DRAFT

WESTERN OREGON STATE FOREST HABITAT CONSERVATION PLAN

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Message to the Reader

This draft Habitat Conservation Plan (HCP) was developed by the Oregon Department of Forestry (ODF) under the direction of the Board of Forestry and in collaboration with the Western Oregon State Forest HCP Scoping Team and Steering Committee, which includes representatives of state and federal resource agencies. This draft represents work completed between December 2018 and September 2020. This HCP is being presented as a draft because, while the analysis and strategies have been thoroughly developed by ODF and their technical consultants, and revised based on comments and recommendations by the Scoping Team, it is understood that some refinements will be needed in order to complete a public draft HCP. The refinements will occur in late 2020 and early 2021 in preparation for the HCP to be assessed under the National Environmental Policy Act, should the Board of Forestry vote to advance the process during the October 2020 meeting. The refinements are not expected to result in substantial changes to the analyses or strategies presented herein and therefore are not anticipated to result in substantial changes to economic, conservation, or social outcomes as presented to the Board of Forestry on October 6, 2020. The refinements will be focused on adding specificity to analyses and strategies that are already described in the HCP and making clear how the HCP will be implemented if approved. ODF is not requesting public comments at this time. The public will have an opportunity to formally review and comment on a public draft HCP and Environmental Impact Statement that is expected to be published in late 2022 or early 2023.

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Contents

Tables

Figures

Acronyms and Abbreviations

AIP	Aquatic Inventories Project
AOP	Annual Operation Planning
BLM	Bureau of Land Management
BMPs	best management practices
BO	biological opinion
BOF	Board of Forestry
BOFL	Board of Forestry Lands
CCAA	Candidate Conservation Agreement with Assurances
CFR	Code of Federal Regulations
cfs	cubic feet per second
CSFL	Common School Forest Lands
DBH	diameter at breast height
DDI	Diameter Diversity Index
DEQ	Department of Environmental Quality
DPS	Distinct Population Segment
DSL	Department of State Lands
EPA	U.S. Environmental Protection Agency
ERZ	Equipment Restriction Zone
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FIA	Forest Inventory and Analysis
FMP	Forest Management Plan
FPA	Forest Practices Act
FTE	full-time employee
FY	fiscal year
GBIF	Global Biodiversity Information Facility
GIS	geographic information system
HCAs	habitat conservation areas
HCP	Habitat Conservation Plan
HCP Handbook	Habitat Conservation Planning and Incidental Take Permit Processing Handbook
HE	high energy
HUC	hydrologic unit code
ITPs	incidental take permits
LSRs	Late Successional Reserves
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NWFP	Northwest Forest Plan
NWI	National Wetland Inventory
OAR	Oregon Administrative Rules

ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OHVs	off-highway vehicles
OPE	Other Payroll Expense
ORS	Oregon Revised Statute
PCT	precommercial thinning
PDFT	are potential debris flow tracks
RCAs	riparian conservation areas
SDI	Stand Density Index
SE	standard error
SHA	Safe Harbor Agreements
TPA	trees per acre
TPZ	Temperature Protection Zone
U.S.C.	United States Code
UAS	Unmanned Aircraft Systems
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

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Chapter 1
Introduction

1.1 Overview

The Oregon Department of Forestry (ODF) has prepared this multi-species Western Oregon State Forest Habitat Conservation Plan (HCP) to support the issuance of incidental take permits (ITPs) under the federal Endangered Species Act (ESA) for Western Oregon State Forests that are managed by ODF. The HCP is a long-term plan that will support the conservation of threatened and endangered species, or those species that are likely to become listed as such, while allowing management of the forest, including ongoing timber harvest activities.

Section 9 of the ESA prohibits the taking of species listed as threatened or endangered, with *taking* defined as, "to harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S. Code [USC] 1532). *Harm* is further defined as including "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 Code of Federal Regulations [CFR] 17.3). ODF cannot conduct their otherwise lawful activities of forest management, road system management, and construction and maintenance of recreation facilities in state forests without removing or altering habitat for listed, proposed, or candidate species. To the extent this alteration injures or kills one of more of these species or results in "habitat modification or degradation that significantly impairs essential behavioral patterns," it may be considered take under Section 9 of the ESA.

