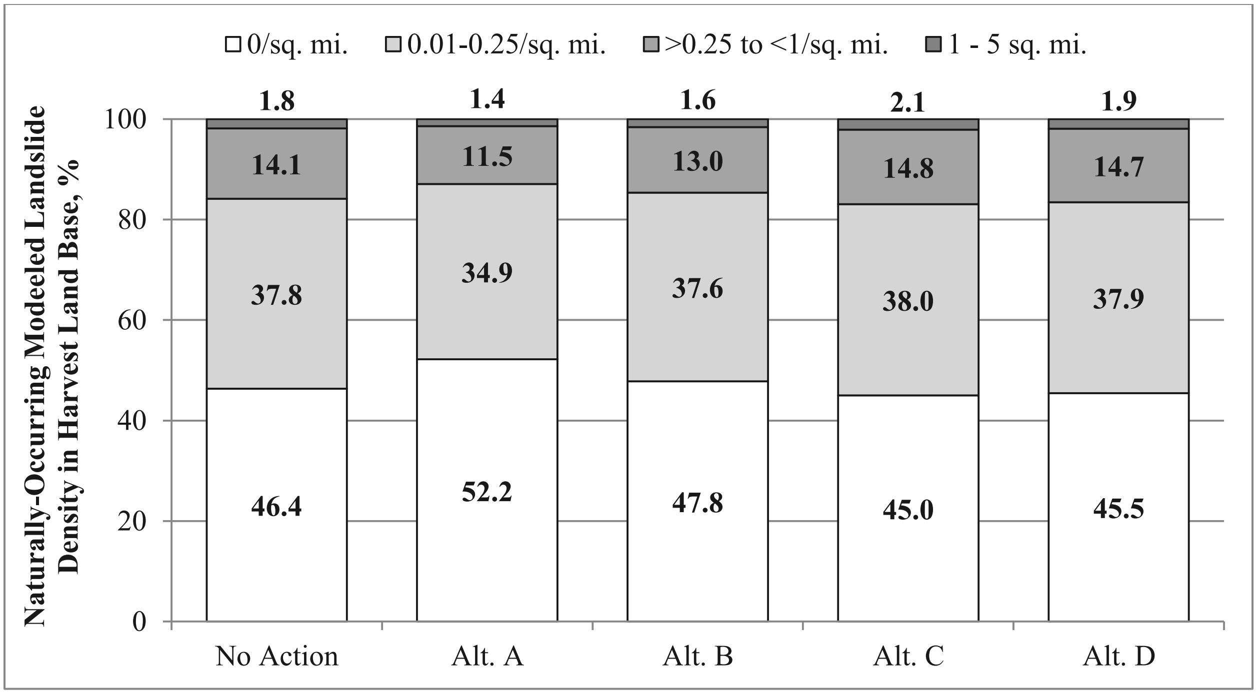

Figure 3-99. Cumulative area of naturally-occurring modeled landslide density within the Harvest Land Base by alternative, number/sq. mi.

Over 50 years, the average landslide density in the Harvest Land Base would increase by varying amounts among the alternatives. Alternative C would have the highest average landslide density among all alternatives, and Alternative A would have the least (**Figure 3-100**). However, Alternative A would have the most increase in average relative landslide density from the naturally occurring landslide density, and Alternative D would have the least. In descending order, Alternatives C, the No Action alternative, and Alternative B would have less increase in average relative landslide density from the naturally occurring landslide density than Alternative A, but more than Alternative D.

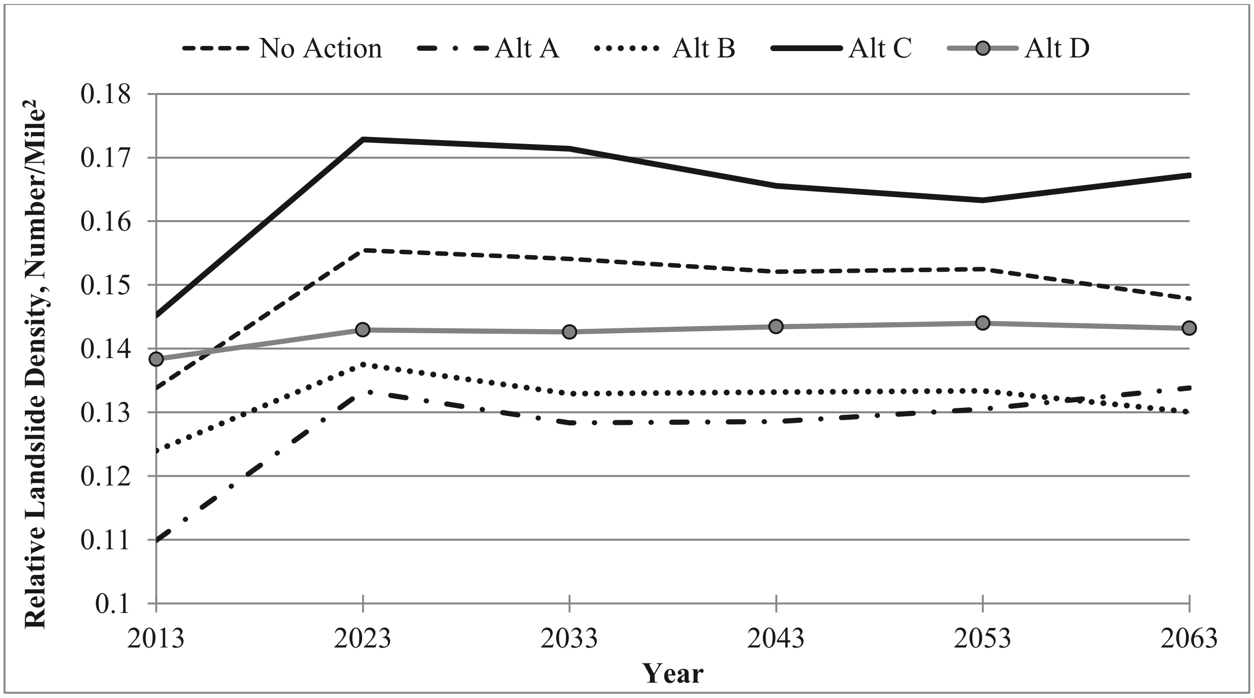

Figure 3-100. Relative landslide density in the Harvest Land Base compared to intrinsic potential at 2013.

The alternatives would vary in the amount of regeneration harvest, and consequently in the potential effect on landslide density. Over 50 years, Alternative A would implement regeneration harvest on the largest percentage of the Harvest Land Base at 11 percent, followed by Alternative C at 9 percent, the No Action alternative at 7 percent, Alternative B at 5 percent, and Alternative D at 3 percent.

The differences in relative landslide density differences among the alternatives are a result of a combination of the naturally occurring relative landslide density that is included in the Harvest Land Base by alternative, and the amount and specific locations of regeneration harvest under each alterative. Within the Harvest Land Base, Alternatives C and D have approximately twice the acres of steep slopes (**Figure 3-98**), compared to Alternatives A and B, and a corresponding higher natural relative landslide density. As noted under Analytical Methods, regeneration harvest under Alternatives B and D and the No Action alternative would retain live trees within the harvest units, in contrast to regeneration harvest under Alternatives A and C. This retention within regeneration harvest units may reduce the average relative landslide density towards what is naturally occurring, but the degree of improvement is not known. The highest risk of landslides is restricted to 2 percent of the Harvest Land Base upon steep slopes, where modeled naturally occurring landslides would exceed one per square mile. The average relative landslide density differences among the alternatives in **Figure 3-100** are slight and similar to what would naturally occur. Contrasted to regeneration harvest areas, a small percentage of young, mature, and structurally-complex forested areas would naturally fail over time, regardless of forest management.

The size and placement of the Harvest Land Base is as important as the intensity of regeneration harvest. For example, as shown in **Figure 3-100**, Alternatives A, and B would have lower average landslide density with regeneration harvest than the naturally occurring landslide density of the No Action alternative, indicating the importance of included or excluded lands in the Harvest Land Base and where suitable stands are available for regeneration harvest. During project planning, the BLM would evaluate project areas for slope stability and would reserve unstable areas under the Timber Productivity Capability Classification.

Under all alternatives, portions of the Harvest Land Base would be susceptible to deliver sediment to a channel by shallow landsliding, whether managed or not. In the context of extreme storms, an average of eight percent of the regeneration harvest areas under all alternatives (ranging from four percent under Alternative D in 2023 to 13 percent in alternative C in 2063) would have some measure of susceptibility to deliver to a channel over the next 50 years. The remaining regeneration harvest areas would have essentially no susceptibility at all. **Figure 3-101** shows the acres of channelized debris flow susceptibility for Alternative C by decade would be approximately twice the acreage under the No Action alternative, while the acreage under Alternatives A and B would be approximately one-half the acreage under the No Action alternative. The acres of channelized debris flow susceptibility by decade under Alternative D would be approximately one-quarter of the acreage under the No Action alternative.

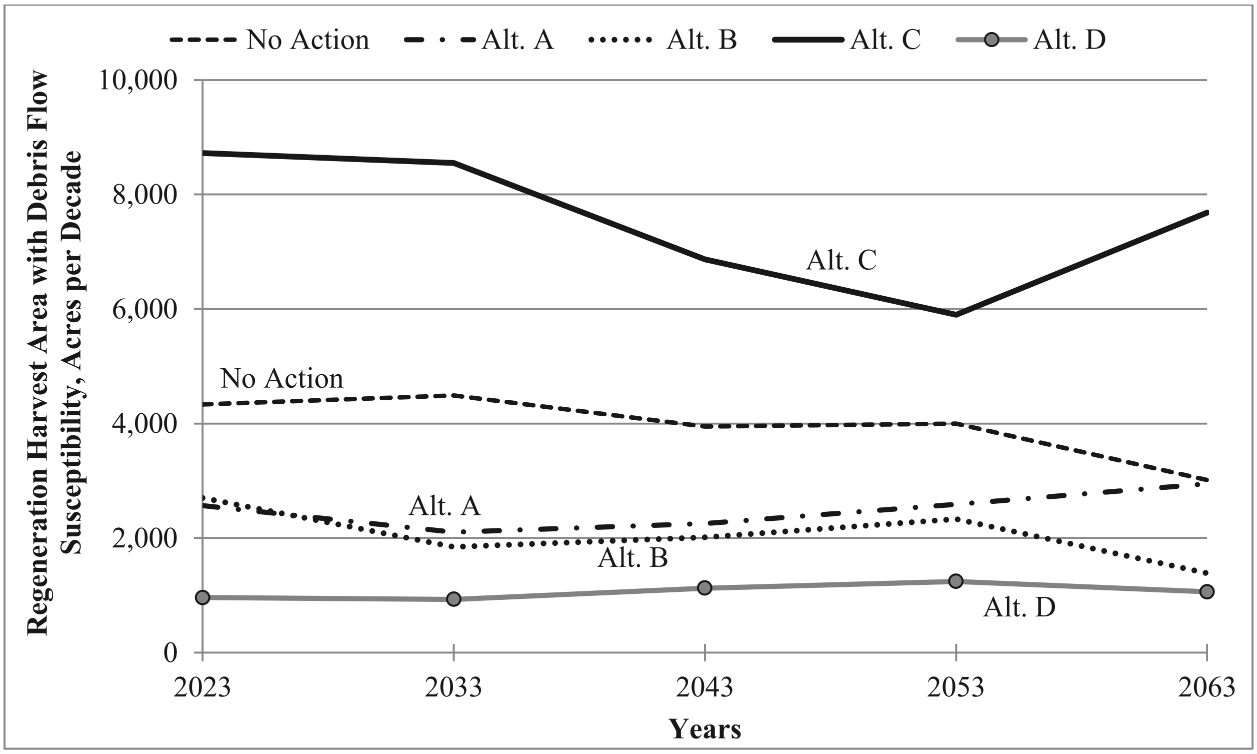

Figure 3-101. Regeneration harvest area with debris flow susceptibility, acres per decade.

Shallow landsliding may contribute sediment, rocks, and forest debris to stream channels from susceptible portions of regeneration harvest areas during extreme storms, and from other unmanaged areas of the Harvest Land Base. There is increased risk for landsliding where the combination of steep slopes and geomorphic factors lower hill slope stability. Removal of vegetation by regeneration harvest would lower the strength of live roots binding the soil. If an extreme storm would occur during the early-successional period, the susceptibility of landsliding would be increased compared to forests where basal area would be maintained. Under all alternatives over the next 50 years, the area of increased landsliding susceptibility with potential to deliver to streams would average no more than 8 percent of the regeneration harvest area and less than one percent (0.63 percent) of the Harvest Land Base.

Issue 4

How would new BLM road construction and road decommissioning under the alternatives affect disturbance and sources of fine sediment that may deliver to stream channels?

Summary of Analytical Methods

The analysis compares surface erosion from roads for existing roads and the projected new roads under each alternative. Sediment delivery from roads can result from surface erosion, gullying, and mass wasting. However, due to limitations of model capability and geospatial processing across the large planning area, this discussion is restricted to surface erosion from roads.

The empirical basis for this analysis is the Washington Road Surface Erosion Model (WARSEM) Manual (Dube *et al.* 2004). In this analysis, the BLM used the WARSEM methodology combined with BLM spatial GIS data layers to derive estimates of annual long-term sediment production. Factors affecting surface erosion include geologic parent material, surface type, age of the road, road drainage, degree of vegetative cover on cut and fill slopes, and traffic factors including winter haul. In this analysis, the BLM evaluated watersheds (approximately 60 to 300 mi^2) (USGS hydrologic unit code 10, which had previously been termed “fifth-field” watersheds).

In this analysis, the BLM used projected timber volume by alternative and road ratios by harvest type described in the Planning Criteria (USDI BLM 2014, pp. 127-128, Tables 28-31) to determine miles of new temporary and permanent road construction for natural and aggregate surfaced road by forest treatment type. The BLM used these road ratios from analysis in the 2008 RMP/EIS and calculated miles of existing and new permanent BLM road construction by surface type within a 200-foot sediment delivery distance to streams using selected WARSEM parameters (formally DNR Reference Road model) and the 2008 RMP/EIS 10-Year Scenario (USDI BLM 2008, Appendix I, Water, pp. 239-240).

This analysis calculated potential fine sediment delivery (tons/year) from new temporary and permanent roads by alternative through 2023. Although the Planning Criteria displayed calculations over a longer period, this analysis is restricted to a ten-year time span because estimations of road construction beyond ten years become speculative. After ten years of implementation of any alternative, the road system would be fully developed for the most part. That is, the BLM would have built most of the road network necessary to provide access to the actively managed forest stands and road construction would decline over time. In addition, new road construction and logging technology and changing harvest types would continue to reduce the road construction necessary to provide access to the actively managed forest stands. Therefore, potential fine sediment delivery from new roads in future decades would be lower than the sediment delivery calculated for the first decade.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, and is incorporated here by reference (USDI 2014, pp. 82-88).

Background

Soil erosion is a natural occurrence in a forested landscape, aided by water, climate, gravity, soil properties, and lack of vegetative cover. Forest roads are unnatural, compacted surfaces and offer opportunities for accelerated erosion and potential sediment delivery to stream channels from a variety of sources, including small slumps and slides into the roadway from the cut bank, water channeling from the road or ditches if not properly directed and controlled, and blocked culverts and road fill washouts during floods. Sediment sources from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (USDI BLM 2008, pp. 343-346).

Roads can deliver up to 90 percent of the total sediment production from forestry activities. This especially occurs on older roads where mid-hillslope construction and side casting of excess soil material was common (EPA 2005). Newer roads built in the last 30 to 40 years typically use ridge top locations, full bench construction practices across steep slopes removing excess soil material to offsite waste areas, and manage drainage more effectively. In general, modern road construction practices produce less sediment delivered to streams from forest roads than older road construction practices (Copstead 1998).

The distance that sediment travels along roadways depends upon a number of factors, including underlying geology, age of road since construction, road gradient, road drainage, and ground cover. The average sediment travel distance from seven studies in different geologies is 40 feet, with a range of zero to 639 feet. Sediment travel distances from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (USDI BLM 2008, p. 345).

There are 14,330 miles of inventoried BLM-controlled roads in the planning area, distributed as 1,390 miles paved (10 percent), 10,242 miles gravel surface (71 percent), and 2,698 miles natural surface (19 percent). There are a higher proportion of paved roads in the precipitation-dominated Coast Range province than in the drier Klamath province. When evaluating all BLM roads, the highest potential sediment yield is from natural surface roads, which average 9.61 tons/ mi^2/year. The lowest yield is from paved roads, which average 1.58 tons /mi^2/ year (USDI BLM 2008, p. 346).

Approximately 36 percent of all existing BLM-controlled roads on BLM-administered lands are within a 200-foot delivery distance (5,096 miles of 14,330 total miles). The average potential fine sediment delivery yield to streams from existing BLM-controlled roads within the 200-foot sediment delivery distance is 2.26 tons/mi^2/year as shown in **Table 3-72** (USDI BLM 2008, p. 347, **Table 3-71**). The highest potential fine sediment yield is from natural surface roads, while the lowest potential fine sediment yield is from paved roads.

Table 3-72. Potential fine sediment delivery from existing roads.

Existing Roads[a]	Roads Within Fine Sediment Delivery Distance (Miles)[b]		Potential Fine Sediment Delivery (Tons/Year)[c]		Watershed Potential Fine Sediment Delivery (Tons/Mile²/Year)[c]	
	BLM	Other	BLM	Other	BLM	Other
Natural	1,738	15,874	23,050	233,054	0.86	8.75
Aggregate	2,590	22,938	28,938	30,765	1.09	1.15
Paved	767	2,436	8,277	33,807	0.31	1.27
Totals	**5,096**	**21,249**	**60,265**	**297,626**	**2.26**	**11.17**

[a] Includes BLM-controlled roads and private roads within the decision area from BLM GIS GTRN (roads) coverage.
[b] Includes road segments within 200 feet of a stream channel where ditch flow, carrying fine sediment, could enter streams.
[c] Planning criteria estimate in which calculations are based on surface type for each HUC 10 watershed and summed for the planning area.

Implementation of Best Management Practices is a primary reason that BLM roads currently result in a minor portion of the total sediment delivery to streams from roads. In addition, the existing BLM road system has approximately 900 miles of road within the 200-foot sediment delivery distance not used or maintained, or decommissioned. The process of decommissioning includes the application of Best Management Practices, including blocking the road, out-sloping and adding waterbars for drainage control, applying erosion control and ensuring stream hydrologic conductivity, thereby reducing potential sediment delivery from roads.

Forest management activities require Best Management Practices in designing and constructing permanent and temporary roads under all alternatives to maintain or improve water quality. The Best Management Practices include methods that either avoid or minimize the delivery of sediment to streams. Specific Best Management Practices have been developed for timber harvesting, road construction and maintenance, road decommissioning, energy and mineral development, fuel treatments, and other forest activities. Examples of the important Best Management Practices that involve road construction and use include are shown in **Table 3-73 (**Appendix I has a complete listing).

Table 3-73. Best Management Practices for road and landing construction.

Best Management Practice	Oregon Dept. of Forestry/ Oregon Administrative Rules[59] Forest Roads - Division 625
Locate temporary and permanent roads and landings on stable locations, e.g., ridge tops, stable benches, or flats, and gentle-to-moderate side slopes. Minimize construction on steep slopes, slide areas, and high landslide hazard locations.	(OAR) 629-625-0200 (3) ODF, Road Location
Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.	(OAR) 629-625-0200 (3-4) ODF, Road Location
Design roads to the minimum width needed for the intended use.	(OAR) 629-625-0310 (3) ODF, Road Prism
Place sediment-trapping materials or structures such as straw bales, jute netting, or sediment basins at the base of newly constructed fill or side slopes where sediment could be transported to waters of the state.	(OAR) 629-625-0440 ODF, Stabilization
Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.	(OAR) 629-625-0600 ODF, Road Maintenance
Retain low-growing vegetation on cut- and fill-slopes.	(OAR) 629-625-0600 ODF, Road Maintenance

Affected Environment and Environmental Effects

The 5,096 miles existing BLM-controlled roads within the 200-foot sediment delivery distance produce 60,265 tons/year of potential fine sediment delivery.

All alternatives would include new road construction that would increase the amount of potential fine sediment delivery through 2023. The incremental increase in potential fine sediment delivery from new road construction over the next 10 years would range from 50 tons/year under Alternative D to 367 tons/year under the No Action alternative, as shown in **Figure 3-102.** Under all alternatives, this increase would constitute less than one percent increase above current levels of fine sediment delivery from existing roads (note the logarithmic scale of **Figure 3-102**). Although the absolute values for increased potential fine sediment delivery through 2023 vary by alternative, these differences do not represent a substantial difference in the effects of the alternatives, because the increases in sediment delivery and the differences among the alternatives in future increases in sediment delivery are so small in comparison to the existing sediment delivery.

[59] BLM BMP's are cross-walked to applicable Oregon Forest Practices and Oregon Administrative Rules.

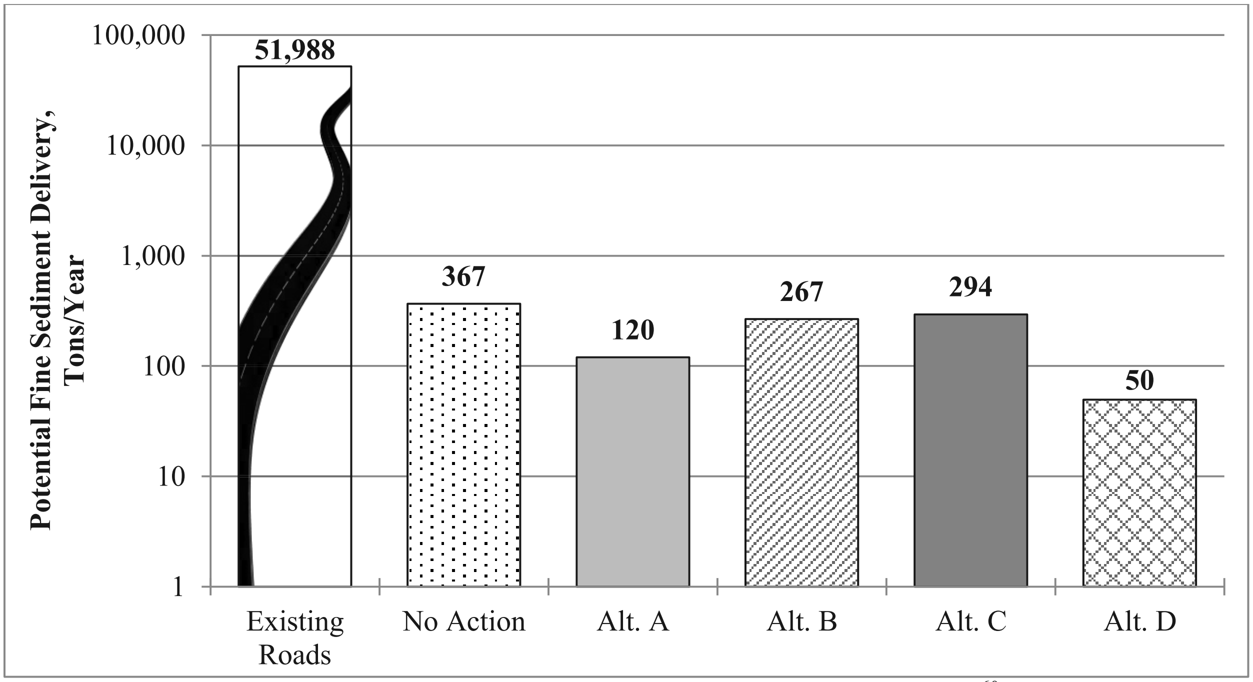

Figure 3-102. Potential fine sediment delivery to streams from new roads by 2023.[60]

This increase in potential fine sediment delivery would vary under the alternatives with the amount of new road construction within the sediment delivery distance as shown in **Figure 3-103**. Under all alternatives, fewer new roads would be located inside a 200-foot sediment delivery distance than in upslope areas , because many transportation routes that parallel streams within a sediment delivery distance to streams are existing, permanent roads. Under all alternatives, there would be an average of less than 1 percent increase in roads within a sediment delivery distance to streams channels, compared to an average 6 percent increase in upland areas outside a sediment delivery distance for planned permanent and temporary roads, as shown in **Figure 3-103**.[61]

[60] The vertical axis is logarithmic to view the range of data.
[61] The road ratios for harvest type and volume are proportioned inside the sediment delivery buffer at the same rate as upslope, which overestimates newly constructed permanent roads.

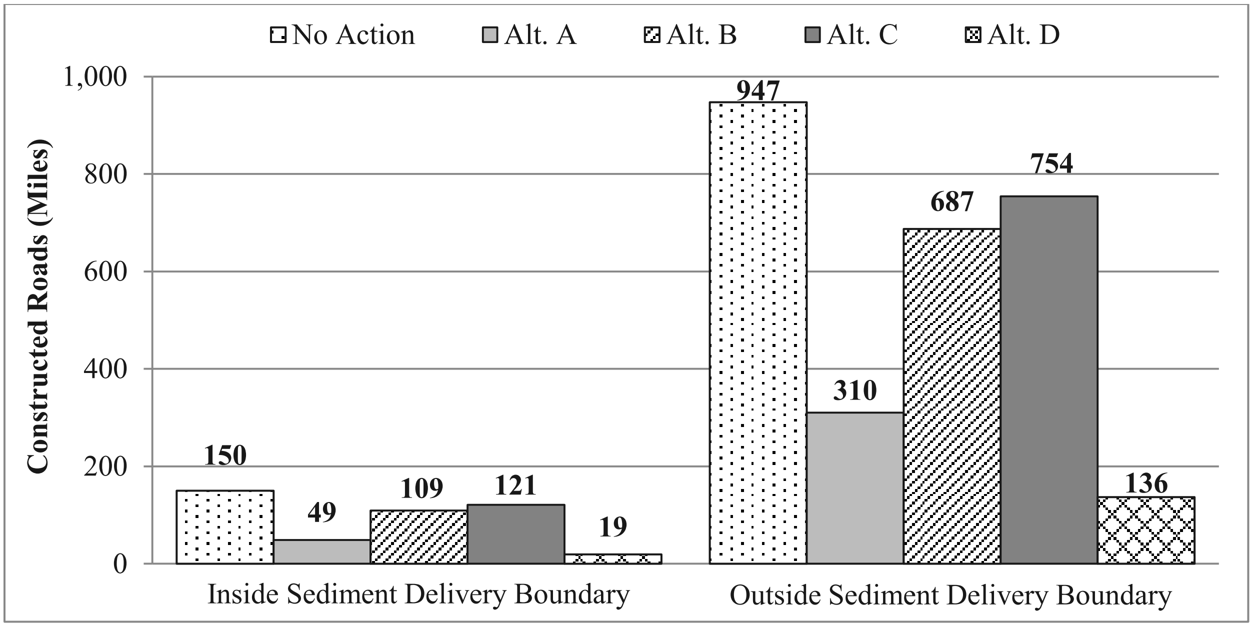

Figure 3-103. Projected newly constructed roads within a sediment delivery distance compared to newly constructed roads by 2023.[62]

Under all action alternatives, management direction in the inner zone of the Riparian Reserves would reduce the need for road construction in the sediment delivery distance and ensure that riparian forests maintain an effective sediment filtration area along streams. All action alternatives define a near-stream inner zone, in which the BLM would not thin stands. This inner zone would vary in width by stream type and by alternative, from 50 to 120 feet on either side of streams. New road locations would not be needed under any of the action alternatives to provide access for thinning riparian stands in the inner zone, and would therefore intrude into the 200-foot sediment delivery distance only where there would be no other reasonable routes to access upslope forest stands. Within the sediment delivery distance (200 feet), newly constructed roads would primarily be constructed to provide access for forest thinning within the Riparian Reserve. In the action alternatives, this thinning would be limited to the outer zone of the Riparian Reserve. Except for roads very near the stream channel or stream crossings (with connected ditches to the first upslope cross-drain), this unthinned, inner zone riparian forest near streams would result in effective sediment filtration, when compared to the mean sediment travel distance of 40 feet (USDI BLM 2008, p. 345, Table 3-58). Additionally, under Alternative A, no commercial thinning would be conducted within the Riparian Reserves in moist forests (inner or outer zone) and only for the purpose of fuels reduction in the dry forests (outer zone only), further reducing the need for roads within the sediment delivery distance.

There is an element of uncertainty related to road construction within the sediment delivery boundary under the No Action alternative compared to the action alternatives. As explained in analytical methods in the Fisheries section, riparian thinning under the No Action alternative is allowed anywhere in the Riparian Reserve with no specific retention requirements. However, activities must meet the Aquatic Conservation Strategy objectives, which are often difficult to interpret at the site scale. Nevertheless, the 1995 RMPs do not define a “no-thinning” inner zone, which makes the estimation of road construction related to riparian thinning under the No Action alternative less certain than under the action alternatives.

[62] Includes permanent and temporary roads

This greater uncertainty related to riparian thinning under the No Action alternative would result in greater uncertainty about the effectiveness of riparian forests in providing a sediment filtration area along streams.

Under all alternatives, the BLM would decommission 372 miles of permanent road by 2023, bringing the total road in long-term storage to 1,272 miles (8 percent of the entire road system). Decommissioning includes a variety of practices, ranging from simply blocking access to the road to “full decommissioning,” which may include re-establishing drainage by removing culverts and re-contouring, and planting the road bed. The BLM estimates that approximately one-quarter of the roads decommissioned would be “fully decommissioned,” which would typically reduce potential fine sediment delivery by 11 to 13 tons/mile/year, based on the data used to derive **Table 3-72** in the Background section. For all decommissioned roads, potential fine sediment delivery would decline over time, but the amount of improvement would be difficult to estimate. The reduction in potential fine sediment delivery following decommissioning would depend on site-specific and road-specific factors and the level of decommissioning, which cannot be predicted and evaluated at this scale of analysis. The BLM may reopen these decommissioned roads in the future if needed to provide access for management, such as when timber stands in the Harvest Land Base reach harvestable age. Unneeded roads would remain decommissioned. Which roads would be decommissioned and whether they would remain decommissioned would depend on site-specific and road-specific conditions related to whether the road would be needed to provide access for future management actions.

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Invasive Species

Key Points

- The risk of introducing and spreading invasive plant species over the next 10 years, and in the long-term, would be lowest under Alternative D, and highest under Alternatives B and C.
- In the Coos Bay and Medford Districts, and the Klamath Falls Field Office, the overall relative risk for the introduction and spread of invasive aquatic species would be lowest under Alternative D and highest under the No Action alternative and Alternative C.
- In the Eugene, Roseburg, and Salem Districts, the overall relative risk for the introduction and spread of invasive aquatic species would be lowest under Alternatives A and B and highest under Alternative C.
- Sudden oak death infestations would occupy 100 percent of the Riparian Reserve in Infestation Zone 2 and almost 90 percent in Infestation Zone 3 by 2033 under Alternatives A and B.

Issue 1

How would alternatives affect invasive plant introduction and spread?

Summary of Analytical Methods

The BLM compared the relative risk of introducing and spreading invasive species resulting from the alternatives' varied land use allocations and planned management activity levels, while taking into consideration the collective distribution of a representative set of invasive plant species. Invasive species are non-native species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. The chosen species characterize the general distribution and condition of invasive species occurrences on BLM-administered lands in western Oregon. They represent a variety of strategies for introduction, spread, and resistance to certain treatment methods. The alternatives' differing approaches to land use allocations (including off-highway vehicle designations), timber harvest levels, harvest methods, Riparian Reserve widths and direction, new road construction, and livestock grazing drives the variation in the effects on invasive species.

The Planning Criteria provides detailed information on the invasive plant analysis and assumptions, which the BLM incorporates here by reference (USDI BLM 2014, pp. 90-98).

The BLM measured the effects of timber harvest, road management activities, off-highway vehicle (OHV) use, and livestock grazing on the introduction and spread of invasive plant species in terms of susceptibility and risk at the scale of HUC 10 watersheds (formerly known as 5th-field watersheds). Susceptibility is the extent to which an area is vulnerable to the introduction and spread of invasive species; risk accounts for both susceptibility and the existing distribution and abundance of invasive species in a given area. The higher the susceptibility and the higher the distribution and abundance in a particular area the more at risk it is. Timber harvest, road management activities, and OHV use can create susceptibility for invasive plant species introduction and spread.

In this analysis, the BLM assumed that OHV users would operate vehicles consistent with BLM decisions about OHV use. Although the BLM has some site-specific and anecdotal information about illegal OHV use, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal OHV use. In addition, much of the decision area has physical limitations to potential illegal OHV use, including dense vegetation, steep slopes, and locked gates. In most of the interior/south, the ability to track numerous different routes across the open spaces can lead to degradation and erosion in a greater proportion than most of the coastal/north. However, the BLM lacks a basis for characterizing current illegal OHV use or forecasting such potential illegal OHV use in the future under any of the alternatives at this scale of analysis.

The BLM used the following factors to assess the relative levels of risk for the inadvertent introduction of invasive plant species on the BLM-administered lands:

- Distribution and abundance of invasive plant species
- Types of timber harvest and logging methods
- Proximity of harvest activity to streams
- Intensity and distribution of management activities
- Designations for OHV use
- Availability for livestock grazing

The analysis assumed that actions on other ownerships and actions other than timber harvest, road management activities, OHV use, and livestock grazing on BLM-administered lands would continue to contribute to invasive plant species introduction and spread at current levels. These actions include BLM management of special forest products, rights-of-way agreements, road maintenance, and fuels reduction treatments. Any future changes in the contribution from these other activities to the risk of introduction and spread of invasive plant species would be speculative and depend largely on site-specific factors that are inappropriate to analyze at this scale. There is no basis for speculating that such changes would vary among the alternatives. Therefore, information on the contribution of these other management actions to the risk of introduction and spread of invasive plant species is not necessary for a reasoned choice among the alternatives.

Determining Species Distribution Categories

The BLM pooled representative invasive plant species occurrence data from BLM corporate datasets and iMapInvasives (OBIC 2013). The BLM evaluated the collective pool of reported sites to determine representative invasive plant presence for each square mile in a grid applied to the planning area. Invasive plant species distribution categories of Abundant, Limited, and Low are based on the known representative species' distribution in the HUC 8 (4^{th}-field) and HUC 10 (5^{th}-field) watersheds, depending on the issue being analyzed:

- Abundant – the representative invasive species reported from more than 25 percent of the square miles within the watershed
- Limited – the representative invasive species reported from more than one percent and less than 25 percent of the square miles within the watershed
- Low – the representative invasive species reported in no more than one percent of the square miles within the watershed

HUC 10 watersheds fitting the Abundant species distribution category are more likely to have invasive species introduction and spread associated with management and human activities than those fitting the Limited and Low species distribution categories because there are already relatively more infestations within them.

Figure 3-104 visually presents reported infestations of representative invasive plant species within the planning area.

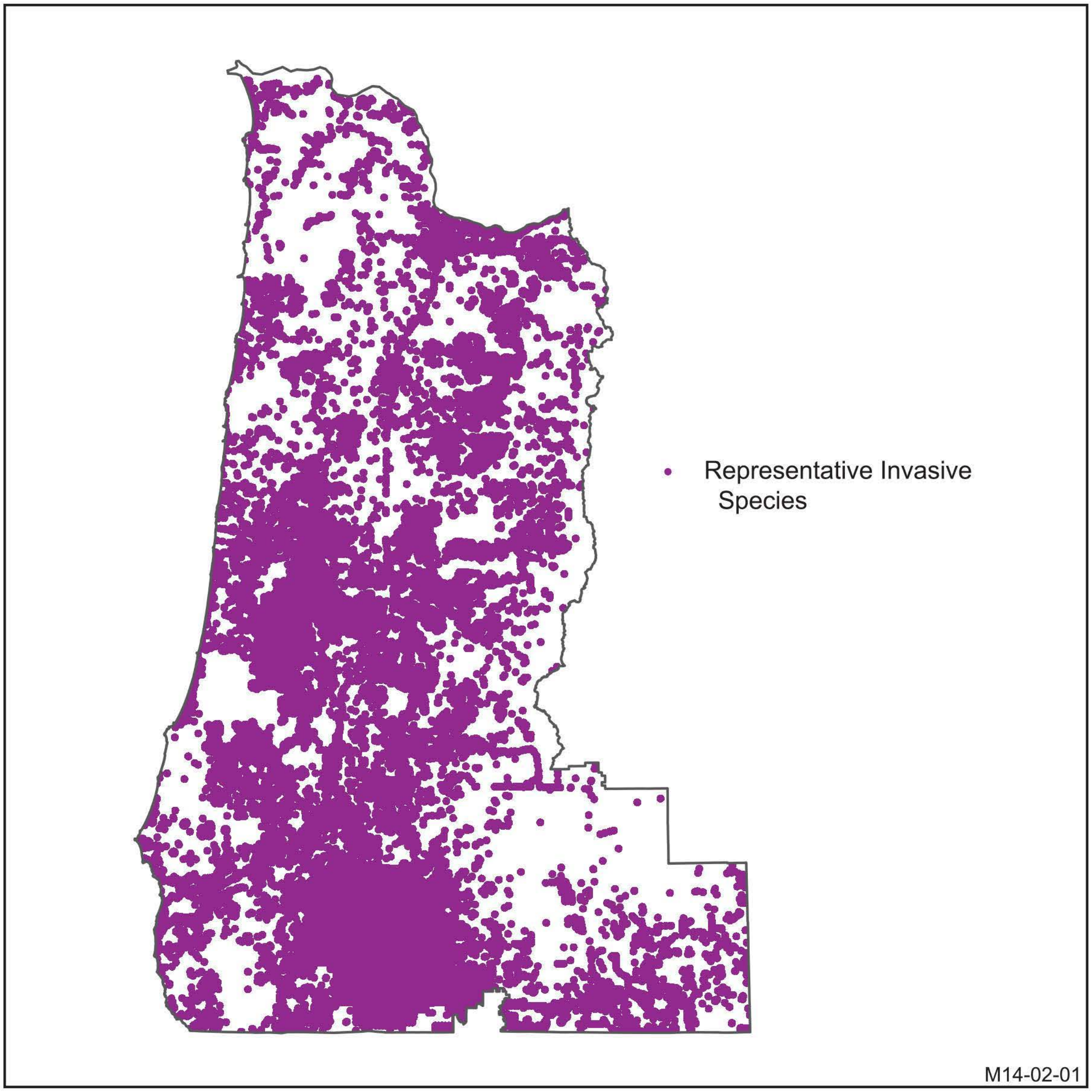

Figure 3-104. Reported infestations of representative invasive plant species within the planning area.

Assessing Risk Associated with Timber Harvest of Invasive Plant Species Introduction and Spread to Watersheds

The risk of introducing invasive plant species over the next 10 years as a result of timber harvest activities would vary by alternative. The BLM used the invasive plant distribution categories, the acres of the different timber harvest types (thinning, regeneration harvest, and uneven-aged management), and the methods of logging to determine the relative risk of introducing invasive plant species in each alternative. For the purposes of this analysis, the BLM assumed:

- Regeneration harvests would create higher light levels than commercial thinning and uneven-aged management. Lower retention levels in regeneration harvests would create higher light levels after harvest than regeneration harvests with higher retention levels.
- Ground-based logging methods would disturb more soil, cable skyline systems would disturb less

soil, and aerial logging systems would disturb the least amount of soil. Logging methods are not generally prescribed in the draft alternatives; the BLM used logging method assumptions for this analysis that are based on assumptions developed for the 2008 RMP/EIS.

The BLM determined the susceptibility of watersheds to invasive species introduction associated with timber harvest by analyzing the alternatives' estimates of timber harvest volumes from the Woodstock vegetation model and the timber harvest type and harvest method coefficients developed for the 10-year scenarios in the 2008 RMP/EIS (**Appendix C**). The geographic arrangement of timber harvests is a modeling product and not a product of actual site-specific project planning.

For each alternative, the BLM estimated the acres of timber harvest activities for HUC 10 watersheds in the planning area for the next 10 years using the harvest volumes generated from the Woodstock vegetation model. Each timber harvest type, based on their respective post-harvest light levels, received a relative weight of 1 or 5. Each logging method, based on their respective levels of soil disturbance received a relative weight of 1, 3, or 5. The BLM assumed the non-commercial restoration thinnings in the moist forests reserves under Alternative A would neither increase the light levels nor disturb the soil enough to create susceptibility for invasive species introduction and spread. Multiplying the weighted values by the HUC 10 watersheds' estimated acres for the timber harvest types and methods over the next 10 years allowed the BLM to generate combined timber harvest activity weighted value for each HUC 10 watershed.

Dividing these combined timber harvest values into three groups of Low, Moderate, and High allowed the BLM to assign each HUC 10 watershed to one of these three susceptibility categories for introduction of invasive plant species from timber harvest activities.

The BLM determined the risk for invasive species introduction associated with timber harvest by considering both the susceptibility category and the presence of invasive plant species. HUC 10 watersheds with a low distribution of invasive plant species and that are in the Low susceptibility category would have the lowest risk of invasion. The greatest risk of invasion would be in HUC 10 watersheds that are both in the High susceptibility category and where invasive plant species are abundant. Watersheds with no reported sites for the representative sample set of invasive plant species in the analysis, no BLM-administered lands, or no timber harvest activity susceptibility category in the first ten years do not have an assigned risk category.

Assessing Risk of Invasive Plant Species Introduction and Spread into Riparian Habitats Associated with Riparian Reserve-Adjacent Timber Harvest and Thinning in Riparian Reserves

The BLM assessed the susceptibility of invasive species introduction into riparian habitats associated with each alternative by considering the relative impact of the widths of Riparian Reserves, management direction within the Riparian Reserve, and levels of restoration timber harvest activity within the Riparian Reserve. These factors affect the light levels in riparian habitats; the higher the light levels, the higher the risk for the introduction of invasive plant species. As described in the Planning Criteria, the BLM assumed that the light levels of areas within 100 feet of timber harvest would increase and that the light levels farther than 100 feet from timber harvest would remain unaffected.

The effects of Riparian Reserve-adjacent timber harvest activity on invasive species in riparian habitats over the next ten years were analyzed using spatial analysis to determine susceptibility values for the effects of timber harvest activities occurring outside of and adjacent to the Riparian Reserve with widths less than 100 feet on either side of streams. Multiplying Riparian Reserve acres susceptible to effects from the alternatives' timber harvest activities by weights accounting for the relative differences in the combination of factors below provides a range of HUC 10 watershed riparian susceptibility values and subsequent susceptibility categories of High, Moderate, and Low:

- Light generated by timber harvest types
- Soil disturbance from different timber harvest methods
- Shade reduction in stands adjacent to timber harvest activities

The BLM uses riparian susceptibility and species distribution categories to determine the risk by alternative of introducing invasive plant species into riparian habitats over the next 10 years.

Probable restoration thinning acres in the outer zones of the Riparian Reserve from the Woodstock model's pivot tables provide a basis to compare the susceptibility of introducing invasive plant species into riparian habitats through such restoration thinning across the alternatives over the next 10 years for each office. For the purposes of this analysis, the risk of introducing invasive plants into riparian habitats from restoration thinning activities matches the level of susceptibility.

As described in Fisheries, there is an element of uncertainty related to riparian thinning under the No Action alternative compared to the action alternatives. Riparian thinning under the No Action alternative is allowed anywhere in the Riparian Reserve with no specific retention requirements. However, activities must meet the Aquatic Conservation Strategy objectives, which are often difficult to interpret at the site scale. Nevertheless, the 1995 RMPs do not define a "no-thinning" inner zone, which makes the implementation of riparian thinning less certain than under the action alternatives.

Assessing Risk of Invasive Plant Species Introduction and Spread Associated with New Road Construction

Road construction and associated road management activities involving disturbance to soil and increased light levels contribute to the introduction of new infestations and the spread of existing invasive plant infestations. New infestations start when invasive plant species seed or vegetation hitchhike on road construction equipment to a project area. Soil disturbance and increased light created by road construction activities provide opportunities for invasive plants already present in a project area to thrive. Light and disturbed soils provide favorable conditions for invasive plant seed germination and plant establishment.

The BLM determined the susceptibility of watersheds to invasive species introduction associated with new road construction by prorating each HUC 10 watershed with the road construction estimates for each alternative produced in the Trails and Travel Management section. These susceptibility values fall into relative susceptibility categories allowing the BLM to compare the susceptibility of the HUC 10 watersheds to invasive plant species introduction and spread. The geographic arrangement of timber harvests is a modeling product and not a product of actual site-specific project planning so the actual location of new road construction is just an estimate.

The BLM used the susceptibility categories and species distribution categories for the HUC 10 watersheds to determine each alternative's relative risk of invasive plant introduction associated with road construction.

Assessing Risk of Invasive Plant Species Introduction and Spread Associated with Off-Highway Vehicle Use

New infestations can start when invasive plants and seeds hitchhike to uninfested areas on OHVs.

Infestations associated with OHV use tend to spread along road and trail corridors. OHV use along roads and trails disturb soil, especially along new trials. The combination of disturbed soil conditions from OHV use and OHVs serving as inadvertent invasive plant vectors create susceptibility.

The BLM assessed the susceptibility of BLM-administered lands in the planning area to invasive species introduction associated with OHV use by comparing each alternative's acres of *open*, *closed*, and *limited* OHV designations. The BLM assumed that areas designated as *open* to OHV use would be more susceptible to having new introductions of invasive plant species and infestation spread than areas designated as *limited* or *closed* to OHV use. The BLM assumed that all closures would be respected and that areas designated *closed* to OHV use would not be susceptible to new introductions and spread of invasive plant species associated with OHV use.

The BLM assigned OHV designation weights to each part of the HUC 10 watershed having a different OHV designation under each alternative. OHV designation susceptibility weights are the following:

- Open = 5
- Limited = 3
- Closed = 0

For each alternative, the BLM multiplied the susceptibility weights by total acres per watershed for each of the three designations to generate a set of susceptibility values for the HUC 10 watersheds and then divided them into three categories: High, Medium, and Low.

The BLM used the susceptibility weights and species distribution categories for the HUC 10 watersheds to determine each alternative's relative risk of invasive plant introduction associated with OHV designation.

Assessing Risk of Invasive Plant Species Introduction and Spread Associated with Livestock Grazing

The BLM assessed the risk of invasive species introduction associated with livestock grazing by comparing the relative amount of land available for grazing under each alternative. Livestock grazing creates ground disturbance, which creates susceptibility for the introduction and spread of invasive plants. The BLM assumed invasive plants occur in the areas available for livestock grazing. Therefore, areas that the BLM determined would be susceptible for introduction and spread of invasive plants associated with livestock grazing would be at risk. Comparing each district's acreage available for livestock grazing provides a relative assessment for the introduction and spread of invasive plants across the alternatives.

Assessing Risk of Long-Term Introduction and Spread of Invasive Plant Species

The analysis used a 10- to 20-year period after the first 10 years of implementation for the discussion of long-term effects of inadvertent introduction and spread of invasive plants because of BLM management activities across the planning area. The effectiveness of prevention practices, treatment effectiveness, and new introductions of invasive plants over time are too uncertain to allow for a useful analysis beyond 30 years.

Over the long-term, the BLM assumed that the potential for the introduction and spread of invasive plant species would be higher in the Harvest Land Base than in the reserves under all alternatives. Although some restoration thinning would occur in reserves, the contribution of thinnings toward invasive plant introduction and spread would be less than the contribution from the sustained yield timber harvest in the

Harvest Land Base.

The BLM determined the long-term risk for invasive species introduction into riparian habitats associated with timber harvest activities by considering the relative amount of Riparian Reserve under each alternative, the Riparian Reserve widths, and the management direction for timber harvest activities within 100 feet on either side of streams.

Affected Environment

The Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts describes the Invasive Plant management program in detail, which the BLM incorporates here by reference (USDI BLM 2008, pp. 274-282). This reference includes definitions, magnitude of invasive species diversity in the planning area, and information about how land management activities contribute to invasive plant introduction and spread within the planning area.

While the affected environment section from the 2008 planning effort is still pertinent, data sharing among land managers has led to a more robust understanding of the distribution of invasive plant species than was available in 2008. The distribution of invasive plant species is available at iMapInvasives (online at www.imapinvasives.org). While this data is more robust then that available in 2008, the fact that there is no requirement for county, private, or corporate landowners to report invasive plant information still limits the data.

Figures 3-105 and **3-106**, and **Table 3-74** show that the representative invasive plant species are common throughout the planning area and demonstrate the relative density of the reported infestations.

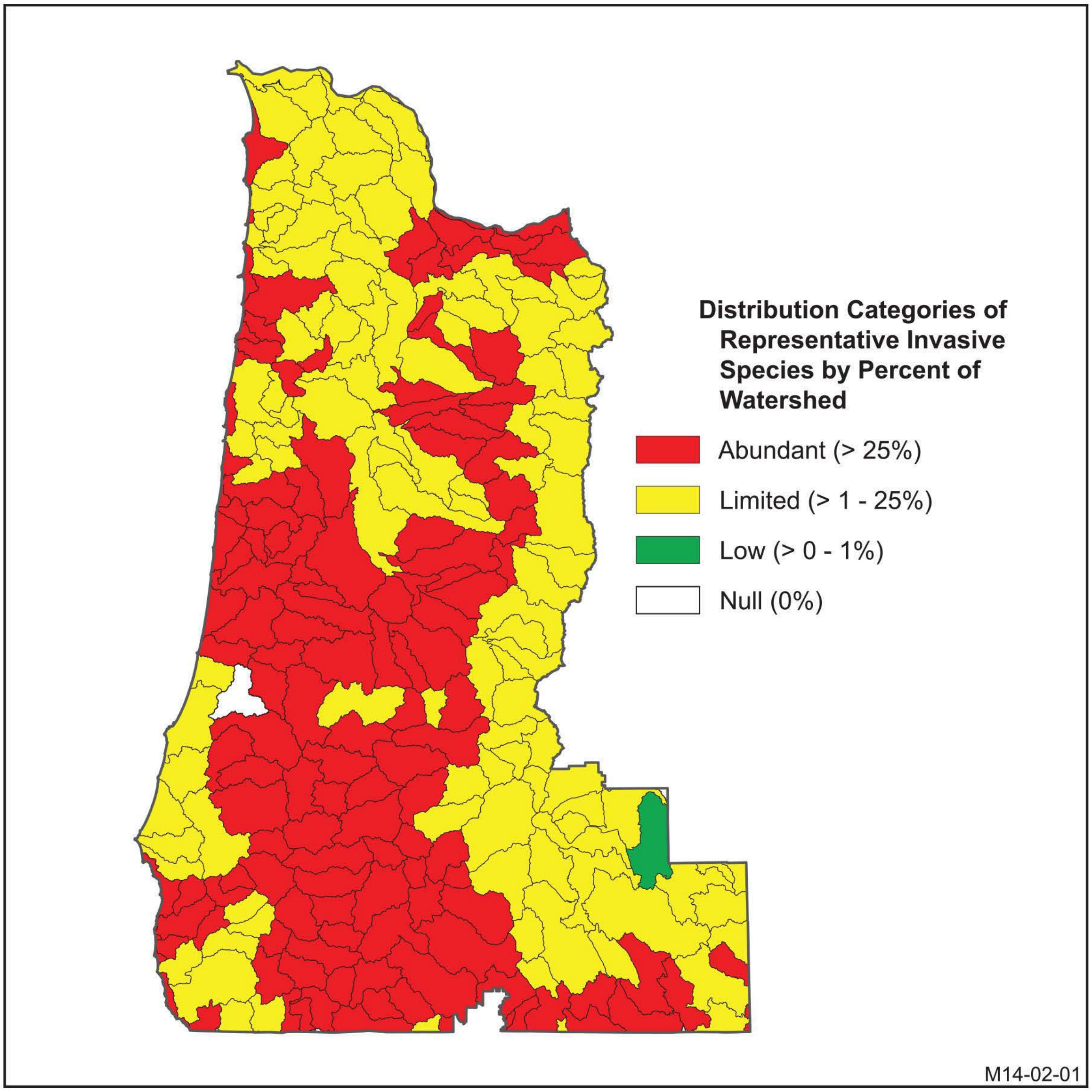

Figure 3-105. Distribution categories of invasive plant species for the HUC 10 watersheds within the planning area.

Table 3-74. Number of HUC 10 watersheds per district in each species distribution category.

District/Field Office	Species Distribution Categories		
	Low	Limited	Abundant
Coos Bay	-	14	13
Eugene	-	11	22
Klamath Falls	1	19	12
Medford	-	6	35
Roseburg	-	11	16
Salem	-	63	36
Total Watersheds	**1**	**124**	**134**

The BLM can reasonably conclude that invasive plants commonly occur throughout the planning area. Reported infestations of the representative invasive plant species are less than the total amount of all invasive plant species infestations occurring within the planning area, but provide a sense of how invasive species are distributed. Almost all of the HUC 10 watersheds currently fit the Limited or Abundant species distribution categories. Only one HUC 10 watershed fits the Low species distribution category and one HUC 10 had no reported sites. Neither of these watersheds contains BLM-administered lands.

Environmental Effects

This analysis examines timber harvest, road management activities, and OHV use for the potential to introduce and spread invasive plant species would result from the alternatives.

Introduction of and Spread of Invasive Plant Species Associated with Timber Harvest

Figure 3-106 shows a comparison of the relative susceptibility associated timber harvest among HUC 10 watersheds by alternative.

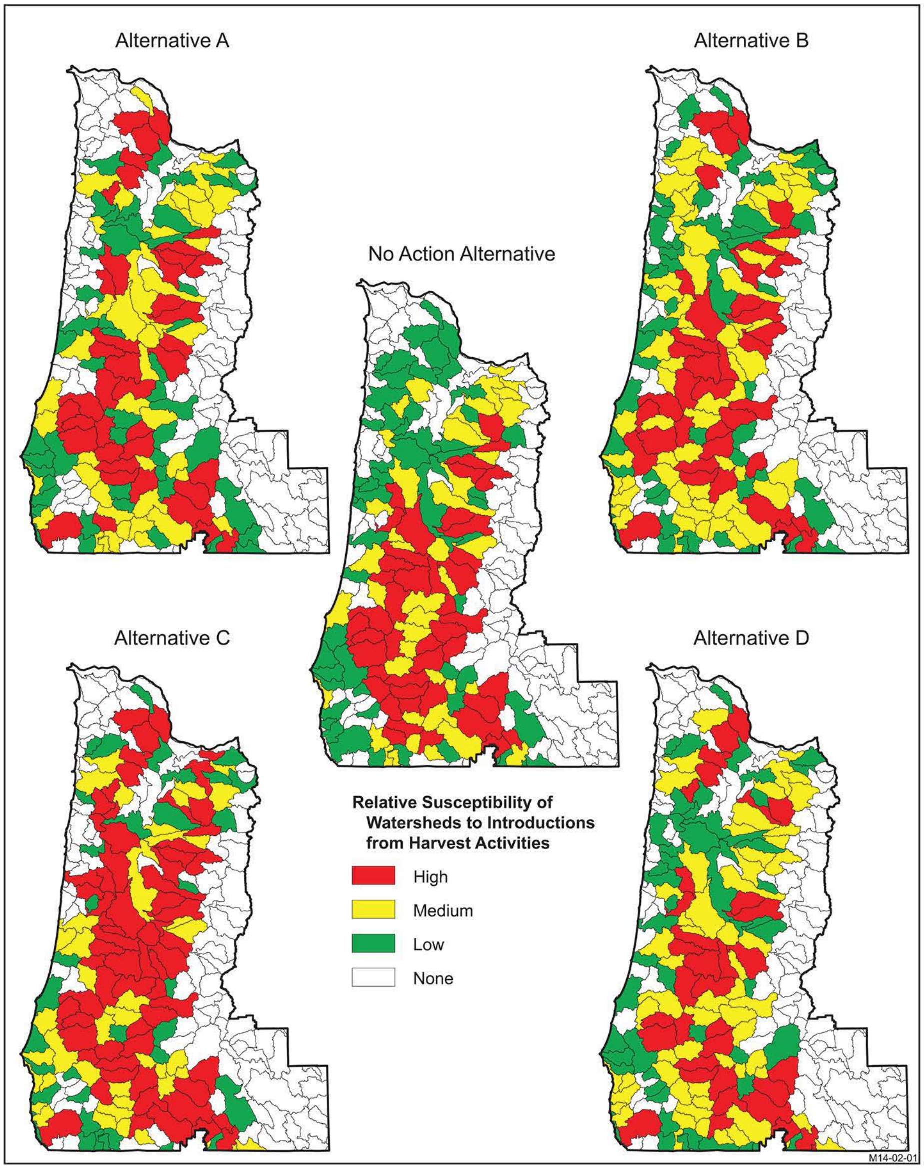

Figure 3-106. Relative susceptibility of HUC 10 watersheds to invasive plant species introduction associated with timber harvest activities over the next 10 years.

Susceptibility to the introduction and spread of invasive plant species due to timber harvest would be greatest under Alternative B, which would have 157 watersheds that have some level of susceptibility associated with timber harvest activities over the next ten years. Alternative A would have the least watersheds with some level of susceptibility from timber harvest activities, with 136 susceptible watersheds. The No Action alternative, and Alternatives C and D, would be intermediate in susceptibility, with 143, 144, and 146 susceptible watersheds, respectively.

The watersheds in the high susceptibility category occur evenly throughout the planning area under all alternatives, with Alternative C having the most watersheds in this category and Alternative D having the fewest, at 67 and 35 watersheds, respectively. The No Action alternative, and Alternatives A and B would have an intermediate number of high susceptibility category watersheds at 44, 40, and 39 respectively. HUC 10 watersheds with the potential for the most area with timber harvest activities that would generate soil disturbance and reduced shade over the next 10 years fall into the highest susceptibility categories.

Figure 3-107 displays the risk of invasive plant species introduction by HUC 10 watershed resulting from timber harvest associated activities over the next 10 years for each alternative. Within this figure, categories for the distribution of invasive plant species and the categories for the susceptibility of introduction from timber harvest activities determine the relative risk categories for the inadvertent introduction of invasive plant species. For example, watersheds with both a high density of representative invasive species and a high level of susceptibility would be in the High risk category.

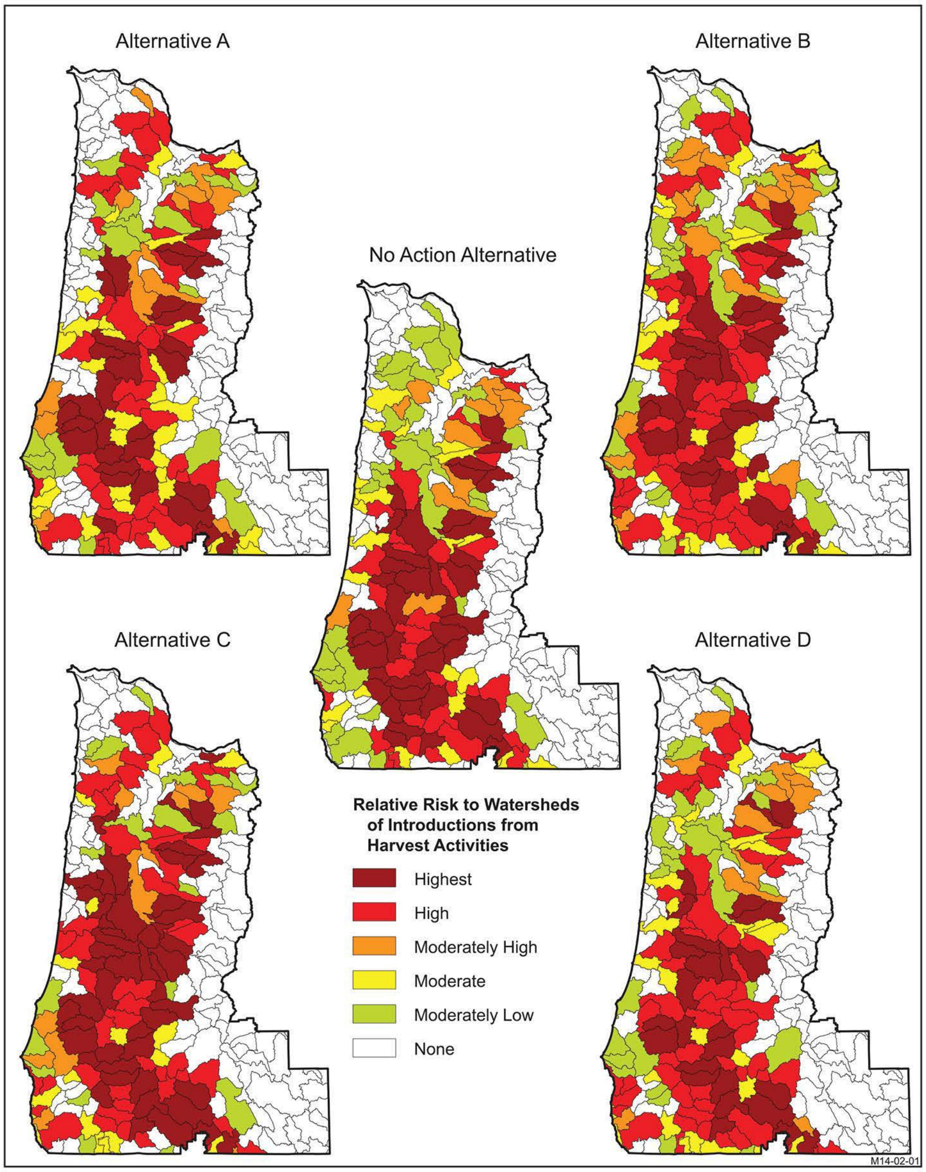

Figure 3-107. Comparison of the risk by mapped watershed for the introduction of invasive plant species associated with timber harvest activities over the next 10 years for each alternative

Table 3-75 contains the relative risk for the introduction and spread of invasive plant species that are associated with timber harvest activities over the next 10 years.

Table 3-75. Risk comparison for the introduction and spread of invasive plant species associated with timber harvest in the HUC 10 watersheds across the alternatives over the next 10 years.

Risk Ranking	No Action (# of Watersheds)	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
Highest	42	30	30	52	26
High	33	43	56	46	57
Moderately High	11	12	16	11	11
Moderate	24	32	28	16	26
Moderately Low	33	19	26	19	26
Low	-	-	-	-	-
Total at Risk	143	136	156	144	146
Total Not at Risk	132	139	119	131	129
Total Watersheds	**275**	**275**	**275**	**275**	**275**

Over the next 10 years, Alternative B would have the most HUC 10 watersheds at some level of risk (156) and Alternative A would have the least HUC 10 watersheds at some level of risk (136). Under all alternatives, between 50-60 percent of the watersheds in the planning area would experience some level of risk of introduction of invasive plant species associated with timber harvest activities over the next 10 years. The highest degree of risk would occur under Alternative C and the lowest would occur under Alternative A with 98 and 73 watersheds in the High and Highest risk categories respectively. Intermediate levels of risk intensity associated with timber harvest in the HUC 10 watersheds over the next 10 years would occur under Alternatives D, B, and the No Action alternative as shown in **Table 3-75**. Between 13-21 percent of the HUC 10 watersheds would experience moderate to moderately low risk of invasive plant species introduction associated with timber harvest activities over the next 10 years.

Invasive Plant Species Introduction into Riparian Habitats Associated With Riparian Reserve-adjacent Timber Harvest

The Riparian Reserve is wide enough (i.e., more than 100 feet) to leave the riparian habitat light levels unchanged from adjacent timber harvest activities (including regeneration harvest where the Riparian Reserve is surrounded by Harvest Land Base and thinning where they are surrounded by Late-Successional Reserves) under the following alternatives and stream types:

- No Action alternative, Alternatives A and D – all streams
- Alternative B – fish-bearing and perennial streams and debris-flow-prone, non-fish-bearing, intermittent streams
- Alternative C – fish-bearing streams

However, the shade levels associated with riparian habitats along the non-debris-flow-prone, non-fish-bearing intermittent streams under Alternative B and non-fish-bearing streams under Alternative C would be more susceptible to increases in light levels associated with adjacent timber harvests because these reserves are narrower at 50 feet on either side of the streams.

Figure 3-108 shows the susceptibility comparison for the introduction and spread of invasive plant species into riparian habitats associated with Riparian Reserve associated timber harvest activities of the next 10 years.

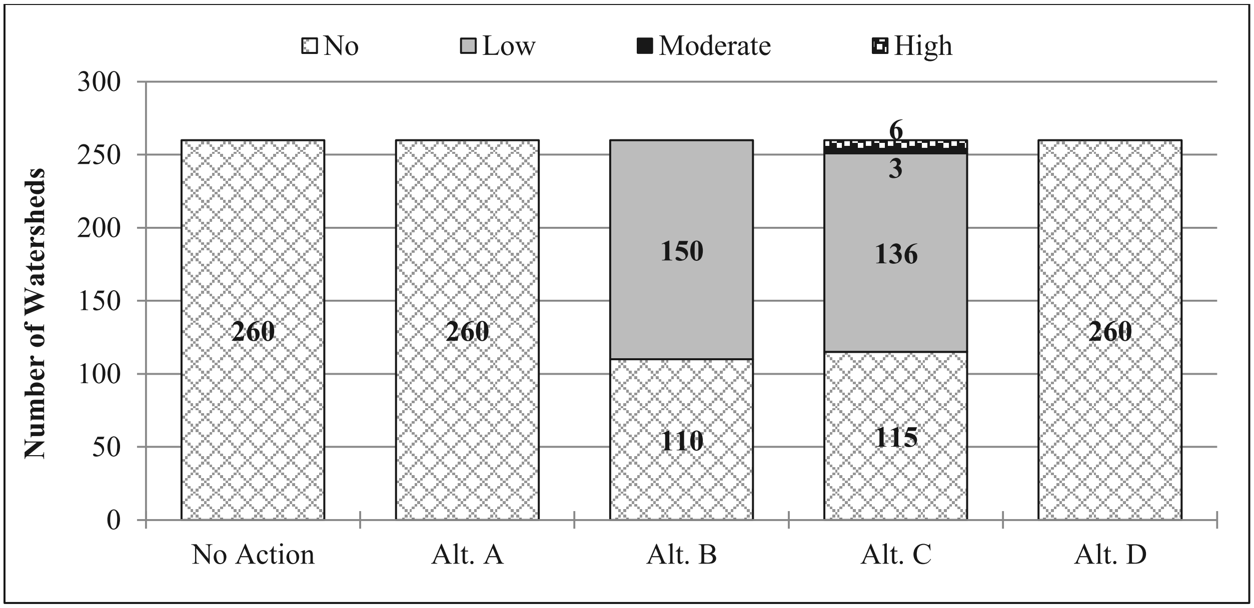

Figure 3-108. Susceptibility comparison for the introduction of invasive plant species into riparian habitats associated with Riparian Reserve-adjacent timber harvest activities over the next 10 years.

Under Alternative C, 145 of the 260 HUC 10 watersheds in the planning area would be susceptible to invasive plant introduction into riparian habitats associated with Riparian Reserve-adjacent timber harvest activities over the next 10 years. Nine watersheds would have Moderate to High susceptibility. Under Alternative B, 150 HUC 10 watersheds would have a Low susceptibility and no watersheds would have Moderate to High susceptibility. Under the No Action alternative, and Alternatives A and D, there would be no susceptibility for invasive plant introductions into riparian habitats associated with Riparian Reserve-adjacent timber harvest activities. Under Alternatives B and C, no more than 58 percent of the HUC 10 watersheds would be susceptible for invasive plant introductions into riparian habitats associated with Riparian Reserve-adjacent timber harvest activities over the next 10 years.

Riparian Reserve-adjacent timber harvest activities would only generate susceptibility for the introduction and spread of invasive plants into riparian habitats under Alternatives C and B. Alternative C would have a slightly higher level of risk than Alternative B.

The highest overall risk of the introduction of invasive plant species into riparian habitats that are associated with adjacent timber harvest activities over the next 10 years would occur under Alternatives C and B. Under Alternative C, nine of the HUC 10 watersheds would have relatively higher levels of risks than any other alternative. Under Alternative B, 150 at risk HUC 10 watersheds compared to 145 at risk HUC 10 watersheds under Alternative C and no HUC 10 watersheds at risk under the No Action alternative and Alternatives A and D. **Figure 3-109** shows the risk to watersheds from the introduction of invasive plant species in riparian habitats.

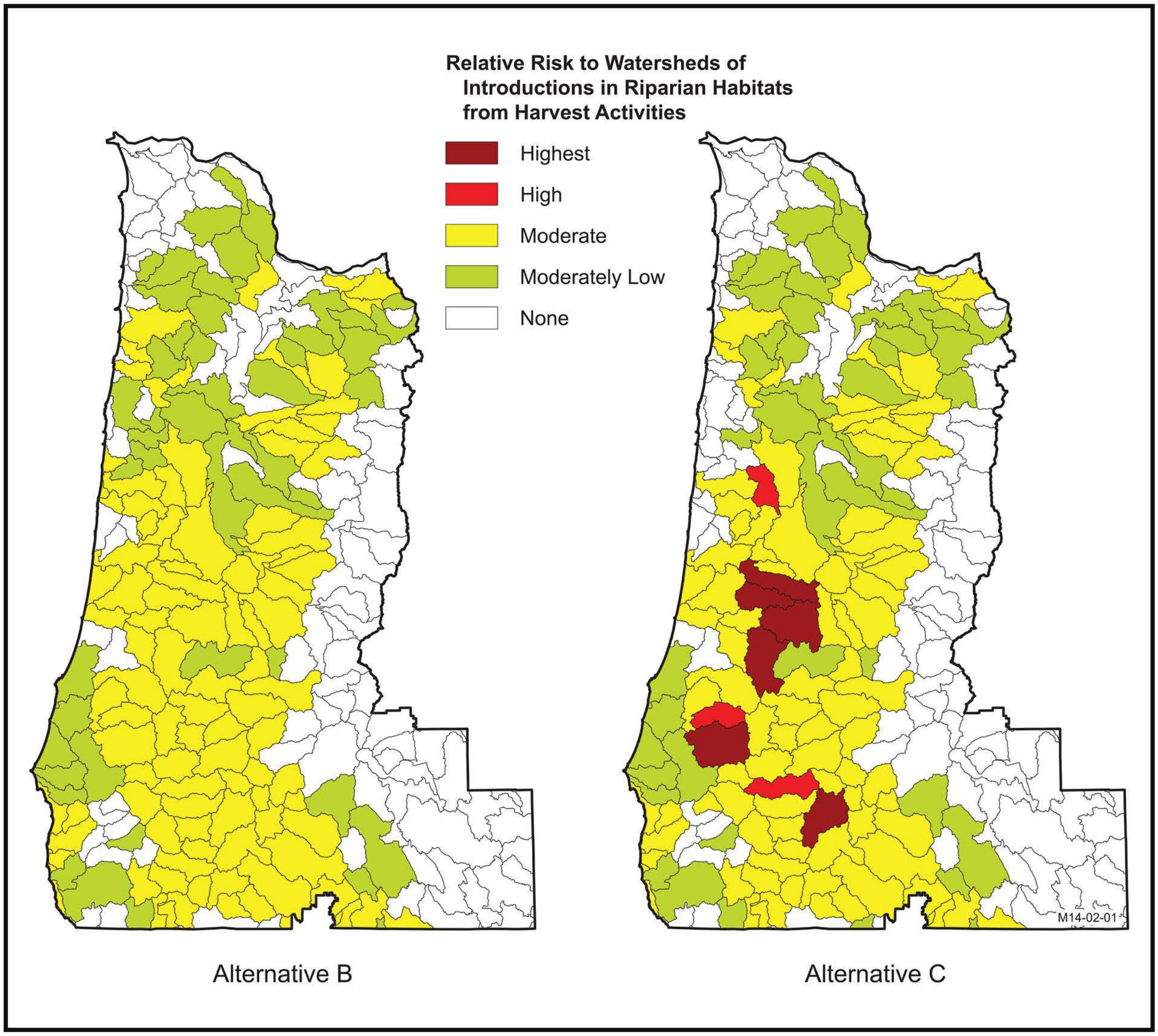

Figure 3-109. Relative risk of introducing invasive plant species in riparian habitats over the next 10 years.

Table 3-76 provides a risk comparison among the alternatives for invasions into riparian habitats associated with Riparian Reserve-adjacent timber harvest activities over the next 10 years.

Table 3-76. Risk comparison for introduction of invasive plant species into riparian habitats associated with adjacent timber harvest in the HUC 10 watersheds across the alternatives over the next 1- years.

Risk Ranking	No Action (# of Watersheds)	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
Highest	-	-	-	6	-
High	-	-	-	3	-
Moderate	-	-	102	91	-
Moderately Low	-	-	48	45	-
Total at Risk	-	-	150	145	-
Total Not at Risk	260	260	110	115	260
Total Watersheds	**260**	**260**	**260**	**260**	**260**

Invasive Plant Species Introduction into Riparian Habitats Associated With Restoration Thinning

Under all alternatives, restoration thinning activities would occur within the Riparian Reserve at varying levels in the next 10 years. Restoration thinning would be limited to outside of the inner zone of the Riparian Reserve under all action alternatives and could occur anywhere in the Riparian Reserves under the No Action alternative.

Under Alternative D, the inner zone Riparian Reserve boundaries are greater than 100 feet from the streams and are broad enough to prevent thinning activities in the outer zone from reducing shade levels in riparian habitats.

Under Alternative A, the restoration-thinning activities in the moist forests would include snag and coarse woody debris creation (no commercial thinning would be allowed). These activities would not change shade levels enough to increase the susceptibility of the treatment areas to the introduction and spread of invasive plant infestations. Dry forest restoration-thinning activities to reduce fire hazards would create lower shade levels within 50 feet on either side of non-fish-bearing, intermittent streams. These dry forest restoration-thinning activities would alter the resulting shade levels and disturb the soil, making the riparian habitats more susceptible to the introduction and spread of invasive plants. The inner zone Riparian Reserve boundary is greater than 100 feet on all other types of streams, leaving the riparian habitats protected from restoration-thinning associated invasive plant infestation introductions.

Under Alternatives B and C, the boundaries of the inner zone of the Riparian Reserve are the same widths and are less than 100 feet from either side of all streams. The Riparian Reserve restoration-thinning activities would create susceptibility for the introduction of invasive plant species into riparian habitats over the next 10 years.

Under the No Action alternative, there is no defined area excluding restoration-thinning activities within the Riparian Reserve, which leaves all riparian habitats susceptible to invasive plant introductions associated with restoration-thinning activities.

With respect to restoration thinning in the Riparian Reserve, of all of the alternatives, Alternative D would have the lowest level of susceptibility for introducing invasive plants into riparian habitats. Alternative A would have the second lowest level of susceptibility for introducing invasive plants into riparian habitats and Alternatives B and C would have a moderate level of susceptibility. The No

Action alternative would have the highest level of susceptibility for the introduction of invasive plants into riparian habitats from restoration-thinning activities.

Risk of invasive plant introductions into riparian habitats from restoration-thinning activities varies over the next 10 years between the alternatives based on their relative susceptibility. Probable restoration thinning acres for the outer zones of the Riparian Reserve over the next 10 years, generated by the Woodstock vegetation model provides the values used and the basis for determining susceptibility and risk for this part of the analysis. Restoration-thinning activities reduce shade levels and disturb the soil. Both of these changes in a project area would create opportunities for invasive species introductions to a project site and for resident infestations to flourish.

Under the No Action alternative, more than 45,000 acres across the planning area would likely have restoration thinning activities over the next 10 years and a proportion of those acres could be within 100 feet of streams. Areas with restoration-thinning activities within 100 feet of streams would be susceptible to and at risk for the introduction and spread of invasive plants in riparian habitats. Relative to the other alternatives, the risk of introducing invasive plants into riparian habitats from restoration-thinning activities is highest under the No Action alternative.

Over the next 10 years, just over 7,000 acres of outer zone Riparian Reserve restoration thinning activities would likely occur under Alternative C and almost 16,000 acres in under Alternative B. With respect to restoration thinning activities in the Riparian Reserve under the different alternatives, Alternative C would have a moderate level of risk and Alternative B would have the second highest level of risk for introducing invasive plants into riparian habitats.

Under Alternative A, only the dry forest restoration-thinning activities would generate susceptibility for introducing invasive plants into riparian habitats. Under this alternative, approximately 1,000 acres of thinning in the outer zone of the Riparian Reserve would occur over the next 10 years across BLM-administered lands within the planning area. Compared to the other alternatives, Alternative A would have the second lowest level of risk for introducing invasive plants into riparian habitats from outer zone restoration thinning activities over the next 10 years. Although there would be a few acres of outer zone restoration thinning under Alternative D, all of the activities would be too far away from riparian habitats for there to be any risk of introducing invasive plants into them. Under Alternative D, there would be no risk.

Invasive Plant Species Introduction Associated with New Road Construction

See **Table 3-77** for the risk comparison for the introduction of invasive plant species into HUC 10 watersheds resulting from new road construction activities among the alternatives.

Table 3-77. Risk comparison for the introduction of invasive plant species associated with new road construction by HUC 10 watershed over the next 10 years.

Risk Ranking	No Action (# of Watersheds)	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
Highest	41	10	34	33	7
High	37	40	40	45	43
Moderately High	18	13	17	13	11
Moderate	22	51	32	25	50
Moderately Low	25	31	34	29	35
Low	-	-	-	-	-
Total at Risk	143	145	157	145	146
Total Not at Risk	132	130	118	130	129
Total Watersheds	**275**	**275**	**275**	**275**	**275**

Under Alternative B, 157 HUC 10 watersheds would experience risk of introduction of invasive plant species associated with new roads in the next 10 years compared to the remaining alternatives that would have between 143 and 146 watersheds at risk of introduction of invasive plant species associated with new roads in the next 10 years. Under the No Action alternative and Alternative C, 78 HUC 10 watersheds would have the High to Highest relative risk rankings making them the alternatives with the most intensive level of relative risk of having new road construction related invasive plants introductions in the next 10 years. Under both, Alternatives A and D, the lowest amount of HUC 10 watersheds would have risk rankings in the High to Highest risk categories.

Overall, the greatest relative risk of invasive plant species introduction associated with new road construction activities would occur under Alternative B compared to the other alternatives, and the lowest risk would occur under the Alternative D. There would be some watersheds in the Highest risk category under all alternatives, but the fewest under Alternative D.

Invasive Plant Species Introduction Associated with Off-Highway Vehicle Use

The relative differences in susceptibility to invasive plant introductions based on OHV designations is minor over much of the analysis area, because the topography and vegetation make most of the landscape non-conducive to cross-country vehicle travel, even by OHV. Only under the No Action alternative would areas be designated *open* for OHV use.

The number and distribution of areas, such as Areas of Critical Environmental Concern with OHV use restrictions and areas managed to protect their wilderness characteristics, creates the variation across alternatives in the risk results. Areas with *open* OHV designations under the No Action alternative also create some of this the variation in the risk analysis.

Figure 3-110 shows a relative risk comparison between the alternatives for the introduction of invasive plant species into HUC 10 watersheds associated with the OHV designations.

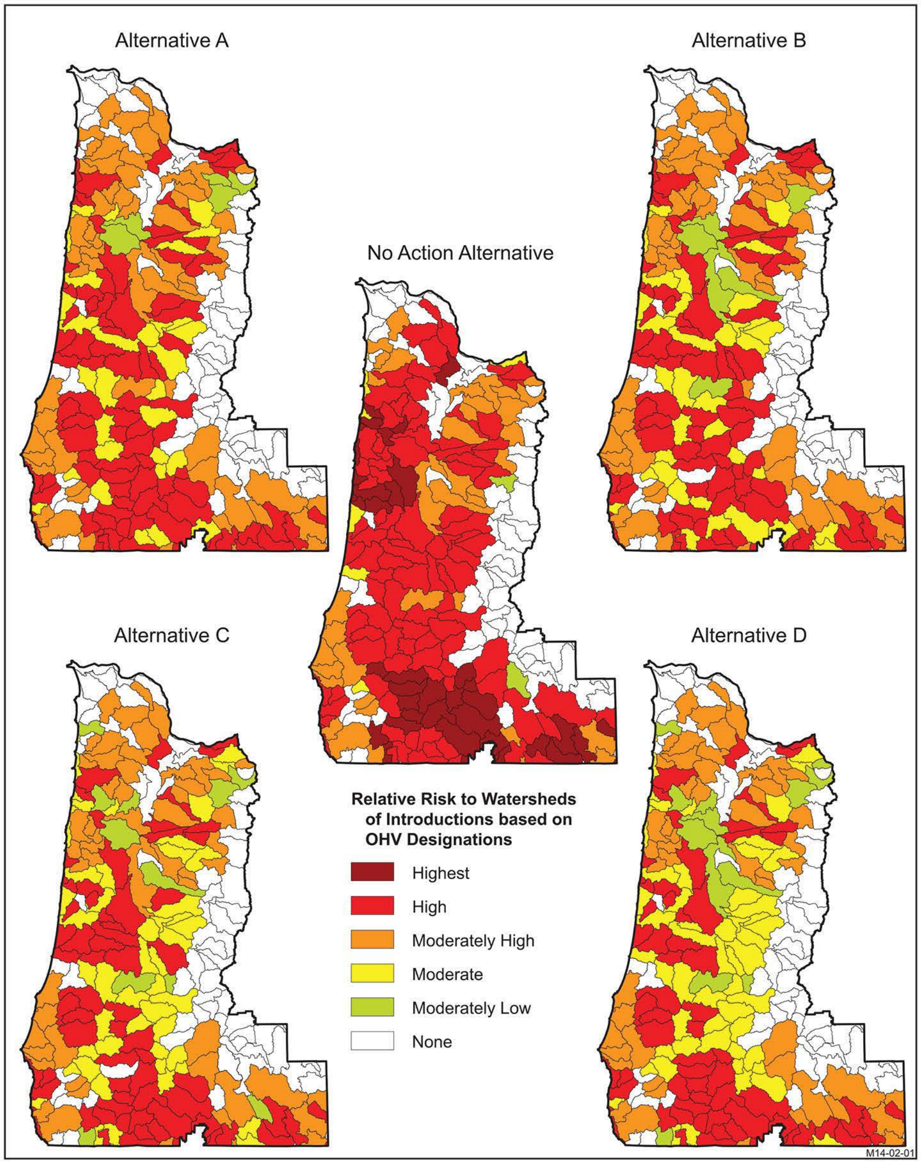

Figure 3-110. Relative risk for introduction of invasive plant species associated with OHV designations.

Table 3-78. Risk comparison for introduction of invasive plant species associated OHV use.

Risk Ranking	No Action (# of Watersheds)	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
Highest	13	-	-	-	-
High	121	86	80	68	64
Moderately High	43	63	62	57	55
Moderate	6	30	35	47	52
Moderately Low	3	6	7	12	14
Low	-	-	-	-	-
Total at Risk	186	185	184	184	185
Total Not at Risk	89	90	9	91	90
Total Watersheds	**275**	**275**	**275**	**275**	**275**

Almost 70 percent of the HUC 10 watersheds would be at risk for invasive plant species introductions associated with OHV use, under all of the alternatives. As the only alternative with *open* area designations, the No Action alternative has higher risk levels than the action alternatives.

Only under the No Action alternative would there be any watersheds in the Highest risk category for invasive plant species introductions associated with OHV use. Of all the alternatives, the No Action alternative would have the most HUC 10 watersheds in the High risk category. Under the action alternatives, Alternative A would have the most HUC 10 watersheds in the High risk category for introduction of invasive plants species associated with OHV use and Alternative D, the fewest. Of the action alternatives, Alternative B would have the second highest risk and Alternative C the second lowest.

Risk of Invasive Plant Species Introduction and Spread Associated with Livestock Grazing

Figure 3-122 (Livestock Grazing) lists the BLM-administered land acres available for livestock grazing by alternative. In the planning area, BLM-administered lands are only available for grazing in the Coos Bay and Medford Districts and the Klamath Falls Field Office. Where livestock grazing would be available, susceptibility and risk for invasive plant introductions and spread associated with livestock grazing would occur. Livestock movement and associated activities, like the transport of contaminated hay, can introduce invasive plants into new locations.

The No Action alternative would create the greatest risk of invasive plant introduction and spread on the Coos Bay District compared to all of the action alternatives because there would be no lands available for livestock grazing under the action alternatives compared to 543 acres available under the No Action alternative.

In the Klamath Falls Field Office, the No Action alternative would create the greatest risk of introduction and spread with 209,852 acres available for livestock grazing compared to Action Alternatives A, B, and C with 205,627 acres available for livestock grazing. Alternative D with no acres available for livestock grazing would also have no risk.

In the Medford District, the No Action alternative would create the greatest risk of introduction and spread with 284,795 acres available for livestock grazing compared to Action Alternatives A, B, and C with 161,760 acres available for livestock grazing. Alternative D with no acres available for livestock grazing would also have no risk.

In sum, for districts that currently have livestock grazing, the greatest susceptibility and risk for invasive plant introductions and spread associated with livestock grazing would occur under the No Action alternative and no susceptibility or risk would take place under Alternative D.

Long-Term Introduction and Spread of Invasive Plant Species and Summary

Over the long-term, the potential for the introduction and spread of invasive plant species would be higher in the Harvest Land Base than in the non-Harvest Land Base under all alternatives.

The highest risk in the long-term would occur under Alternative C, which would have the largest Harvest Land Base, and the second highest risk would be the No Action alternative with the second highest Harvest Land Base. Alternatives with intermediate levels of long-term risk include Alternatives D and B. The least risk of invasive plant species introduction and spread from timber harvest over the long term would occur under the Alternative A, because it would have the smallest Harvest Land Base among the alternatives.

The long-term risk of the spread of invasive plant species along riparian habitats would be higher under the No Action alternative and Alternatives B and C than under Alternatives A and D because more watersheds would be at risk of initial invasion from a combination of restoration thinning and Riparian Reserve-adjacent timber harvest activities. Shade reducing activities within 100 feet of streams increases the light in riparian habitats enough to invigorate plant growth. Soil disturbance in these areas reduces plant competition and prepares soil for seed germination. Invasive plants already present in or introduced to disturbed areas would have a good chance of thriving. Under all alternatives, the associated road construction and level of road use and maintenance expected to support the timber harvest activities would create risk for invasive plant introduction into riparian habitats over the long-term.

Alternative C would have the highest long-term risk because it would have the most area within 100 feet of streams available for Riparian Reserve-adjacent timber harvest activities and for restoration thinning treatments. Under Alternative C, restoration thinning with commercial timber removal would occur as close as 60 feet on either side of fish-bearing streams and 50 feet on either side of non-fish-bearing streams. Timber harvest activities could also occur as close as 50 feet on either side of non-fish bearing streams.

Alternative B would have the second highest long-term risk because the total Riparian Reserve width of 50 feet along non-debris-flow prone, non-fish-bearing streams would permit Riparian Reserve-adjacent timber harvest activities within 100 feet of the streams. Alternative B would also permit restoration thinning within 100 feet of non-fish-bearing intermittent streams.

The No Action alternative's direction for restoration thinning within the Riparian Reserve is the least restrictive. The total Riparian Reserve widths are greater than 100 feet on either side of all streams under the No Action alternative. The long-term risk of introducing and spreading invasive plants in riparian habitats would be moderate under the No Action alternative.

Under Alternative D, no effects to invasive species introduction into riparian habitats from timber harvest activities would occur because direction permits all timber harvest activities to occur more than 100 feet from all streams, too far from riparian habitats to have an impact on invasive plant introduction and spread.

The No Action alternative would have a higher risk of invasive plant introductions and spread due to having area with *open* designations and fewer acres designated *closed* to OHV use. Of the action alternatives, the long-term risk of the spread of invasive plant species associated with OHV use would be highest under the Alternative A. The long-term risk of invasive plant species introduction and spread would be lowest under Alternative D because it has the fewest watersheds in the Moderately High to High risk categories for the introduction of invasive plants associated with OHV use.

When the effects of all of the risk activities are considered, the overall potential for introduction and spread of invasive plants over the next ten years, and in the long term, would be lowest under Alternative D, intermediate under the No Action alternative and Alternative A, and highest under Alternatives B and C.

Table 3-79 shows a relative risk comparison between the alternatives, by analysis factor, for the introduction of invasive plant species over both the long- and short-term.

Table 3-79. Relative risk of long- and short-term introduction and spread of invasive plant species by analysis factor.

Risk Analysis Factor	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Number of highest and high risk HUC 10 watersheds from timber harvest activities over the next 10 years	Low	Lowest	High	Highest	Moderate
Number of highest and high risk HUC 10 watersheds for introduction into riparian habitats from timber harvest activities over the next 10 years	None	None	None	Highest	None
Relative risk of introducing invasive plants into riparian habitats associated with restoration thinning activities over the next 10 years	Highest	Low	High	Moderate	None
Number of HUC 10 watersheds assigned risk categories from new road construction associated with timber harvest activities over the next 10 years	Low	Moderate	Highest	Moderate	Moderate
Introduction into HUC 10 watersheds associated with OHV use (long- and short-term)	Highest	High	High	Moderate	Low
Long-term introduction associated with timber harvest and associated activities	High	Lowest	Moderately Low	Highest	Moderate
Long-term introduction and spread along riparian habitats	Moderate	Low	High	Highest	Lowest
Overall Potential to Introduce and Spread Invasive Plant Species.	**Moderately Low**	**Low**	**High**	**Highest**	**Lowest**

Issue 2

How would alternatives affect invasive aquatic species introduction and spread?

Summary of Analytical Methods

The BLM designed the analysis to compare the relative risk of introducing and spreading aquatic invasive species resulting from the relative differences in human activity levels in the different RMA designations and in timber harvest-related new road construction under the alternatives while taking into consideration the collective distribution of a representative set of aquatic invasive plant species. Variation of the effects between the alternatives results from the differences in RMA designations, the area available to livestock grazing, the levels of timber harvest associated new road construction over the next 10 years and over the long-term. The Planning Criteria provides detailed information on the invasive plant analysis and assumptions, which the BLM incorporates here by reference (USDI BLM 2014, pp. 90-98).