In accordance with Section 10 of the ESA, ODF has applied to the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries (collectively referred to as the Services) for ITPs that will allow specified levels of take of listed species. When implemented, this HCP will ensure that ODF avoids, minimizes, and, when necessary, mitigates take of listed species to the maximum extent practicable while conducting their otherwise lawful activities.

1.1.1 HCP Mission and Vision

ODF's mission statement for this HCP is as follows:

> To provide protection and conservation for selected listed species and species likely to become listed under the federal or state Endangered Species Acts during the permit term, while providing for long-term, multi-benefit management of the State's public forestlands subject to the Western Oregon State Forest Management Plan. The HCP will support the range of economic, social, and environmental benefits that ODF is statutorily required to provide under the Greatest Permanent Value rule and will help to meet fiduciary responsibilities for Common School Forest Lands (CSFL). It will also meet specific criteria that must be satisfied before NMFS [National Marine Fisheries Service] and USFWS can issue ITPs.

ODF has the following vision for the HCP, which defines the future outcome of state forests with the HCP:

The Western Oregon HCP ensures species protection and conservation as well as increased certainty that working state forestlands will continue to benefit all Oregonians. Multi-objective forest stewardship activities provide revenue to counties, rural communities, the Common School Fund, and ODF; create jobs; support resilient forest ecosystems, clean air, and high water quality; provide high-quality habitats for native fish and wildlife; and promote educational, recreational, and other partnership opportunities to enhance enjoyment of public forest benefits.

1.1.2 HCP Program Goals

ODF staff developed a set of five broad program goals for the HCP in collaboration with the HCP Steering Committee (Section 1.6.1, *Steering Committee*). These program goals were used as a foundation to develop the biological goals and objectives and the conservation strategy described in Chapter 4, *Conservation Strategy*.

1. Meet the regulatory requirements of the federal and state ESA through an approved HCP, using a multi-species approach to managing forest ecosystems across the landscape.
2. Ensure active and sustainable management of state forest lands under a Western Oregon HCP and an associated Forest Management Plan designed to meet the social, economic, and environmental goals articulated in the Greatest Permanent Value Rule.
3. Increase operational certainty, cost savings, and predictability of revenue generation (including related timber harvest, jobs, and other economic values) using the HCP as a programmatic approach to comply with the federal and state ESA over the permit term.
4. Increase certainty for long-term persistence of covered wildlife species by protecting and maintaining high-quality habitats, conducting habitat enhancement activities in areas of lower quality habitat, and mitigating the impacts of covered activities on covered species.
5. Advance partnerships and engagement related to management approaches and outcomes associated with, but not limited to, revenue generation and economic outcomes, conservation, forest conditions and health, tribal interests and traditional cultural uses, research, monitoring, education, recreation, and the equitable enjoyment of benefits that state public forests provide.
6. Use science-based forestry to promote conditions that create sustainable, productive forests that are resilient to large fires, climate change impacts, and other disturbance events. Use an adaptive management approach to address uncertainty and change over time.

1.1.3 State Forest Management

ODF was created in 1911. Its main purpose was to control forest fires. In 1925, the Oregon Legislature passed a law allowing the Board of Forestry (BOF) to accept gifts or donations of forest lands. The State Forests Acquisition Act of 1939 created procedures for the BOF to acquire tax-delinquent forest lands from counties, manage the land, and return most net revenues from the land to the counties. Amendments to the State Forests Acquisition Act since then have adjusted the distribution of revenues and legal direction for forest management on these lands. Today, lands owned by the BOF are known as Board of Forestry Lands (BOFL). The lands are managed to secure the greatest permanent value by providing healthy, productive, and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic, and environmental benefit to the people of Oregon. BOFL are actively managed in a sound environmental manner to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts.