Representative Species

The following are the representative aquatic invasive species that the BLM selected to characterize the general condition of aquatic invasive species on BLM-administered lands within the planning area:

- American bullfrog (*Rana catesbeinana*)
- Asiatic clam (*Corbicula fluminea*)

- New Zealand mudsnail (*Potamopyrgus antipodarum*)
- Nutria (*Myocastor coypus*)
- Yellow flag iris (*Iris pseudacorus*)

Each of these species has a unique distribution and strategy for spreading and resisting different control methods. Although each species is unique, this sample of aquatic invasive species represent a range of life histories and methods of introduction and spread sufficient to describe the condition of aquatic invasive species on BLM-administered lands within the planning area. The BLM considered these dispersal strategies when developing its assumptions around how management activities would affect aquatic invasive species introduction. **Figure 3-111** illustrates the presence of invasive aquatic species in the planning area.

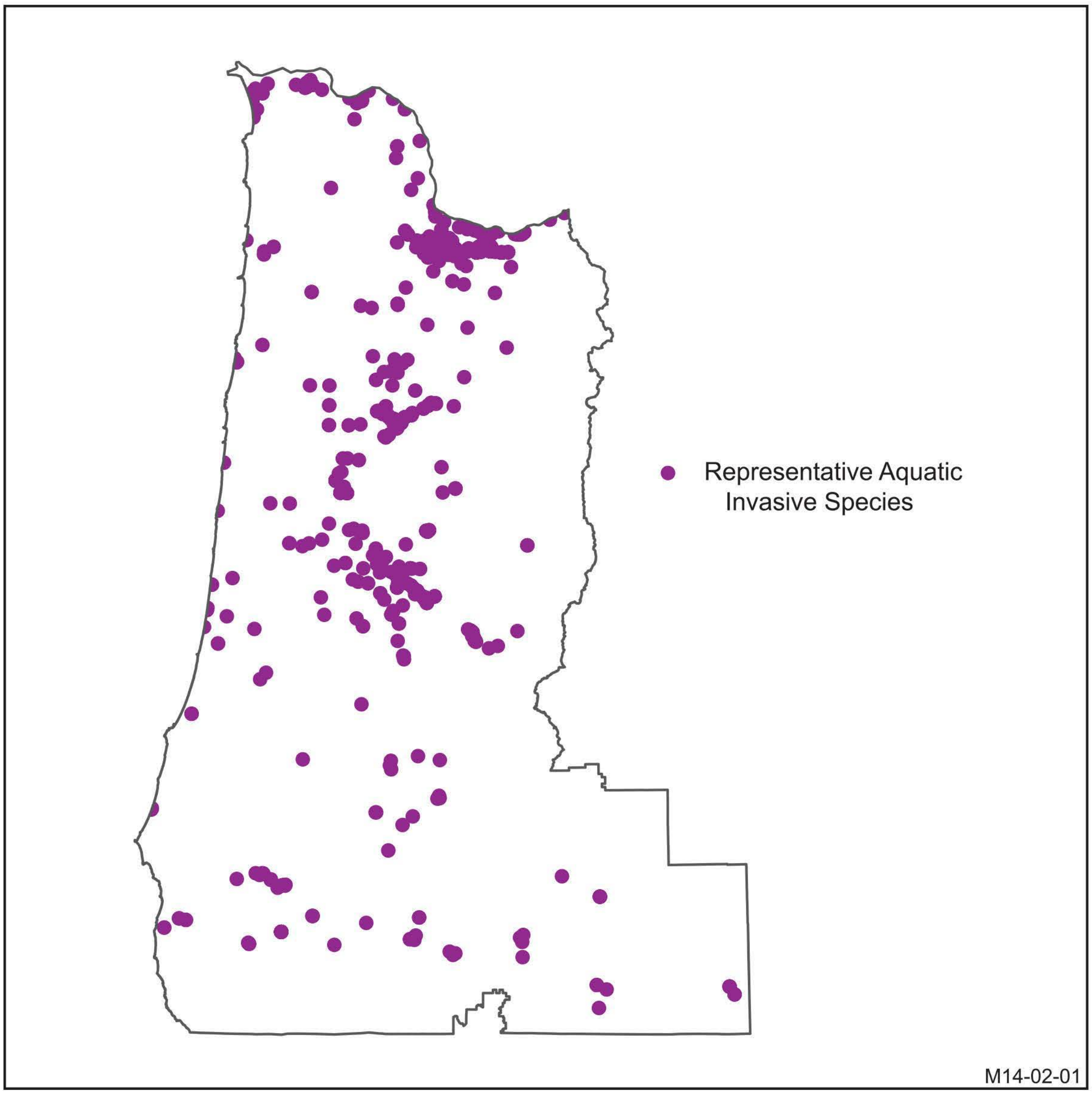

Figure 3-111. Reported infestations of representative invasive aquatic species within the planning area.

Risk of Introduction

The factors considered in the analysis of the relative levels of risk for the introduction of invasive aquatic species on the BLM-administered lands include:

- Distribution and abundance of invasive aquatic species
- Levels of timber harvest-associated new road construction over the next 10 years
- Designations for RMAs
- Proximity of RMA designations to streams and water bodies
- Area available to livestock grazing

The relative risk of introducing and spreading invasive aquatic species would vary by alternative. This analysis compares the effects road construction, recreation use and grazing on the introduction and spread of invasive aquatic species in terms of susceptibility and risk. The only part of the analysis focused solely on the short term is the new road construction assessment over the next 10 years. The BLM considered these risk factors in conjunction with the distribution of invasive aquatic species to assess relative risk of introducing invasive aquatic species between the alternatives.

The analysis assumed that actions on other ownerships and actions, other than those listed above, would continue to contribute to aquatic invasive plant species introduction and spread at current levels. These other actions include BLM management of special forest products, right-of-way agreements, road maintenance, and fuels on BLM-administered lands. Any future changes in the contribution from these other activities to the risk of introduction and spread of invasive aquatic species would be speculative and depend largely on site-specific factors that are inappropriate to analyze at this scale. There is no basis for speculating that such changes would vary among the alternatives. Therefore, information on the contribution of these other management actions to the risk of introduction and spread of invasive plant species is not necessary for a reasoned choice among the alternatives.

Assessing Risk of Invasive Aquatic Species Introduction Associated with New Road Construction

Road construction and associated road management activities contribute to the introduction of new infestations and the spread of existing invasive aquatic species infestations. New infestations start when invasive aquatic species hitchhike on road construction equipment and materials from one contaminated aquatic system to another. In addition, disturbance and modification of riparian habitats by way of road construction creates better habitat conditions for some invasive aquatic species. Modification of stream crossings disturbs soil and opens up forest canopies.

Over the long-term, the BLM assumed that the majority of the BLM's new road construction would occur in the Harvest Land Base to facilitate timber harvest activities. Restoration thinning in Reserves and the need for new roads associated with these harvests, would taper off over time. In the Harvest Land Base, new roads would facilitate the timber harvest activities into the future without decline.

This analysis used levels of new road construction associated with timber harvest activities over the next 10 years to compare the relative risk of invasive aquatic species introduction associated with road construction across the alternatives.

The BLM determined the susceptibility of sub-basins (HUC 8) to invasive species introduction associated with timber harvest associated new road construction by analyzing the alternatives' estimates of road construction from the Woodstock vegetation model and the coefficients developed for the 10-year scenarios in the 2008 RMP/EIS (**Appendix C**). The geographic arrangement of timber harvests is a modeling product and not a product of actual site-specific project planning.

The BLM prorated the road construction estimates for the subbasins in the planning area for each alternative across. The BLM used levels of new road construction associated with timber harvest activities under each alternative over the next 10 years to generate susceptibility values for each sub-basin. The BLM used these susceptibility values to compare the susceptibility of the subbasins to invasive plant species introduction and spread.

Both the susceptibility of a sub-basin to invasion due to timber harvest-associated road construction in the next 10 years and the presence of invasive aquatic species determine the risk of invasion. Subbasins with a low distribution of invasive aquatic species and low susceptibility for the introduction of invasive aquatic species would have the lowest risk of invasion. The greatest risk of invasion would be in subbasins where both invasive aquatic species are relatively more abundant and susceptibility would be relatively higher. Subbasins without a risk category meet at least one of the following conditions: no reported sites for the representative sample set of invasive aquatic species in the analysis and no BLM-administered lands in the sub-basin.

Assessing Risk of Invasive Aquatic Species Introduction Associated with Recreation Management Area Designations

Visitors to recreation areas could introduce invasive aquatic species to new locations in a number of different ways. Sometimes people deliberately release aquatic pets they no longer want in areas with easy access to water. Aquatic invasive species introductions occur when invasive organisms drop into in new aquatic environments after they have hitchhiked on recreational equipment from infested waters.

The relative levels of human activity in the different Recreation Management Area (RMA) designations would create varying levels of opportunity for introducing invasive aquatic species into new locations. Visitor use and concentration would be higher and more concentrated in Special Recreation Management Areas (SRMAs) than in Extensive Recreation Management Areas (ERMAs) and the lowest in areas outside of designated RMAs. The analytical assumption is that, with increased visitor use and activity, there would be a corresponding increase in the chance of introducing infestations. As a result, this analysis assumed that SRMAs would be more susceptible to having new introductions of invasive aquatic species and infestation spread than ERMAs and both would be more susceptible than areas with no RMA designation.

New guidance on applying RMA allocations on BLM-administered lands creates a marked difference in how RMA designations are defined under the No Action alternative and the action alternatives. ERMAs, under the No Action alternative would include lands not managed for recreation use. The BLM would not put these lands under a RMA designation under the action alternatives. Because the RMA designation definitions differ between the No Action alternative and the action alternatives, the relative ranking analysis can only be used for the action alternatives.

The BLM assessed susceptibility to invasive aquatic species introduction and spread by using subbasins as the basic unit of analysis. SRMAs received the highest weight. Susceptibility values for each sub-basin result from multiplying the acres of each type of RMA by the relative weight for each alternative. The BLM organized the susceptibility categories into relative susceptibility categories of High, Medium, and Low.

The BLM determined the risk for invasive aquatic species introduction associated with RMA designations by considering both the susceptibility of a sub-basin to invasion from recreation in RMA designations and the presence of invasive aquatic species. Subbasins with a low distribution of invasive aquatic species and low susceptibility would have the lowest risk of invasion. The greatest risk of invasion would be subbasins where both invasive aquatic species are relatively abundant and susceptibility would be high. Sub-basins without a risk category meet at least one of the following conditions: no reported sites for the representative sample set of invasive aquatic species in the analysis and no BLM-administered lands in the sub-basin.

The BLM compared the number of sub-basins in the relative risk categories to determine the relative risk from each alternative of introducing and spreading invasive aquatic species into the planning area associated with RMA designations.

Assessing Risk of Invasive Aquatic Species Introduction and Spread Associated with Livestock Grazing

The BLM assessed the risk of invasive aquatic species introduction associated with livestock grazing by comparing the amount of land available for grazing in each alternative by BLM office. Livestock grazing creates opportunities for livestock and livestock management associated equipment to move through streams and other aquatic environments, which creates susceptibility for the introduction and spread of invasive plants. Areas within grazing allotments are available for issuance of grazing leases/permits and by extension are susceptible to the introduction and spread of invasive aquatic species associated with livestock grazing.

The BLM assumed invasive aquatic species occur in the areas available for livestock grazing. In addition, livestock and livestock management equipment and supplies coming from other geographic areas could have invasive aquatic species hitchhikers. Therefore, the BLM assumed that areas susceptible for introduction and spread of invasive aquatic species associated with livestock grazing would be at risk. Comparing each offices's acreage available for livestock grazing provides a relative assessment for the risk of introduction and spread of invasive aquatic species due to this activity across the alternatives.

Background

Aquatic invasive species include non-native species in all taxa groups whose introduction causes economic or environmental harm, or harm to human health. Numerous invasive species identified in the Oregon Conservation Strategy (ODFW 2006) occur in the planning area. Some of these invasive species include New Zealand mud snails, ringed crayfish, bullfrogs, and bluegill. Other priority aquatic invasive species with documented sightings in western Oregon that have the potential to be introduced and documented in the planning area include quagga mussels, Eastern snapping turtle, and Louisiana swamp crawfish. In this analysis, the BLM is specifically looking at the following representative species, all of which occur within the planning area.

American Bullfrog

American bullfrogs (*Lithobates catebeinus)* inhabit river and stream segments with slow moving waters, ponds, lakes, and boggy areas and prefer simplified, modified aquatic habitats (Fuller *et al.* 2011). Tadpoles require moisture year round to mature. American bullfrogs move to new sites by a variety of mechanisms including: aquaculture and garden water feature escapes, translocation into private wetlands from pet store purchases, and release of bullfrog pets into the wild (Crayon *et al*. 2009). Bullfrogs disperse from ponds into natural water bodies up to at least two miles during periods of seasonally high water (Adams *et al*. 2003).

Habitat modifications that make better conditions for American bullfrog establishment include simplifying the plant community and altering seasonally wet habitats to those with permanent water. Simplification of the plant community allows for easier hunting and increased water temperatures (Crayon *et al*. 2009).

American bullfrog occurs on Roseburg District BLM-administered land (USDI BLM 2013) and in numerous widespread locations across western Oregon.

Asiatic Clam

The Asiatic clam (*Corbicula fluminea*) is a filter feeder inhabiting the surface and top layer of sediment in rivers and reservoirs. This species can reproduce rapidly under warm conditions and can persist in cool temperatures. Only one individual Asiatic clam introduced into a new location can multiply into a new population because the species is capable of self-fertilization and cloning. Asiatic clam are successful invasive species because they have multiple reproductive strategies, reproduce rapidly, easily relocate in aquatic systems, and tolerate a wide range of environmental conditions. The species does have some limits on its life history requirements that limit its ability to spread including intolerance to high temperatures, low pH and low calcium (Kramer-Wilt 2008).

People introduce Asiatic clam to new locations by way of contaminated sand and gravel for construction projects, bait buckets, and imported aquaculture purchases. (Weidemer and Chan 2008.). They also move to new areas in water currents, on contaminated sporting and restoration equipment, and through the transfer of infested water (Foster *et al*. 2014).

Asiatic clam occurs and within the administrative boundaries of the Coos Bay, Eugene, Roseburg, and Salem Districts.

New Zealand Mudsnail

The New Zealand mudsnail (*Potamopyrgus antipodarum*), a clonal mollusk species, thrives in disturbed fresh and brackish waters in a broad spectrum of aquatic conditions. This habitat generalist spreads very easily, likes to burrow in sediment, and grows healthy populations under high nutrient flows. New Zealand mudsnails live equally well on organic matter or silt in lakes and in slow-moving streams or burrowed in sediment in fast-moving streams.

Sources for New Zealand mudsnail introductions into new locations include passage through fish digestive tracts; contaminated fishing, sporting, and in-stream restoration equipment; and contaminated water from game fish relocations (Oregon Sea Grant 2010). Once introduced into an aquatic system New Zealand mudsnails spread within aquatic environments as hitchhikers on fish and aquatic plants. This species has the potential to be a biofouler of facilities drawing infested waters. New Zealand mudsnail populations can become very dense and out compete native snails for habitat and food (Benson *et al*. 2014).

New Zealand mudsnail are reported across the planning area, on BLM-administered lands in the Coos Bay District, and within the administrative boundaries of the Eugene, Medford, Roseburg, and Salem Districts.

Nutria

Humans introduced nutria (*Myocastor coypus*), a large rodent to Oregon and Washington in the 1930s for two purposes: fur trade and undesirable aquatic plant control. Within a decade, nutria escaped captivity and became feral (Washington Department of Fish and Wildlife 2006). Today nutria remains well established throughout the planning area. Nutria travel long distances over land to find new habitat as their populations expand (Washington State Lake Protection Association 2011). They inhabit burrows in riparian areas near still to slow moving water bodies like marshes, wetlands, ponds, rivers. Dense populations of nutria modify riparian ecosystems by overgrazing riparian vegetation and building numerous burrows. The burrows also weaken fabricated structures like roadbeds and dikes. Intolerance to freezing temperatures is the primary factor limiting nutria spread in Oregon (ODFW 2014).

Yellow Flag Iris

Yellow flag iris (*Iris pseudacorus*) is a tall and showy invasive perennial wetland species introduced to North America for multiple purposes including: gardening, erosion control, and to remove metals from wastewater in sewage treatment plants. Yellow flag iris reproduces sexually by seed and vegetatively by rhizomes. The species tolerates a broad array of habitat conditions including high soil acidity, high salinity, low soil oxygen, and periods of drought but does not tolerate long periods of freezing temperatures (Ramey 2001).

The popular water garden species escapes from gardens, erosion prevention plantings, and sewage treatment plants. Although yellow flag iris is a quarantined species in Oregon, avid water gardeners can easily obtain yellow flag iris in nurseries and from plant dealers over the internet. Gardeners often share yellow flag iris rhizomes in trades with other gardeners because it is beautiful and easy to grow. Similar to other invasive plants, yellow flag iris can be introduced to new locations when it hitches a ride on ground disturbing equipment.

Once introduced, yellow flag iris expands to form thickets in mud and shallow water. Seeds can float long distances and start new colonies downstream. Any disturbance to yellow flag iris infestations provides an opportunity for the species to spread via rhizome fragments. Yellow flag iris thickets crowd out most other vegetation, including aggressive native plants like cattails (Ramey 2001).

Yellow flag iris has limited to widespread distribution in western Oregon and occupies BLM-administered lands in the Coos Bay, Eugene, and Medford Districts.

Affected Environment

Because there is no requirement for county, private, or corporate landowners to report invasive aquatic species occurrences, an accurate accounting of the distribution of invasive species are still unavailable. Despite the limited reporting on invasive aquatic species occurrences, a sufficient picture of the distribution of invasive aquatic species is available on a species-by-species basis on the NAS – Nonindigenous Aquatic species database managed by the U.S. Geological Survey (online at http://nas.er.usgs.gov/) and iMapInvasives (online at www.imapinvasives.org). Enough baseline occurrence data existing in iMapInvasives and the NAS – Nonindigenous Aquatic species database allow for an analysis of aquatic invasive species among alternatives using the HUC 8 watersheds as the basic analysis unit.

The representative aquatic invasive generally have the following distribution in the planning area:

- American bullfrog occurs in numerous widespread locations across western Oregon
- Asiatic clam occurs within the administrative boundaries of the Coos Bay, Eugene, Roseburg, and Salem Districts
- New Zealand mudsnail infestations are reported across the planning area
- Nutria are well established throughout the planning area
- Yellow flag iris has limited to widespread distribution in western Oregon and occupies BLM-administered lands in the Coos Bay, Eugene, and Medford Districts

Figure 3-112, below, shows the representative invasive aquatic species well distributed throughout the planning area and demonstrate the relative density of the reported infestations. This figure also provides species distribution categories (Abundant, Limited, Low, Null).

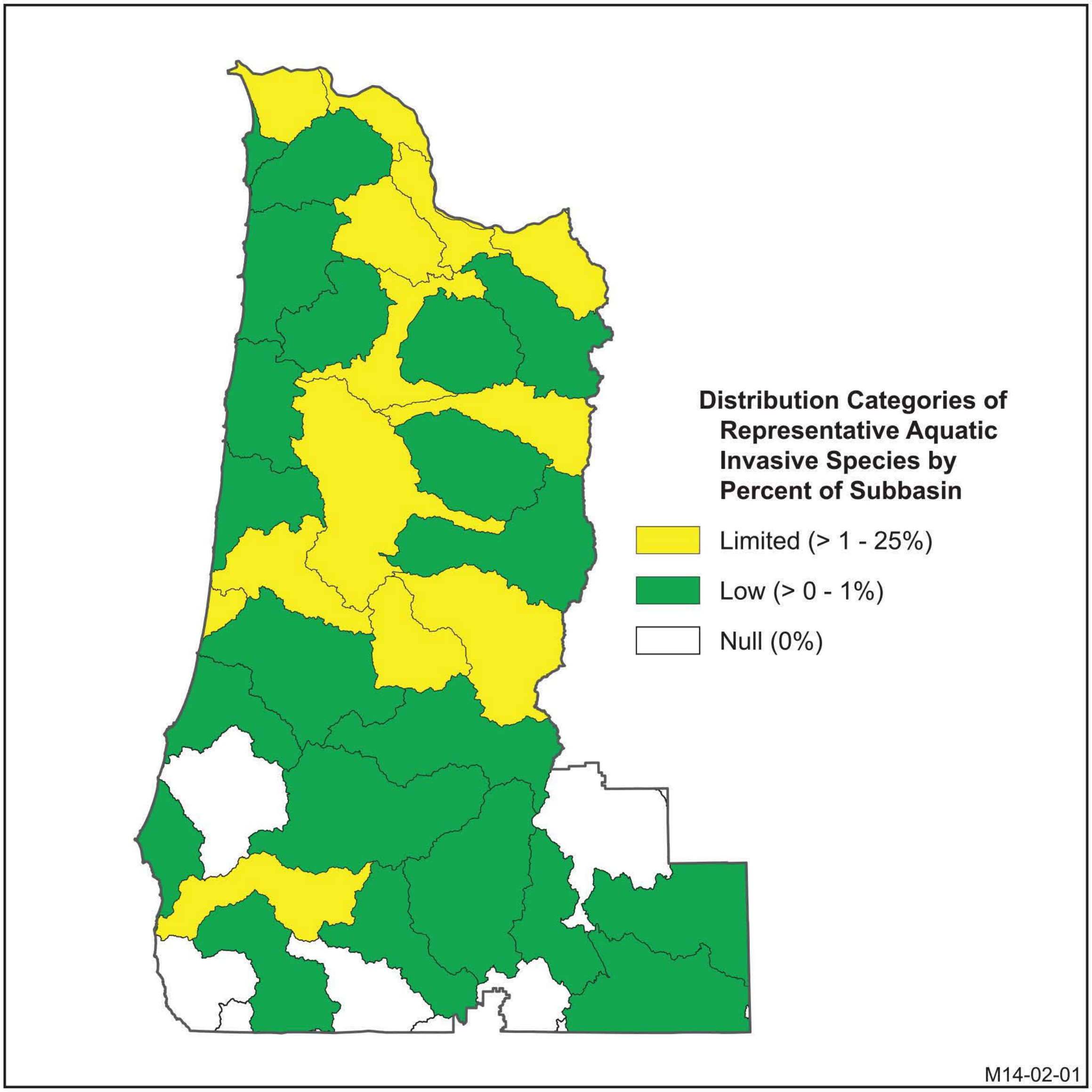

Figure 3-112. Distribution categories of invasive aquatic species by sub-basins (HUC 8) within the planning area.

Forty-one sub-basins either are completely within the planning area, or have enough acreage in the planning area to have an effect with regard to analyzing the risk of invasive aquatic species introductions and spread. Of these 41 subbasins, none of them have enough reported infestations of the representative invasive aquatic species to fall into the Abundant species distribution category, 13 sub-basins qualify for the Limited distribution category, and 21 sub-basins qualify for the Low distribution category. In the planning area, 83 percent of the subbasins have reported representative aquatic invasive species infestations. Sub-basins assigned to the Limited aquatic invasive species distribution category are predominately located in the Eugene and Salem Districts and a few are in the Coos Bay and Medford Districts.

Environmental Effects

Invasive Aquatic Species Introduction and Spread Associated with New Road Construction

Figure 3-113 shows a comparison among the alternatives of the relative susceptibility of sub-basins to invasive aquatic species introduction and spread associated with new road construction for timber harvest activities over the next 10 years.

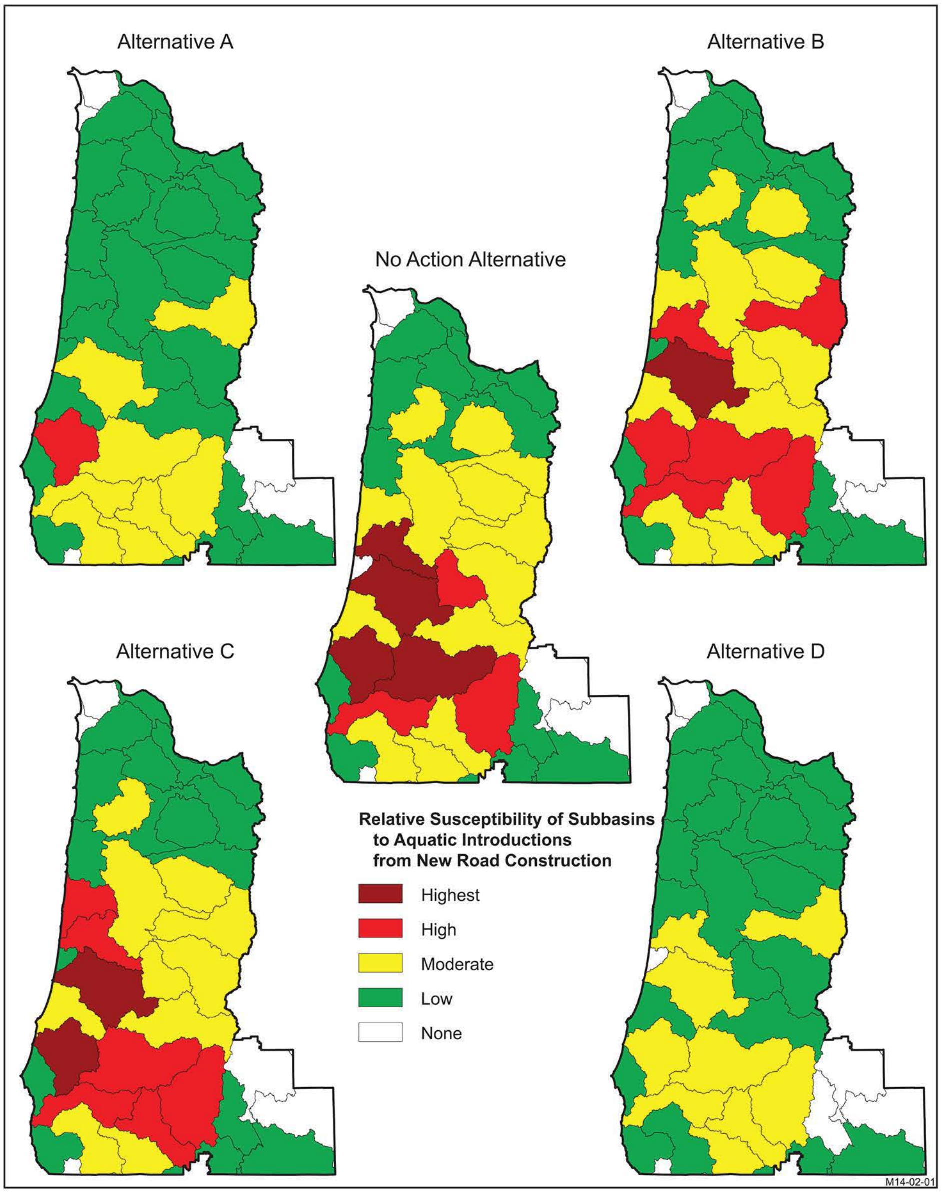

Figure 3-113. Relative susceptibility of sub-basins (HUC 8) to invasive aquatic species introduction and spread associated with new road construction for timber harvest activities over the next 10 years.

The No Action alternative has the greatest susceptibility because it has the most sub-basins in the highest susceptibility ranking and would have 35 sub-basins with some level of susceptibility that is associated with new road construction for timber harvest over the next 10 years. Alternative C would have the least susceptibility to the introduction and spread of aquatic invasive species, with 28 sub-basins having some level of susceptibility and all of those sub-basin susceptibility rankings would be Moderate to Low. Alternative B would be the second highest in susceptibility, Alternative A would be intermediate, and Alternative D second to the least susceptible.

The four subbasins in the highest susceptibility category under the No Action alternative are located in the Coast Range and include lands administered by the Eugene, Roseburg, Coos Bay, and Medford Districts. The Umpqua sub-basin in the Roseburg and Coos Bay Districts would be the only sub-basin in the High susceptibility category under Alternative B. Under Alternatives, A, C and D there would be no subbasins in the High susceptibility category.

See **Table 3-80** for the risk comparison for the introduction and spread of invasive aquatic species into subbasins resulting from new road construction activities among the alternatives.

Table 3-80. Risk comparison for the introduction and spread of invasive aquatic species associated with new road construction by subbasins over the next t10 years.

Risk Category	No Action (# of Watersheds)	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
High	1	0	0	0	0
Moderately High	7	1	6	6	2
Moderate	1	0	3	3	0
Moderately Low	13	16	14	13	13
Low	7	13	7	8	13
Total at Risk	**29**	**30**	**30**	**30**	**28**

The greatest relative risk of invasive aquatic species introduction and spread associated with new road construction activities over the next 10 years would occur under the No Action alternative compared to the other alternatives, and the lowest risk would occur under Alternative D. Only one sub-basin (Eugene District) would be in the High risk category under the No Action alternative and all sub-basins would be at or below the Moderately-High risk category for the other alternatives.

Figure 3-114 displays the risk of invasive aquatic species introduction and spread by sub-basin, resulting from timber harvest associated new road construction over the next 10 years. The highest risk would occur under the No Action alternative, and the lowest risk would occur under Alternative D. Alternatives B and C would generate an intermediate level of risk compared to the other alternatives. The next lowest level of relative risk would occur under Alternative A.

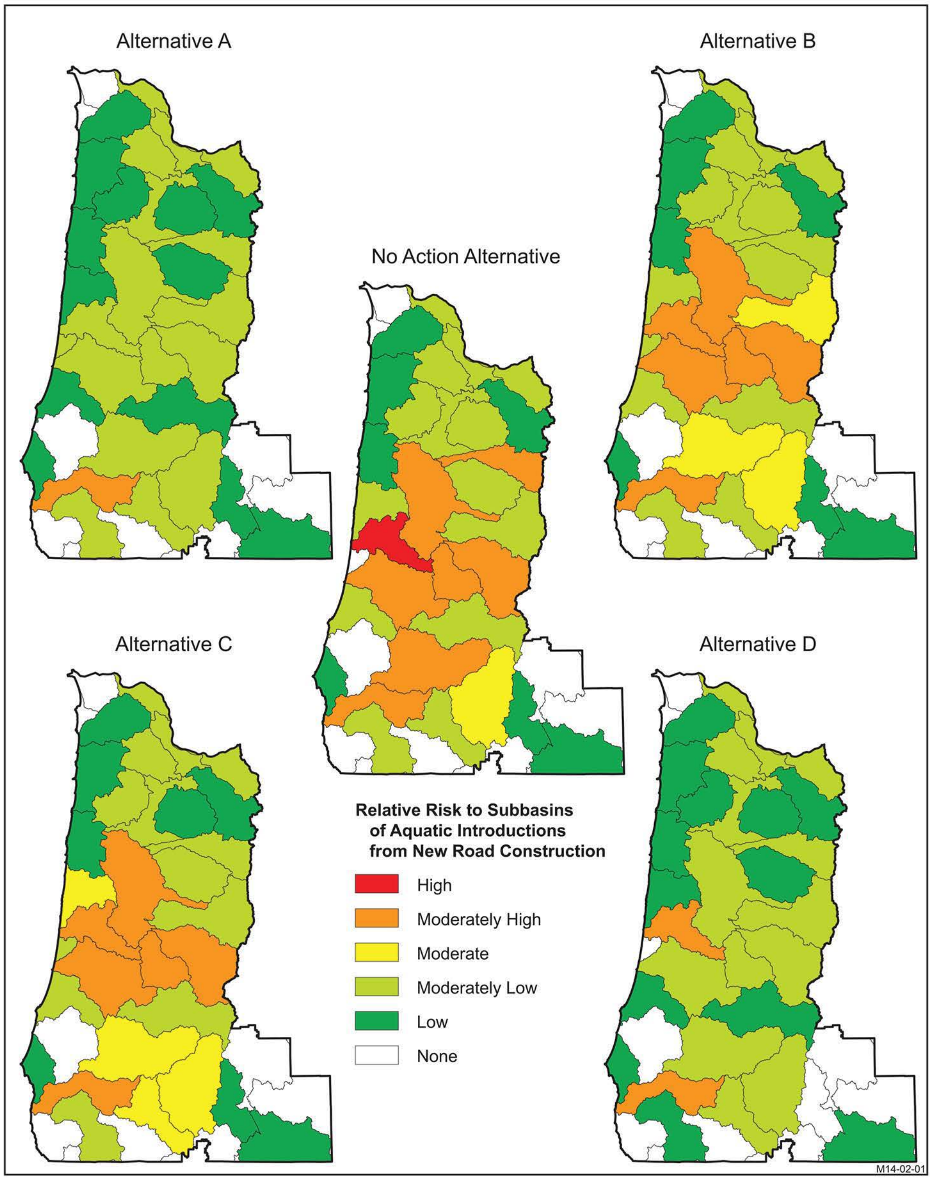

Figure 3-114. Comparison of risk by sub-basin for the introduction and spread of invasive aquatic species associated with timber harvest.

Risk of Invasive Aquatic Species Introduction and Spread Associated with Recreation Management Area Designations

Variability in the RMA designations between the alternatives creates the relative differences in the susceptibility and risk across alternatives of introducing and spreading invasive aquatic species into the subbasins from recreation use.

Susceptibility from recreation associated with RMA designations exists in 33 of 41 sub-basins in the planning area under all alternatives (**Figure 3-115**). The BLM's analysis shows Alternative D would contain the most subbasins (12) in the High susceptibility category while none are in the High category under Alternative A. Alternative C and B have eight and three subbasins in the High susceptibility category, respectively.

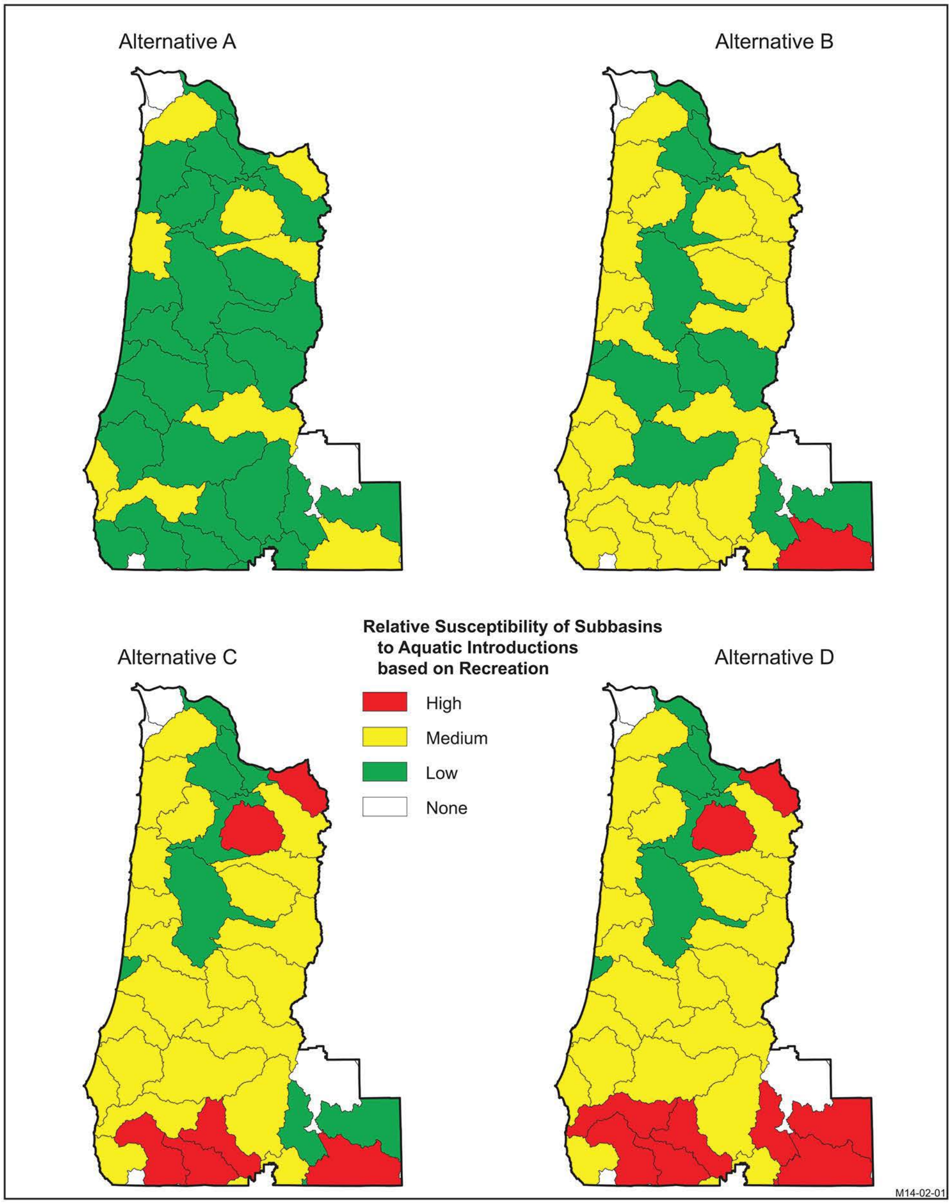

Figure 3-115. Relative susceptibility for introduction and spread of invasive aquatic species associated with Recreation Management Area designations.

Alternative D would have the most subbasins with High risk rankings (Coos Bay, Medford, and Salem Districts) and none with a Low risk ranking. The second highest risk for introduction of invasive aquatic species associated with recreation use would occur under Alternative C. One High Risk sub-basin (Salem District) and five Moderately-High risk subbasins (Eugene, Roseburg, and Salem Districts) would occur under Alternative C. The lowest risk for invasive aquatic species introduction and spread would occur under Alternative A with three Moderately High risk subbasins (Coos Bay, Medford, and Salem Districts).

Figure 3-116 and **Table 3-81** show a relative risk comparison between the alternatives for the introduction of invasive aquatic species into subbasins associated with the RMA designations.

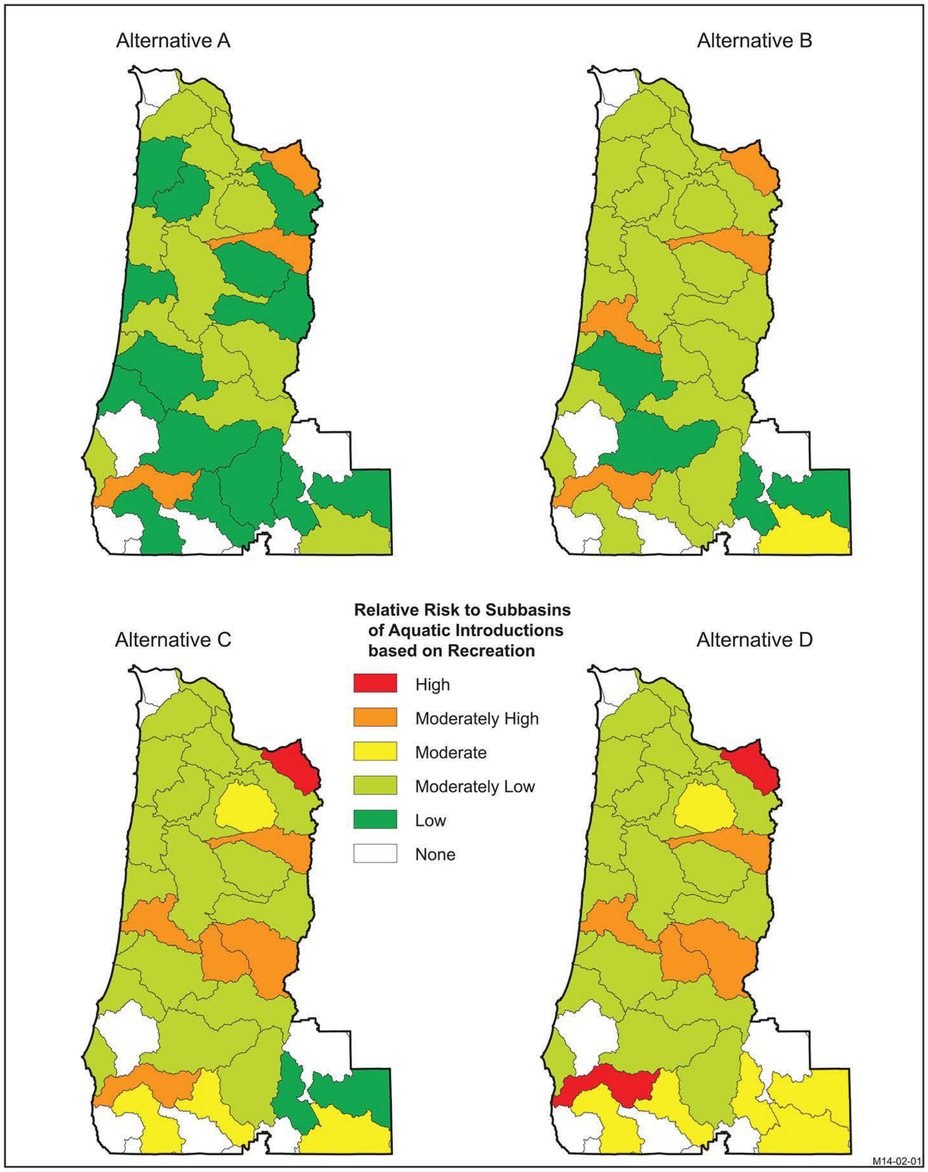

Figure 3-116. Relative risk for introduction and spread of invasive aquatic species associated with Recreation Management Area designations.

Table 3-81. Risk comparison for introduction and spread of invasive aquatic species associated with recreation use.

Risk Ranking	Alt. A (# of Watersheds)	Alt. B (# of Watersheds)	Alt. C (# of Watersheds)	Alt. D (# of Watersheds)
High	-	-	1	2
Moderately High	-	4	6	4
Moderate	-	1	4	6
Moderately Low	19	24	20	21
Low	14	4	2	-
None	8	8	8	8
Total at Risk	33	33	33	33
Total Not at Risk	8	8	8	8
Total Watersheds	**41**	**41**	**41**	**41**

Risk of Invasive Plant Species Introduction and Spread Associated with Grazing

In the invasive plant analysis, **Figure 3-122** (Livestock Grazing) shows the BLM-administered land acres available for livestock grazing by alternative. In the planning area, BLM-administered lands are only available for livestock grazing in the Coos Bay District, Klamath Falls Field Office, and Medford District. Where livestock grazing would be available, susceptibility and risk for invasive aquatic introductions and spread associated with grazing would occur. Livestock movement and associated activities, like the transport of grazing management equipment and supplies, can introduce invasive aquatic species into new locations (USDI BLM 2008).

The No Action alternative would create the greatest risk of invasive aquatic species introduction and spread on the Coos Bay District compared to all of the action alternatives because there would be no lands available for livestock grazing under the action alternatives compared to 543 acres available under the No Action alternative.

In the Klamath Falls Field Office, the No Action alternative would create the greatest risk of introduction and spread with 209,852 acres available for livestock grazing compared to Action Alternatives A, B, and C with 205,627 acres available for livestock grazing. Alternative D, with no acres available for livestock grazing, would have no risk.

In the Medford District, the No Action alternative would create the greatest risk of introduction and spread with 284,795 acres available for livestock grazing compared to Action Alternatives A, B, and C with 161,760 acres available for livestock grazing. Alternative D, with no acres available for livestock grazing, would have no risk.

In sum, for districts that currently have livestock grazing, the greatest susceptibility and risk for invasive aquatic introductions and spread associated with livestock grazing would occur under the No Action alternative and no susceptibility or risk would take place under Alternative D.

Long-Term Introduction and Spread of Invasive Aquatic Species and Summary

With the exception of impacts from road construction, the BLM expects the effects described above to continue in a similar way over the long-term. The potential for the introduction and spread of invasive aquatic species would be higher under alternatives with more area in the Harvest Land Base due to greater long-term road construction in that allocation.

The least risk of invasive aquatic species introduction and spread associated with new road construction over the long term would occur under Alternative A and the great risk, under Alternative C. After restoration thinnings in the Reserves taper off, the BLM would require fewer new roads to support timber harvest activities in the relatively smaller Harvest Land Base under Alternative A, compared to the other alternatives. The most new roads would be required under Alternative C, because it has the most dispersed and largest Harvest Land Base of all of the alternatives.

The BLM expects the 10-year impacts of RMAs to continue as described above over the long-term. The long-term risk of invasive aquatic species introduction and spread in the SRMAs and ERMAs would be consistently higher than in the surrounding areas because of the higher level of human activity. Among the action alternatives, Alternative D would have the highest long-term risk and Alternative A would have the least number of subbasins in the Moderate to High risk categories for the introduction and of invasive aquatic species associated with recreation use.

The effects of grazing under the alternatives would continue as described above. Over the long-term, the amount of land available to livestock grazing would be greatest under the No Action alternative and so would the associated risk of introducing and spreading aquatic invasive species. Alternative D, with no acres available for livestock grazing, would have no risk of invasive aquatic species introductions and spread.

The BLM assigned an overall risk ranking, by office, to each alternative based on the relative risks associated with all of the factors analyzed. For the Coos Bay and Medford Districts, and the Klamath Falls Field Office, the overall risk for the introduction and spread of invasive aquatic species would be highest under the No Action alternative and Alternative C, moderate under Alternatives A and B, and lowest under Alternative D. For the Eugene, Roseburg, and Salem Districts, the overall risk for the introduction and spread of invasive aquatic species would be highest under Alternative C, high under Alternative D, moderate under the No Action alternative and the lowest under Alternatives A and B.

Table 3-82 shows a relative risk comparison between the alternatives, by analysis factor, for the introduction of invasive aquatic species over both the long and short term.

Table 3-82. Relative risk of long and short-term introduction and spread of invasive aquatic species by analysis factor.

Risk Analysis Factor	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Number of Moderately High and High Risk subbasins from timber harvest associated new road construction over the next 10 years	Highest	Low	Moderate	Moderate	Lowest
Number of subbasins assigned risk categories from new road construction associated with timber harvest activities over the next 10 years.	Moderate	Most	Most	Most	Fewest
Number of High and Moderately High risk subbasins from recreation use levels associated with recreation management area designations		Lowest	Low	High	Highest
Area available for livestock grazing	Highest	Moderate	Moderate	Moderate	None
Overall relative risk for the introduction and spread invasive aquatic species (Coos Bay, Medford, Klamath Falls)	High	Moderate	Moderate	High	Low
Overall relative risk for the introduction and spread invasive aquatic species. (Eugene, Roseburg, and Salem)	Moderate	Lowest	Lowest	Highest	High

All alternatives include management direction to "prevent, detect, and rapidly control new invasive aquatic species infestations." This management direction is general, as is appropriate to the scope and scale of this action. Across alternatives, the BLM may mitigate some of the effects by incorporating prevention measures in the planning and design of implementation-level actions, to prevent the introduction of new infestations. These specific measures may include, but are not limited to, the following:

- Clean road construction, restoration, and livestock grazing management equipment that would operate off roads. In infested areas, where the transport of invasive species seeds, propagules, or individuals on equipment is likely, clean the equipment before leaving the project site
- Use sterile road building materials and weed-free straw and mulch
- Use native plant species to promote competitive exclusion of invasive plant species
- Retain native plant communities in and around riparian and aquatic habitats and minimize soil disturbance, consistent with project objectives

Issue 3

How would alternatives affect sudden oak death introduction and spread?

Summary of Analytical Methods

The BLM designed the analysis to project the rate of sudden oak death infestation expansion for the periods of 2013-2023 and 2023-2033 considering the different management strategies under the alternatives. The analysis shows the relative differences in the expected rate of sudden oak death infestation expansion resulting from the BLM not treating infestations, treating them only outside of the Riparian Reserve as defined under Alternative B, and treating all infested areas. The Planning Criteria provides detailed information on the sudden oak death analysis and assumptions, which the BLM incorporates here by reference (USDI BLM 2014, pp. 101-104).

This analysis examines different *Phytophtora ramorum* treatment strategies to compare how sudden oak death introduction and spread would result from the alternatives.

The effects of where sudden oak death treatments would occur on BLM-administered lands is measured in terms of the location and amount of area projected to become infested in the sudden oak death expansion zones over the next 10-20 years.

The factors that were considered in the analysis relative to the projected sudden oak death infestation levels and spread over the next 10-20 years include:

- BLM's *Phytophtora ramorum* treatment strategy by alternative: treat all infestations under the No Action alternative and Alternatives C and D; no treatments under Alternative A; and treat all infestations outside of the Riparian Reserve under Alternative B
- Sudden oak death projected infestation zones for the next 10-20 years

The natural rate of the sudden oak death expansion realized from the date of first detection in 2001 through 2013 defines the boundaries of the infestation zones for the next 10-20 years. Under the status quo, technical experts anticipate the infestation area would expand by approximately 1 mile to the south, 5 miles to the east and 17 miles to the north every 10 years for the next 20 years as it has done in the previous 10 years (Frankel and Palmieri 2014).

A team of technical experts including Ellen Goheen (U.S. Forest Service), Alan Kanaskie (Oregon Department of Forestry), and Everett M. Hansen (Department of Botany and Plant Pathology, Oregon State University) worked with the BLM to project the rate of disease expansion and infestation zones for the next 10-20 years under the alternatives.

The experts used their professional opinions, the proportion of infestation acres on BLM-administered lands in the Riparian Reserve (as described under Alternative B) compared to total infestation area on BLM-administered lands, and the principles within a sudden oak death distribution model to arrive at the projected rates of expansion and infestation levels on BLM-administered lands. Under Alternative B, there would be no sudden oak death treatments within the Riparian Reserve.

The technical experts added assumptions to facilitate the analysis after the Planning Criteria was developed. These include:

- The acres treated on BLM-administered lands in the period 2001-2013 represent the infested area for the same period
- The area treated expands at the same rate on BLM-administered land in the second and third decades as it did between 2001 and 2013
- Disease management practices on nearby non-Federal land will influence amount of disease on BLM-administered lands; sudden oak death will spread and intensify when left untreated resulting in disease intensification and spread from infected trees for several years and accelerated mortality in untreated areas
- All infestations on other ownerships would be treated

The analysis does not account for the following:

- Regrowth of vegetation on sites that were treated and replanted or naturally re-vegetated
- Variation in abundance of tanoak across the landscape
- Treatments that remove tanoak but leave overstory conifer and non-host hardwoods intact

Background

Non-native forest pathogens, whose introduction causes economic or environmental harm, or harm to human health, are invasive species. Sudden oak death, caused by the invasive pathogen *Phytophthora ramorum*, threatens Oregon's forest and nursery industry.

Phytophthora ramorum, a water mold (oomycete) caused high levels of tanoak and live oak mortality in California for several years before its presence in Curry County, Oregon became evident in 2001. *Phytophthora ramorum* also infects nursery stock of a wide range of host species in Europe, California, Oregon, and Washington. However, the European and North American mating types are not the same, which indicates the source population for the North American infestations is not from Europe. In 2001, Oregon had several infection centers in close proximity to one another on private residential, industrial forestland, and BLM-administered land. The original quarantine area covered 9 square miles (Goheen *et al*. 2006). By 2013, despite aggressive coordinated education, prevention, and early detection and treatment efforts the quarantine area expanded to 264 square miles from natural spread of the disease.

Phytophthora ramorum travels long distances via nursery stock and infected wood of some host species. For that reason, the pathogen is subject to both State (ORS 603-052-1230) and Federal (7 CFR 301.92) quarantine regulations that restricts the movement of host material from infested areas into disease-free areas. *Phytophthora ramorum* infects more than 46 host species and more than 90 associated species (USDA APHIS 2013). Regulated material includes host nursery stock and wood, log, and lumber of identified host species. Many of these species are native trees and shrubs found in forests managed by the BLM, including tanoak and Canyon live oak. *Phytophthora ramorum* causes mortality in susceptible oak, tanoak, rhododendron, viburnum, evergreen huckleberry, and other plant species.

Phytophthora ramorum affects the stem, twigs and leaves of its host. The species spreads by both resting (chlamydospores) and swimming (zoospores) spores. Sporangia released from the canopies of infected trees travel to new host trees or the ground through the air assisted by wind and rain. Zoospores can move through water along the stems, twigs and leaves of host plants and some ultimately penetrate and infect new hosts. The spores travel in water where some splash onto new susceptible host plants and start new infections. Irrigation water from infested drainages or water sources also carries spores to new sites. Chlamydospores, which can survive periods of warmth and drought, move to new locations on infested soil, leaf and twig litter (Goheen *et al*. 2006).

Outside of nurseries, pathologists have not detected *Phytophthora ramorum* infections on conifer species in Oregon. Pathologists believe the aggressive treatments in Oregon's forests have kept the spore levels down to a level where understory conifer species growing in infestation areas have escaped inoculation. However, in California, infestation levels are relatively high and several species of conifers in the understory of infected oaks have become infected. The list of susceptible conifers in California includes Douglas-fir, several other fir species, coast redwood, and Pacific yew. When left untreated the disease intensifies as the infected hosts produce more spores for several years. In Oregon, where the disease has been aggressively treated since 2001 the spore loads have not reached high levels.

Early in 2013, the State of Oregon revised the quarantine rule to establish a Generally Infested Area where landowners are no longer required to try to eradicate infestations. The BLM and other Federal agencies have continued aggressive treatments within the Generally Infested Area (Frankel and Palmieri 2014). Pathologists do not know if higher spore levels in untreated areas in Oregon will lead to infections on understory conifers, such as in California, but pathologists do know the spore loads will increase. With higher spore loads come more opportunities for the spores to infect more hosts and to move off site to new locations.

The Coos Bay District has been coordinating treatment activities with adjoining landowners, the Oregon Department of Forestry, and the U.S. Forest Service to control sudden oak death infection sites in the state-designated quarantine area since 2001 when pathologists first became aware of its presence in Curry County. After pathologists found new infestations north of the established quarantine area in 2013, the Animal and Plant Health Inspection Service (APHIS) and the State of Oregon expanded the quarantine area in Curry County to 264 square miles (USDA APHIS 2013). Pathologists have found no new infestations from the movement of nursery stock outside of Oregon's quarantine area, which suggests the quarantine program established in 2002 has been effective (USDA APHIS 2014).

The Coos Bay District uses an integrated pest management approach to control all detected Sudden Oak Death infestations. Treatments include cutting, piling, and applying herbicides to host species within 300 feet of infected trees. Treatments often include broadcast or pile burning of cut material. Pathologists from the Oregon Department of Forestry and the U.S. Forest Service perform follow-up surveys until the area has been determined to be disease-free for 2 successive years. If the disease is still present, the area is retreated. The Coos Bay District plants treatment areas with Douglas-fir within 2 years of treatment.

Affected Environment

In 2001, Oregon had several infection centers in close proximity to one another on private residential, industrial forestland and on BLM-administered land. The original quarantine area covered 9 square miles (Goheen *et al*. 2006). By 2013, despite aggressive coordinated education, prevention, and early detection and treatment efforts the quarantine area expanded to 264 square miles from natural spread of the disease. All of the western Oregon districts are at risk for sudden oak death infestations (Václavík *et al.* 2010), but Coos Bay District is the only one with known sites.

Sudden oak death infestation Zone 1 represents the broader infested area over the period of 2001 through 2013 (**Figure 3-117**). The Coos Bay District manages over 10,000 acres (almost 15 percent) of the total area within Zone 1. *Phytophthora ramorum* infests almost 1,000 acres (10 percent) of the Coos Bay District administered lands in Zone 1. Because the pathogen thrives in wet environments, trees closer to streams have a higher infection rate than those in upland habitats. More than 25 percent of the infested area is either within one site-potential tree height of perennial and fish-bearing streams or within 50 feet on non-fish bearing intermittent streams, or both.

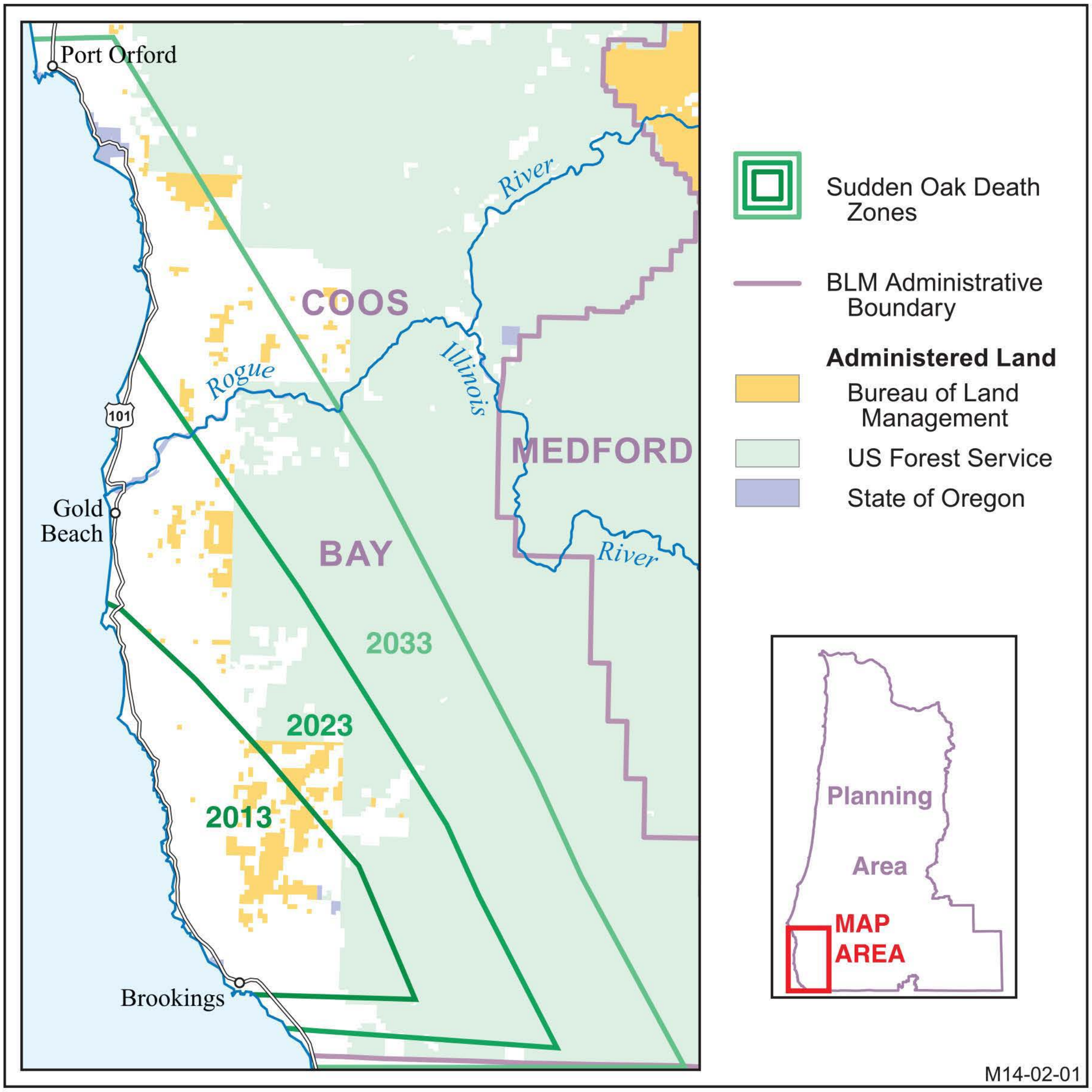

Figure 3-117. Sudden oak death infestation zones for the next 20 years.

Between 2001 and 2013, integrated pest management treatments to control sudden oak death occurred on 959 acres. Most areas were treated using more than one method. In 2013, the Coos Bay District treated 46 acres by cutting and piling, over 160 acres by pile burning, and 24 acres by herbicide treatments. No retreatments occurred in 2013. Cumulative treatments between 2001 and 2013 include more than 830 acres of cutting and piling, almost 700 acres of pile burning, 17 acres of broadcast burns and almost 80 acres of retreatments.

Environmental Effects

Zone 1 covers infestation area for the period between 2001 and 2013; Zone 2 shows the expected extent of the infested area by 2023, and Zone 3 by 2033.

The intensity and area of the infestations would vary under the different treatment strategies. The lowest amount of sudden oak death infestation intensification and increase in infested acres would occur under the No Action alternative, and Alternatives C and D, because the BLM would treat all detected infestations. The infestation would still increase under this aggressive treatment strategy as it has over the past 10 years. Spore loads would have less opportunity than under other alternatives to increase and spread to new hosts due to rapid response treatments by the Coos Bay District. By the end of the first decade, the infestation would have increased in both Zones 1 and 2 and would total over 2,700 acres. By the end of the second decade, the infestation would have entered Zone 3 and the cumulative total for all zones would exceed 5,200 acres or 22 percent of BLM-administered lands in Curry County (**Table 3-83**).

Table 3-83. Sudden oak death infestations levels by infestation zone over the next 10 and 20 years across the alternatives.

Infestation Zone (Time Frame)	Alt. A	Alt. B	No Action, Alt. C and D
Zone 1 (2014 – 2023)	10,013	4,440	1,858
Zone 2 (2014 – 2023)	4,893	2,111	878
Zone 3 (2014 – 2023)	305	39	-
Zone 1 (2024 – 2033)	10,013	5,874	2,877
Zone 2 (2024 – 2033)	8,143	3,978	1,755
Zone 3 (2024 – 2033)	3,050	1,429	639

A higher level of infestation intensification and increase in infested acres would occur under Alternative B. Under this alternative, no treatments would occur within the Riparian Reserve, but treatments would occur on all detected infestations outside of the Riparian Reserve. Sudden oak death would spread and intensify from the untreated areas in the Riparian Reserve. Spores produced within the Riparian Reserve from untreated trees would spread to both additional hosts within and outside of the Riparian Reserve for several years. Ultimately, more tanoak would die from this intermediate treatment strategy under Alternative B than would die under the aggressive strategy prescribed under the No Action, and Alternatives C and D. By the end of the first decade, the infestation would have increased in Zone 1 and entered Zones 2 and 3. Cumulatively the infestation would cover almost 6,600 acres. By the end of the second decade, the infestation would have increased in all zones with a cumulative total infestation covering almost 11,300 acres or 47 percent of BLM-administered lands in the cumulative three-zone area.

Under Alternative A, the Coos Bay District would not treat sudden oak death infestations, which would allow for the most intense and largest levels of infestations on BLM-administered lands. Left untreated, infected trees would produce and release spores over several years. No sudden oak death treatments would allow for rapid and uncontrolled infestation intensification on BLM administered lands. The highest levels of tanoak mortality would occur under Alternative A.

Under Alternative A, by the end of the first decade, sudden oak death infestations would occupy all BLM-administered lands in Zone 1 (10,013 acres). Infestations would occupy all of the BLM ownership within the quarantine area and a quarter of the remaining BLM ownership within Zone 2. Sudden oak death infestations would occupy 5 percent (more than 300 acres) of the BLM ownership in Zone 3 within the first 10 years.

Sudden oak death would infest 87 percent (21,200 acres) of BLM-administered lands in the cumulative three-zone area by the end of the second decade under Alternative A.

Decadal initial sudden oak death treatments under Alternative B would be almost two times higher than the expected treatment levels under the No Action and Alternatives C and D over the next 10 years and one and a half times greater in the second 10 years (**Table 3-84**).

Table 3-84. Initial sudden oak death treatment levels over the next 10 and 20 years.

Sudden Oak Death Decadal Treatment Periods	No Action, Alt. C and D (Acres)	Alt A (Acres)	Alt B (Acres)
Initial treatments for 2014 – 2023	1,777	-	3,292
Initial treatments for 2014 – 2023	2,536	-	3,854
Cumulative Treatments	4,313	-	7,146

Comparing the expected sudden oak death infestation increase within the Riparian Reserve and over all BLM-administered lands within the decadal infestation zones reveals the relative differences in effects across the different treatment strategies with respect to treatments in the Riparian Reserve. Under Alternatives A and B sudden oak death infestations would occupy 100 percent of the Riparian Reserve area in Zone 2 and almost 90 percent in Zone 3 by 2033 compared to 31 percent in Zone 2 and 34 percent in Zone 3 under the other alternatives. Under the No Action alternative and Alternatives C and D, the Riparian Reserve in Zone 3 would still be free of infestations by 2023.

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Lands and Realty

Key Points

- Under all alternatives, BLM-administered lands are generally available for right-of-ways. Action Alternative D would most constrain the BLM's ability to grant right-of-ways.

Issue 1

How would the alternatives affect land tenure in western Oregon?

Summary of Analytical Methods

The BLM identified how many acres in each alternative would be included in each land tenure zone and considered the probable impact of this on the BLM's land holdings in western Oregon given recent trends in land acquisition, exchange, and disposal.

Background

Through RMP-level decisions, the BLM places all of the lands the BLM administers into one of following three land tenure zones:

- Lands in Zone 1 are retained under BLM administration
- Lands in Zone 2 are available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict
- Lands in Zone 3 are available for disposal using appropriate disposal mechanisms

Across the action alternatives, the BLM used the following criteria to determine land tenure zones (**Appendix J**):

- Zone 1 lands would include:
    - National Landscape Conservation System designated lands
    - Areas of Critical Environmental Concern
    - Lands acquired with Land and Water Conservation Funds
- Zone 2 lands would include all BLM-administered lands not listed in the descriptions of both Zone 1 and Zone 3 lands.
- Zone 3 lands would include:
    - Lands that are either not practical to manage, or are uneconomical to manage (because of their intermingled location and non-suitability for management by another Federal agency)
    - Survey hiatuses – an area between two surveys where the record describes them to have one or more common boundary lines with no omission
    - Unintentional encroachments – an unintended unlawful and adverse intrusion within the boundary of BLM property where the BLM has discretion to determine if suitable for disposal

Affected Environment

Under the 1995 RMPs, the BLM has acquired 8,962 acres of lands by purchase, which encompasses 0.36 percent of lands within the planning area. Ongoing land acquisition projects include the Sandy River/Oregon National Historical Trail (Salem District).

The majority of BLM-administered lands within the planning area are currently within Zone 2 (suitable for exchange). Current land tenure acreages are presented with the alternatives in **Table 3-85**. Under the 1995 RMPs, the BLM has made only limited use of land exchanges (acres acquired 22,390; acres disposed 7,367). Federal legislation, rather than discretionary agency action, directed most land exchanges and transfer activities within the planning area.

There are 18,266 acres (approximately 0.7 percent of the total decision area acres) of BLM-administered land within the planning area designated as Zone 3 (suitable for disposal). Under the 1995 RMPs, the BLM has sold 3,798 acres of Zone 3 lands. The BLM sold these lands primarily to resolve unintentional encroachment cases, where an individual had unintentionally built a development on BLM-administered lands. The BLM does not sell lands identified for disposal if project-level reviews show conflicts with the land tenure adjustment criteria found in Appendix J.

Environmental Effects

Only the arrangement and acreage of Areas of Critical Environmental Concern cause the acreages in the land tenure zones to vary between alternatives. The adjustment in acres for Areas of Critical Environmental Concern affects both Zone 1 and Zone 2 lands, (i.e., as more acres are proposed for Areas of Critical Environmental Concern, the difference of acres are reflected in Zone 2). Zone 3 acreage does not adjust per alternative (**Table 3-85**).

Table 3-85. Proposed land tenure zone acres by alternative.

Land Tenure Zone	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Zone 1 – Lands Suitable for Retention	188,249	199,582	193,019	191,696	199,376
Zone 2 – Lands Suitable for Exchange	2,287,140	2,275,807	2,282,370	2,283,693	2,276,013
Zone 3 – Lands Suitable for Disposal	18,266	18,266	18,266	18,266	18,266

The No Action alternative has the smallest acreage in Zone 1 (smallest acreage in ACECs) and the largest acreage in Zone 2. Alternative A has the largest acreage in Zone 1, with 11,333 more acres than the No Action alternative. This acreage difference accounts for approximately 0.45 percent of the total planning area. The minimal variation in acreage will have little effect on the BLM's current ability to exchange lands.

Issue 2

How would the alternatives affect the availability of BLM-administered lands for right-of-ways in western Oregon?

Summary of Analytical Methods

The BLM identified how many acres in each alternative would be designated as Right-Of-Way Avoidance and Exclusion Areas and considered how these designations would affect the availability of rights-of-way on BLM-administered lands in the western Oregon.

Background

Through RMP-level decisions, the BLM may identify certain BLM-administered lands as Right-of-Way Avoidance or Exclusion Areas.

- Right-Of-Way Avoidance Areas – Areas with sensitive resource values where the BLM will strongly discourage right-of-ways and land use authorizations. The BLM will make authorizations in avoidance areas only when compatible with the purpose for which the area was designated and not be otherwise feasible outside the avoidance area.

- Right-Of-Way Exclusion Areas – The BLM would not grant future right-of-ways except when mandated by law.

Across the action alternatives, the BLM used the following criteria to identify BLM-administered lands that it would identify as Right-Of-Way Avoidance Areas:

- Areas of Critical Environmental Concern
- Recreation Management Areas
- Wilderness Study Areas
- Designated and Suitable Wild and Scenic Rivers classified as scenic and recreation rivers
- Class II Visual Resource Management Areas

Across the action alternatives, the BLM used the following criteria to identify BLM-administered lands that it would identify as Rights-Of-Way Exclusion Areas:

- Lands designated as Wilderness
- Lands managed for their wilderness characteristics
- Designated and suitable Wild and Scenic Rivers classified as wild rivers
- Class I Visual Resource Management areas

The checkerboard land ownership pattern of the O&C lands generates most of the need to cross public lands in order to provide access and utilities to intermingled private lands. The BLM generally does not know the location and nature of such proposals until the Bureau receives an application.

Currently, most right-of-ways the BLM grants over BLM-administered land in western Oregon are for access roads. In most cases, other linear right-of-ways (for such uses as domestic or irrigation waterlines, or utility lines for servicing residences) are authorized within or adjacent to existing road-clearing limits. In addition, the BLM has authorized other activities on public land using temporary use permits, including:

- Apiary (beehive) sites
- Agricultural cultivation of small areas
- Residential encroachments or other structures pending their removal or long-term authorization
- National Guard or military reserve training
- Other miscellaneous short-term activities

Affected Environment

BLM-administered land is currently generally available for needed right-of-ways where consistent with local public resource values. Under the 1995 RMPs, the BLM has authorized numerous types of right-of-ways, including right-of-ways for county roads, private access roads, power transmission lines, communication sites, and bicycle paths. New right-of-way proposals across public lands are likely to continue in the future.

Of the current 6,254 authorized right-of-ways, 78 percent are for roads. There are eighty-three communication sites on BLM-administered land within the planning area.

Major existing right-of-way corridors within the planning area are shown in **Figure 3-118**. Existing facilities located within right-of-way corridors include Bonneville Power Administration and private electric transmission lines, pipelines, fiber-optic lines, and transportation infrastructure.

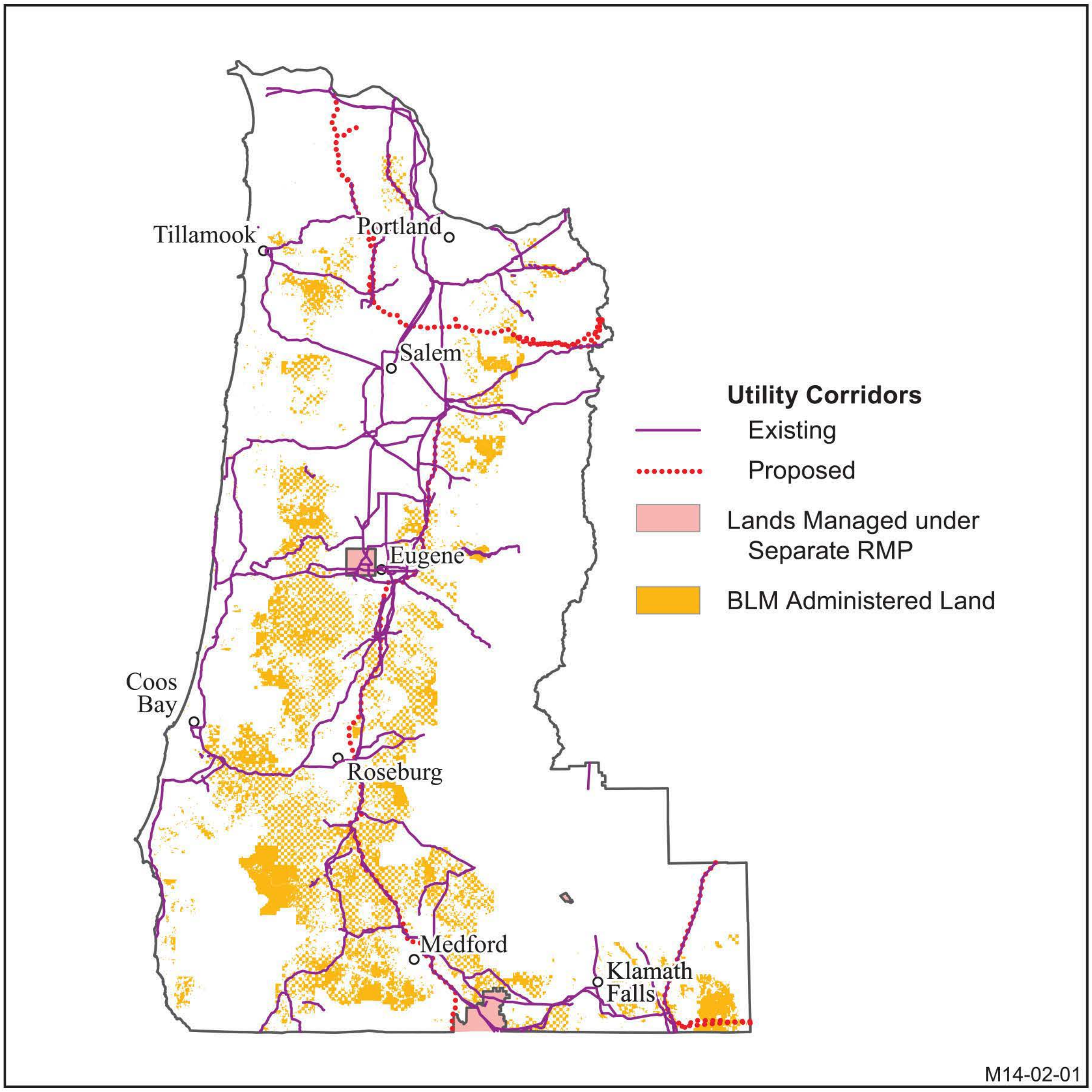


Figure 3-118. Utility corridors.

Pacific Connector Pipeline Project

The Federal Energy Regulatory Commission released the Jordan Cove Energy and Pacific Connector Pipeline Project Draft EIS in November 2014 (Federal Energy Regulatory Commission 2014). The Pacific Connector Gas Pipeline project would include an approximately 232-mile-long, 36-inch-diameter underground natural gas pipeline extending from a proposed Jordan Cove Energy liquefied natural gas export terminal in Coos Bay, Oregon to an interconnection with the existing interstate natural gas systems of Ruby Pipeline LLC and Gas Transmission Northwest LLC near Malin, Oregon. The proposed route extends across 40 miles (approximately 800 acres) of BLM-administered land in the Coos Bay, Lakeview and Roseburg Districts. Implementation of the Pacific Connector Pipeline would require a right-of-way grant from the BLM to cross BLM-administered lands. The Final Environmental Impact Statement is scheduled to be completed in 2015.

Environmental Effects

The analysis shows that Right-Of-Way Avoidance Area acres range from Alternative A with the least Avoidance Areas (179,436 acres) and Alternative D with the most Avoidance Acres (871,713 acres) (**Table 3-86**). While having fewer acres in Avoidance Areas than Alternative D, Alternative C would still have more than double the No Action alternative. Alternative A has fewer acres than the No Action alternative. The large acreage difference is primarily due to Recreation Management Areas where the range of acreage is from 8,217 acres to 666,862 acres. With this large acreage of Avoidance Areas, the BLM's ability to grant right-of-ways under Alternative D, and to a slightly lesser degree under Alternative C, would be constrained relative to the current conditions.

Table 3-86. Right-Of-Way Avoidance Areas by alternative.

Avoidance Area Criteria	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Areas of Critical Environmental Concern	94,657	105,990	99,427	98,104	105,784
Recreation Management Areas	8,217	18,543	164,141	416,616	666,862
Wilderness Study Areas	1,208	1,208	1,208	1,208	1,208
Designated and Suitable Wild and Scenic Rivers (Scenic and Recreation only)	20,414	20,414	27,557	27,557	64,083
Visual Resource Management Class II that is not Included in Right-Of-Way Exclusion Areas	123,756	48,185	48,958	48,999	58,309
Total Avoidance Acres*	**243,928**	**179,436**	**326,510**	**575,444**	**871,713**

* Right-of-way avoidance acreage is not a direct sum from the individual criteria acres due to criteria that overlap geographically. Areas that overlap with Right-of-way Exclusion Areas are subtracted from the sum of the total avoidance acres since Right-Of-Way Exclusion is more restrictive than Right-Of-Way Avoidance.

The No Action alternative would have the least acres in Right-Of-Way Exclusion Areas (42,382 acres) (**Table 3-87**). Alternative A would have the most acreage in Exclusion Areas (129,389). This acreage difference of 87,007 acres accounts for approximately 3.49 percent of the total planning area. The minimal variation in acreage for Right-Of-Way Exclusion Areas will have little effect on the BLM's ability to grant right-of-ways on BLM-administered land.

Table 3-87. Right-Of-Way Exclusion Areas by alternative.

Exclusion Area Criteria	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Lands Designated as Wilderness	14,309	14,309	14,309	14,309	14,309
Lands Managed to Protect their Wilderness Characteristics	-	88,029	50,706	50,706	-
Designated and Suitable Wild and Scenic Rivers (Wild Only)	5,937	5,937	5,937	5,937	5,937
Visual Resource Management Class I	22,136	21,114	21,114	21,114	21,114
Totals	**42,382**	**129,389**	**92,066**	**92,066**	**41,360**

Lands with Wilderness Characteristics

Key Points

- Alternative A provides the greatest protection of identified Lands with Wilderness Characteristics within the decision area.
- Alternatives B and C provides intermediate protection of Lands with Wilderness Characteristics within the decision area.
- Alternative D provides no protection of Lands with Wilderness Characteristics within the decision area.
- Under all action alternatives, the BLM assumed that identified wilderness characteristics within the Harvest Land Base would degrade over time.

Issue 1

Issue 1: How would the alternatives affect BLM-administered lands with identified wilderness characteristics?

Summary of Analytical Methods

This section analyzes the environmental effects to Lands With Wilderness Characteristics outside designated Wilderness Areas and existing Wilderness Study Areas (WSAs) within the planning area that could result under the alternatives.

The BLM analyzed the extent to which each alternative would protect or degrade identified Lands with Wilderness Characteristics (i.e., size, naturalness, and either outstanding opportunities for solitude or primitive and unconfined recreation). The BLM did so by comparing the acres managed for wilderness characteristics under each alternative as well as considering the acres not managed for wilderness characteristics to which the BLM would apply management actions likely to degrade wilderness characteristics.

The BLM assumed that where an alternative would manage an area for its wilderness characteristics these wilderness characteristics would persist for at least the duration of the RMP. The BLM also assumed that where an area was not managed for its wilderness characteristics, these wilderness characteristics would be lost over time. The BLM particularly considered instances where alternatives would prioritize another resource over wilderness characteristics. For example, in Alternatives B and D, the BLM does not manage for wilderness characteristics where doing so would be in conflict with proposed recreation or OHV designations.

In this analysis, the BLM assumed that OHV users would operate vehicles consistent with BLM decisions about OHV use. Although the BLM has some site-specific and anecdotal information about illegal OHV use, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal OHV use. In addition, much of the decision area has physical limitations to potential illegal OHV use, including dense vegetation, steep slopes, and locked gates. In most of the interior/south, the ability to track numerous different routes across the open spaces can lead to degradation and erosion in a greater proportion than most of the coastal/north. However, the BLM lacks a basis for characterizing current illegal OHV use or forecasting such potential illegal OHV use under any of the alternatives at this scale of analysis.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 125-126).

Analysis Assumptions

- Where an alternative would manage an area for its wilderness characteristics these wilderness characteristics would persist for at least the duration of the RMP.
- BLM-administered lands identified as having wilderness characteristics contain all wilderness characteristics (that is, all characteristics exist in the area: size, naturalness and outstanding opportunities for solitude or primitive and unconfined types of recreation).
- Effects to any of the wilderness characteristics in an area would affect the overall area's status as having wilderness characteristics.
- Adverse effects to wilderness characteristics would result from any management action that allows surface-disturbing activities that degrade naturalness.
- Where a portion of an area identified as having wilderness characteristics overlaps with the Harvest Land Base under a particular alternative, the effected sub-unit would have all inventoried acres eliminated from protection unless the remaining acreage is over 5,000 acres.

Background

The BLM's authority to conduct wilderness reviews, including the establishment of new Wilderness Study Areas, expired on October 21, 1993, pursuant to Section 603 of the Federal Land Policy and Management Act (FLPMA). However, the BLM retained the authority under Sections 201 and 202 of the FLPMA to inventory wilderness characteristics and to consider such information during land use planning.

As required under the FLPMA and current BLM policy, the Bureau updated its Lands With Wilderness Characteristics inventories for western Oregon in 2013. This update included BLM-administered lands contained in citizen's wilderness proposals. The impetus for this update was the need for accurate information for the ongoing revision of the RMPs for western Oregon. In conducting these inventories, the six BLM offices followed the guidance provided in BLM Manual 6310—Conducting Wilderness Characteristics Inventory on BLM Lands (USDI BLM 2012). Those inventories are incorporated here by reference and are available at http://www.blm.gov/or/plans/rmpswesternoregon/lwci.php.

As inventory maintenance, the BLM used the same criteria from Section 2(c) of the Wilderness Act to determine the presence or absence of wilderness characteristics. Following this guidance, the BLM inventoried areas for the requisite wilderness characteristics: sufficient size of a roadless area, naturalness, and outstanding opportunities for solitude or primitive and unconfined recreation. The BLM wilderness inventory did not find wilderness characteristics to be present within any portion of the citizen-proposed areas.

In Alternative A, the BLM would protect all lands with identified wilderness characteristics that are not within the Harvest Land Base. In Alternatives B and C, the BLM would protect all lands with identified wilderness characteristics that are outside of the Harvest Land Base and are compatible with existing and potentially non-compatible recreation opportunities (motorized and mechanized uses). In Alternative D, the BLM would not protect any identified lands with wilderness characteristics.

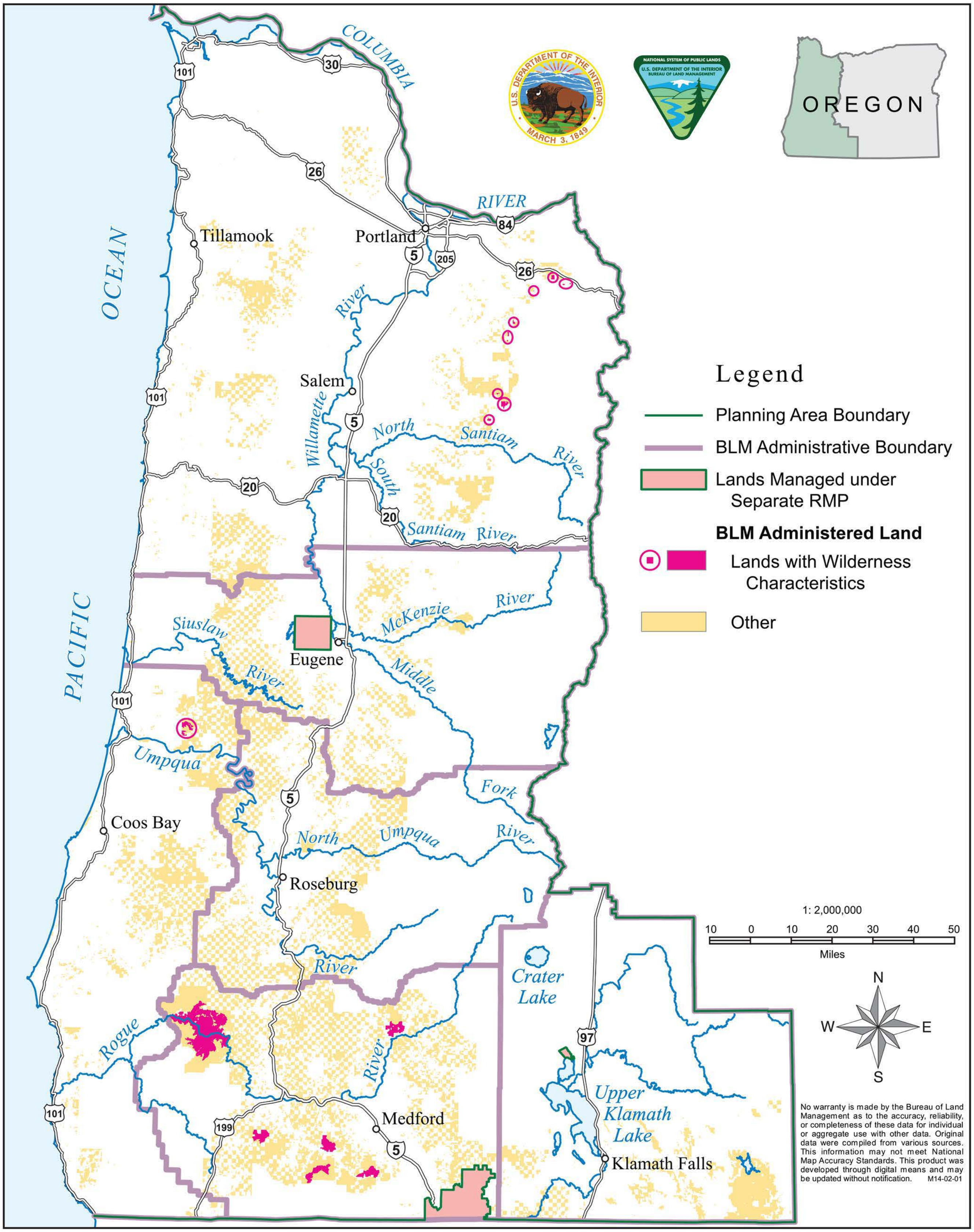
Affected Environment

Through inventories, the BLM identified 90,199 acres of Lands with Wilderness Characteristics in the Coos Bay, Medford, and Salem Districts.

The Coos Bay District inventory found one area that possesses wilderness characteristics totaling 3,048 acres. The Coos Bay District re-validated their 2006 inventory updates. The interdisciplinary review resulted in the conclusion that the Wasson Creek unit remains sufficient in terms of relevance and supporting rationale. The Medford District inventory found seven areas that possess wilderness characteristics totaling 85,254 acres. The Salem District inventory found four areas, including nine subunits that possess wilderness characteristics, resulting in a total of 2,624 acres. All areas in the Salem District rely on adjacent BLM wilderness or other Federal Lands with Wilderness Characteristics to meet the size criterion. **Table 3-88** lists the areas found by the BLM to possess wilderness characteristics.

Table 3-88. Lands with Wilderness Characteristics within the decision area.

District/Field Office	Sub-Unit	Totals (Acres)
Coos Bay		
Wasson Creek	-	3,408
Eugene		
No lands were identified with wilderness characteristics		
Klamath Falls		
No lands were identified with wilderness characteristics		
Medford		
Berry Creek	-	6,459
Burton Nine Mile	-	6,103
Dakubetede	-	5,099
Round Top Mountain	-	5,295
Wellington	-	5,711
Whiskey Creek	-	6,187
Wild Rogue	-	51,249
Roseburg		
No lands were identified with wilderness characteristics		
Salem		
Bull of the Woods/Opal Creek Additions	Nasty Rock	1,196
Bull of the Woods/Opal Creek Additions	Evans Mountain	278
Table Rock Wilderness Additions	Table Rock	95
Salmon Huckleberry Additions	Boulder Creek	506
Salmon Huckleberry Additions	Eagle River	14
Salmon Huckleberry Additions	Salmon River	120
Clackamas Wilderness/South Fork Clackamas River	Memaloose Creek	195
Clackamas Wilderness/South Fork Clackamas River	South Fork Clackamas #1	178
Clackamas Wilderness/South Fork Clackamas River	South Fork Clackamas #2	42



Map 3-4: Lands with Wilderness Characteristics within the Planning Area

Environmental Effects

This analysis considers the effects to inventoried Lands with Wilderness Characteristics both through management for wilderness characteristics under various alternatives and through management that would degrade wilderness characteristics where alternatives do not manage for them.

Effects Common to All Alternatives

- While the alternatives vary in the acreage of areas they manage for their wilderness characteristics, under all alternatives the BLM would not manage Lands with Wilderness Characteristics that overlap with the Harvest Land Base for their wilderness characteristics. Management actions for other resources would likely degrade these characteristics over time.

- The BLM would successfully protect areas with identified wilderness characteristics that exist outside of the Harvest Land Base, and where the BLM chooses to protect these wilderness characteristics.

- Where wildland fire threatens safety of property, suppression could degrade wilderness characteristics even in areas managed for their wilderness characteristics.

Effects of Managing Lands for their Wilderness Characteristics

The alternatives vary in the extent that they would allocate lands to be managed for their wilderness characteristics. **Table 3-89** and **Figure 3-119** show the amount of Lands with Wilderness Characteristics that the BLM would maintain by alternative. Under Alternative A, the BLM would manage all Lands with Wilderness Characteristics not in the Harvest Land Base for their wilderness characteristics. Under Alternatives B and C, the BLM would manage all Lands with Wilderness Characteristics not in the Harvest Land Base, and not over lapping with conflicting recreation designations, for their wilderness characteristics. Under both the No Action alternative and Alternative D, the BLM would not manage Lands with Wilderness Characteristics for their wilderness characteristics.

Table 3-89. BLM-administered Lands with Wilderness Characteristics maintained by alternative.