Some lands managed by ODF are owned by the State Land Board, which consists of the Governor, the Secretary of State, and the State Treasurer. When Oregon became a state in 1859, the federal government granted sections 16 and 36 of every township[1] to the new state for the use of schools. Oregon's grant included 3.5 million acres of grazing and forest lands. Eventually, much of the land was sold for the benefit of schools. The state also exchanged some lands in order to consolidate land into larger blocks. The remaining forest lands owned by the State Land Board are known as Common School Forest Lands. Eventually, the State Land Board signed an agreement with the Department of Forestry authorizing ODF to manage the CSFL, with the objective of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management. Each land ownership has its own set of legal and policy mandates.

ODF is currently managing Western Oregon State Forests under the 2010 Northwest and Southwest Oregon State Forests Management Plans (Oregon Department of Forestry 2010a, 2010b), which provides management direction for all BOFL and CSFL in western Oregon. The forest management plans present guiding principles, a forest vision, and resource management goals. The plans describe each forest resource and explain the concepts for integrated forest management and management strategies. The resource management goals and strategies are intended to balance the resources and achieve the greatest permanent value through a system of integrated management.

Currently, ODF is managing state forests consistent with the forest management plans and in a manner that avoids and minimizes the risk of take of any listed species. This management approach has been increasingly costly, disruptive to ODF operations, and difficult to plan for given the changing regulatory landscape from shifting species distribution and the potential for new listed species. In 2018, the BOF commissioned a business case analysis that examined the costs and economic benefits of preparing a programmatic HCP across all BOFL in Western Oregon with an assumed 50-year permit term (ECONorthwest and ICF 2018). This business case concluded that an HCP would provide economic benefits to the BOF and ODF, greatly reduce uncertainty, and improve the conservation of species listed and expected to be listed over the 50-year analysis period. As a result of this business case analysis, the BOF in November 2018 directed ODF staff to pursue an HCP.

1.2 Scope of the HCP

This section describes the scope of the HCP, including the plan area, permit area, permit term, covered activities, and covered species. Collectively these key elements of the HCP frame the analysis in the rest of this document. The analysis will only be conducted within the plan area on the activities proposed for coverage, and will be limited to the species included as covered species.

1.2.1 Plan Area

The HCP plan area includes all state forestlands west of the Cascade Range that are managed by ODF (Figure 1-1). Most of these state forest lands are in northwestern Oregon in the Tillamook, Clatsop, and Santiam State Forests. In southwest Oregon, state forest lands are found in southern Douglas and northern Josephine counties, and are known as the Glendale block. Smaller tracts of state forest

[1] A section is 640 acres, or 1 square mile. A township is a survey boundary that is typically 6 miles square, or 36 sections (23,040 acres).

land are scattered throughout the plan area. State forest lands in the Klamath-Lake District or in eastern Oregon are not included in this HCP.

As described further in Chapter 3, *Covered Activities*, the State Land Board has authorized ODF to manage all CSFL outside the Elliott State Forest according to the certification process in Oregon Revised Statute (ORS) 530.490. The ODF currently manages 25,826 acres of land in Western Oregon on behalf of the State Land Board and Department of State Lands. All of these lands are also included in the HCP plan area.

To allow for possible future changes in ODF's ownership, the HCP plan area includes areas not currently owned by ODF but that are identified in Land Acquisition and Exchange Plans published by many of the districts in the plan area. This additional area totals 84,206 acres (Table 1-1; Figure 1-1). Not all of that area will be acquired by ODF during the permit term; these lands represent a boundary in which acquisition will mostly likely occur. Net acquisitions are estimated to be on the order of 25,000 acres. Because ODF does not yet own these parcels, they are not part of the permit area. As soon as ODF takes ownership of these parcels they would become part of the permit area. Similarly, if ODF disposes of land as part of this routine land transfer and exchange process, lands no longer owned or managed under the authority of the BOF would not be covered by this HCP and therefore would be removed from the permit area.