District	Unit Name	Totals (Acres)	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Coos Bay	Wasson Creek	2,467	-	2,467	-	-	-
Medford	Berry Creek	6,241	-	6,045	-	-	-
	Burton Nine Mile	5,933	-	5,778	-	-	-
	Dakubetede	5,092	-	4,870	-	-	-
	Round Top Mountain	5,291	-	5,291	-	-	-
	Wellington	5,697	-	4,272	-	-	-
	Whiskey Creek	6,187	-	6,187	-	-	-
	Wild Rogue	50,670	-	50,636	50,670	50,670	-
Salem	Bull of the Woods/Opal Creek Additions-Nasty Rock	1,191	-	1,183	-	-	-
	Bull of the Woods/Opal Creek Additions-Evans Mountain	277	-	247	-	-	-
	Table Rock Wilderness Additions	96	-	96	58	58	-
	Salmon Huckleberry Additions-Boulder Creek	506	-	506	-	-	-
	Salmon Huckleberry Additions-Eagle River	14	-	6	-	-	-
	Salmon Huckleberry Additions-Salmon River	117	-	117	-	-	-
	Clackamas Wilderness Additions-Memaloose Creek	199	-	168	-	-	-
	Clackamas Wilderness Additions-South Fork Clackamas #1	178	-	158	-	-	-
	Clackamas Wilderness Additions-South Fork Clackamas #2	43	-	43	-	-	-
	Totals	**90,199**	**-**	**88,070**	**50,728**	**50,728**	**-**

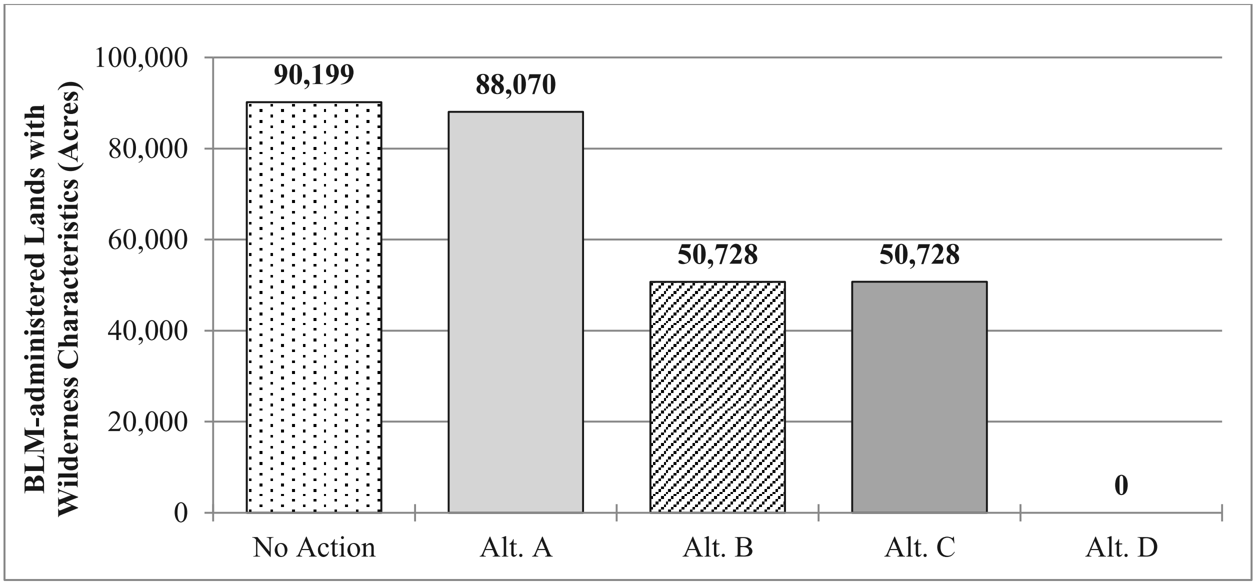


Figure 3-119. Acres of BLM-administered Lands with Wilderness Characteristics maintained by alternative.

Where the BLM would manage an area for wilderness characteristics, the BLM would apply a suite of protective management direction to achieve this objective. This management direction includes closing the area to motorized travel, making the area a Right-Of-Way Exclusion Area, managing for VRM Class I or II, closing the area to salable minerals, requiring stipulations on leasable minerals, and recommending to withdraw the area from locatable minerals. **Table 3-90** lists the acres protected by any of these management protections by alternative.

Table 3-90. Acres of management protections for Lands with Wilderness Characteristics managed for their wilderness characteristics.

	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Applied Management Protections	-	88,070	50,728	50,728	-

No Action Alternative

The 1995 RMPs do not identify Lands with Wilderness Characteristics outside of designated Wilderness Areas and Wilderness Study Areas. Thus, the No Action alternative would not manage any Lands with Wilderness Characteristics for their wilderness characteristics. While management for other resources may provide some level of protection for these qualities, without specific management protections, these wilderness characteristics are likely to degrade.

Alternative A

Alternative A includes management for wilderness characteristics in all areas identified during wilderness inventories that are outside of the Harvest Land Base. Management actions to protect other resources and special areas would offer some protection of wilderness characteristics, although surface-disturbing activities and casual use (e.g., recreation) would have the potential to alter the natural setting as well as reduce opportunities for solitude or primitive recreation for all Lands with Wilderness Characteristics units that are not managed for their wilderness characteristics.

Of the 90,199 acres of Lands with Wilderness Characteristics, the BLM would manage 88,070 acres (97.6 percent) for their wilderness characteristics. The other 2,129 would be in the Harvest Land Base and would likely be lost over time.

Alternatives B and C

Alternatives B and C manage Lands with Wilderness Characteristics for their wilderness characteristics when they are outside of the Harvest Land Base and are compatible with existing and potential recreation opportunities and activities. Under Alternatives B and C, the BLM would manage two units totaling 50,728 acres for their wilderness characteristics. The 39,471 acres not managed for their wilderness characteristics would be either be in the Harvest Land Base or would be managed by the BLM under incompatible recreation and OHV management; their wilderness characteristics would likely be lost over time.

Alternative D

Alternative D does not manage any lands with wilderness characteristics for their wilderness characteristics. While some management for other resource might provide some level of protection for wilderness characteristics, the 90,199 acres of wilderness characteristics are likely to degrade over time, particularly where they overlap with the Harvest Land Base or incompatible recreation and OHV designations.

Effects from Forest Management to Lands With Wilderness Characteristics

Because of the inherent incompatibility between managing for wilderness characteristics and sustained-yield timber harvest, the BLM is not considering managing for wilderness characteristics any lands in the Harvest Land Base under a given alternative. Wilderness characteristics are likely to degrade where the BLM does not specifically manage for them, therefore, wilderness characteristics in the Harvest Land Base would almost certainly be lost over time. While retention levels vary among alternatives, all lands within the Harvest Land Base would eventually be subject to sustained-yield timber harvest, which is incompatible with preserving wilderness characteristics, at least over the life of the plan. **Table 3-91** shows the acres of lands with wilderness characteristics that would be in the Harvest Land Base by alternative.

Table 3-91. BLM-administered lands with wilderness characteristics in the Harvest Land Base by alternative.

District	Unit Name	Totals (Acres)	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Coos Bay	Wasson Creek	2,467	-	-	-	1	146
Medford	Berry Creek	6,241	2,574	196	1,094	786	613
	Burton Nine Mile	5,933	5,052	155	-	-	2,522
	Dakubetede	5,092	4,322	222	734	769	634
	Round top mountain	5,291	-	-	-	-	25
	Wellington	5,697	4,533	1425	1,837	1,923	1,520
	Whiskey Creek	6,187	2,586	-	-	-	350
	Wild Rogue	50,670	3,706	34	-	-	2,835
Salem	Bull of the Woods/Opal Creek Additions-Nasty Rock	1,191	-	8	11	112	125
	Bull of the Woods/Opal Creek Additions-Evans Mountain	277	-	30	47	138	11
	Table Rock Wilderness Additions	96	-	-	38	38	42
	Salmon Huckleberry Additions-Boulder Creek	506	-	-	-	94	-
	Salmon Huckleberry Additions-Eagle River	14	7	8	7	8	8
	Salmon Huckleberry Additions-Salmon River	117	-	-	-	-	-
	Clackamas Wilderness Additions-Memaloose Creek	199	42	31	29	37	22
	Clackamas Wilderness Additions-South Fork Clackamas #1	178	73	20	20	20	20
	Clackamas Wilderness Additions-South Fork Clackamas #2	43	20	-	-	-	-
	Totals	**90,199**	**22,915**	**2,129**	**3,817**	**3,926**	**8,873**

The No Action alternative would have the largest acreage of lands with wilderness characteristics in the Harvest Land Base, followed by Alternative D. Alternative A would have the least.

Effects from Recreation and Visitor Services Management

Wilderness characteristics would diminish within Recreation Management Areas where the BLM would manage for non-compatible motorized and mechanized recreation use. In Alternative A, the BLM prioritizes the management of wilderness characteristics over incompatible recreation and OHV designations. Under Alternatives B and C, the BLM would not manage for wilderness characteristics where incompatible recreation management area and OHV designations are proposed. Under Alternatives B and C, the BLM would not manage 39,433 acres of lands with wilderness characteristics for their wilderness characteristics in order to manage them for incompatible Recreation Management Area and OHV designations. Under Alternative D, the BLM would not manage lands with wilderness characteristics for their wilderness characteristics; all 90,199 acres of lands with wilderness characteristics would be available to either mechanized use or motorized use with either an *open* or *limited to existing* OHV designation. Wilderness characteristics would diminish in Alternative D from incompatible recreation use.

Livestock Grazing

Key Points

- Under Alternatives A, B, and C, BLM-administered land available for livestock grazing would decrease from 495,190 acres (20 percent of the decision area) to 359,049 acres (14 percent of the decision area). This change would occur through the BLM making currently vacant lots unavailable for grazing.
- Under Alternative D, the BLM would no longer authorize livestock grazing within the decision area, a change that would affect 495,190 acres (20 percent of the decision area) for the life of the plan.

Background

The 1934 Taylor Grazing Act (43 U.S.C. 315 *et seq.*), which established a system for granting livestock grazing privileges on Federal land, provides for grazing on both BLM-administered lands within a grazing district (through Section 3 permits) and those outside a grazing district (through Section 15 leases). The BLM manages Section 3 permits and Section 15 leases under different policies. The only permits administered under Section 3 in the decision area are within a grazing district described as the "Gerber Block" in the Klamath Falls Field Office.

The majority of BLM-administered lands within the decision area are outside of established livestock grazing districts, and, where it takes place, Section 15 of the Taylor Grazing Act permits grazing on this land through leases. These allotments are comprised of private land intermingled with BLM-administered lands. The private land typically provides the majority of livestock grazing acres. The BLM gives preference for leases to the owner of the private land nearby and adjoining those BLM-administered lands. The BLM permits most leases for 10 years, though that is not required.

Only the Coos Bay District, Klamath Falls Field Office, and Medford District administer livestock grazing in the decision area. The BLM does not currently administer livestock grazing within the Eugene, Roseburg, or Salem Districts.

Issue 1

How would each of the alternatives affect the acres of BLM lands allocated for livestock grazing?

Summary of Analytical Methods

The BLM compared the number of allotments and acres that would be available for livestock grazing on BLM-administered lands under each alternative. The BLM did not include small exclosures within an allotment that exclude livestock grazing for the purpose of this analysis.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 62-65).

Affected Environment

The Coos Bay District, Klamath Falls Field Office, and Medford District administer livestock grazing on 495,190 acres of BLM-administered lands, representing 21 percent of the decision area (**Table 3-92**).

Table 3-92. Livestock grazing statistics by district or field office.

District/ Field Office	Number of Allotments[a]	Total BLM Acres within Allotments	Number of Active AUMs	Number of Permittees
Coos Bay	4	543	23	4
Klamath Falls	95	209,852	12,947	63
Medford	87 (11[b])	284,795	10,255	43
Totals	**197**	**495,190**	**23,225**	**110**

[a] Allotments include vacant without current permit/lease, and closed. These do not include unallotted lands.
[b] These 11 allotments have been removed from the reporting system since no grazing has occurred since before the 1995 RMP. This RMP proposes these allotments as unavailable for grazing, so it is important to account for them here.

There are six allotments within the planning area containing acreage in the Cascade Siskiyou National Monument, which is outside the decision area. **Table 3-93** displays the acres of each allotment in the planning area and in the monument. The Klamath Falls Field Office administers the Dixie and Buck Mountain Allotments and the Medford District administers the Deadwood Allotment. The Soda Mountain Allotment, Siskiyou Allotment, and Keene Creek Allotment have no livestock grazing authorized.

Table 3-93. BLM-administered livestock grazing allotments with acres within the Cascade Siskiyou National Monument (CSNM) and allotments within the decision area.

Allotment Name	Allotment Number	Acres in CSNM	Acres in Decision Area	Total AUMs	Decision
Buck Mountain	00103	739	7,416	204	Current permit to graze
Deadwood	20106	37	7,967	788	Current permit to graze
Dixie	00107	1283	4,436	320	Current permit to graze
Keene Creek	10115	10,600	13,019	-	CSNM-grazing was removed by PL111-011
Siskiyou	10118	2,163	260	-	CSNM-grazing was removed by PL111-011
Soda Mountain	10110	35,619	413	-	CSNM-grazing was removed by PL111-011

Table 3-94 displays the change in the number of active allotments from levels identified in the 1995 RMPs to current levels. The number of vacant allotments and leases has increased from 17 (all in the Medford District) in 1995 to 56 (42 in the Medford District and 14 in the Klamath Falls Field Office). A vacant allotment is an allotment that currently does not have an active permit or lease. Some allotments have been vacant since the 1970s. The reasons for the increase in vacant allotments include:

- Relinquishment by operators
- Cancellation due to nonuse or noncompliance
- Lack of interest
- Difficulties to graze within an allotment because of intermingled private land
- Conflicts with other users of public land
- Lack of fencing to control livestock on public land
- Change of boundary fencing that excludes BLM-administered lands

Table 3-94. Current grazing levels compared to 1995 RMP levels.

District/ Field Office[a]	1995 RMP Levels			2014 Levels		
	Available AUMs	Active Allotments	Vacant Allotments	Available AUMs	Active Allotments	Vacant Allotments
Coos Bay	270	7	-	120	4	-
Klamath Falls	13,662	95	-	12,947	83	12
Medford	17,458	99	18	10,255	50[b]	46
Totals	**31,390**	**201**	**18**	**23,322**	**137**	**58**

[a] For reporting purposes all allotments and AUMs the districts administer are counted, including vacant allotments and their associated AUMs. Some of these allotments and associated AUMs do not occur within the planning area.

Existing grazing leases/permits within the BLM-administered lands in the decision area authorize 23,322 active Animal Unit Months (AUMs) of active use. Current levels of available grazing are 8,068 AUMs less than permitted levels in 1995. These AUMs are all available for grazing, but some allotments are vacant and not being used. Actual levels of livestock use on active allotments can vary due to annual fluctuations of individual livestock operations or environmental conditions such as drought, relinquishment by operators, transfers, or changes in grazing leases or permits due to nonuse, noncompliance, or lack of interest. The change in use of allotments is due to several reasons including the voluntary elimination of grazing associated with the Cascade Siskiyou National Monument, combining multiple allotments into one, splitting of allotments into more than one, and reductions in grazing for resource protection.

Environmental Consequences

Under all alternatives, all components of livestock grazing authorizations (acres for grazing, number of allotments, AUMs, permittees/lessees) would either remain the same or decrease, as shown in **Table 3-95**. Alternatives A, B, and C would retain all active allotments but would make vacant allotments unavailable for grazing. Therefore, the number of AUMs billed would remain at current levels in all alternatives except Alternative D. Under Alternative D, the BLM would cease to authorize any livestock grazing within the decision area and receive no payments for AUMs for the life of the plan.

Table 3-95. Livestock grazing authorizations for each alternative for the Coos Bay District, Klamath Falls Field Office, and Medford District.

District/ Field Office	Alternative	Allotments[1]	Public Land[2] (Acres)	Permitted Use AUMs	Active/Available AUMs	Permittees
	No Action	4	543	-	120	-
Coos Bay	Alt. A, B, C	-	-	-	-	-
	Alt. D	-	-	-	-	-
	No Action	95	209,852	12,762	12,947	63
Klamath Falls	Alt. A, B, C	94	205,627	12,762	12,927	63
	Alt. D	-	-	-	-	-
	No Action	96	284,795	10,255	12,553	43
Medford	Alt. A, B, C	59	161,760	10,255	10,255	43
	Alt. D	-	-	-	-	-
	No Action	196	495,190	23,017	25,500	106
Total	Alt. A, B, C	155	359,049	23,017	23,182	106
	Alt. D	-	-	-	-	-

[1]Number of allotments available to grazing by alternative.
[2]Public land acres available for livestock grazing by alternative.

Under Alternatives A, B, and C, the amount of BLM-administered land available for livestock grazing through the issuance of grazing leases/permits would decrease from 495,190 acres (20 percent of the decision area) to 359,049 acres (14 percent of the decision area) (**Table3-95**). In Alternative D, the BLM would eliminate authorized use and the acres would become unavailable for livestock grazing for the life of the plan.

Figure 3-120 shows the acres available for livestock grazing by alternative.

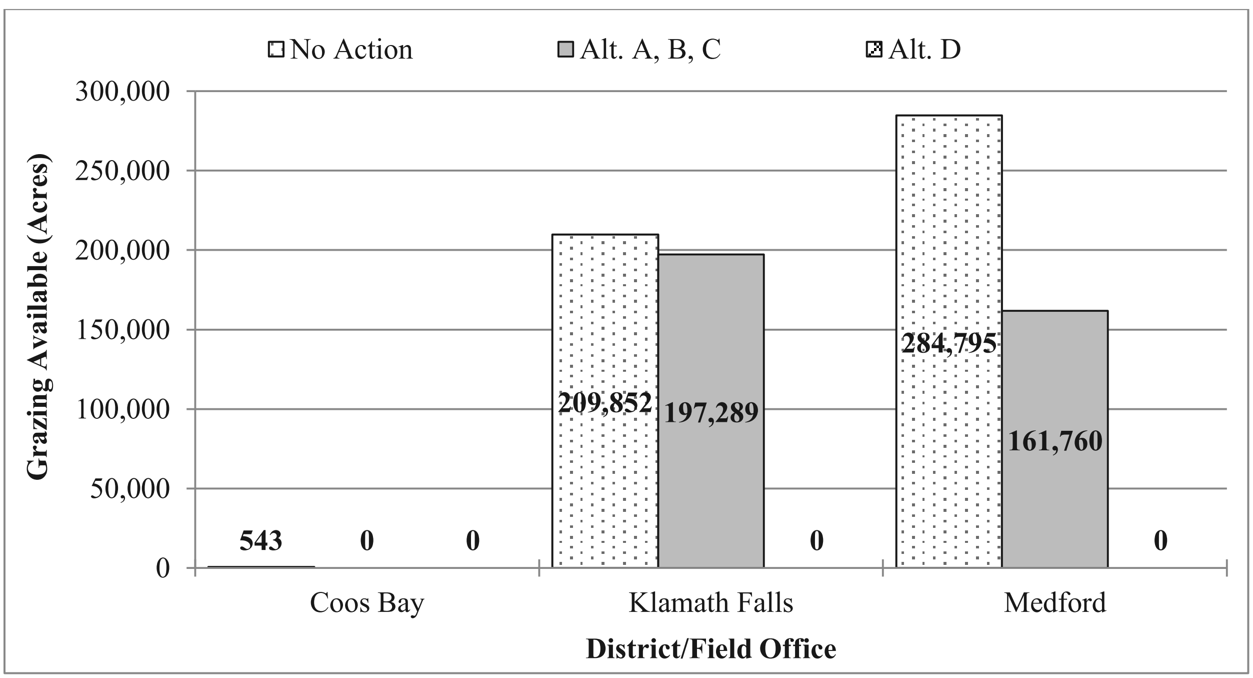


Figure 3-120. Change in acres available for livestock grazing by alternative.

On the Medford District, Alternatives A, B, and C would decrease the number of available allotments as compared to the No Action alternative; the decrease would occur on allotments that have been vacant for five years or more. The number of allotments available to graze would decrease by 40. The BLM-administered lands available for livestock grazing would decrease by 135,612 acres and approximately 2,298 AUMs. This decrease would not reduce the number of allotments or permittees that have an active permit or lease (**Figure 3-121**).

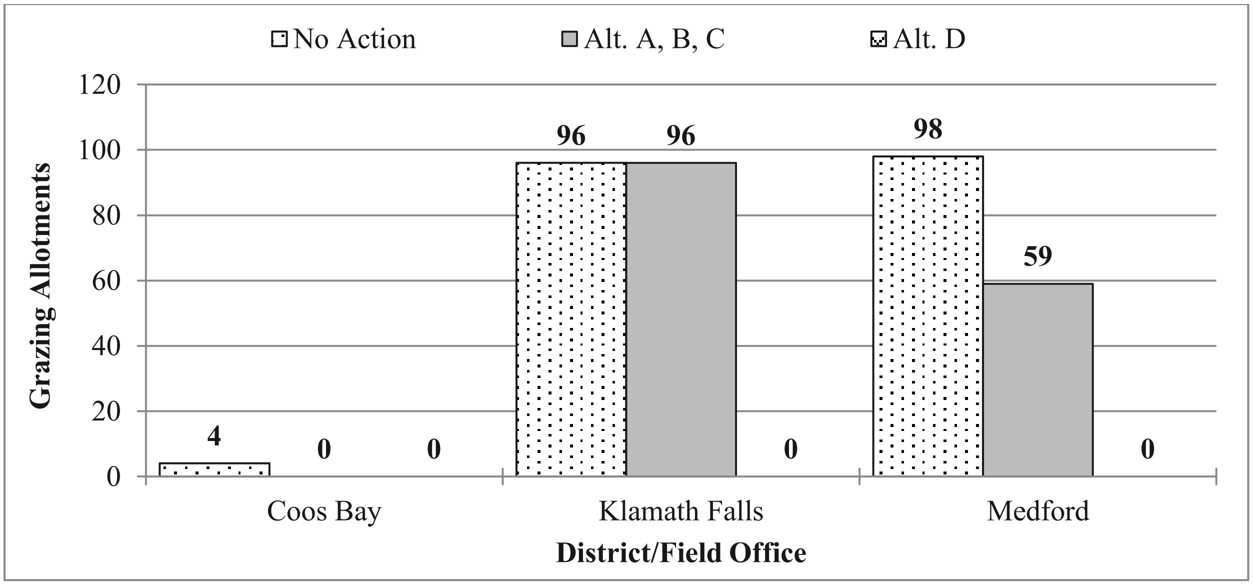


Figure 3-121. Change in the number of allotments available to graze by alternative.

For the Klamath Falls Field Office, Alternatives A, B, and C would decrease the number of acres available to grazing in two allotments, as compared to the No Action alternative. A portion of the Edge Creek Allotment (4,065 acres) is fenced off from livestock grazing and included in the Klamath River Area of Critical Environmental Concern (ACEC). The BLM would make this area unavailable to grazing in Alternatives A, B, and C. No AUMs are currently associated with these ACEC acres and no livestock grazing is currently occurring in this area. The remainder of the Edge Creek Allotment would continue to be available for livestock grazing. The BLM would also make the Plum Hills Allotment unavailable to livestock grazing. Plum Hills is a vacant allotment with 160 acres and 20 available AUMs.

Figure 3-122 shows the locations of the areas available, unavailable, and unallotted within the Coos Bay and Medford Districts and the Klamath Falls Field Office.

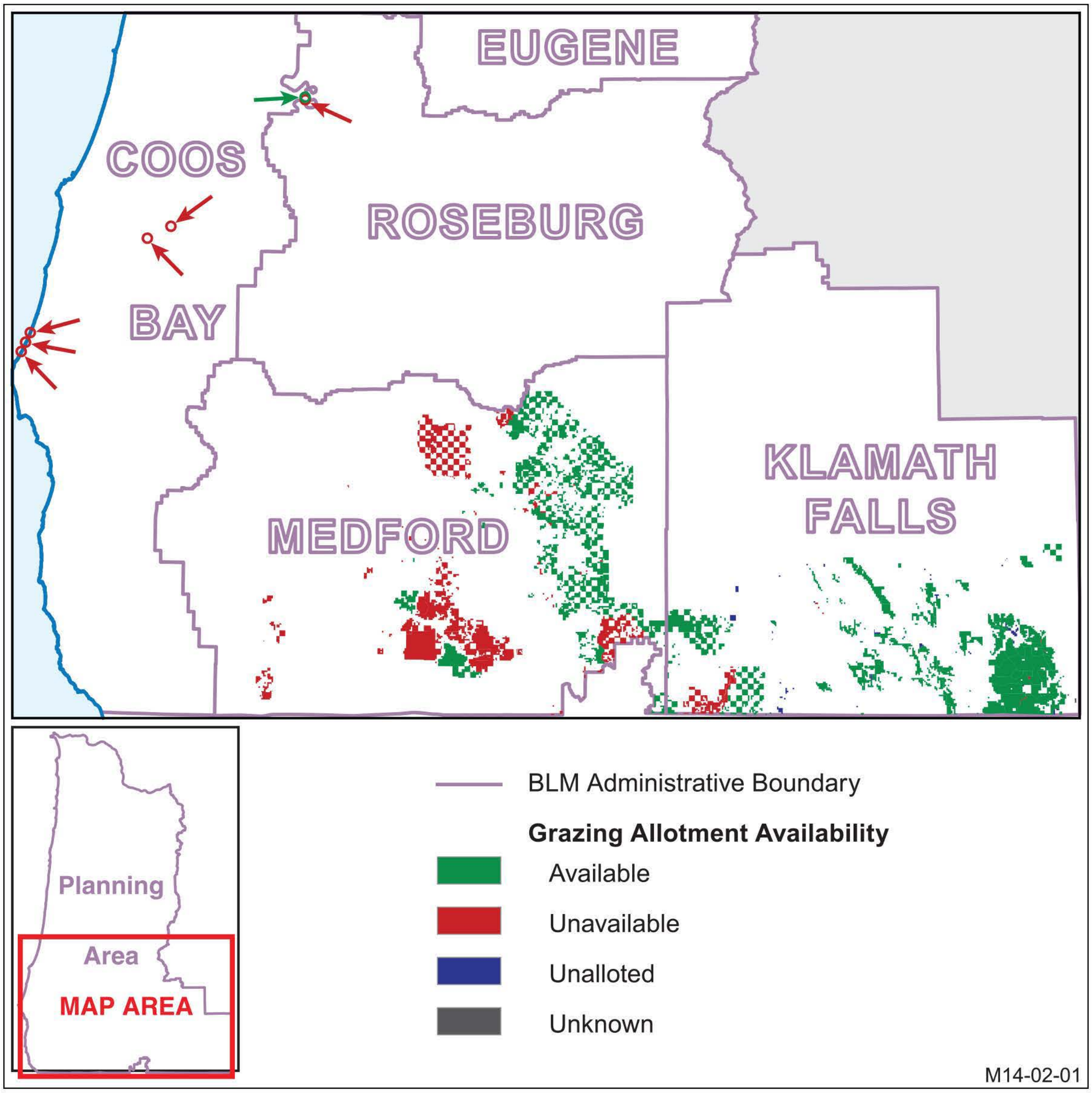


Figure 3-122. Grazing allotment availability under Alternatives A, B, and C.

On the Medford District and the Klamath Falls Field Office in Alternatives A, B, and C, management of ACECs could have an effect on the number of acres available for livestock grazing through site-specific protection (e.g., exclosures) or management actions (e.g., restricting season of use) in the future. The BLM may decrease stocking levels through subsequent agreements or decisions as necessary.

On the Coos Bay District, all action alternatives would decrease the number of available allotments as compared to the No Action alternative. The decrease would occur on allotments that have been vacant for a year or less. Four allotments covering approximately 543 acres with an associated 120 AUMs would no longer be available for livestock grazing. The number of permittees would not change.

Under Alternative D, the BLM would no longer authorize livestock grazing within the decision area, a change that would affect 495,190 acres (20 percent of the decision area) in the No Action alternative. One-hundred-and-six permittees would lose 25,500 AUMs of forage compared to the No Action alternative and 23,017 AUMs in Alternatives A, B, and C. The BLM would no longer collect fees on these AUMs. The BLM discusses economic losses to permittees more under Socioeconomics. Alternative D would have the greatest effect to livestock grazing for the Medford District and the Klamath Falls Field Office when compared to the other alternatives.

Issue 2

How would each of the alternatives affect the attainment of Standards for Rangeland Health and Guidelines for Livestock Grazing Management on those lands allocated for livestock grazing?

Background

Current grazing regulations direct the BLM to manage livestock grazing in accordance with Standards for Rangeland Health. The BLM developed the 1997 Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington in consultation with Resource Advisory Councils, Provincial Advisory Committees, Tribes, and others. The standards are the basis for assessing and monitoring rangeland conditions and trend (USDI BLM 1997).

The 43 CFR part 4180.2 (c)(1) provides:

“If a standards assessment indicates to the authorized officer that the rangeland is failing to achieve standards or that management practices do not conform to the guidelines, then the authorized officer will use monitoring data to identify the significant factors that contribute to failing to achieve the standards or to conform with the guidelines. If the authorized officer determines through standards assessment and monitoring that existing grazing management practices or levels of grazing use on public lands are significant factors in failing to achieve the standards and conform with the guidelines that are made effective under this section, the authorized officer will, in compliance with applicable laws and with the consultation requirements of this part, formulate, propose, and analyze appropriate action to address the failure to meet standards or to conform to the guidelines.”

(i) Parties will execute a documented agreement and/or the authorized officer will issue a final decision on the appropriate action under §4160.3 as soon as practicable, but no later than 24 months after a determination.

(ii) BLM may extend the deadline for meeting the requirement established in paragraph (c)(1)(i) of this section when legally required processes that are the responsibility of another agency prevent completion of all legal obligations within the 24-month time frame. BLM will make a decision as soon as practicable after the legal requirements are met.

Prior to the 2015 changes, the regulations required:

“(c) The authorized officer shall take appropriate action as soon as practicable but not later than the start of the next grazing year upon determining that existing grazing management practices or levels of grazing use on public lands are significant factors in failing to achieve the standards and conform with the guidelines that are made effective under this section.

Appendix K includes the complete “Standards for Livestock Grazing Management for Public Lands in Oregon and Washington.”

Summary of Analytical Methods

For this analysis, the BLM considered why certain allotments are not meeting rangeland health standards in a general manner and what affect the alternatives would have on meeting those standards.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 62-65).

Affected Environment

The BLM has assessed 94 percent of livestock grazing allotments and leases within the decision area to determine whether they are meeting rangeland health standards. As shown in **Table 3-96**, the BLM found livestock grazing to be a contributing factor in not meeting rangeland health standards in 12 allotments (5 in Medford and 7 in Klamath Falls). In those allotments, the BLM adjusted livestock grazing management to ensure significant progress toward meeting the standards and to eliminate livestock grazing as the causal factor for not meeting the health standard. In this situation, adjusting livestock grazing management would usually require changes in livestock numbers, season of use, or animal unit months (AUMs), construction of range improvements, or implementation of intensive grazing systems. On 6 percent of allotments within the decision area, a Rangeland Health Assessment has not yet been completed. Some of those allotments are currently not grazed and are proposed to be made unavailable for livestock grazing in Alternatives A, B, C, and D. Those allotments lacking a Rangeland Health Assessment have a schedule to complete the assessment based on district priorities.

Table 3-96. Rangeland Health Standards Assessments for the Coos Bay District, Klamath Falls Field Office, and Medford District.

Assessments	Coos Bay		Klamath Falls		Medford	
	Allotments	Acres	Allotments	Acres	Allotments	Acres
Rangelands Meeting All Standards or are Making Significant Progress Toward Meeting the Standards	4	543	52	107,929	23	124,584
Rangelands Not Meeting All Standards with Appropriate Action Taken to Ensure Significant Progress Toward Meeting the Standard (Livestock was a contributing factor)	-	-	7	25,988	5	7,784
Rangelands Not Meeting All Standards or Making Significant Progress Toward Meeting the Standard Due to Causes Other Than Livestock Grazing	-	-	11	46,745	19	21,260
Allotments Assessed and closed to grazing with a previous decision	-	-	-	-	3	13,692
Total Assessed	4	543	70	180,662	50	153,628
Allotments Not Assessed	-	-	25	15,254	44	120,154
Total	**4**	**543**	**95**	**195,196**	**94**	**284,795**

Opportunities to achieve desired rangeland health conditions may be limited in some areas due to past management activities. An example of this would be historic vegetative treatments that converted an area from a perennial grass/forb understory to an invasive plant understory (like Medusahead, dogtail, or bulbous bluegrass). Therefore, the upland Rangeland Health Standard 1 may not be met from even Alternative D where removal of livestock is proposed unless intensive reseeding combined with intensive weed treatments are additionally implemented. Completed Rangeland Health Assessments by allotment are available on the BLM web sites for each district located at: http://www.blm.gov/or/districts/medford/plans/medfordrmp.php and http://www.blm.gov/or/districts/lakeview/plans/inventas.php.

Environmental Consequences

The BLM assumed that for the 12 grazing allotments in **Table 3-96** where grazing was a casual factor within one year of the Rangeland Health Assessment, the BLM would make, or has made, a change in livestock grazing that will result in significant progress toward fulfillment of the standards.

Therefore, in all alternatives, including the No Action alternative, either those allotments would make significant progress toward meeting the standard or that livestock grazing is no longer a contributing factor. Only Alternative D would make these 12 allotments unavailable to livestock grazing. In Alternative D, some allotments not meeting rangeland health standards would recover at a faster rate with fewer disturbances when compared to other alternatives.

Issue 3

How would each of the alternatives affect BLM's ability to provide forage on those lands allocated for livestock grazing?

Summary of Analytical Methods

For the purposes of this analysis, the BLM assumed that regeneration harvest generally improves forage production due to the decreased competition between understory and overstory vegetation. Given this assumption, the BLM compared the size of the Harvest Land Base by alternative to determine how the alternatives would affect the BLM's ability to provide forage.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 62-65).

Affected Environment

The forage conditions within individual allotments are variable based on historic livestock grazing levels, past management actions, and current grazing management. Past timber harvest activities within allotments created canopy openings that provide increased forage for livestock.

On the Coos Bay District, a mix of native grass species, noxious weeds, and non-native pasture vegetation characterizes the vegetation on BLM-administered lands within the four livestock grazing leases. The non-native pasture vegetation is typically dominant. A mix of grassland, chaparral, mixed conifers, and hardwoods, characterizes the Medford District vegetation on BLM-administered lands. The eastern side of the Klamath Falls Field Office is characterized by non-forested uplands comprised of sagebrush and juniper communities. The western portion of the field office is comprised of mixed conifers and hardwoods.

Environmental Consequences

Under Alternatives A, B, and C, timber harvest activities occurring within allotments may create temporary reductions in available livestock grazing. The BLM may need to rest harvest areas from livestock grazing the first year after disturbance activities to allow understory vegetation to recover and to protect seedlings. Long-term effects (occurring after 5-10 years) of timber harvest activities could result in small increases in understory vegetation. The forage differences between alternatives may vary slightly with the largest forage likely to be available in Alternative C coinciding with the largest Harvest Land Base acreage.

Forage availability increases from Alternative A to Alternative B to Alternative C, which has the largest Harvest Land Base. This increased forage availability by alternative may affect livestock distribution within allotments; however, no increases in stocking rate would occur due to increased forage available. Increased forage could cause small increases in weight gain of livestock (Walburger *et al.* 2007). These alternatives would provide adequate livestock forage for livestock grazing levels.

Alternative D would eliminate livestock grazing, thus the impacts of an increase or decrease in forage for livestock is irrelevant.

References

USDI BLM. 1997. Standards for rangeland health and guidelines for livestock grazing management for public lands administered by the Bureau of Land Management in the states of Oregon and Washington. Oregon State Office, Portland, OR. 19 pp.

---. 2014. Resource management plans for western Oregon planning criteria. Bureau of Land Management, Oregon/Washington State Office, Portland, OR. http://www.blm.gov/or/plans/rmpswesternoregon/plandocs.php.

Walburger, K. T., T. DelCurto, and M. Vavra. 2007. Influence of forest management and previous herbivory on cattle diets. Rangeland Ecology & Management **60**(2): 172-178.

Minerals

Key Points

- Under all of the action alternatives, the acres of land recommended for withdrawal from locatable mineral entry would increase by 6-8 percent of the decision area. The BLM ranks 38-65 percent of these lands as high for mineral occurrence and development. Recommending the withdrawal of these 80,000-110,000 acres (depending on alternative) of high-ranked lands could have negative effects to the development of known and undiscovered mineral resources.
- Approximately 90 percent of the decision area remains open to locatable and salable mineral entry under all action alternatives.
- Unless closed by legislation, under all action alternatives, the decision area is open to leasable mineral development.

Background

The BLM administers the mineral estate on nearly 40 million acres of BLM, U.S. Forest Service, and other Federally-administered and Indian Trust lands in Oregon. Within the decision area, the BLM manages approximately 2.5 million acres of Federal surface ownership and an additional 68,600 acres of Federal minerals with private surface ownership. **Table 3-97** lists the acres by office.

Table 3-97. Acres of surface and mineral estate.

District/Field Office	Federal Surface and Mineral Estate (Acres)*	Federal Minerals and Private Surface (Acres)*
Coos Bay	329,600	12,200
Eugene	317,400	1,300
Klamath Falls	212,000	21,000
Medford	866,300	4,700
Roseburg	425,600	1,700
Salem	398,100	27,800
Totals	**2,549,000**	**68,700**

* 2008 data from the Western Oregon Plan Revision EIS and district-specific information.

Physiography

The planning area contains five geologic physiographic regions.[63] They are the Coast Range, Willamette Valley, Cascade Mountains (High and Western), Klamath Mountains, and the Basin and Range (**Figure 3-123**). Each region's unique geology influences the mineral occurrences.

[63] These are different from the terrestrial physiographic regions described in FEMAT and illustrated in **Figure 3-2**.

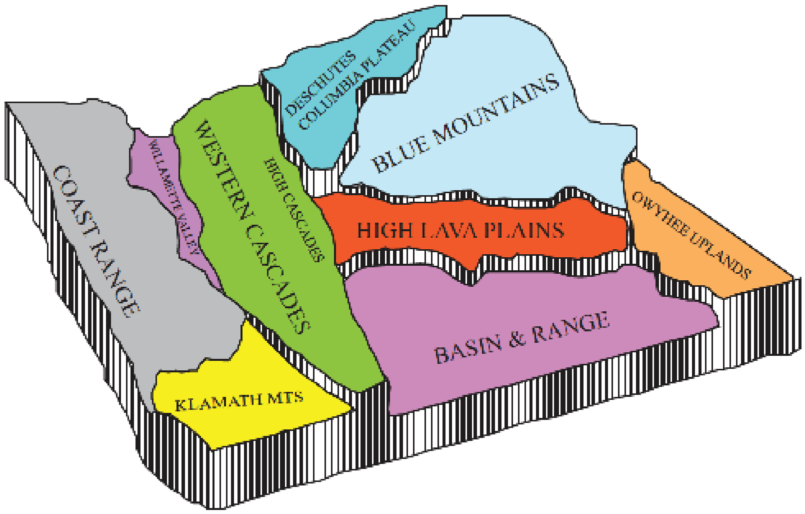


Figure 3-123. Physiographic Regions in the decision area (Orr and Orr 2012).

Mineral Resources of the planning area

The Oregon Department of Geology and Mineral Industries (DOGAMI) database (MILO) shows that the vast majority of mineral resources used in Oregon are common rock for aggregate used in construction and road surfacing (http://www.oregongeology.org/sub/milo/index.htm). There are over 5,500 mapped quarry sites throughout the planning area. This MILO database shows 300 occurrences for other mineral commodities such as clay, limestone, pumice, and silica sand scattered thorough the planning area. There are 150 occurrences for coal with most sites in coastal areas concentrated in the Coos Bay area. In addition, there are 3,300 metal occurrences (gold, silver, copper, nickel, chromite, and other minerals) with nearly all being located in southwest Oregon.

Coast Range Mineral Resources

Coal seams occur throughout the Coast Range, with the majority in Coos County. On the Coos Bay District, there is a coalbed natural gas Area of Mutual Interest. The Coast Range has oil and gas potential and development; the State's first commercial gas field was located in 1979 near Mist in Columbia County; this field has 18 wells and has produced 65 billion cubic feet of gas. Other economically valuable minerals include beach placers containing gold and platinum from Cape Blanco to Cape Arago.

Willamette Valley Mineral Resources

Deeply-weathered basalts that have resulted in bauxite enriched with aluminum and iron occur in the Willamette Valley, with the thickest deposits in Washington and Columbia counties. Limonite localities also occur in Lake Oswego.

A 20-mile-wide belt of cinnabar exists in Lane, Douglas, and Jackson counties, which has been mined for mercury, especially near the southern end of the Willamette.

Cascade Mountains Mineral Resources

Gold and silver has been mined in the Bohemia Mountain region south of Cottage Grove and the Quartzville and Blue River mining districts by McKenzie Bridge. The North Santiam mining district has also historically yielded copper, zinc, lead, silver, and gold.

A series of hot springs in an irregular, roughly 12-mile-wide, north-south belt marks a thermal boundary existing between the High Cascades and Western Cascades. Temperatures of the waters can range between 90-190 degrees Fahrenheit in certain areas. The thermal gradients of the region may represent a large potential source of renewable geothermal energy.

Klamath Mountains Mineral Resources

The Klamath province has substantial mineral resources due to its geologic diversity. Mineralization is primarily attributed to tectonic plate evolution and secondarily to later plutonic intrusion. This province has historically produced gold, silver, copper, nickel, chromite, and other minerals. Most of these minerals are closely associated with ophiolites and plutons in the areas of Ashland, Gold Hill, and Grants Pass. As much as 75 percent of the gold produced from this province has come from placers deposits. Copper was historically mined from the Josephine ophiolite near Grants Pass, nickel from weathered ophiolites near Riddle, and chromite from ophiolites throughout the Klamath Mountains. Chromite rich beach sands derived from the Klamath Mountains occur on the southern Oregon coast.

Basin and Range Mineral Resources

There was historic uranium, mercury, and borax production in this province and diatomite occurs near the Sprague River. This region has a thin crust, numerous faults, and high heat flow, which creates an increased possibility for geothermal resources.

Issue 1

How would the alternatives affect salable mineral development or existing BLM rock quarries?

Summary of Analytical Methods

The BLM evaluated how the acreage proposed for closure to salable mineral materials under each alternative would affect the possible future development of this resource. Under each alternative, the BLM would close lands managed for their wilderness characteristics, eligible Wild and Scenic River segments, some Areas of Critical Environmental Concern (ACECs), and Recreation Management Areas (RMAs), to salable mineral development. The BLM evaluated data from LR2000,[64] data supplied by each office, and data from the Oregon Department of Geology and Mineral Industries to determine the location of mineral material sites (primarily rock quarries) in the decision area. It was determined that this data could not be utilized to predict the location for future mineral material sites. The BLM will not complete a formal mineral potential report for salable minerals for this RMP revision. Information regarding mineral potential reports, and when they are required, can be found in BLM Manual 3031.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which the BLM incorporates here by reference (USDI BLM 2014, p.104).

[64] This is a BLM database containing information about minerals.

Background

Salable minerals are mineral materials and include common variety quarry rock used in construction and road surfacing, and sand and gravel, clay, and volcanic pumice and cinders. The regulations found in 43 CFR 3600 guide the exploration, development, and disposal of mineral material resources and the protection of resources and the environment. The disposal of mineral materials includes sale at fair market value to the public and through free use permits to government entities or non-profit organizations. Disposal of mineral materials is discretionary on the part of BLM.

Within the decision area, the BLM's primary salable mineral material is quarry rock. The BLM, timber companies, and local governments crush the majority of this quarry rock to create aggregate for road surfacing. Other uses of quarry rock include rip-rap for fish enhancement projects, jetty and boat ramps, and reclamation projects. The BLM also disposes of sand and gravel, soil or fill, clay, volcanic pumice and cinders, and specialty stone through sales or free use permits.

Affected Environment

The use of mineral materials is dependent on the demand by the BLM, private companies, local governments, and the public. **Figures 3-124** and **3-125** display mineral material production by cubic yard and the number of sales across the decision area for the years 2007-2013 (LR2000).

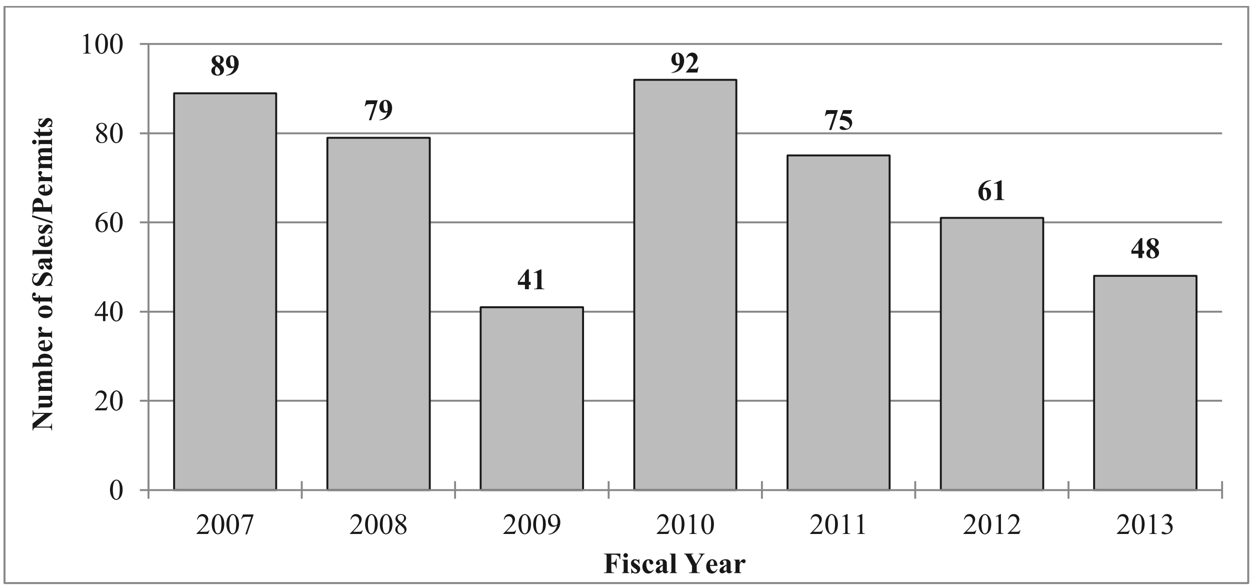


Figure 3-124. Number of sales or permits for mineral material by year in the decision area.

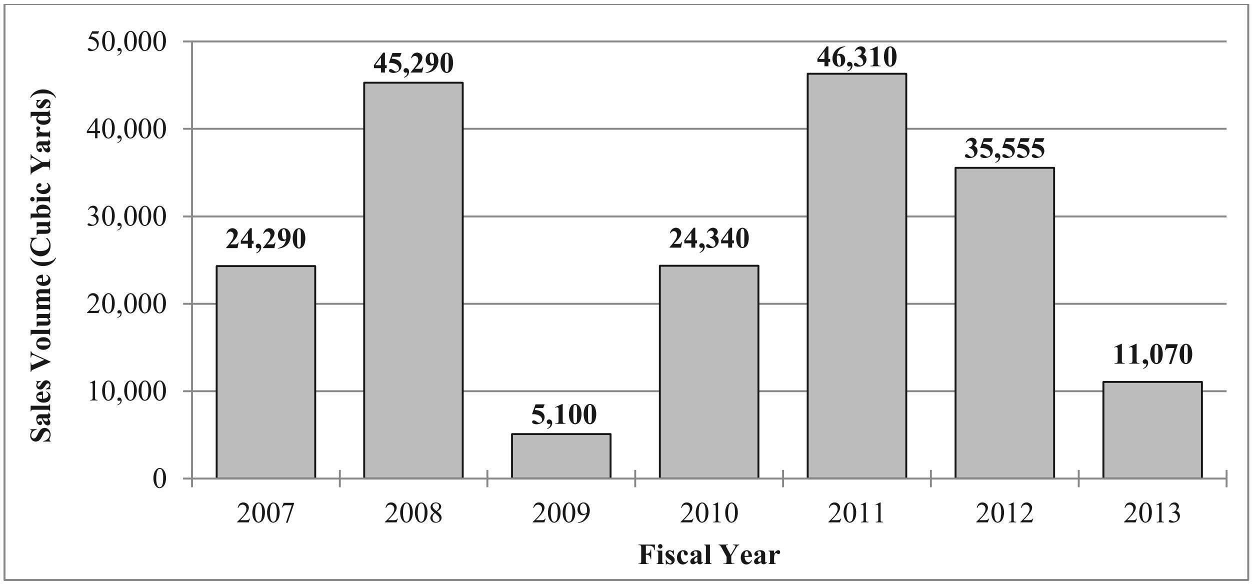


Figure 3-125. Cubic yards of mineral material produced by year in the decision area.

Mineral material sales data from 2007-2013 show that sales and permits (BLM use is tracked by permits) in the decision area are both numerous and of low volume, with nearly 500 disposals during this period averaging about 400 cubic yards each.

There are just over 600 developed quarry sites in the decision area. The majority of these quarries are used for in-place quarry rock, although a few sites are for pumice, sand, gravel, or dimension stone. Many of these sites were developed before the 1990s and have been in use for decades. The footprint, or area of disturbance, of quarry sites is variable and ranges from about 0.01-5 acres. A typical quarry is about 0.5 acre in size. The BLM estimates that that approximately 25-33 percent of these rock quarries are near depletion with just a few thousand cubic yards of rock remaining. At some sites, continued removal could require expansion of the existing footprint. The BLM does not have an inventory of potential rock quarry sites in the decision area.

The BLM locates rock quarries based on the suitability of the available rock to meet the required specifications. However, access, proximity to area of use, and environmental considerations are also important factors in determining where to develop a quarry. **Figure 3-126** shows the spatial distribution of quarry sites in the decision area.

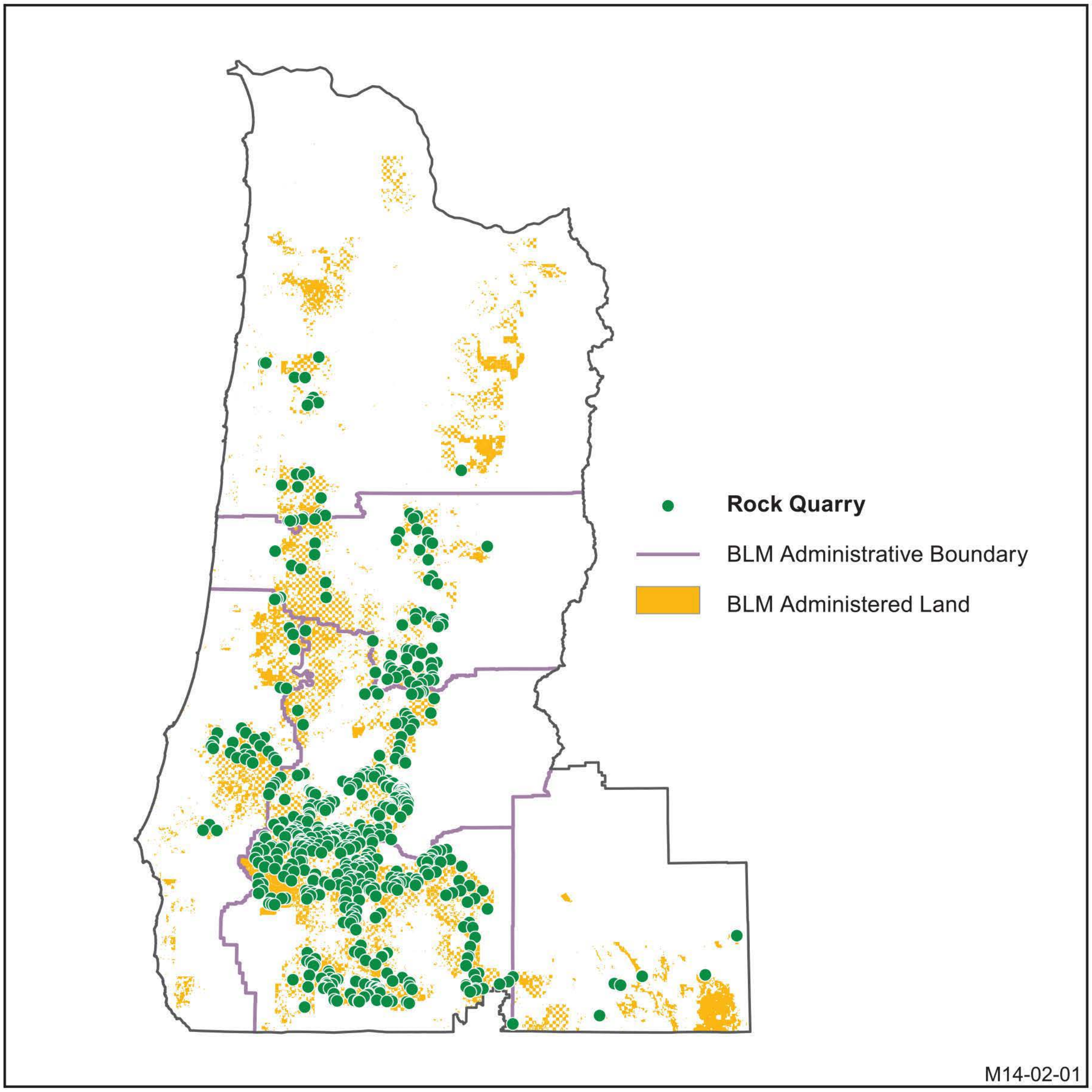


Figure 3-126. Developed quarry sites in the decision area from office inventories.

Table 3-98 shows the number of rock quarry sites per district or field office in the decision area as of 2014 based on office inventories.

Table 3-98. Rock quarry sites in the decision area.

District/Field Office	Quarry Sites (#)
Coos Bay	31
Eugene	87
Klamath Falls	13
Medford	250
Roseburg	203
Salem	18
Totals	**602**

The majority of these quarries are used for in-place quarry rock, although a few sites are for pumice, sand and gravel, or dimension stone. The BLM does not have a complete inventory of potential rock quarry sites in the decision area, but as **Figures 3-125** and **3-126** show, there is ongoing interest in BLM quarries, with 40 to 90 sales a year.

All of the salable activity described above takes place on BLM-administered lands that are open to salable mineral entry. **Table 3-99** provides a breakdown by office of the acres of BLM-administered lands that are currently closed to salable mineral development. Closed nondiscretionary lands, which total 31,530 acres, remain closed under all alternatives. As **Table 3-99** shows, the Salem District has the majority of lands closed to salable mineral entry.

Table 3-99. Acres of lands currently closed to salable mineral development (No Action alternative).

District/Field Office	Salable (Acres)*	Closed Nondiscretionary+ (Acres)*	Closed Discretionary+ (Acres)*	Totals (Acres)
Coos Bay	-	600	14,700	**15,300**
Eugene	-	100	9,100	**9,200**
Klamath Falls	-	300	14,500	**14,800**
Medford	-	24,600	20,800	**45,400**
Roseburg	-	30	8,400	**8,430**
Salem	-	5,900	220,400	**226,300**

* 2008 data from The Western Oregon Plan Revision EIS.
+ Legal mandates establish non-discretionary closures while a discretionary closure is the result of an agency management decision.

There are over 5,500 quarry sites for stone/aggregate and an estimated 300 sites for other types of saleable minerals other than quarry rock or aggregate in the planning area (DOGAMI MILO). They include commodities such as clay, limestone, pumice, silica, and others (**Table 3-100**).

Table 3-100. Estimated number of mineral material sites in the planning area.

Commodity	Number of Sites
Cement Materials	108
Clay	84
Other Minerals*	89
Pumice	4
Quarry Stone and Aggregate	5,500
Silica Sand	19

* Talc, soapstone, certain gemstone, refractory graphite, serpentine, quartz crystal, optical calcite

Trends in salable mineral material developments for rock quarries and development guidance can be found in **Appendix L**.

Environmental Effects

Figure 3-127 and **Table 3-101** show acres that the BLM would close to salable mineral development by alternative and land use category.

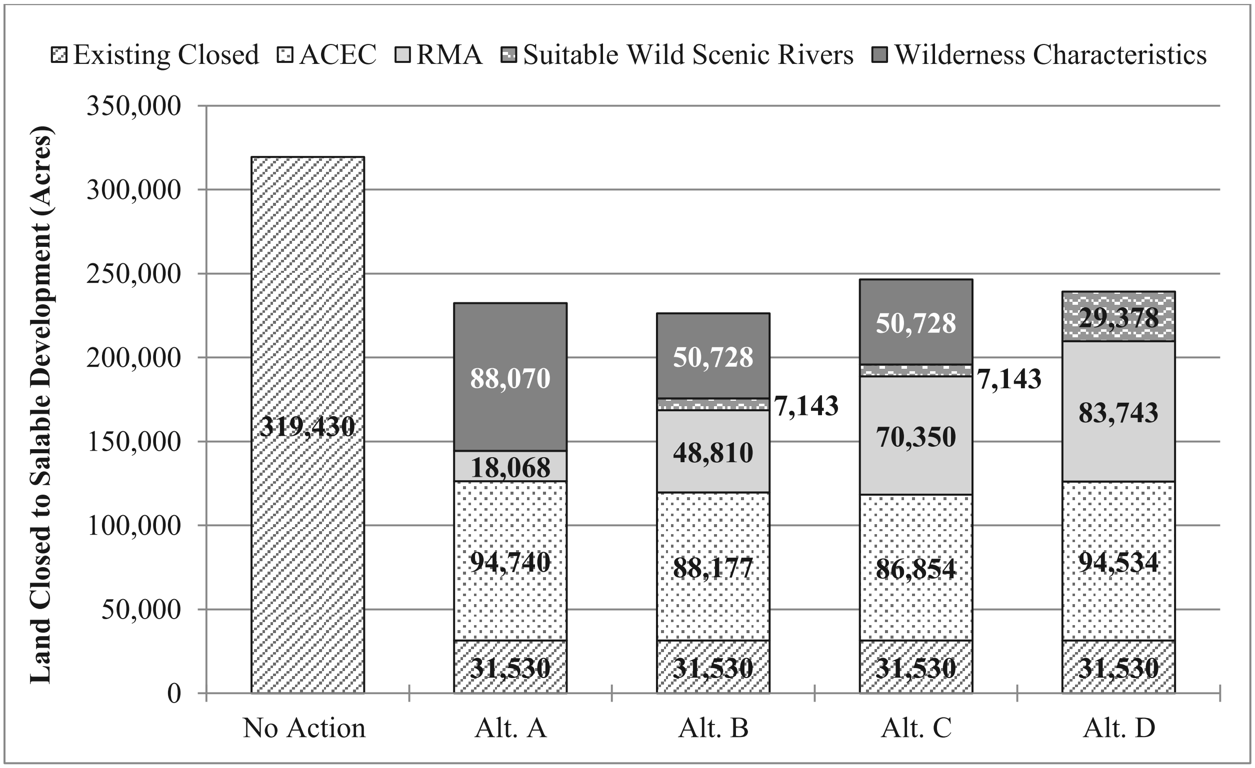


Figure 3-127. Acres closed to salable development by land category and alternative.

Table 3-101. Acres closed to salable mineral entry.

Land Category	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
ACEC	-	94,740	88,177	86,854	94,534
RMA	-	18,068	48,810	70,350	83,743
Lands Managed for Wilderness Characteristics	-	88,029	50,728	50,706	0
Eligible Wild Scenic Rivers	-	0	7,143	7,143	29,378
Closed Nondiscretionary+	31,530	31,530	31,530	31,530	31,530
Closed Discretionary+ under the 1995 RMPs	287,900	0	0	0	0
Totals	**319,430**	**232,367**	**226,388**	**246,583**	**239,185**

+ Legal mandates establish non-discretionary closures while a discretionary closure is the result of an agency management decision.

All the action alternatives open more land to salable mineral entry than the No Action alternative (the allocations driving these closures are in **Table 3-101**). Under the No Action alternative, 13 percent of the decision area is closed to salable mineral entry, the majority in the Salem District. Under the action alternatives, the BLM would reduce the total acres closed to saleable minerals to 9 to 10 percent of the decision area. Data is not readily available to spatially display the areas closed to salable mineral entry under the No Action alternative, therefore a comparison map is not included in this analysis. **Appendix L** lists each ACEC, RMA, lands managed for wilderness characteristics, and eligible WSRs closed to salable entry through this RMP revision. The overall percentage of closed acreage for each action alternative is similar, though the allocations driving the closures change across alternatives (**Table 3-102**). Compared to the No Action alternative, mineral materials would be slightly more available under the action alternatives, with Alternative B having the most acreage available.

Table 3-102. Percentage of lands closed to salable mineral entry in the decision area.

Land Category	No Action (Percent)	Alt. A (Percent)	Alt. B (Percent)	Alt. C (Percent)	Alt. D (Percent)
ACEC, RMA, Land managed for Wilderness Characteristics, Eligible WSRs	-	8%	8%	9%	9%
Nondiscretionary Closure	1%	1%	1%	1%	1%
Discretionary Closure under 1995 RMPs	12%	-	-	-	-
Totals	**13%**	**9%**	**9%**	**10%**	**10%**

Depending on the alternative, there are up to 19 developed rock quarries in allocations that the BLM would close to mineral development. **Table 3-103** shows the number or quarry sites that are located in each land use category by alternative.

Table 3-103. Number of rock quarries located in each land use category by alternative that would be closed to mineral development.

Land Category	No Action (Quarries)	Alt. A (Quarries)	Alt. B (Quarries)	Alt. C (Quarries)	Alt. D (Quarries)
ACEC	8	6	6	6	6
RMA	-	-	3	4	4
Lands Managed for Wilderness Characteristics	-	10	6	6	-
Eligible Wild and Scenic Rivers	-	-	-	-	9
Total Quarries	**8**	**16**	**15**	**16**	**19**

Closing existing rock quarries prevents future use by the BLM, local governments, and the public, which may necessitate the development of new quarries elsewhere to offset the loss. Closing 15 to 19 quarries, depending on the alternative, could require the development of new sites, which could increase the cost and environmental footprint of quarry development or necessitate a long haul of rock material. In addition to this, there would be an effective loss of resources available for future use for each quarry closed.

Appendix L contains the developed rock quarries by district and name within each ACEC, RMA, lands managed for wilderness characteristics and eligible WSRs closed to salable mineral development under the alternatives.

Issue 2

How would the alternatives affect the acres of land recommended for withdrawal from locatable mineral entry?

Summary of Analytical Methods

The BLM identified by alternative the acres of land recommended for withdrawal from locatable mineral entry. The BLM assumed that areas recommended for withdrawal from locatable mineral entry under each alternative to be withdrawn for the purposes of this analysis. The BLM then ranked each ACEC, RMA, lands managed for wilderness characteristics and eligible WSRs that is recommend for withdrawal as high, medium or low. The ranking is based on geology, mining claim density, historic mines, prospects, and occurrences. This ranking can be used to determine the potential impacts to mineral development for each recommended withdrawal. Withdrawing areas ranked as high would have a greater impact to the possible development of a mineral resource then withdrawing areas ranked as low. The BLM also analyzed the potential impacts on mining claim fee revenue.

The BLM will not complete a formal mineral potential report for locatable minerals for this RMP Revision. Prior to actual withdrawal, the BLM must prepare a mineral potential report for each recommended withdrawal proposal.

The BLM estimated the historic mineral occurrence and/or development for each ACEC, RMA, lands managed for Wilderness Characteristics and eligible WSRs that the BLM would recommend for withdrawal from locatable mineral entry under each alternative. For this evaluation, the BLM relied on the Mineral Resource Map of Oregon (1984) for geology, mineral deposits, and mining history and on LR2000 for the number of claims per quarter section of closed and active mining claims. The rankings are from high to low.

High historic mineral occurrence or development areas are—

- Regions with historic major gold mining;
- Areas with laterites and beach placers that contain more than ten active or closed mining claims;
- Areas with favorable geology for mineral production and/or potential and containing more than ten active or closed mining claims; and
- Areas with more than thirty active or closed mining claims.

Medium historic mineral occurrence or development areas are—

- Areas with favorable geology for mineral production or potential;l
- Areas with laterites, beach placers, and no mining claims; and
- Areas with one to thirty active or closed mining claims.

Low historic mineral occurrence or development areas are areas with no mining claims and that do not fall into the High or Medium categories.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which the BLM incorporates here by reference (USDI BLM 2014, p.104).

Background

Locatable minerals include the metals gold, silver, copper, lead, zinc, nickel, and chromite and certain nonmetallic minerals determined to be uncommon, such as fluorspar and certain varieties of limestone.

The Mining Law of 1872, as amended, gives citizens the right to prospect, explore, and develop locatable minerals on lands open to mineral entry. BLM regulations at 43 CFR 3700 and 3800 establish procedures for locating mining claims, preventing unnecessary or undue degradation, compliance with Federal and State laws related to environmental protection, and performance standards. Surface Management Regulations from 43 CFR 3809 include that a Plan of Operations must be submitted for any operations causing surface disturbance greater that casual use in designated ACECs, areas in the National Wild and Scenic Rivers System, and areas designated as *closed* to OHV use (as defined in 43 CFR 8340.0-5). A Plan of Operations is subject to NEPA.

A withdrawal from locatable mineral entry removes lands from the location of new mining claims and places certain requirements on existing mining claims for development of the minerals. These requirements include that after the date on which the lands are withdrawn, the BLM will not approve a Plan of Operations or allow notice-level operations to proceed until the BLM has prepared a mineral examination report to determine mining claim validity. Cost recovery applies to this process. Congress can designate withdrawals, or the BLM can undertake a withdrawal process ending with a decision signed by the Secretary of Interior. This RMP revision does not withdraw lands from locatable mineral entry.

Affected Environment

The planning area contains over 3,300 occurrences of locatable mineral resources and has a long history of mineral development (DOGAMI MILO). Mining claim records show that about 39,500 claims have been located on public lands in the planning area since BLM recording requirements began with the passage of FLPMA. The 1,045 active mining claims in the decision area attest to the ongoing interest in locatable minerals.

Table 3-104 shows the number of active mining claims, Notices, and Pending or authorized Plan of Operation in the decision area by office. **Figure 3-128** shows the general locations of active mining claims in the decision area.

Table 3-104. 2013 Active mining claims, Notices, and pending or authorized Plans of Operation in the decision area.

District/Field Office	Active Mining Claims	Notices	Plans of Operation-Pending or Authorized
Coos Bay	38	1	-
Eugene	36	1	-
Klamath Falls	1	-	-
Medford	840	24	10
Roseburg	123	-	1
Salem	7	1	-
Totals	**1,045**	**27**	**11**

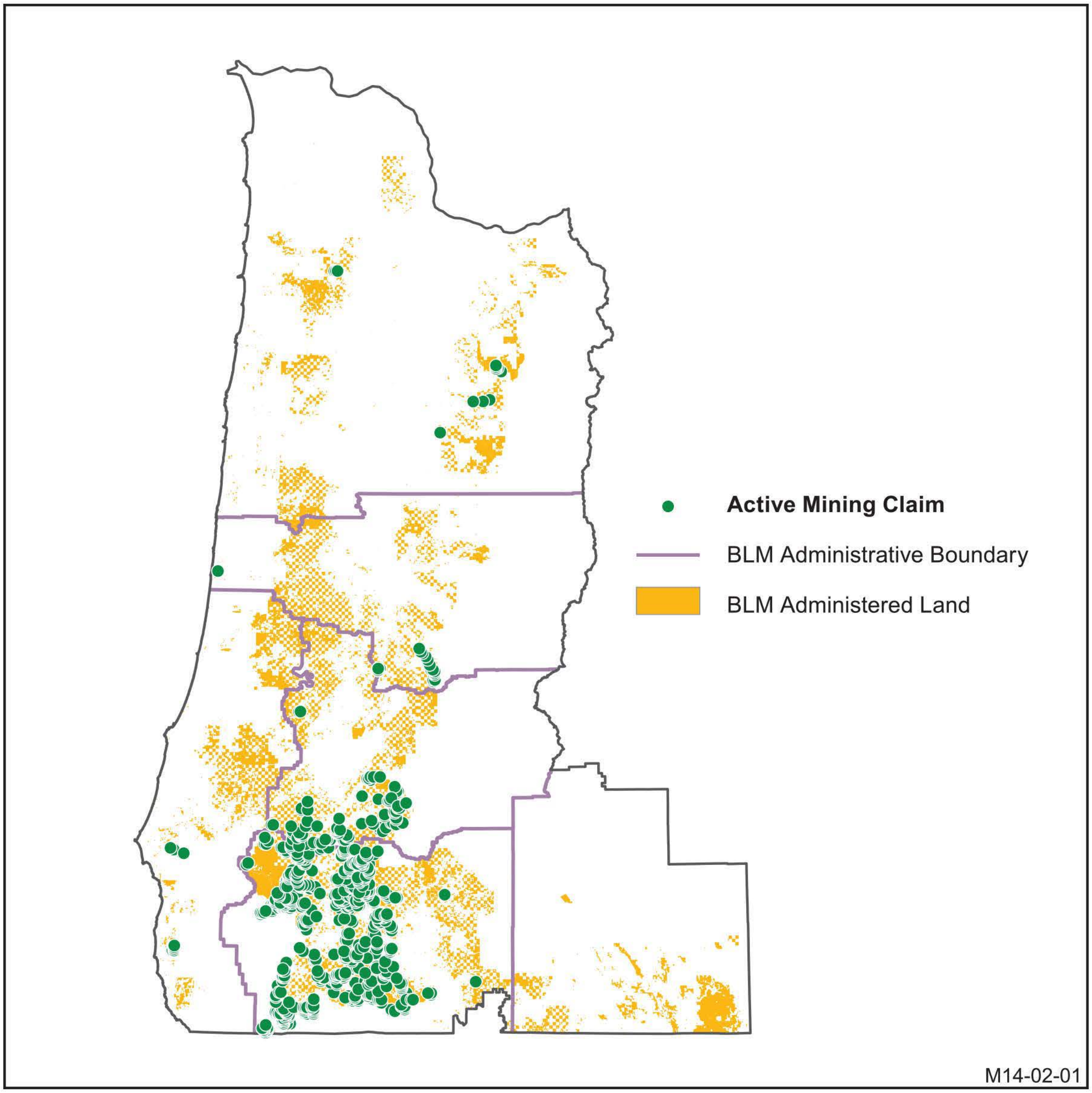


Figure 3-128. Active mining claims in the decision area in 2013.

Table 3-105 shows by office the acres of land currently withdrawn from locatable mineral entry, a total of 98,400 acres. The BLM would maintain these 98,400 previously-withdrawn acres under all alternatives.

Table 3-105. Acres of lands previously withdrawn from locatable minerals.

District/Field Office	Previously Withdrawn From Locatable Minerals (Acres)*
Coos Bay	12,500
Eugene	15,700
Klamath Falls	5,400
Medford	37,600
Roseburg	5,100
Salem	22,100
Totals	**98,400**

*2008 data from the Western Oregon Plan Revision EIS.

Trends in locatable mineral developments and regulations are described in **Appendix L**.

Environmental Effects

Figure 3-129 and **Table 3-106** show the acres that the BLM would recommend for withdrawal from locatable mineral entry by alternative for each ACEC, RMA, lands managed for wilderness characteristics, and eligible WSRs. The BLM did not rank existing withdrawals in this discussion, but included the existing acres.

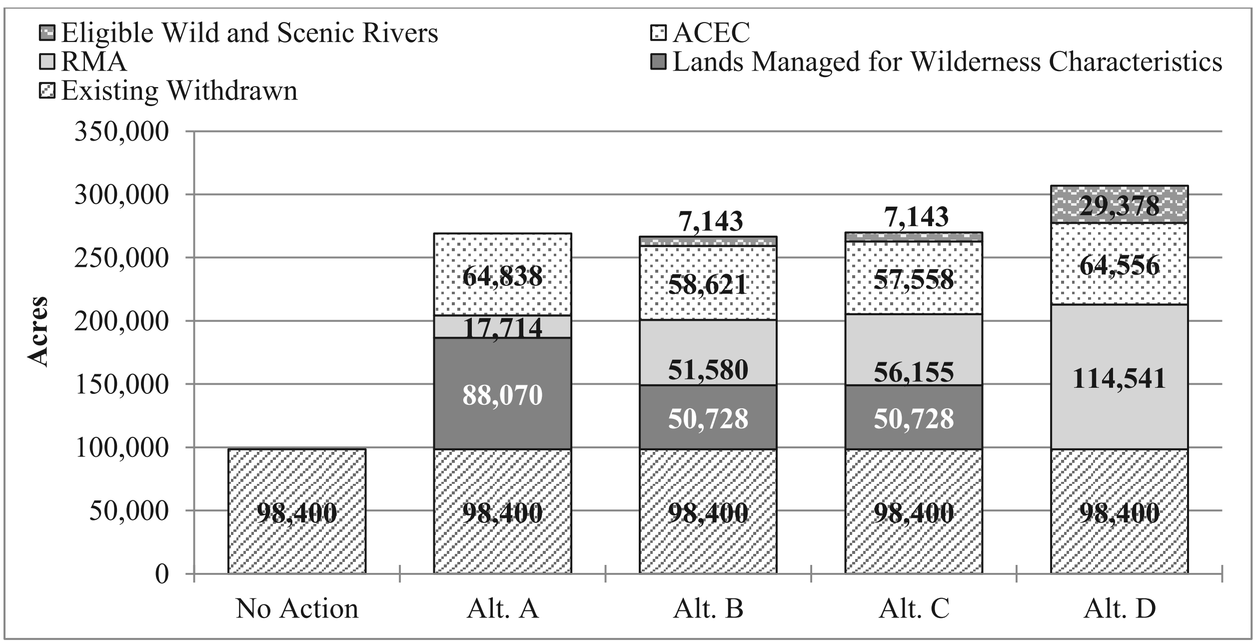


Figure 3-129. Acres that the BLM would recommend for withdrawal from locatable mineral entry by alternative and land category and previously withdrawn acres.

Table 3-106. Acres the BLM would recommend for withdrawal from locatable mineral entry by alternative and previously withdrawn acres.

Land Category	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
ACEC		64,838	58,621	57,558	64,556
RMA	-	17,714	51,580	56,155	114,541
Lands managed for Wilderness Characteristics	-	88,070	50,728	50,728	-
Eligible Wild Scenic Rivers	-	-	7,143	7,143	29,378
Totals	**98,400**	**170,622**	**168,072**	**171,584**	**208,475**

Under all action alternatives, the BLM would recommend increasing the lands withdrawn from locatable mineral entry; this increase would range from 168,050 acres under Alternative B to 208,475 acres under Alternative D (**Table 3-106**). About 4 percent of the 2.5 million acre decision area is currently withdrawn from locatable mineral entry (**Table 3-107**). The BLM would retain the previously withdrawn acres under all alternatives. Alternatives A, B, and C would increase the percentage of lands withdrawn by 6 percent, and Alternative D would increase the percentage of lands withdrawn by 8 percent. Withdrawing an additional 6-8 percent of the decision area could affect the development of locatable mineral resources.

Table 3-107. Percentage of lands recommended for withdrawal to locatable mineral entry by alternative and land category including and percentage of previously withdrawn lands in the decision area.

Land Category	No Action (Percent)	Alt. A (Percent)	Alt. B (Percent)	Alt. C (Percent)	Alt. D (Percent)
ACEC, RMA, LWC, SWSR	-	6%	6%	6%	8%
Previously Withdrawn	4%	4%	4%	4%	4%
Totals	**4%**	**10%**	**10%**	**10%**	**12%**

To understand better the effects of the recommended withdrawals, the BLM ranked the estimated historic mineral occurrence or development for the acres of land for each ACEC, RMA, lands managed for wilderness characteristics, and eligible WSRs that the BLM would recommend for withdrawal under each alternative. **Figure 3-130** shows this ranking by alternative and the proportion of acres that fall into each mineral ranking category (High, Medium, Low). Existing withdrawals are not analyzed or ranked, but the acres are included in **Figure 3-130**.

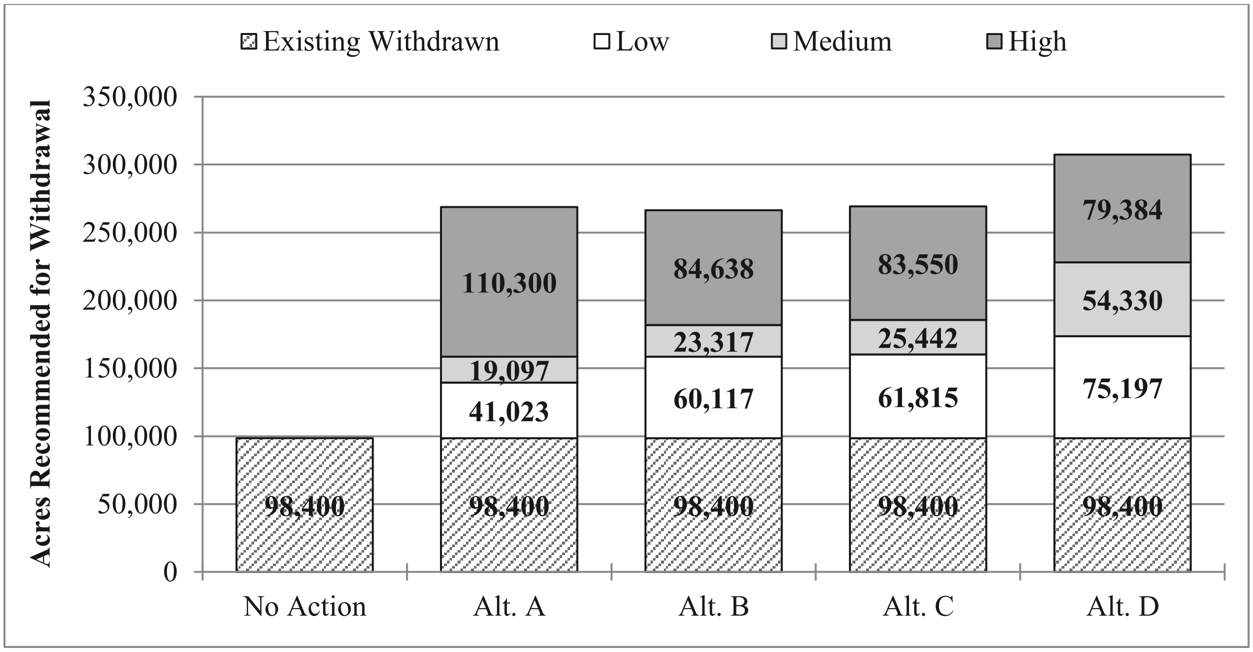


Figure 3-130. Acres that would be recommended for withdrawal with mineral ranking of estimated prospective mineral occurrence or development for each land category by alternative (includes previously withdrawn acres).

Figure 3-130 shows that the BLM ranks a substantial portion (38-65 percent) of the lands recommended for withdrawal as High for prospective mineral occurrence or development. Alternative A would recommend for withdrawal the greatest acreage of lands that ranked High (110,300) and Alternative D would recommend for withdrawal the least acreage of lands that ranked High (79,384). Removal of approximately 80,000-110,000 acres of these High ranked lands from locatable mineral exploration and development could have negative effect to development of known and undiscovered mineral resources.

Appendix L for the estimated ranking of each ACEC, RMA, lands managed for wilderness characteristics, and eligible WSRs recommended for withdrawal from locatable mineral entry.

An additional effect that would occur in association with withdrawing additional lands from locatable mineral entry is the reduction of revenue collected from public lands through mining claim fees to the government. To illustrate how withdrawal might affect fees, LR2000 records show there have been about 3,500 mining claims located in the areas that the BLM would recommend for withdrawal from locatable mineral entry under the action alternatives. Using the current fee structure for mining claim location this represents approximately $742,000 in revenue paid to the government. In addition to these filing fees there are mining claim maintenance fees (currently $140 per year) that in most cases, must be paid annually; however these fees are not included in this estimate. While withdrawals would not affect existing claims, the public cannot file new claims in lands that are withdrawn from locatable mineral entry, resulting in no new fees collected. However, holders of existing claims would still pay maintenance fees if applicable.

Issues considered but not analyzed in detail

How would the alternatives affect the acres of land with fluid leasable mineral restrictions: no surface occupancy, conditional surface use, and timing limitations?

The alternatives would impose proposed fluid mineral stipulations on each ACEC, RMA, lands managed for wilderness characteristics, and eligible WSRs. **Table 3-108** shows the acres for which the BLM would propose stipulations across the alternatives. As show the no action alternative contains the most acreage with stipulations and alternative A the least. The differences in the action alternatives are due to the differing arrangements in each alternative of ACECs, RMAs, lands managed for Wilderness Characteristics, and eligible WSRs. It is important to note that while the No Action alternative acreage includes only acres to which the BLM has applied no surface occupancy stipulations, the Action Alternative acreages include all proposed stipulations which include specific stipulations, such as no surface occupancy or conditional surface uses based on resource protection needs.

Table 3-108. Acres that would have leasable stipulations across alternatives in ACECs, RMAs, lands managed for wilderness characteristics, and eligible WSRs

	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Leasable stipulations	692,100*	190,389	211,638	318,915	498,525

* This includes only acres that are no surface occupancy

Acreage not included in table above for the action alternatives are site-specific stipulations as needed to protect Federally-listed threatened and endangered species and their critical habitats

The BLM will not complete a formal mineral potential report for leasable minerals for this RMP revision. Information regarding mineral potential reports and when they are required can be found in BLM manual 3031.

Site-specific stipulations, such as no surface occupancy, conditional surface uses, or timing restrictions, can be imposed on each lease as needed to protect other resource values, as identified in this RMP. The BLM is identifying such stipulations for certain areas, but since they do not prevent the development of some leasable minerals and only somewhat hinder development, there will be no foreseeable effects of the alternatives regarding mineral leasing of oil, gas, or Coalbed Natural Gas resources. The stipulation of no surface occupancy could impact geothermal resources; this resource is a part of the sustainability energy section of this document.

Reasonably foreseeable mineral material developments and development guidance can be found in **Appendix L**.

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National Trails System

Key Points

- Regardless of the National Trail Corridor width, the BLM does not administer enough lands within the viewshed to protect the Pacific Crest National Scenic Trail resources and setting characteristics adequately.
- Alternative D provides the largest National Trail Corridor and protects the greatest number of acres within the viewshed. However, these acres only account for 9 percent of all viewable acres.

Issue 1

Issue 1: How would the alternatives affect the BLM's ability to protect National Trails?

Summary of Analytical Methods

The BLM considered how the designation of various widths of trail corridors by alternative would affect the values and uses associated with the trails. The BLM conducted a trail viewshed analysis for the portion of the Pacific Crest Trail that passes through BLM-administered lands to determine the percent of BLM-administered land within the trail's viewshed.

For the purposes of this analysis, the BLM assumed that its management decisions for National Trail Management Corridors would adequately protect the values and uses associated with the National Trails. The BLM bases this assumption on the management direction applied to these corridors under all alternatives. Within the corridors, the BLM would:

- Designate a Special Recreation Management Area
- Manage for Visual Resource Management Class II
- Designate as *closed* to off-highway vehicles
- Close to recreational target shooting
- Allow timber harvest activity only to protect or maintain recreation setting characteristics or to achieve recreation objectives
- Apply a controlled surface use stipulation on surface occupancy and surface disturbing activities
- Recommend for withdrawal from locatable mineral entry
- Close to salable mineral development
- Apply stipulations for leasables including no surface occupancy, controlled surface use, and timing limitations

Pacific Crest National Scenic Trail Viewshed Analysis

The Pacific Crest National Scenic Trail (PCT) viewshed is defined as the area within 5 miles of any point of the portion of the PCT that runs through BLM-administered lands (**Figure 3-131**). This definition is based on the assumption that the average traveler along the PCT has the ability to see 5 miles from any point along the trail. It should be noted that this 5 miles is a fixed distance and so the viewshed actually includes areas that are not visible from the trail. Thus, in addition to determining the acres of BLM-administered lands within the viewshed, the BLM also determined the acres of BLM-administered lands actually visible from the trail. The BLM conducted the viewshed analysis based on available digital elevation data. The results of this analysis are displayed in **Table 3-109**.

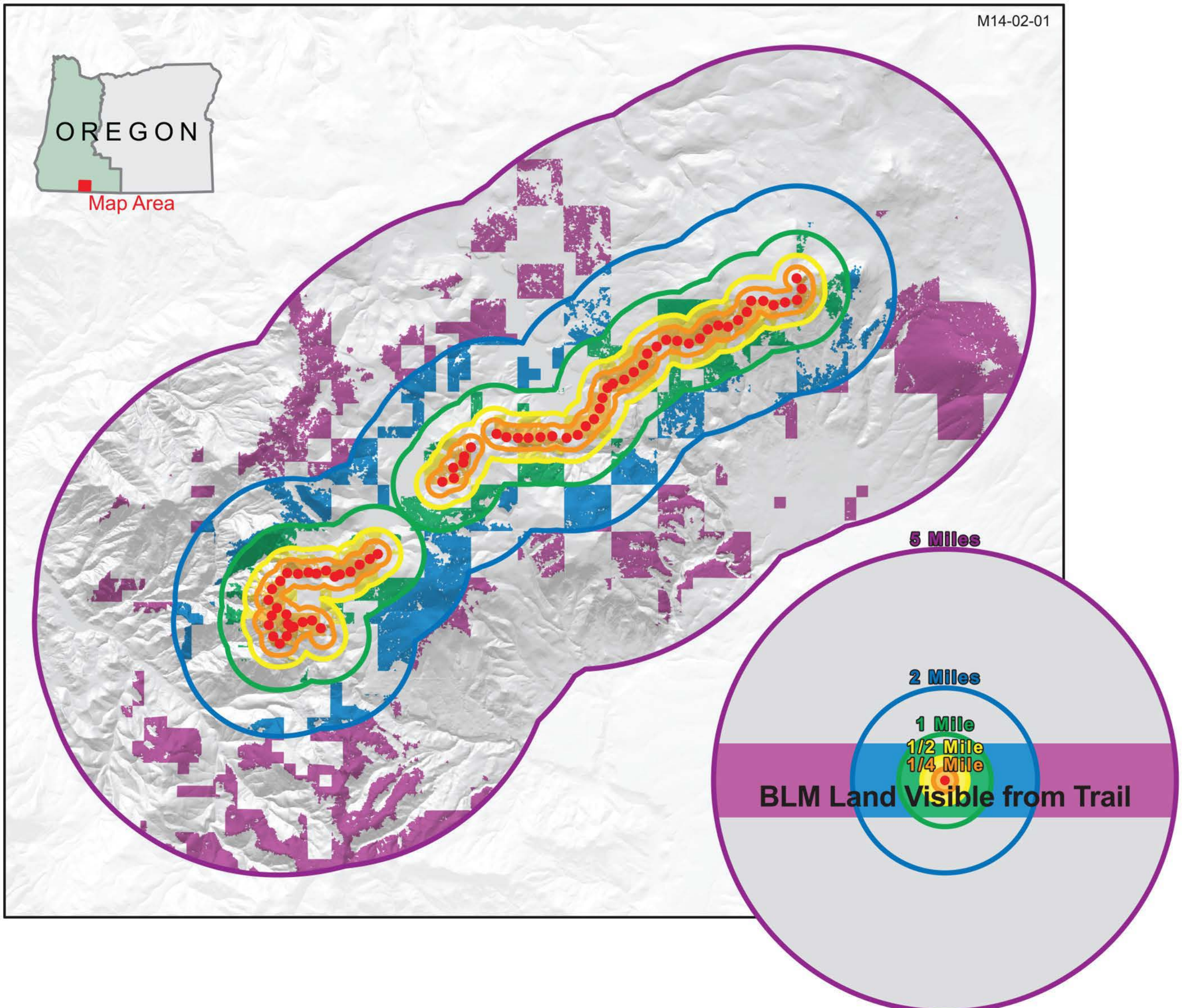

Figure 3-131. The 5-mile Pacific Coast Trail view shed.

Table 3-109. Pacific Crest Trail viewshed results for BLM administered lands within the 5-mile viewshed distance.

Description	Percentage
BLM-administered lands within the Pacific Crest Trail Viewshed	19.3%
BLM-administered lands within the Pacific Crest Trail Viewshed that are visible	28.1%
BLM-administered lands within the Pacific Crest Trail viewshed that are visible and within the planning area	23.2%

National Trails Background

Congress designated three classifications of trails for public use under separate criteria established in the National Trails System Act of 1968, Sec. 3(a). The following definitions provide an overview of these three trail classification types, as well as of the allocation through which agencies manage them and the specific trails that pass through the BLM-administered lands within the planning area.

National Recreation Trail

The Secretary of the Interior can designate National Recreation Trails within parks, forests, recreation areas, or where lands administered by the Department of the Interior are involved. These would be subject to the consent of the Federal agency, State, political subdivision, or other appropriate administering agency having jurisdiction over the lands involved.

National Scenic Trail

Only Congress can establish National Scenic Trails, which are extended trails intended to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historical, natural, or cultural qualities of the areas through which the trails pass.

National Historic Trail

Only Congress can establish National Historic Trails, which are extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historic significance. Their purpose is to identify and protect historic routes and their historic remnants and artifacts for public use and enjoyment.

National Trail Management Corridor

A National Trail Management Corridor is a land use plan allocation which is based on Section 7(a)(2) of the National Trails System Act "rights-of-way." The National Trail Management Corridor includes all public land area of sufficient width within which to encompass National Trail resources, qualities, values, and associated settings and the primary use or uses that are present or that the managing agency is to restore. For the purposes of this planning effort, National Trail Management Corridors include all BLM-administered lands containing resources, values, and associated settings that support the nature and purposes of a given National Trail.

Other Federal lands, State trust lands, private land, or other interests in lands, including split estate, that contain National Trail resources, qualities, values, and associate settings and the primary use or uses are included in the National Trail Management Corridor. Although these lands are included within the management corridor, they are not subject to BLM management. Interested landowners may voluntarily elect to participate in National Trail management on private or State lands through a cooperative agreement or other instrument with the BLM.