The current Land Acquisition and Exchange Plans likely do not predict all of the acquisitions or transfers that ODF will undertake during this HCP. To account for additional shifts in land ownership, the plan area includes another 10,000 acres of forestland that could occur anywhere adjacent to current ODF ownership in the permit area. These areas are not shown in Figure 1-1.

The plan area includes a total of 733,695 acres (Figure 1-1), the components of which are summarized in Table 1-1.

1.2.2 Permit Area

The HCP permit area is defined as the portion of the plan area that ODF currently controls and where all covered activities and conservation measures will apply. The HCP permit area includes all BOFL described above for the plan area. The HCP permit area also includes the 25,826 acres of CSFL managed by ODF. These CSFL are included in the permit area and covered by this HCP in order to provide ODF with take authorization for their activities on this land, and only as long as there is an enforceable agreement that provides ODF with the authority to manage those lands. The ITPs issued for this HCP would not provide take authorization for another land manager besides ODF to manage CSFL.

As part of its typical operations ODF buys, exchanges, or transfers forest parcels in order to consolidate its ownership, increase public use opportunities of state forestland, improve management efficiency, reduce adverse environmental effects, and reduce neighbor conflicts. Over the last 20 years, for example, ODF has disposed of 12,125 acres and obtained 13,002 acres of forest, for a net change of 877 acres added to state forests in this time period (a net change of about 0.1%). ODF expects this to continue into the future, so the HCP needs to be flexible enough to accommodate their shifting ownership. Periodically, ODF identifies and publishes maps of the specific parcels that it is interested in exchanging or acquiring from willing sellers at fair market value.[2]

When lands are removed or added to the permit area ODF will demonstrate that the level of take authorized by the ITP and the mitigation provided by the conservation strategy for each covered species, as described in Chapter 4, remain intact. The process for adding or removing land from the permit area is described in Chapter 8, *Plan Implementation*.

The permit area includes a total of 639,489 acres (Figure 1-1): 613,663 acres of BOFL[3] and 25,826 acres of CSFL (Table 1-1). The intention of the HCP is to cover any Western Oregon State Forest Lands managed by ODF, no matter where they occur in the plan area. The permit area will remain fluid during the permit term, as the land owned and managed by ODF changes through exchanges and acquisitions, but will never extend outside of the plan area.

The HCP would also be applied and permit coverage extended to ODF covered activities on Bureau of Land Management (BLM) lands. ODF conducts activities on adjacent BLM lands during the course of covered activities described in Chapter 3. In situations where covered activities would occur on BLM lands ODF would follow the terms of the HCP and permits. This work would continue to be managed under the 1960 right-of-way agreement between ODF and BLM. Under that agreement the BLM assesses ODF activities to ensure that activities are implemented consistent with federal law, including the ESA. Previous to this HCP ODF was managing that work using take avoidance strategies. By implementing covered activities on BLM lands consistent with the HCP and permits ODF would remain in compliance with the ESA.

[2] These desired parcels are identified in "Land Acquisition and Exchange Plans" published by each forest District as required by the State Forest Land Acquisitions and Exchanges administrative rule (OAR 629-003-0015) and under the State Forests Enabling Statues (ORS 530), both of which are further discussed below in Section 1.3.3.4. Publicly-available Exchange Plans are here: https://www.oregon.gov/odf/working/pages/stateforests.aspx

[3] There are approximately 200 acres of BOFL that are used for ODF administrative purposes. No covered activities will be occurring on those lands so they are not included in the plan area or permit area.