Pacific Crest National Scenic Trail

The Pacific Crest National Scenic Trail (PCT) is a long-distance hiking and equestrian trail closely aligned with the highest portion of the Sierra Nevada and Cascade mountain ranges. The Pacific Crest Trail was designated a National Scenic Trail in 1968. The trail's southern terminus is on the U.S. border with Mexico and its northern terminus is on the U.S. border with Canada; its corridor through the U.S. travels through the states of California, Oregon, and Washington. The PCT is 2,663 miles long and ranges in elevation from just above sea level at the Oregon Washington border to 13,153 feet in the Sierra Nevada mountain range.

The PCT enters BLM-administered lands within the planning area from California along the crest of the Siskiyou Mountains east of Mt. Ashland and proceeds east towards Soda Mountain and then proceeds northeasterly along the western Cascades to the Rogue Siskiyou National Forest boundary. Hikers can access the PCT by numerous Federal, State, and county roads. Although the trail is easily accessible from numerous roads, the trail itself is closed to motorized and mechanized use.

Table 3-110. Pacific Crest National Scenic Trail mileage by ownership within the decision area.

Landowner	Approximate Mileage
BLM	17.0
Private Lands	3.6
Private Timber Companies	7.1
State of Oregon	0.9
Totals	**28.6**

The main use of the BLM-administered segment of the PCT is for day hikes, primarily by residents of the Rogue Valley. The main recreational activity within the PCT on BLM-administered lands is hiking, followed by equestrian use. In addition to these activities, sightseeing, wildlife observation, photography, camping, and hunting occur. In the winter months, cross-country skiing occurs along the trail. The BLM estimates that day use along the BLM-administered segment of the PCT is approximately 25,000 visitors annually.

The nature and purpose of the PCT is to provide a high quality hiking and horseback-riding experience, highlighting the scenic, natural, historic, and cultural resources along the high ridges of the Pacific mountains. The PCT is designed and managed to provide the most primitive recreational experience possible as identified through the BLM's Recreation Opportunity Spectrum. The trail includes a permanently protected corridor that provides for the nature and purpose of the trail, including side and connecting trails as well as PCT-dependent facilities such as campsites, water sources, and viewpoints. Public lands within the trail corridor, including lands acquired and managed for the PCT, are managed to maximize a natural appearing landscape where human development does not dominate the viewer's experience, and meet a minimum visual quality retention objective. The PCT experience is managed cooperatively and seamlessly across unit and agency boundaries and with significant involvement of citizen stewards.

California National Historic Trial-Applegate Trail Route

The National Park Service is preparing a feasibility study to evaluate 41 routes for possible addition to the California National Historic Trail. The feasibility study evaluates eligibility of the study routes for potential inclusion into the National Trails System. Congress authorized this study under the Omnibus Public Land Management Act of 2009. Approximately 10.9 miles of the evaluated Applegate trail route are located on BLM administered lands within the planning area. **Table 3-111** shows a mileage breakdown by ownership, within the planning area boundaries.

Table 3-111. California National Scenic Trail mileage breakdown by ownership within the planning area.

Landowner	Approximate Mileage
Bureau of Land Management	10.9
Private Lands	405.0
Private Timber Companies	5.6
State of Oregon	5.0
Totals	**426.5**

The California National Historic Trail follows the route taken by farmers, settlers, gold miners, and others who forged their way from Missouri to the Pacific Coast during the California gold rush. The California National Historic Trail is approximately 2,000 miles in length spanning across the western half of North America. The first half of the California trail followed the same corridor of networked river valley trails as the Oregon Trail and the Mormon Trail. The California National Historic Trail splits into the Applegate route just north of the Oregon and California border.

The purposes of the California National Historic Trail are to enable all people to envision and experience the heritage and impacts of the western overland migration and to encourage preservation of its history and physical remnants. The California National Historic Trail is significant for several reasons. First, it was one of the major highways of the 19th century and provided a 2,400-mile path for emigrants to the West, including those drawn as part of the California gold rush. The arrival of these emigrants dramatically changed the peoples, cultures, and landscapes of the northwest. The California National Historic Trail's route originated through earlier use by Native American and western explorers and travelers.

Affected Environment

Pacific Crest National Scenic Trail

The BLM's Medford district currently manages the approximately 30 miles of the Pacific Crest National Scenic Trail that passes through as a Special Recreation Management Area (SRMA) The current SRMA plan established a 100-foot wide (50 feet off center-line) trail corridor for the trail. The BLM administers approximately 488 acres within this corridor. The Klamath Falls Field Office manages an additional mile of the Pacific Crest Trail. The BLM has not established a protective trail corridor for the portion of the PCT that passes through the Klamath Falls Field Office.

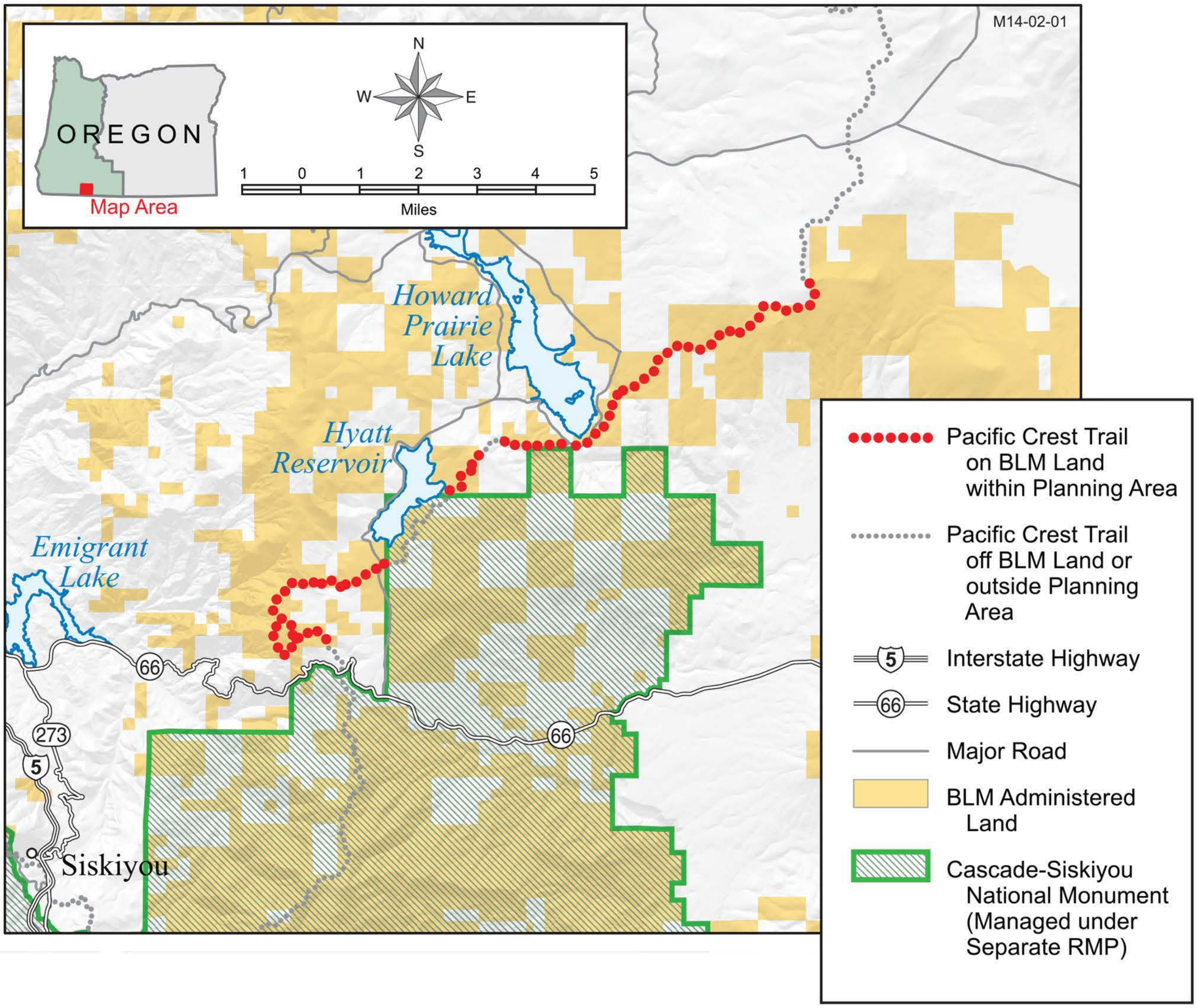

Figure 3-133. Pacific Crest National Scenic Trail corridor on BLM-administered lands within the planning area.

California National Historic Trail-Applegate Route

The BLM has not established a protective trail corridor for the portion of the California National Historic Trail that passes through BLM-administered lands within the planning area. **Figure 3-134** shows an illustration of the California National Historic Trail Corridor that travels through BLM-administered lands within the planning area.

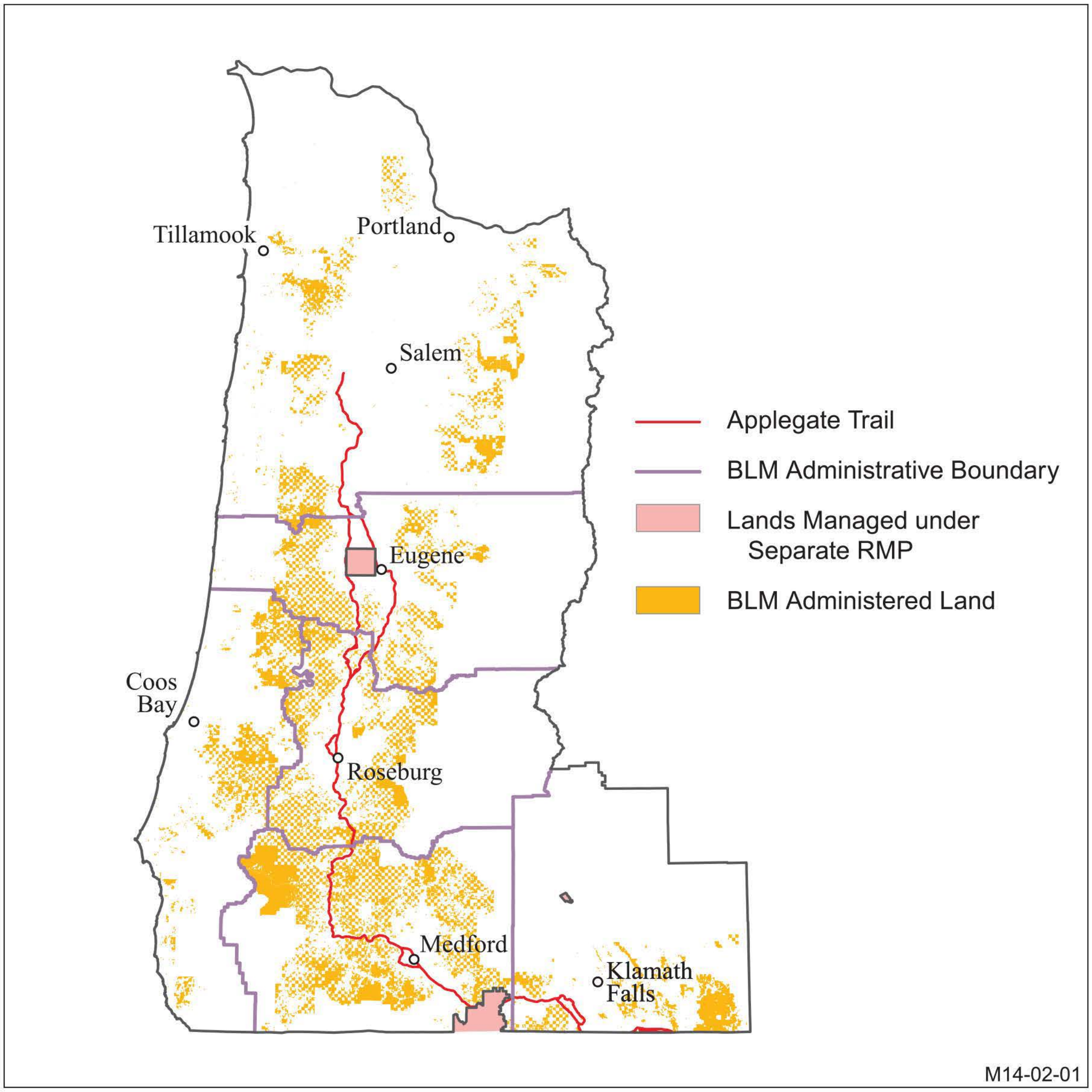

Figure 3-134. California National Historic Trail Corridor on BLM-administered lands in the planning area.

Environmental Effects

The variation in effects between alternatives is driven by the application of widths of trail corridors. As described above, the management within the corridors would be constant and protective across alternatives.

California National Historic Trail-Applegate Route

The No Action alternative does not provide protections because protective corridors do not currently exist for the Applegate route of the California National Historic Trail. The No Action alternative would result in impacts to the Applegate Route of the California National Historic Trail resources, values, recreation setting, and primary uses because protective management direction does not exist and would not be applied to areas of the trail that pass through BLM-administered lands within the planning area.

In all alternatives, the BLM would apply a 100-foot wide trail corridor (50-feet off centerline) along all portions of the California National Historic trail that cross BLM-administered lands within the planning area. This would result in adequate protection of National Trail resources, values, setting characteristics and primary uses for which the California National Historic trail is currently being studied.

Pacific Crest National Scenic Trail

The BLM would establish a National Trail Corridor on the 17 miles of the Pacific Crest National Scenic Trail (PCT) that crosses BLM-administered lands within the planning area. This corridor width would vary across alternatives. In this analysis, the BLM considers the effects of these widths on PCT resources, values, recreation setting, and primary uses.

Table 3-112 shows the percentage of visible acres present in the PCT corridor by alternative. This table also shows the total acres of BLM-administered lands visible from the BLM portion of the PCT within the planning area by alternative.

Table 3-112. Percent of total and visible acres of BLM-administered lands within Pacific Crest Trail corridor by alternative.

Areas	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Trail corridor width	100 feet	500 feet	0.25 mile	1 mile	2 miles
BLM lands within the corridor (Acres)	411	526	737	1,355	2,453
BLM lands within the corridor (% of all lands)	97.1%	81.2%	56.1%	30.4%	30.9%
BLM lands within the 5-mile viewshed and within the corridor (% of all lands)	0.4%	0.9%	0.7%	3.6%	8.0%
BLM lands visible within 5 miles of the corridor (% of all visible lands)	1.5%	1.9%	1.3%	4.9%	8.8%

Regardless of the National Trail Corridor width, the BLM does not administer enough lands within the viewshed to protect PCT resources and setting characteristics adequately. Under the most protective Alternative (Alternative D), the BLM would administer only 8.8 percent of the total visible acres within the viewshed. Management activities that result in visual impacts could take place on the 90 percent of the viewshed that the BLM does not administer resulting in impacts to the setting characteristics that are beyond the BLM's control.

No Action Alternative

Under the No Action alternative, the BLM would continue to provide a 100-foot trail management corridor off centerline (50 feet on each side) on the Pacific Crest Trail (PCT). This would result in the protection of 411 acres of BLM administered lands along the 17-mile segment of the PCT included in this analysis. Compared to the acres of visible lands from the PCT (6,464 acres), the No Action alternative would preserve 7 percent of the visible BLM-administered lands from the PCT for the enjoyment of the nationally significant, scenic, historic, natural, or cultural qualities of the areas through which the trail passes. The No Action alternative provides the least amount of protection to the PCT's resources when compared with all action alternatives.

Alternative A

Under Alternative A, the BLM would establish a 500-foot trail management corridor off the centerline (250 feet on each side) on the PCT. This would result in the protection of 526 acres of visible BLM-administered lands along the 17-mile segment of the PCT included in this analysis. Alternative A would protect 8 percent of the 6,464 acres of BLM-administered lands that are visible from the PCT using the protective management direction described in the methods section.

Alternative A provides greater protection to the PCT's resources when compared with the No Action alternative and less protection when compared to Alternatives B, C, and D.

Alternative B

In Alternative B, the BLM would establish a 1/4 -mile trail management corridor off the centerline on the PCT. This would result in the protection of 737 acres of BLM-administered lands along the 17-mile segment of the PCT included in this analysis. Alternative B would protect 11 percent of the 6,464 acres of BLM-administered lands that are visible from the PCT using the protective management direction described in the methods section.

Alternative B provides greater protection than the No Action alternative and Alternative A, and less than Alternatives C and D.

Alternative C

In Alternative C, the BLM would establish a 1-mile trail management corridor off the centerline (1/2 mile on each side) on the PCT. This would result in the protection of 1,355 acres of visible BLM-administered lands along the 17-mile segment of the PCT included in this analysis. Alternative C would protect 21 percent of the 6,464 acres of BLM-administered lands that are visible from the PCT using the protective management direction described in the methods section.

Alternative C provides greater protection than the No Action alternative and Alternatives A and B and less than Alternative D.

Alternative D

In Alternative D, the BLM would establish a 2-mile trail management corridor off the centerline (1 mile on each side) on the Pacific Crest Trail (PCT). This would result in the protection of 2,453 acres of BLM-administered lands along the 17-mile segment of the PCT included in this analysis. Alternative D would protect 38 percent of the 6,464 acres of BLM-administered lands that are visible from the PCT using the protective management direction described in the methods section.

Alternative D provides the greatest level of protection to the PCT's resources compared to the other alternatives. Alternative D provides five times the level of protection as the No Action alternative.

Rare Plants and Fungi

Key Points

- Only two Federally-listed plant species potentially occur within the Harvest Land Base under all alternatives: Kincaid's lupine and Gentner's fritillary. Under all alternatives, the BLM would conduct pre-disturbance surveys and apply conservation measures for these two species.
- The six Federally-listed plant species and one Federal candidate plant species within the decision area are shade-intolerant.
- The BLM would manage Bureau Sensitive plant and fungi species under the BLM's Special Status Species program under all alternatives. However, under Alternative D, the BLM would manage these species on O&C lands only in such a way that would not conflict with sustained-yield timber production.
- None of the action alternatives would include the Survey & Manage standards and guidelines. Under all action alternatives, species that are currently Survey & Manage and not included on the Bureau Sensitive species list would receive no specific protections.
- All action alternatives allocate more acres to Late-Successional Reserve than the No Action alternative, which would benefit rare plants and fungi associated with mature and structurally-complex forest.

Background

There are 269 special status plant and fungi species within the planning area: 179 vascular plants, 41 bryophytes (mosses and liverworts), 22 lichens, and 27 fungi. Included on the Special Status Species list are Federally-listed, proposed, and candidate species, and Bureau Sensitive species. BLM State Directors can designate rare and threatened species known or suspected to occur on BLM-administered lands within their respective states as Bureau Sensitive. The State Directors also can designate species known or suspected to occur on BLM-administered land that botanists know little about as Bureau Strategic, a tracking or "watch list" category that is not part of the Special Status Species program.

Of the 269 plant and fungi Special Status Species within the planning area, there are 178 documented species on BLM-administered land. The remaining 91 speciesare suspected or likely to occur on BLM-administered lands. These suspected species are included on the Special Status Species list because known sites occur nearby, their range coincides with the planning area, or suitable habitat exists on BLM-administered land.

Separate from the Special Status Species program, little known species thought to be associated with late-successional or old-growth forests currently receive special management attention under the Survey & Manage measures (USDA FS and USDI BLM 1994). Some, but not all, of the Survey & Manage species qualify for inclusion on the Bureau Sensitive species list. Of the 241 Survey & Manage species within the planning area, 47 are also on the Bureau Sensitive list and an additional 65 are on the Bureau Strategic list.

Distribution, Habitat, and Biology

The planning area is vegetatively diverse due to the physical geography of the area and it falls within five of the Level III ecoregions[65] mapped by the Environmental Protection Agency: Willamette Valley, Coast Range, Cascades, Klamath Mountains, and Eastern Cascades Slopes and Foothills (Omernik and Griffith 2012).

Within the State of Oregon, there are more than 4,677 recognized taxa of vascular plants (Oregon Flora Project 2013). There is a substantial diversity of non-vascular plants (bryophytes and lichens) and fungi within the planning area; however, there is not a single comprehensive list of these organisms because scientists have not studied and catalogued these species as well as vascular plants. The majority of the plants and fungi found in Oregon are common and the current threat of extinction is slight. Some species are naturally rare or uncommon due to many biological and physical factors. For example, some rare plant species (e.g., crinite mariposa lily (*Calochortus coxii*)) are strictly associated with serpentine soils that occur in the planning area within the Klamath Mountains ecoregion (Oregon Biodiversity Information Center 2014). Rare species may occur in very small numbers or may be abundant within a narrow distribution. Other rare species may have a broad distribution, but occur in small numbers where found (e.g., clustered lady's-slipper (*Cypripedium fasciculatum*)) (Oregon Flora Project 2014). Some species are rare because of changes to their habitat (e.g., farming, urban and rural development, mining, and construction of roads).

The distribution of rare plant species is not even across the landscape. Mapping of species sites provides distribution and density patterns. "Hot spots" are areas of high Special Status Species richness and density. "Hot spots" can occur at fine spatial scales, such as special habitat features (meadows, wetlands, rock outcrops, and other non-forested areas), and at larger geographic scales where high levels of endemism occurs on the broader landscape level (**Appendix M**). The figure in **Appendix M** is based upon data in the BLM's Geographic Biologic Observations (GeoBOB) database. Because the BLM does not have complete botanical surveys, that figure shows the relative density of Special Status Species sites based upon current data. Both **Table 3-113** and **3-114** indicate that the greatest abundance and density of Special Status plant species within the planning area is within the Medford District. This is because the Medford District lies primarily within the Klamath Province that has the highest total species richness of any province within the planning area. The complex geology of the Klamath Province supports diverse plant communities.

Table 3-113. Plant and fungi sites by status and taxonomic group.

District/ Field Office	Bureau Sensitive (# of Sites)				Bureau Strategic (# of Sites)				Totals
	Bryophytes	Lichens	Vascular Plants	Fungi	Bryophytes	Lichens	Vascular Plants	Fungi	
Coos Bay	14	128	195	19	57	10	11	57	**491**
Eugene	8	23	92	8	7	19	1	24	**182**
Klamath Falls	-	-	53	6	-	-	2	4	**65**
Medford	9	-	2,918	11	35	165	48	38	**3,224**
Roseburg	1	40	103	9	5	18	-	18	**194**
Salem	16	171	29	102	3	14	-	73	**408**
Totals	**48**	**362**	**3,390**	**155**	**107**	**226**	**62**	**214**	**4,564**

[65] Ecoregions are areas within which ecosystems are generally similar based upon geology, vegetation, climate, and hydrology. These are different from the physiographic provinces described in **Figure 3-10** or **Figure 3-123**.

Table 3-114. Special Status, Strategic, and Survey & Manage sites documented between January 2009 and July 2013.

District/Field Office	Special Status (# of Sites)	Strategic (# of Sites)	Survey & Manage (# of Sites)	Surveyed (Acres)
Coos Bay	9	2	15	8,217
Eugene	8	5	16	36,197
Klamath Falls	-	-	-	234
Medford	207	74	94	47,917
Roseburg	7	6	45	19,117
Salem	3	1	10	9,615
Totals	**226**	**88**	**180**	**121,297**

Field surveys are the best method to confirm presence or absence of rare species and to increase knowledge of range, distribution, and habitat characteristics. From January 2009 to July 2013, the BLM surveyed approximately 121,297 acres within the decision area and found a total of 226 new Special Status Species sites, 88 new Strategic Species sites, and 180 new Survey & Manage species sites. On average, this works out to be one new Special Status, Strategic, or Survey & Manage site for every 246 acres surveyed. However, BLM found the majority of the new sites within the Medford District with 92 percent of the Special Status sites, 84 percent of the Strategic sites, and 52 percent of the Survey & Manage sites. The detection rate for the Medford District was one new site for every 128 acres surveyed, while the detection rate for the Eugene District was much less with one new site found for every 1,248 acres surveyed. During this period, surveyors did not document any new sites within the Klamath Falls Field Office.

Certain species, especially fungi, are difficult to detect during much of the year (USDA FS and USDI BLM 2004, pp. 148-149). Many fungi grow below the soil surface or within down woody debris and surveyors can only detect them when their fruiting bodies are present. Most of the structure (mycelium) of fungi species is not visible because it is within whatever substrate the fungus lives (e.g., logs, tree stumps, duff, and soil). Generally, botanists consider fungi impractical to survey for because they do not produce sporocarps (fruiting bodies) every year, or produce sporocarps everywhere that they may occur, and the sporocarps are usually present for a short time. Most of the Special Status and Survey & Manage fungi are mycorrhizal and associated with conifer trees. Other species are decomposers or are parasites on other fungi. Even when sporocarps are present, they are an unreliable indicator of location and activity of mycelia (Dahlberg and Stenlid 1995). Visual observation cannot determine the size of a genetic individual or a population of a fungal species. The plant community composition gives an indication of the fungal community under the surface. The plant community influences the development of mycorrhizal populations (i.e., when the aboveground vegetation changes, the fungal community changes with it).

Likewise, many vascular plant species may germinate only when growing conditions are favorable for the species and the presence of flowers may be required for positive identification. To optimize detection, botanists must conduct surveys during the appropriate season and when local field conditions are favorable for the species. The numbers of Special Status Species sites listed **Table 3-114** represent a snapshot in time and give an indication of relative abundance and diversity of rare plant and fungi species among the BLM administrative units in the planning area. The BLM conducted the majority of the surveys for pre-disturbance surveys for individual projects (e.g., timber sales, culvert replacements, noxious weed treatments).

Many rare plants are associated with distinct and narrow habitat types within larger vegetative communities shaped by geologic features and substrate, climate, and hydrologic influences. These habitats range from rock substrates and outcrops of different origins with variable soil types and conditions (including sand dunes) to seasonal and permanent wetlands, vernal pools, fens, bogs, and marshes. Because they have persisted over time, these habitats have become refugia for unusual plant communities and rare species adapted to specialized environments. However, even within these habitats, rare species occur very infrequently.

Rare vascular plant species occur in a broad range of plant communities, habitat types, and substrates, including aquatic, riparian, rock, and terrestrial. Generally, botanists understand the habitats associated with rare vascular plants. Bryophytes and lichens are associated with a variety of habitats including conifer trees, rock, soils, and riparian areas, although primarily in conifer and hardwood communities. Many of these species are closely associated with a particular substrate, habitat condition, and environment. Fungi occur in a number of forms. Most are mycorrhizal and usually associated with host species in conifer and hardwood forest communities. The habitat characteristics for many rare lichen and bryophyte species are less certain and more conceptual than those for vascular plants. Fungi have even less certain habitat characteristics than the lichens and bryophytes. The habitat groups discussed later in this section organize BLM Special Status Species into broad habitat types based on current understanding.

Mycorrhizal fungi grow in a symbiotic relationship with vascular plant species. One or both organisms are dependent upon the other for food or resources. Mycorrhizal fungi depend upon actively growing root tips of the vascular plant with which it is associated. When the vascular plant community changes, the mycorrhizal fungi also change. Tree removal results in a decline in fine root activity and a similar reduction in the diversity of mycorrhizal fungi (Hagerman *et al*. 1999). Clear-cutting results in the loss of fungal species richness, (i.e., the larger the clearcut, the greater the impact to the mycorrhizal fungal community) (Dural *et al*. 1999, Hagerman *et al*. 1999, Kranabetter and Kroeger 2001). Green tree retention and smaller clearcuts allow fungi to continue to persist in the harvested area and allow for early recolonization of mycorrhizal species post-harvest (Kranabetter and Kroeger 2001, Luoma and Eberhart 2005, Miller *et al*. 1998, Wiensczyk *et al*. 2002).

Biological factors play important roles in determining the distribution and abundance of a species. These factors include reproductive strategies, inbreeding depression, pollinators and pollination, consumption by herbivores, weed invasion, habitat connectivity, disease, predation, habitat change, and global climate change. Often the biological factors that affect a species rarity are difficult to isolate or are interrelated and cause uncertainty as to the real cause of rarity. Some rare Oregon species appear to be remnant populations from historic plant communities that have shifted since the last ice age. Other rare species in Oregon are narrow endemics adapted over long periods to specific habitats or substrates, such as the serpentine endemic group. Some rare species may have evolved as isolated populations that are diverging morphologically from the greater population, or may be the result of hybridization (e.g., Gentner's fritillary). Certain rare species of lichens and bryophytes, while geographically widespread, appear to be locally adapted to narrow environmental conditions along the Pacific Northwest coast. A number of species in Oregon are rare due to loss of habitat and the introduction and spread of invasive plants.

Natural disturbances, such as wildfires, windstorms, and floods, change plant communities and habitat conditions for rare plants and fungi. Many factors determine whether a population will survive a disturbance. These include the following:

- Type, extent, duration, and intensity of the disturbance
- Frequency and season of the disturbance
- Habitat and life-cycle requirements of a species

- Adaptability of a species to a changed environment

Some rare plant species (e.g., Bradshaw's desert-parsley) are adapted to frequent, low-intensity fires and respond positively in most cases (Kaye *et al.* 2001). Species such as Gentner's fritillaria and Kincaid's lupine can respond positively to the increased light and moisture from the loss of overtopping and competing vegetation and the increase in nutrients available after a wildfire. Although certain species respond positively to disturbance, they remain rare because of infrequent disturbances, loss of habitat, and rapid invasion by annual weeds. Alternatively, fire consumes many rare lichen, bryophytes, and fungi, along with some vascular plants without fire-adaptive mechanisms. These sites, as well as their habitat and hosts, would be lost unless protected in a niche or island where the fire was absent or less severe.

Floods and debris flows alter riparian and aquatic plant communities and can alter the rare plant populations that occur in disturbed areas. These types of events are very dynamic with some rare plant sites benefiting whereas others are lost. Although floods may appear to destroy the existing riparian and aquatic vegetation initially, they also deposit sediment, distribute seed, and reduce native and invasive vegetation. This facilitates vigorous re-sprouting and reseeding of riparian associated shrubs, perennial and annual grasses, and forbs. For example, many rare juncus and sedge species associated with streams and wetlands are adapted to periodic floods by prolific seed production.

Federally-Listed Species

There are twelve Federally-listed and one candidate plant species that occur or have occurred historically within the planning area. The BLM has documented seven of these species within the decision area: Gentner's fritillary, western lily, Cook's lomatium, rough popcorn flower, Kincaid's lupine, Nelson's checker-mallow, and Siskiyou mariposa lily. The U.S. Fish and Wildlife Service has designated critical habitat for four of the Federally-listed plants: Willamette Valley daisy, large-flowered wooly meadow-foam, Cook's lomatium, and Kincaid's lupine. The U.S. Fish and Wildlife has completed recovery plans for all of the Federally-listed plants within the planning area.

Gentner's fritillary is a member of the lily family (*Liliaceae*) and has showy deep red to maroon flowers on a single erect flowering stem arising from an underground bulb. The bulbs produce small bulblets that are loosely attached to the parent individual. These asexually produced bulblets are the primary means of reproduction for the species (Amsberry and Meinke 2007). Many Gentner's fritillary plants do not flower or flower only in some years, thus making positive identification of newly discovered sites difficult. Gentner's fritillary occurs in scattered locations throughout the Rogue and Illinois River watersheds within the Medford District. Habitat is diverse, ranging from Oregon white oak woodlands, moist riparian areas, Douglas-fir forests, and serpentine areas. The Medford District has surveyed an average of 40,000 acres per year for the years 2008-2013. On average, the surveyors found one new Gentner's fritillary site for every 4,400 acres surveyed in suitable habitat. Most sites are very small – less than 12 individuals. However, a few sites contain several hundred flowering plants with many more bulbs producing only vegetative leaves. There are currently 162 sites on BLM-administered lands within the decision area. There are an additional 36 sites within the Cascade Siskiyou National Monument, which is outside of the decision area. Gentner's fritillary occurs within nine livestock grazing allotments. The Medford District has surveyed all suitable habitats within grazing allotments, and populations generally occur on steeper slopes outside of riparian areas where cattle use is light. Botanists monitor the effects of grazing on Gentner's fritillary and there is little evidence of direct grazing or trampling by cattle (M. Wineteer, BLM, personal communication, 2014). The Medford District has worked to augment sites by outplanting bulblets since 2002.

Western lily is a perennial in the lily family (*Liliaceae*) and occurs in a narrow strip along the immediate Pacific coast between Coos Bay, Oregon, and Eureka, California, in a variety of early-successional habitats: freshwater wetlands, coastal prairie and scrub, and the edges of Sitka spruce forest. The single BLM site occurs within the New River ACEC in the Coos Bay District. An experimental introduction of Western lily within the New River ACEC in 1996 has yet to flower as of 2014 (Guerrant 2006, as cited in USDI FWS 2009). Suitable habitat for additional introductions within the New River ACEC is limited (T. Rodenkirk, BLM Botanist, personal communication, 2014).

Cook's lomatium is a perennial forb in the carrot family (*Apiaceae*). The species occurs in the Medford District in the Agate Desert of Jackson County on the edge of vernal pools and in the Illinois Valley in seasonally wet grassy meadows, oak woodlands, and serpentine meadow and shrub habitats. The largest BLM populations are in and adjacent to the French Flat Area of Critical Environmental Concern. Rural development, illegal refuse dumping, and recreational use threaten Cook's lomatium habitat in the Illinois Valley. Illegal uses such as OHV trespass and refuse dumping occasionally damage sites on BLM, although the use of barricades and law enforcement efforts have successfully reduced effects in recent years (R. Showalter, BLM, personal communication, 2014). BLM does not authorize livestock grazing of any habitats containing Cook's lomatium, eliminating effects from livestock grazing.

Rough popcorn flower is an annual to perennial herb in the borage family (*Boraginaceae*) that occurs in seasonally wet meadows or Oregon ash-swale openings in northern Douglas County within the Roseburg District. There are no naturally occurring populations of rough popcorn flower on BLM-administered land. The Oregon Department of Agriculture, in cooperation with the BLM, planted three sites within the North Bank Habitat Management Area ACEC starting in 1998. One of these populations is thriving and has expanded to fill the potential habitat within the area. The second site is still extant; however, the number of plants has declined drastically over the years, likely due to a change in the site's hydrology. The BLM planted additional suitable habitat adjacent to the original planted location in 2006. The third population occurs in marginal habitat that is too dry for the species, and it is unlikely that the species still occurs there.

Kincaid's lupine is a long-lived herbaceous perennial species in the pea family (*Fabaceae*). It ranges from Lewis County, Washington, to Douglas County, Oregon. Botanists first described the species from the Willamette Valley, where most of the known and historic populations occur. The habitat for Kincaid's lupine in the Willamette Valley consists primarily of upland prairie remnants. Within the planning area, the primary habitat is open woodland and meadow edges, often near roadsides, associated with Pacific madrone, incense cedar, and Douglas-fir trees with a relatively open canopy cover. There are currently 10 Kincaid's lupine sites known to occur in the decision area. In addition, there are five sites on BLM-administered land within the West Eugene Wetlands, which is outside of the planning area. Within the decision area, there is designated critical habitat on BLM lands only within the West Eugene Wetlands. In 2006, the U.S. Fish and Wildlife Service designated critical habitat for Kincaid's lupine in the Willamette Valley and Washington State, but not in the southern portion of its range in Douglas County. In April 2006, the Roseburg District, U.S. Fish and Wildlife Service, and the Umpqua National Forest completed a programmatic conservation agreement for Kincaid's lupine in Douglas County (USDI BLM, USDI FWS, and USDA FS 2006). The three cooperating agencies completed the "Management Plan for Kincaid's Lupine in Douglas County, Oregon" in March 2008 (USDI BLM, USDI FWS, and USDA FS 2008). The management actions specified in the management plan tier to the management goals and objectives for recovery of Kincaid's lupine (USDI FWS 2010). The primary threats to Kincaid's lupine in the planning area are forest succession and resulting canopy shading, noxious weed invasions, and road maintenance. In addition, the populations in the planning area are generally small and isolated from each other. This isolation limits the likelihood of cross-pollination between populations, which could result in inbreeding depression.

Nelson's checker-mallow is a long-lived perennial in the mallow family (*Malvaceae*) that occurs in the Willamette Valley from Benton County, Oregon, and north into Cowlitz and Lewis Counties, Washington. In the Willamette Valley, Nelson's checker-mallow occurs in wet prairies, stream sides, and occasionally in Oregon ash woodlands or among woody shrubs. On BLM-administered land, the species occurs at one site in the Walker Flat ACEC on the Salem District. Most of the plants in this population occur on adjacent City of McMinnville property. Nelson's checker-mallow requires open habitats; succession and canopy closure is a threat to the species (USDI FWS 2012).

Siskiyou mariposa lily is another perennial in the lily family (*Liliaceae*). It is endemic to three disjunct ridge tops in the Klamath-Siskiyou Range on the California-Oregon border. The habitat for the species is rocky openings within a montane shrub plant community. The one BLM site consists of one to five plants within a 54-square-foot area (USDI BLM, USDI FWS, and USDA FS 2013).

The following six species occur or occurred historically within the planning area, but are unlikely to occur on BLM-administered lands: Applegate's milk-vetch, Willamette Valley daisy, large-flowered wooly meadow-foam, Bradshaw's desert parsley, golden paintbrush, and water howellia.

Applegate's milk-vetch in the pea family (*Fabaceae*) is a narrowly distributed endemic, known to occur only in southern Klamath County, Oregon. It occurs within interior alkali grassland with rabbitbrush and greasewood in areas with periodic flooding and drying. Very little of this habitat is present on BLM-administered land in the planning area, and the species is unlikely to occur on BLM-administered land within the Klamath Falls Field Office (R. Currin, USFWS, personal communication, 2014, and J. Blanchard, personal communication, 2014).

Willamette Valley daisy in the sunflower family (*Asteraceae*) occurs in both wet and dry prairie grasslands within the Willamette Valley where woody cover is nearly absent and where herbaceous vegetation is low in stature. Five sites occur on BLM-administered lands within the West Eugene Wetlands, which is outside of the decision area. The only designated critical habitat on BLM-administered lands within the planning area is also within the West Eugene Wetlands.

Large-flowered wooly meadowfoam in the meadowfoam family (*Limnanthaceae*) is associated exclusively with the margins around shallow vernal pools in the Agate Desert of the Rogue Valley in Jackson County, Oregon. There are 18 extant sites within the Agate Desert on private, State, and Federal land managed by the Bureau of Reclamation (USDI FWS 2012b). There is no designated critical habitat on BLM-administered lands.

Bradshaw's desert parsley in the carrot family (*Apiaceae*) is restricted to wet prairie habitats with heavy clay soils. The majority of the known sites occur between Salem and Creswell, Oregon; however, two sites are known in Clark County, Washington (USDI FWS 2010). Seven sites occur on BLM-administered land within the West Eugene Wetlands, which is outside of the decision area.

Golden paintbrush in the broomrape family (*Orobanchaceae*) historically occurred in the grasslands and prairies of the Willamette Valley, but agricultural, residential, and commercial development has extirpated all sites in Oregon. The species is currently known from 11 populations in Washington and British Columbia (USDI FWS 2010). Golden paintbrush was last seen growing wild in Oregon in 1938 in Linn County. Researchers began planting small numbers of golden paintbrush within the Finley and Basket Butte Wildlife Refuges in 2005 from seed collected in Washington to test restoration methods for the species (USDI FWS 2010).

Water howellia in the bellflower family (*Campanulaceae*) no longer exists in Oregon, but there are herbarium records showing that the species used to occur in at least four locations within the Willamette Valley and Columbia River floodplain. The species currently occurs in a few sites in Washington, Idaho, Montana, and California. The species appears to be restricted to small, vernal, freshwater wetlands, glacial pothole ponds, or former river oxbows that have an annual cycle of filling with water over the fall, winter, and early spring, followed by drying during the summer months (USDI FWS 1994).

Bureau Sensitive and Strategic Species

The BLM designed the Special Status Species program to conserve rare species and their habitats, promote their conservation, and reduce the likelihood and need for species to be listed under the Endangered Species Act. BLM Manual 6840 (Special Status Species Management; USDI BLM 2008) provides policy guidance and includes specific implementation actions such as surveying BLM-administered land for Special Status Species, monitoring Special Status Species populations and habitats, and developing conservation strategies to meet these program objectives. While the Special Status Species policy applies to all lands managed by the BLM: "The application of the Special Status Species policy to provide specific protection to species that are listed by the BLM as sensitive on lands governed by the O&C Act must be consistent with timber production as the dominant use of those lands" (USDI BLM 2008). The Special Status Species policy directs each BLM State Director to establish Special Status Species lists. In Oregon, the Sensitive and Strategic lists are tied to the Oregon Biodiversity Information Center (ORBIC) rankings. ORBIC is part of the Institute for Natural Resources that was created by the Oregon Legislature with the Oregon Sustainability Act of 2001 (ORS 184.421). The ranks that ORBIC produces are shared through a network of natural heritage programs and conservation centers, allowing information sharing among several countries in the western hemisphere. The BLM updates the Sensitive and Strategic Species lists approximately every two years.

In 2004, the BLM and Forest Service established an interagency program for the conservation and management of rare species in Oregon and Washington known as the Interagency Special Status/Sensitive Species Program (ISSSSP). The ISSSSP has funded a number of inventories, monitoring projects, and the development of species fact sheets and conservation assessments that aid in the management of Special Status Species. The Affected Environment section below summarizes results of these surveys.

Survey & Manage

The Northwest Forest Plan and the 1995 RMPs include the Survey & Manage measures, which require special management attention for little known species thought to be associated with late-successional or old-growth forests. Some species require pre-project surveys and have prescribed management actions if found.

The 2000 Final Supplemental EIS for Amendment to the Survey & Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines and the 2004 Final Supplemental EIS to Remove of Modify the Survey & Manage Mitigation Measure Standards and Guidelines discussed the origin and implementation of the Survey & Manage measures and the need for changes to the measures (USDA FS and USDI BLM 2000, pp. 3-10, 16-24; USDA FS and USDI BLM 2004, pp. 3-9, 15-21), and those discussions are incorporated here by reference.

Those two Supplemental EISs and the 2007 Final Supplement to the 2004 Supplemental EIS also described the Survey & Manage species and their habitat, distribution, and occurrence (USDA FS and USDI BLM 2000, pp. 213-319; USDA FS and USDI BLM 2004, pp. 141-183; USDA FS and USDI BLM 2007, pp. 181-244), and those descriptions are incorporated here by reference.

The 2012 Resource Management Plan Evaluation Report (USDI BLM 2012, pp. 12-13) summarized the history of proposed changes to the Survey & Manage measures and that summary is incorporated here by reference. The Wildlife section of this chapter contains additional information on the history of proposed changes to the Survey & Manage measures.

There are six categories of Survey & Manage species that are found in the planning area (**Table 3-115)**. The categories consider species relative rarity, their level of association with late-successional/old-growth forests, and if pre-disturbance surveys are practical **(Table 3-116)**. Strategic surveys are landscape-scale surveys designed to collect information about a species, including its presence and habitat, and are required for all Survey & Manage species. For Category A and C species, pre-disturbance surveys are required. The Survey & Manage measures specified that if strategic surveys were not completed for Category B species in fiscal year 2006 (fiscal year 2011 for fungi), then surveys equivalent to pre-disturbance surveys would be required prior to management disturbance in old-growth habitat. Twelve years of strategic surveys for fungi have increased the total known sites of Survey & Manage fungi from approximately 3,500 to 14,400 sites within the decision area. Over the course of the program, surveyors found enough sites of 39 fungi species that these fungi are no longer considered rare (Molina 2008). “Equivalent effort” surveys are required for two lichens, four bryophytes, and all Category B fungi species prior to disturbance in old-growth forest, defined by the Northwest Forest Plan as a forest stand, usually at least 180- to 220-years-old, with moderate-to-high canopy closure, a multi-layered, multi-species canopy dominated by large overstory trees, a high incidence of large trees, some with broken tops and other indications of old and decaying wood, numerous large snags, and heavy accumulations of wood, including large logs on the ground (USDA FS and USDI BLM 1994a). The Survey & Manage Category B Fungi Equivalent-Effort Survey Protocol generally requires two years of surveys with visits scheduled in the autumn and spring when sporocarps are more likely present (USDA and USDI 2011).

Table 3-115. Number of Survey & Manage species by taxonomic group and category found within the planning area (2003 list).

Taxa Group	Survey & Manage Categories						Totals
	A	C	B	D	E	F	
Bryophytes	2	-	8	-	3	-	13
Fungi	1	-	163	13	4	3	184
Lichens	10	2	6	-	20	2	40
Vascular Plants	7	3	-	-	-	-	10
Totals	**20**	**5**	**177**	**13**	**27**	**5**	**247**

Table 3-116. Survey & Manage categories and associated survey status by rarity.

Relative Rarity	Pre-Disturbance Surveys Practical	Pre-Disturbance Surveys Not Practical	Survey Status Undetermined
Rare	Category A	Category B	Category E
Uncommon	Category C	Category D	Category F

Oak Woodland

Oak woodlands represent a special habitat within the decision area. While oak species in Oregon are not special status, their habitat is rare and vulnerable to destruction from development, conversion to conifer forest, and high-intensity fire. Oregon white oak (*Quercus garryana*) occurs from Vancouver Island through western Washington, Oregon, and northwest California and in the Sierra Nevada foothills. California black oak ranges (*Quercus kelloggii*) from southern Oregon and throughout California and occurs within the Eugene, Medford, and Roseburg Districts, and the Klamath Falls Field Office. Both Oregon white oak and California black oak may occur within forested stands as component and are often examples of the legacy vegetative community. Oregon white oak is intolerant to shade and relies on the most recent two years of ring growth for water transport. Therefore, it is vulnerable to competition (Gould *et al.* 2011). Prior to European settlement, natural fire and frequent, low intensity burning by Native

Americans limited the extent of coniferous forests and sustained fire-tolerant oak savannah and woodlands (Devine and Harrington 2006, Gould *et al.* 2011, Klamath Bird Observatory and Lomakatsi Restoration Project 2014, Tveten and Fonda 1999). Lack of fire in oak communities has resulted in the invasion of conifers that rapidly overtop, shade, and crowd out the oaks. In addition, lack of frequent fire has often resulted in the accumulation of heavy fuels, making the reintroduction of fire difficult (Fire and Fuels). Releasing Oregon white oaks from overtopping Douglas-fir increases the available soil water content extending the growing season for the oaks and understory vegetation (Devine and Harrington 2007). Even oaks suppressed for many years respond favorably after release with increased stem diameter growth and the growth of epicormic branches (Devine and Harrington 2006). These changes are most significant during the first five years after release.

Issue 1

How would management activities (such as timber harvest, livestock grazing, and mineral development) affect Special Status plant and fungi species, current Survey & Manage species, and special habitats?

Summary of Analytical Methods

Rare plant and fungi species are not evenly distributed across the landscape. Many rare plant and fungi species are difficult to detect through surveys. Distribution data is incomplete for rare plant and fungi species within the decision area. Additionally, the BLM cannot accurately identify at this planning scale the location and timing of future management activities that might affect these species. These compounding uncertainties complicate the analysis of effects on rare plant and fungi species at this scale of planning.

The BLM used species occurrence data where it was available to evaluate the effects of management activities. Botanists have surveyed only a portion of BLM-administered lands within the decision area, generally as a pre-disturbance survey for an individual project (e.g., timber harvest). For vascular species, site data in the BLM regional database (GeoBOB) is likely to overstate the actual number of sites and individuals per population due to the historical age of the data and lack of revisits to the sites. Conversely, this database may under-represent sites of non-vascular and fungi species, because these organisms are difficult to count and map. Despite these limitations, the BLM used this incomplete survey data to describe the relative differences among the alternatives.

Because there is generally little existing information available about the habitat needs and distribution of most of the rare plants and fungi to assess effects at the site level, this analysis assumed that the BLM will survey for rare plants and fungi prior to habitat-disturbing activities except within the Harvest Land Base under Alternative D. As discussed in the background section, fungi are especially difficult to detect even with repeat visits. The BLM assumed that the surveys for rare fungi will be opportunistic in nature. Targeted, repeat surveys for fungi would only occur under the No Action alternative where equivalent-effort fungi surveys are required.

Under Alternative D within the Harvest Land Base, the BLM would rely on existing information and habitat evaluations to assess the site-specific effects of timber management activities on Bureau Sensitive species.

Timber Harvest and other Vegetation Management

In this analysis, the BLM evaluated the effect of timber harvest and fertilization on rare plants and fungi. Other vegetation management treatments have the potential to affect rare plants and fungi, but it is not possible to identify differences in effects among the alternatives at this scale of analysis with the data available.

Timber harvest methods (clearcuts, regeneration harvest with retention, uneven-aged management, and thinning) influence the magnitude of the effect of timber harvest on rare plants and fungi and the extent to which habitat and sites are within the Harvest Land Base. At this planning scale, it is not possible to identify accurately the location and timing of specific future timber harvests that would affect plant and fungi habitat. However, the BLM in this analysis evaluated the relative magnitude of effect of timber harvest on rare plants and fungi based on some broad analytical assumptions.

In this analysis, the BLM evaluated effects of timber harvest on rare plant and fungi habitat based on the relative difference in management activity levels among alternatives. The BLM evaluated the overall acreage of all timber harvest methods by alternative. The BLM assumed that clearcut harvest would have a greater magnitude of effect on rare plant and fungi habitat than other harvest methods, because it would not retain any structural legacies within the harvested area. Although there would be differences in intensity of harvest among the other harvest methods, it is not possible at this scale of analysis with the data available to distinguish the potential differences in effects on rare plant and fungi habitat among the harvest methods other than clearcuts.

The BLM assumed in this analysis that mature, multi-layered canopy and structurally-complex forest provides habitat for rare fungi. The BLM specifically evaluated effects on rare fungi based on the acreage of mature, multi-layered canopy and structurally-complex forest within the Harvest Land Base under each alternative.

The BLM evaluated how the Harvest Land Base overlaps with rare plant and fungi habitat and known sites under each alternative. The BLM assumed that timber activities would not affect Survey & Manage plant and fungi sites directly in the No Action alternative because of pre-disturbance surveys and site protection. The BLM assumed that sensitive plant and fungi sites would not be directly affected by timber activities under any alternative except Alternative D, because of pre-disturbance surveys for plant species and site protection for all sensitive species. Under Alternative D, some sites within the Harvest Land Base would be directly affected by timber harvest, because the BLM would protect known sites on O&C lands only where protection would not conflict with sustained-yield timber production. The BLM assumed that under Alternative D, there would be no additional pre-disturbance surveys for timber harvest. For the purposes of this analysis, the BLM assumed that sites within the Harvest Land Base of Survey & Manage species that are not Bureau Sensitive would eventually be lost because of timber harvest under the action alternatives. The BLM assumed that changes to their habitat from timber harvest under all alternatives could indirectly affect rare plant and fungi species, such as through the introduction or spread of invasive species.

The BLM evaluated the effect of timber harvest on oak woodlands based on the percent change in oak basal area in the Harvest Land Base and the entire decision area among the alternatives over 50 years.

In this analysis, the BLM assumed that fertilization would reduce habitat quality for rare plants and fungi. Although fertilization would promote growth of all vascular species, many rare plant species are adapted to low nitrogen soils and cannot utilize added nitrogen as readily as conifer species. Non-native species also benefit from added nitrogen, giving them a competitive advantage over many rare plant species. Nitrogen fertilization reduces ectomycorrhizal fungi species richness; the higher the rate of added nitrogen, the greater the decrease in ectomycorrhizal fungi (Berch *et al*. 2006, Ryden *et al*. 1997).

Site preparation and fuel reduction treatments, including prescribed burning and biomass treatments, would reduce slash from timber harvest and silviculture activities would remove hazard fuels in the

Wildland Urban Interface (Fire and Fuels and Forest Management). These treatments would affect plant and fungi species in the conifer and mixed evergreen forests, shrub communities, serpentine areas, and oak and hardwood woodlands habitat groups. Site preparation and fuel reduction treatments associated with timber harvest would primarily affect the conifer forest habitat group and oak and hardwood woodlands habitat groups. These treatments could adversely affect rare species by removing the substrate, host species, or modifying the microenvironment upon which the species depends. However, prescribed burning rarely would consume soil duff, large logs, or snags. An indirect effect of prescribed burning is the potential increase in non-native species due to soil disturbance, increased sunlight, and nitrogen availability. Site preparation and fuel reduction treatments may provide beneficial effects on some rare plants and fungi, such as by reducing competition and shade. Vascular plant species not in the conifer habitat group are generally shade-intolerant and respond to increased light and reduction in plant competition with increased growth, flowering, and fruiting (USDA USDI 2003, Giles-Johnson *et al.* 2010, USDI FWS 2006 and 2010). However, any such potential effects, either adverse or beneficial, are highly dependent on site-specific and project-specific factors that cannot be identified at this scale of analysis.

Livestock Grazing

In this analysis, the BLM assumed that livestock grazing would have both positive and negative effects on rare plants and the plant communities in which they occur.

On the positive side, some rare plant species benefit directly from periodic grazing through increased vigor and growth. In areas with a large component of non-native annual grasses, livestock grazing may reduce the biomass of these grasses, allowing native species, especially annual species, to persist (Rilla and Bush 2009). Grazing may also reduce fire fuels and help maintain grasslands that are at risk from shrub or tree invasion.

On the negative side, livestock may directly eat rare plants, reducing the plant's ability to recover and reproduce. Livestock also trample vegetation and may introduce and spread noxious and invasive weed species. Trampling impacts, however, are typically concentrated. In summer, the presence of water is much more important than in the winter, and cattle do not stray far from water. Heavy trampling disturbance occurs around holding pens, water sources, salt blocks, and trails between favored grazing areas; livestock may completely denude these areas. Away from these resources, effects from trampling are usually dispersed.

The BLM evaluated the effects of livestock grazing on rare plants by comparing the acreage open to grazing in each alternative. Additionally, the BLM considered the presence of Federally-listed threatened and endangered plant species in active allotments.

ACEC designation

The BLM designates ACECs where special management attention is required to maintain and protect relevant and important values. In this analysis, the BLM assumed that management for these relevant and important values would also be protective of rare plants and fungi. The BLM compared the acreage of ACECs to evaluate the protection for rare plants and fungi under each alternative. Although rare plant and fungi species are not evenly distributed across the landscape, the BLM assumed in this analysis that all acres designated as ACECs would provide equivalent protection for rare plants and fungi. At this scale of analysis, the BLM does not have sufficient information to identify specific effects of specific ACEC designations on rare plant and fungi species.

Road Construction

In this analysis, the BLM evaluated the effects of road construction on rare plants and fungi based on the miles of new road construction during the first decade under each alternative. The BLM assumed that new road construction would adversely affect rare plants and fungi because of direct disturbance and removal plants and fungi and from disturbance and removal of habitat. Road construction directly removes all vegetation in the construction zone, increases water runoff on the compacted or hardened surface resulting in increased soil erosion adjacent to the road, fragments habitat, creates a conduit for the introduction of noxious and non-native invasive plants, and increases the potential for off-highway vehicle use and camping. In this analysis, the BLM assumed that road construction would cause habitat disturbance and removal across a 45-foot width (see Soil Resources).

Off-highway Vehicle Use

In this analysis, the BLM assumed that areas allocated as open for off-highway vehicle (OHV) use would experience habitat removal and disturbance for rare plants and fungi. Where cross-country travel occurs, vehicles would crush vegetation, displace soils, and create trails that could potentially degrade occupied habitat and damage sites of rare plant and fungi species that may be scattered throughout the area. These conditions allow for the introduction and dispersal of noxious and non-native weed species.

In this analysis, the BLM assumed that OHV users would operate vehicles consistent with BLM decisions about OHV use. Although the BLM has some site-specific and anecdotal information about illegal OHV use, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal OHV use. In addition, much of the decision area has physical limitations to potential illegal OHV use, including dense vegetation, steep slopes, and locked gates. In most of the interior/south, the ability to track numerous different routes across the open spaces can lead to degradation and erosion in a greater proportion than most of the coastal/north. However, the BLM lacks a basis for characterizing current illegal OHV use or forecasting such potential illegal OHV use in the future under any of the alternatives at this scale of analysis.

Areas designated as *closed* would not experience habitat disturbance for rare plants and fungi, because the BLM would not permit OHV use. Areas designated as *limited* would not experience measurable additional habitat disturbance for rare plants and fungi, because the BLM would limit off-highway vehicle use to existing or designated roads and trails, which have already experienced disturbance through the original construction of the roads or trails. Until the BLM completes route designations through implementation level planning, the BLM cannot identify which routes any alternative would design. Therefore, the BLM cannot quantify more site-specific effects in this analysis, and implementation level decisions would address these effects.

Mineral Development

Within the decision area, the BLM's primary salable mineral material is quarry rock. The majority of this quarry rock is crushed aggregate used by the BLM, private companies, and local governments for road surfacing. Quarry activities could have a detrimental effect on a small amount of habitat associated with rare plants and fungi in the rocky areas/outcrops, scree, serpentine, and conifer groups. The BLM assumed in this analysis that the mileage of new road construction would be indicative of the amount of quarry activities, including the expansion of existing sites and the development of some number of new sites. In addition, the BLM also considered the effects of quarry activities on rare plants and fungi based on the acreage closed to salable mineral development under each alternative.

In this analysis, the BLM assumed that leasable mineral development would have no foreseeable effect on rare plants and fungi, because the BLM can impose site-specific stipulations, such as no surface occupancy, on each lease as needed to protect rare plant and fungi sites and habitat.

The BLM assumed that locatable mineral development would adversely affect rare plants and fungi because of habitat removal and disturbance. The BLM evaluated this habitat removal and disturbance based on the acres that the BLM would recommend for withdrawal from locatable mineral development by alternative. The BLM assumed in this analysis that areas recommended for withdrawal would protect rare plant and fungi sites and habitats from effects from locatable mineral development. Locatable mining operations occur primarily in areas occupied by species in the rocky areas/outcrops/scree, serpentine, conifer, and riparian and aquatic habitat groups. While the number of sites of rare plants and fungi that intersect with mining operations would be few, where they do occur the BLM assumed that these sites would be lost. The mining laws allow for consideration of Federally-listed or proposed species, but not for other BLM Special Status Species; therefore, some Special Status Species sites would likely be extirpated and occupied habitat would be destroyed as a result of equipment operations and ground disturbance.

Affected Environment

There are 213 known sites of Federally-listed plants on BLM-administered lands within the planning area (**Table 3-117**). Most occupied sites of the Federally-listed species are very small: approximately 74 percent of all sites occupy 1/10th of an acre or less or comprise less than 10 individuals. All but two of these species occur in habitats uncommon in the planning area: wetlands, meadows, oak woodlands, or rocky areas. The two remaining species—Gentner’s fritillary and Kincaid’s lupine—occur in mixed woodlands and hardwood/conifer habitat.

Table 3-117. Federally-listed plants within the BLM-administered lands in the planning area.

Common Name	Scientific Name	Known Sites	District/Field Office within Range of Species	Notes
Endangered				
Gentner's fritillary	*Fritillaria gentneri*	162	Klamath Falls, Medford	All BLM sites on Medford District with an additional 36 sites within Cascade Siskiyou National Monument; Potential habitat in Klamath Falls Field Office
Western lily	*Lillium occidentale*	1	Coos Bay	An additional introduced site is not yet established
Large-flowered wooly meadow-foam	*Limnanthes pumila* ssp. *grandiflora*	-	Medford	Potential habitat in Medford District
Bradshaw's desert parsley	*Lomatium bradshawii*	-	Eugene, Salem	No potential habitat on BLM within planning area. There are 7 sites within the West Eugene Wetlands.
Cook's lomatium	*Lomatium cookii*	35	Medford	Largest BLM populations in and adjacent to French Flat ACEC
Rough popcorn flower	*Plagiobothrys hirtus*	3	Roseburg	BLM populations are introduced within the North Bank Habitat Management Area
Threatened				
Golden paintbrush	*Castilleja levisecta*	-	Eugene, Salem	No potential habitat on BLM
Water howellia	*Howellia aquatilis*	-	Eugene, Salem	No potential habitat on BLM
Kincaid's lupine	*Lupinus oreganus*	10	Eugene, Roseburg	5 additional sites within West Eugene Wetlands
Nelson's checker-mallow	*Sidalcea nelsoniana*	1	Salem	Within the Walker Flat ACEC
Candidate				
Siskiyou mariposa lily	*Calochortus persistens*	1	Medford	Species mostly known from northern California
	Total	**213**		

There are 4,564 known sites of Bureau Sensitive and Strategic plant and fungi species on BLM-administered lands in the planning area (**Table 3-113**). Sites range in size from just one or a few individuals that occupy much less than 1/10th of an acre to thousands of individuals that comprise several acres. Nearly 90 percent of the known Sensitive and Strategic plant and fungi sites are less than one acre.

The BLM has conducted Survey & Manage fungi equivalent-effort surveys on 5,356 acres in the Medford District and 686 acres in the Klamath Falls Field Office from 2011 to 2013. These surveys found 619 sites during this period, an average of one new site for every 9.8 acres surveyed within potential habitat. The Salem District conducted equivalent-effort fungi surveys on two acres and did not find any fungi.

There are currently 862,408 acres of mature, multi-layered canopy or structurally-complex forest, which provides potential habitat for rare plants and fungi that are associated with late-successional and old growth habitat.

Oak woodland and savanna are limited within the planning area. Within the decision area, Oregon white oak woodland and savannah occur primarily in the Roseburg and Medford Districts and the Klamath Falls Field Office; however, oaks occur in all of the officeswithin the decision area.

Environmental Effects

Under all alternatives, the BLM would—

- Manage Federally-listed species consistent with recovery plans and designated critical habitat, including: the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to recover populations of species;
- Conduct surveys for Federally-listed and candidate plant and fungi species on BLM-administered land with suitable habitat;
- Maintain or restore natural processes, native species composition, and vegetation structure in natural communities outside of the Harvest Land Base through prescribed fire, thinning, removal of encroaching vegetation, retention of legacy components (e.g., large trees, snags, and down logs), and planting or seeding native species;
- Use only species native to the plant community when re-vegetating degraded or disturbed areas; and
- Retain or reconnect the hydrologic flows to wetlands.

The alternatives vary in the approach to pre-disturbance surveys for and management of known sites of Bureau Sensitive and Survey & Manage species. The BLM would conduct pre-disturbance surveys for Bureau Sensitive species under the No Action alternative and Alternatives A, B, and C and would conserve known sites so that BLM actions would not contribute to the need to list these species. Alternative D does not include any requirement for pre-disturbance surveys for Bureau Sensitive species, and the BLM would protect known Bureau Sensitive species sites in the Harvest Land Base on O&C lands only where protection would not conflict with sustained-yield timber production. The No Action alternative would also require pre-disturbance surveys for Survey & Manage species where appropriate and would manage known Survey & Manage sites through implementation of the Survey & Manage standards and guidelines. None of the action alternatives would require pre-disturbance surveys or site management for Survey & Manage species that are not included on the Bureau Sensitive species list.

Under Alternatives A and C, the BLM would take actions to contribute toward the recovery of Federally-listed and Special Status plants. This would involve active management to augment existing populations and create new populations within suitable habitat to meet recovery plan goals for Federally-listed species and to increase the overall resiliency of other Special Status Species to reduce the risk of extirpation.

Under Alternative B, the BLM would manage mixed hardwood and conifer communities outside of the Harvest Land Base to maintain and enhance oak persistence and structure. Since oak species may be a minor component of mixed hardwood and conifer communities, they are likely die off over time without management to prevent conifers from shading them out. Under Alternative B, the BLM would actively manage forest stands for the persistence of these species.

The two Federally-listed species that occur within forest and woodland habitat, Kincaid's lupine and Gentner's fritillary, have known sites within the Harvest Land Base under the alternatives. More sites of these species occur within the Harvest Land Base under all of the action alternatives than under the No Action alternative. However, the BLM would conduct pre-disturbance survey and apply the same conservation measures for these Federally-listed species under all alternatives, regardless of land use allocation. Therefore, the species-specific protections for these species would avoid adverse effects from timber harvest similarly under all alternatives.

In the No Action alternative and Alternatives A, B, and C, timber harvest would not directly affect sites of Bureau Sensitive plants, including lichens and bryophytes, and their occupied habitat within the Harvest Land Base, because the BLM would conduct pre-disturbance surveys and apply conservation measures. These conservation measures would be sufficient to protect sites based on past implementation of these measures. The currently known Special Status and Strategic plant and fungi sites that would occur within the Harvest Land Base under each alternative are listed in **Table 3-118**. Since fungi are difficult to detect even with multiple visits and the BLM cannot delineate their occupied habitat, it is possible that timber activities could affect some Bureau Sensitive fungi sites under all alternatives. However, there is no basis for predicting a difference in effects between the No Action alternative and Alternatives A, B, and C. Under Alternative D, Bureau Sensitive plant and fungi known sites would receive protection within the Harvest Land Base on O&C lands only when protection measures do not conflict with sustained-yield timber production. Also, since there is no provision for pre-disturbance surveys within the Harvest Land Base under Alternative D, potential habitat would be disturbed and previously unknown sites would be affected and potentially lost, contributing to the loss of genetic diversity. However, the majority of the decision area is allocated to reserves under Alternative D, which would limit this potential effect to the population as a whole.

Table 3-118. Special Status and Strategic plant and fungi sites within the Harvest Land Base.

Alternative	Taxa Group	Federal Endangered	Federal Threatened	Sensitive	Strategic	Totals
No Action	Bryophytes	-	-	10	22	32
	Lichens	-	-	110	300	410
	Vascular	15	1	1,287	9	1,312
	Fungi	-	-	99	219	318
	Totals No Action	**15**	**1**	**1,506**	**550**	**2,072**
Alt. A	Bryophytes	-	-	8	6	14
	Lichens	-	-	95	80	175
	Vascular	25	7	490	6	528
	Fungi	-	-	92	44	136
	Totals Alt. A	**25**	**7**	**687**	**136**	**853**
Alt. B	Bryophytes	-	-	4	16	20
	Lichens	-	-	75	184	259
	Vascular	54	7	904	6	971
	Fungi	-	-	112	166	278
	Totals Alt. B	**54**	**7**	**1,095**	**372**	**1,528**
Alt. C	Bryophytes	-	-	8	20	28
	Lichens	-	-	115	201	316
	Vascular	57	8	893	8	966
	Fungi	-	-	117	172	289
	Totals Alt. C	**57**	**8**	**1,133**	**401**	**1,599**
Alt. D	Bryophytes	-	-	10	25	35
	Lichens	-	-	122	224	346
	Vascular	46	8	1,066	7	1,127
	Fungi	-	-	101	102	203
	Totals Alt. D	**46**	**8**	**1,299**	**358**	**1,711**

There are 2,719 currently known Sensitive, Strategic, and Survey & Manage fungi sites within the decision area. Under all alternatives, the majority of known sites of rare fungi would be within Reserve land use allocations. **Table 3-119** shows the number of known fungi sites within the Harvest Land Base under each alternative

Table 3-119. Number of Special Status and Survey & Manage fungi sites within Harvest Land Base by alternative.

Alternative	Sensitive (# of Sites)	Strategic (# of Sites)	Current Survey & Manage Species (# of Sites) (Percent of Known Sites in Decision Area)*	All Species (# of Sites) (Percent of Known Sites in Decision Area)
No Action	99	219	1,045 (38%)	1,363 (50%)
Alt. A	92	44	482 (18%)	618 (23%)
Alt. B	112	166	721 (27%)	999 (37%)
Alt. C	117	172	900 (33%)	1,189 (44%)
Alt. D	101	102	765 (28%)	968 (36%)

* Sites of Survey & Manage species that are not also Sensitive or Strategic

Under the No Action alternative, the BLM would continue to implement Survey & Manage measures to conduct pre-disturbance surveys and protect known sites for the Survey & Manage species. Most Survey & Manage plant and fungi species would have sufficient habitat to maintain stable populations under the No Action alternative (USDA FS and USDI BLM 2000). In addition, mature and structurally-complex forest habitats for Survey & Manage plant and fungi species would increase under the No Action alternative in the decision area.

Under all action alternatives, species that are currently Survey & Manage and not included on the Bureau Sensitive species list would receive no specific protections under the action alternatives. The number of unprotected sites would vary by alternative: Alternative A would have the fewest sites within the Harvest Land Base, and Alternative C would have the largest (**Table 3-120**). Unless these sites co-occur with Sensitive species, timber harvest would affect these sites.

Table 3-120. Current Survey & Manage species sites within the Harvest Land Base.

Alternative	Taxa Group	Current Survey & Manage Species that are not also Sensitive or Strategic (# of Sites)
No Action	Bryophytes	379
	Lichens	428
	Vascular Plants	278
	Fungi	1,045
	No Action Totals	**2,130**
Alt. A	Bryophytes	97
	Lichens	172
	Vascular Plants	58
	Fungi	482
	Alt. A Totals	**809**
Alt. B	Bryophytes	205
	Lichens	341
	Vascular Plants	222
	Fungi	721
	Alt. B Totals	**1,489**
Alt. C	Bryophytes	221
	Lichens	435
	Vascular Plants	193
	Fungi	900
	Alt. C Totals	**1,749**
Alt. D	Bryophytes	235
	Lichens	378
	Vascular Plants	202
	Fungi	765
	Alt. D Totals	**1,580**

There is incomplete and unavailable information relevant to the effects of the action alternatives on Survey & Manage species. With complete and species-specific survey information on the location of habitat and species sites for all Survey &Manage species, the BLM would be able to analyze the effects of all alternatives on Survey & Manage species and compare the effects under each action alternative to the No Action alternative, which would continue to implement the Survey & Manage measure. However, the BLM lacks complete and species-specific survey information for most Survey &Manage species (USDA FS and USDI BLM 2004, pp. 108-109). It would be exorbitantly expensive and time-consuming to conduct random surveys across the decision area for all Survey & Manage species. Consistent with Council on Environmental NEPA regulations at 43 CFR 1502.22, this analysis summarizes the information that is currently available on the effects of the alternatives on Survey & Manage species. The 2004 Final SEIS to Remove or Modify the Survey & Manage Mitigation Measure Standards and Guidelines (USDA FS and USDI BLM 2004, pp. 141-183) and the 2007 Final Supplement to the 2004 SEIS (USDA FS and USDI BLM 2007, pp. 162-244) analyzed the removal of Survey & Manage measures for known site management and pre-disturbance surveys, and that analysis is incorporated here by reference. However, the U.S. District Court in *Conservation Northwest et al. v. Rey et al.*(Case No. C08-1067- JCC) found that the analysis of effects to species in the 2004 Final SEIS and the 2007 Final EIS was insufficient to support the conclusion that the Survey & Manage measure was no longer necessary to meet the goals of the Northwest Forest Plan. Nevertheless, the information in the 2004 SEIS and 2007 SEIS does present analysis based on the incomplete survey information available that concludes that most Survey & Manage species would have sufficient habitat to support stable populations under the No Action alternative without the Survey & Manage measure.

Even in the absence of the Survey & Manage measure, habitat and sites of species that fall within the reserve system would receive protection. Compared to the No Action alternative, all action alternatives allocate more acres to the Late-Successional Reserve, which the Northwest Forest Plan expected to meet the needs of late-successional and old-growth related species (USDA Forest Service and USDI BLM 2000, pp. 201-202). To the extent that the No Action alternative without the Survey & Manage measure would provide sufficient habitat for Survey & Manage species, as analyzed in the 2004 SEIS, the action alternatives would provide additional habitat within the Late-Successional Reserve.

The Survey & Manage species are species associated with "late-successional and old-growth forests" (USDA FS and USDI BLM 2000, p. 8). To the extent that older and more structurally-complex multi-layered conifer forests as defined in the action alternatives encompass the "late-successional and old-growth forests" that provide habitat for Survey & Manage species, all action alternatives reserve such forests from timber harvest within the Late-Successional Reserve. Under all action alternatives, there would be no timber harvest of older and more structurally-complex multi-layered conifer forests, although each alternative uses a different definition to identify older and more structurally-complex multi-layered conifer forests. Therefore, all of the action alternatives, in contrast to the No Action alternative, would protect from timber harvest the forest conditions with which the Survey &Manage species are associated.

In addition to reserving existing older and more structurally-complex multi-layered conifer forests, the acreage of mature and structurally-complex forest (which is a broader category than older and more structurally-complex multi-layered conifer forests) in the decision area would increase under all alternatives. Therefore, the amount of habitat for Survey & Manage plant and fungi species would increase under all alternatives.

In summary, all action alternatives would remove the Survey & Manage measure that requires pre-disturbance surveys and protection of known sites. There is incomplete and unavailable information relevant to the effects of the action alternatives on Survey & Manage species. The 2004 Final SEIS provides an incomplete analysis, but supports the conclusion that most Survey & Manage species would have sufficient habitat to support stable populations under the No Action alternative without the Survey & Manage measure. All action alternatives allocate more acres to the Late-Successional Reserve than the No Action alternative, protect older and more structurally-complex multi-layered conifer forests, and would result in an increase in mature and structurally-complex forest. As a result, and in light of the incomplete information available to the BLM, all action alternatives would protect most existing habitat for Survey & Manage species and would result in an increase in the amount of habitat for Survey & Manage species.

A sub-group of more than 25 lichen, bryophyte, and fungi species (including Special Status Species and current Survey & Manage species that are not Special Status Species) is associated with habitat conditions and forest biological legacy (green trees, coarse wood, and snags) of mature and structurally-complex forests. Important habitat components include coarse wood, snags, and specific host species. The risk to these species would increase as the level of timber harvest activities would increase, biological legacies would be lost during harvest, and timber harvest would reduce interior habitat conditions in the Harvest Land Base over time.

The overall acreage of timber harvest during the first decade would be greatest under Alternative C, with 176,696 acres of total timber harvest, and only slightly lower under Alternative B, with 162,764 acres of timber harvest (**Table 3-121**). Alternative D and the No Action alternative would have substantially lower acreage of total timber harvest, with 139,151 acres and 111,260 acres, respectively. Alternative A would have the lowest acreage of total timber harvest, with 91,782 acres in the first decade. Included in that total for Alternative A is 13,425 acres of restoration thinning without timber extraction, which would be much less likely to have adverse effects on rare plant and fungi habitat than other timber harvest methods, although it is not possible to quantify that difference in this analysis.

Table 3-121. Total acres of timber harvest in the first decade (2013-2023) by alternative.

Harvest Type	No Action (Acres)	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Clearcuts	-	47,644	-	93,935	-
Salvage	3,493	1,086	2,954	4,160	1,973
Selection	-	26,179	67,516	44,464	104,569
Thinning	107,767	3,448	54,362	34,137	7,030
Thinning without Timber Extraction	-	13,425	-	-	-
Two-Age	-	-	37,932	-	25,579
Total Timber Harvest	**107,767**	**91,782**	**37,932**	**176,696**	**25,579**

Under Alternatives A and C, forest management would include clearcuts (i.e., regeneration harvest with no retention) in the High Intensity Timber Area, which comprises 12 percent and 22 percent, respectively, of the decision area. Within the first decade, almost twice as many acres would be clearcut in Alternative C than in Alternative A, 93,935 acres and 47,644 acres, respectively (**Table 3-121**). Early-successional Special Status Species (e.g., wayside aster and tall bugbane) would benefit from the disturbance if they occur within colonization distance of the clearcut. However, the BLM would reforest these clearcuts after harvest, typically within five years of harvest, limiting the duration of any habitat benefit to early-successional species on each harvest unit.

The impacts from salvage harvest would generally the same as harvest of live trees; however, since the BLM would likely not be able to conduct pre-disturbance surveys for salvage harvest following disturbances such as wildfire, undiscovered sites would likely be lost, making the effects of salvage similar among all alternatives. Salvage harvest could remove or damage live trees that are a refuge for rare plant and fungi species. Salvage harvest would primarily affect plant and fungi species in conifer and mixed evergreen forests, riparian and aquatic, serpentine areas, and oak and hardwood habitats. In all alternatives, salvage would take place in the Harvest Land Base after a high or moderate severity fire event. In all alternatives except for Alternative C, salvage would not take place in the Late-Successional Reserve, except for resource protection and safety objectives. Only in Alternative C would timber salvage occur in the Late-Successional Reserves for economic objectives. While it is not possible to predict the locations and amount of salvage harvest that would occur over the next 10 years, the BLM forecasts that salvage harvest would occur on a relatively small acreage under all alternatives, approximately 1 to 2 percent of the total acres of timber harvest.

The No Action alternative and Alternative C would reduce habitat quality for rare plants and fungi because of fertilization. The No Action alternative would include almost twice the acreage of fertilization as Alternative C. The No Action alternative would reduce habitat quality for rare plants and fungi on 12,052 acres in the first decade, and Alternative C would reduce habitat quality on 6,854 acres. Most of the fertilization acres would occur within very young stands that are within early-successional or stand establishment structural stages. However, the No Action alternative would include a small acreage of fertilization within mature and structurally-complex forests in the first decade, increasing the likelihood of reducing habitat quality for rare plants and fungi associated with mature and structurally-complex forest. Alternatives A, B, and D would not include any fertilization and thus would not reduce habitat quality for rare plants and fungi because of fertilization.

Under all alternatives, a majority of the BLM-administered lands would be allocated to reserves, where mature and structurally-complex forest habitat would be retained and additional habitat would develop. All action alternatives allocate more acres to Late-Successional Reserve than the No Action alternative, which would benefit rare plants and fungi associated with mature and structurally-complex forest. The acreage of structurally-complex forest would increase under all alternatives, as would the acreage of stands older than 120 years. Within the Harvest Land Base, the abundance of structurally-complex forest would increase substantially under the No Action alternative and Alternatives B and D, with the largest proportional increase in Alternative D. Additionally, a substantial amount of forest stands with biological legacies would remain on BLM-administered lands in the Harvest Land Base, except for the High Intensity Timber Areas under Alternatives A and C. The abundance of structurally-complex forest would not increase within the Harvest Land Base under Alternatives A and C.

The acreage of potential fungi habitat (i.e., mature, multi-layered canopy and structurally-complex stands) within the Harvest Land Base would vary by alternative (**Table 3-122**). Alternative A would have the fewest potential fungi habitat acres within the Harvest Land Base because most of this habitat would be allocated to reserves. The No Action alternative would have the greatest acreage of potential fungi habitat within the Harvest Land Base; however, most of this habitat would be subject to the Survey & Manage equivalent-effort survey requirement, and the BLM would protect new sites. All of the Sensitive and Strategic fungi sites within the Harvest Land Base are also current Survey & Manage species. Of the action alternatives, Alternative C would have the largest number of potential fungi habitat acres within the Harvest Land Base, followed by Alternatives B and D. The BLM would conduct pre-disturbance surveys under Alternatives A, B, and C for Special Status Species, and the BLM would provide conservation measures for new sites found. The BLM would not survey under Alternative D, and undetected sites would be affected by timber harvest.

Table 3-122. Special Status fungi potential habitat within the Harvest Land Base by alternative.

Alternative	Fungi Habitat Acres within the Harvest Land Base
No Action	207,586
Alt. A	48,601
Alt. B	133,763
Alt. C	172,015
Alt. D	125,001

Although vegetative communities where oak species currently predominate are generally outside of the Harvest Land Base in all alternatives, oak species do occur within the Harvest Land Base. Oaks represent an immeasurable small percentage of the basal area of the forests in the Harvest Land Base in the moist forests of Salem and Eugene. However, oaks represent more than 60 percent of the basal area of some individual dry forest stands in the Klamath Falls Field Office and the Medford and Roseburg Districts. In general, all alternatives would result in a decrease of oak basal area of 1 percent or less across the decision area over 50 years. Canopy cover of all hardwoods (e.g., oaks, madrone, maple, and chinquapin) across all alternatives would decrease by 3 to 4 percent in 50 years. It is likely that the vegetation modeling overestimates any a decline in hardwood abundance in general and oaks in specific, because the tree growth model is designed primarily for fast-growing conifer species such as Douglas-fir, and the model did not account for all management directions that would help to maintain oaks within stands.

In general, oaks would eventually decline in abundance within the Late-Successional Reserve and the Riparian Reserve as stands would continue to grow, and conifers would overtop and shade out oaks. Within the Harvest Land Base, the different harvest methods would have varying effects on oak species. Alternatives A and C would both include clear cuts with no retention, and all oaks present within the stand would be removed. Forest stands with an oak component require natural or management disturbance to prevent oaks from dying out of the stand. Intermediate harvest methods, such as regeneration harvest with retention and uneven-aged management would provide more opportunities for maintaining oaks within stands.

The management direction for the alternatives would mitigate effects of timber harvest on oaks. Management direction common to all alternatives designed to meet objectives for fire and fuels would maintain and promote oaks on lands outside of the Harvest Land Base. Within the Harvest Land Base, the BLM would favor patches dominated by hardwood trees and areas containing unique habitats or high diversity for retention, except in the High Intensity Timber Area under Alternatives A and C. In the dry Late-Successional Reserve under all action alternatives, the BLM would apply vegetation management to increase species diversity and allow for hardwood persistence.

Livestock Grazing

Under the No Action alternative, livestock grazing would be available on 495,190 acres in the Coos Bay District, the Klamath Falls Field Office, and the Medford Districts. However, 140,380 acres of this total are currently vacant, and these areas have not been subject to grazing for several years. The vacant allotments would remain available for grazing under the No Action alternative, and grazing could occur in these areas in the future.

Alternatives A, B, and C would close the vacant allotments to grazing, but keep all active allotments open to grazing. Since livestock do not currently graze these areas, there would be no immediate difference in effects from the No Action alternative. However, closing the vacant allotments would preclude potential future grazing impacts to Special Status plants and fungi.

Under all alternatives other than Alternative D, grazing would continue in active grazing allotments. There are 571 Special Status plant and fungi species sites that occur within active grazing allotments; 98 percent are vascular plants and include Gentner’s fritillary. Currently, 62 sites of Gentner’s fritillary, ranging in size from 1 plant to approximately 30 plants, occur in 8 active allotments. Another 55 Gentner’s fritillary sites occur within 8 vacant allotments. Despite the presence of this species within active allotments in the No Action alternative and Alternatives A, B, and C, there would be no direct negative impacts to this species from grazing under those alternatives: there has been no evidence that cattle eat Gentner’s fritillary or cause measurable trampling impacts (M. Wineteer, BLM, personal communication, 2014). Cattle tend to concentrate in areas with water, while Gentner’s fritillary generally occurs on steeper slopes outside of riparian areas.

Alternative D would close all current active and vacant allotments. Elimination of livestock grazing under Alternative D would have both positive and negative effects for the known special status plant and fungi species that occur within active grazing allotments. Elimination of grazing would reduce direct consumption of these species and trampling. However, elimination of grazing would also result in increased competition and accumulation of fuels, increasing the risk of wildfire. The specific effects of the elimination of grazing under Alternative D on each of the special status plant and fungi species would depend on species-specific and site-specific factors. For example, almost 99 percent of the currently active allotments with Gentner’s fritillary locations are in the Improve management category, meaning that the current resource condition does not meet Rangeland Standards and Guidelines. While cattle do not directly affect Gentner’s fritillary, removing cattle may improve adjacent habitat for the species and allow for expansion.

ACEC Designation

Under the No Action alternative, the BLM would maintain the designation of 50,073 acres of ACECs. In addition, under the No Action alternative, the BLM would continue to provide interim management to protect relevant and important values on 54,310 acres of potential ACECs. As a result, the No Action alternative would effectively manage 104,383 acres to maintain relevant and important values and thereby protect rare plant and fungi species. There are approximately 650 known sites of special status plants and fungi within these areas, and 284 sites of current survey and manage species, in addition to representative examples of many types of diverse vegetation. Alternatives A and D would designate more acres of ACECs than other alternatives: 105,990 and 105,784 acres, respectively. Alternatives B and C would designate fewer acres: 99,427 and 98,104 acres, respectively (see the ACEC section in this chapter for more detailed information on ACEC designation).

As a result, Alternatives A and D would have similar effects and provide the most benefit to rare plant and fungi species through ACEC designation. Even though the No Action alternative would designate the fewest acres of ACECs, it would provide only slightly less benefit to rare plant and fungi species because of the protection provided by interim management of potential ACECs. Alternatives B and C would have similar effects and provide the least benefit to rare plant and fungi species through ACEC designation.

Road Construction

The No Action alternative would result in the greatest mileage of new road construction in the first decade (**Table 3-123**). This mileage of new road construction would result in the removal or disturbance of 5,167 acres of habitat. Alternative D would result in the least mileage of new road construction in the first decade and 1,288 acres of habitat removed or disturbed. Although it is not possible at this scale of analysis with the data available to determine whether these acres represent potential or occupied habitat for rare plants and fungi, the acreage affected by road construction provides a relative evaluation of the effects of road construction on rare plants and fungi.

Table 3-123. Road construction miles for the first 10 years of implementation.

Alternative	Total New Road Construction (Miles)	Habitat Removed or Disturbed (Acres)
No Action	947.3	5,167
Alt. A	310.2	1,692
Alt. B	687.2	3,748
Alt. C	800.6	4,367
Alt. D	254.5	1,388

Off-highway Vehicle Use

Under the No Action alternative, approximately 85,000 acres (3.3 percent) of the decision area would remain *closed* to OHV use, and approximately 330,400 acres (12.8 percent) would remain *open* to OHV use. On the remaining 83.9 percent, OHV use would continue to be *limited to existing or designated roads and trails*. On some portion of the 330,400 acres *open* to OHV use, habitat removal and disturbance has been occurring and will continue to occur in the future. It is not possible for the BLM to determine at this scale of analysis with the data available how much of the 330,400 acres *open* to OHV use is actually experiencing habitat removal or disturbance or will in the future. However, within areas *open* to OHV use, such effects could occur throughout the open area without future analysis or decision-making by the BLM.

Under all action alternatives, no areas would be open to OHV use. The BLM would designate the entirety of the decision area as either *closed* to OHV use or *limited to existing roads and trails*. As such, there would be no additional habitat removal or disturbance from OHV use measurable at this scale of analysis with the data available under any of the action alternatives.

Mineral Development

The No Action alternative would maintain the closure of the largest acreage to salable mineral development, at 319,430 acres closed. The action alternatives would close from 226,367 acres under Alternative A to 246,584 acres under Alternative C. Although there is no basis for evaluating whether closed areas would have been developed if not closed and whether such areas would have included rare plants and fungi, these acreages provide an approximate evaluation of the level of protection for rare plants from the effects of salable mineral development under the alternatives.

Under the No Action alternative, 98,400 acres would continue to be withdrawn from locatable mineral entry. All of the action alternatives would recommend for withdrawal more than double the acreage of the existing withdrawals, totaling from 266,473 acres under Alternative B to 307,308 acres under Alternative D. As described in the Minerals section in this chapter, much of this acreage would have low prospective mineral occurrence or development. Although there is no basis for evaluating whether these areas recommended for withdrawal would have been developed if not withdrawn and whether such areas would have included rare plants and fungi, these acreages provide an approximate evaluation of the level of protection for rare plants from the effects of locatable mineral development under the alternatives.

There are currently approximately 1,045 mining claims of active record in the decision area, the majority of which occur within the Medford District, which has a disproportionate percentage of rare plant and fungi sites. Mining claims, notices, and plans currently exist on areas where there are known rare plant sites such as French Flat (Medford District) and Hunter Creek Bog (Coos Bay District), which are also Areas of Critical Environmental Concern.

Issues considered but not analyzed in detail

How would recreation management affect special status plant and fungi species, current Survey & Manage species, and special habitats?

The BLM assumed that human use concentrated at recreation sites, such as campgrounds and trails, would adversely affect rare plants and fungi as a result of trampling, collection of firewood, introduction and spread of noxious and non-native species, and soil disturbance. Recreation sites would not differ among the alternatives. Changes to recreation sites in the decision area under any of the alternatives, such are development of new sites or elimination of existing sites, would be speculative. As such, there is no basis for describing a difference in effect on rare plant and fungi species from recreation sites among the alternatives.

While recreation use outside of recreation sites could potentially affect rare plants and fungi, such recreation use would be less concentrated than at recreation sites, and effects would be speculative. It is not possible at this scale of analysis with the data available to describe any foreseeable effects on rare plants and fungi of the recreation allocations at the RMP level, such as Special Recreation Management Areas and Extensive Recreation Management Areas.

How would invasive plant introduction and spread affect special status plant and fungi species, current Survey & Manage species, and special habitats?

Invasive plants alter the existing native plant community and reduce rare vascular plant growth and vigor, flowering and fruiting. There is very little information about the adverse effects of invasive plant species to fungi, terrestrial lichens, and bryophytes. Invasive species effects to rare plant and fungi sites would vary depending on many factors, but primarily the invasive species and its biology, site characteristics, and the affected rare plant species and its biology. There is not a reliable way to predict actual location of invasive species introductions relative to sites of rare species because of activities. Actions to control invasive plant species that eradicate or reduce competition would benefit rare plant sites. Generally, larger rare plant and fungi sites would be more resilient to invasive species invasion and persist longer than small sites that are less robust. The Invasive Species section of this chapter analyzed the risk of invasive plant introduction and spread associated with management actions under each alternative. It is not possible to describe that risk of invasive plant introduction and spread in terms of effects on rare plant and fungi species given the incomplete information on rare plant and fungi distribution, the uncertainty associated with forecasting future invasive plant introduction and spread, and the highly species-specific and site-specific interactions between rare plants and fungi and invasive plants.

How would wildfire response affect special status plant and fungi species, current Survey & Manage species, and special habitats?

Wildfire response activities, such as bulldozing for fire line access and construction, safety zone construction, and staging centers, can cause direct effects to rare plant and fungi sites and habitat disturbance. Wildfire response efforts that prevent or reduce habitat loss from uncharacteristic wildfire can preserve rare plant and fungi sites that would otherwise be lost. However, the full range of wildfire response tactics would be available under all alternatives, and maintenance of fire suppression-related infrastructure would not change among alternatives (the Fire and Fuels section contains more information). Because these factors would not differ among the alternatives, there is no reasonable basis on which to identify a difference among the alternatives in the effects of wildfire response on rare plants and fungi.

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