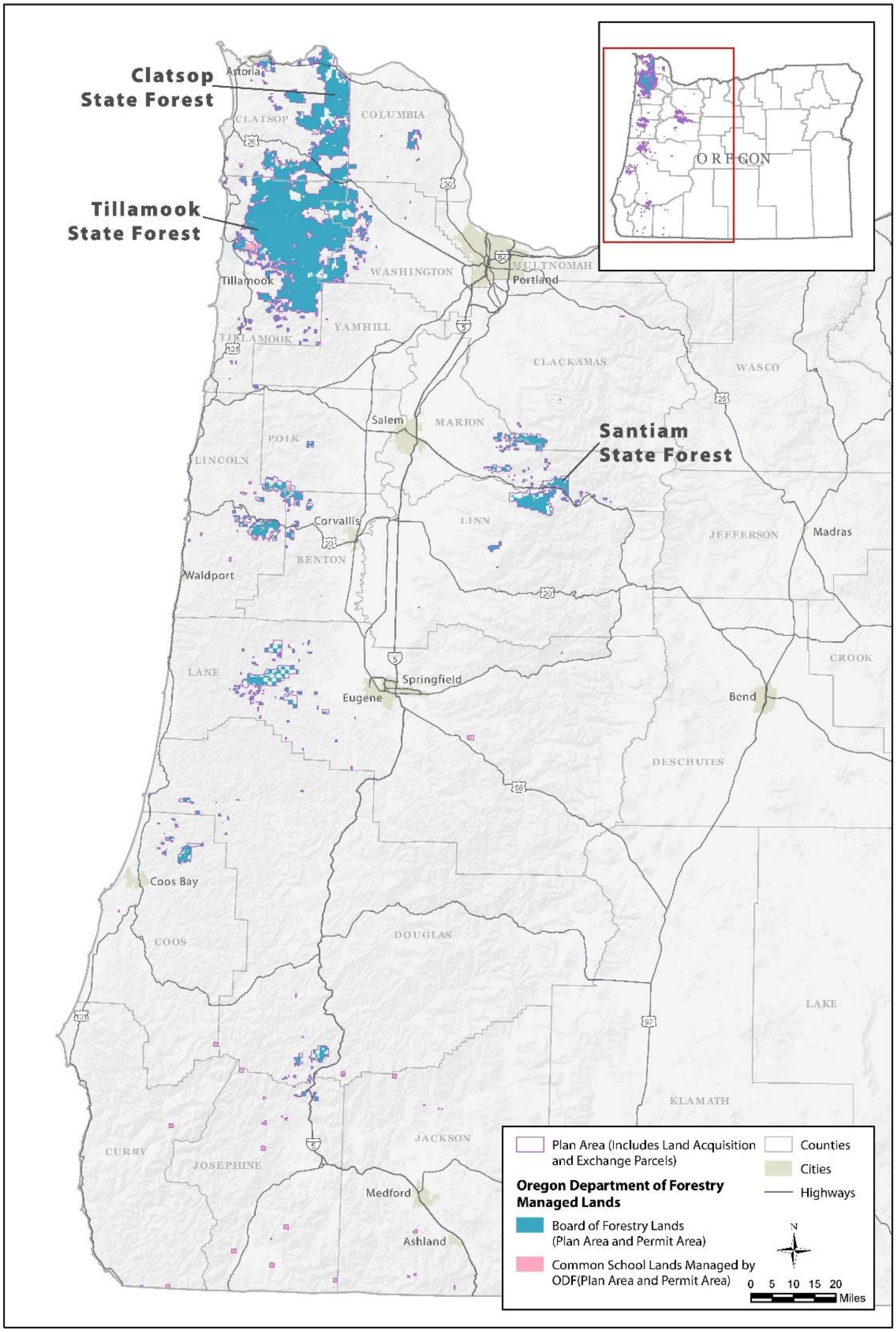

Figure 1-1. Western Oregon State Forest HCP Plan and Permit Area

Table 1-1. Lands in the Plan Area and Permit Area

Land Type	Amount in Plan Area (acres)	Amount in Permit Area (acres)	Explanation
Board of Forestry Lands in Western Oregon	613,663	613,663	
State of Oregon Common School Lands Managed by ODF in Western Oregon	25,826	25,826	In permit area as long as these lands are managed by ODF through an enforceable agreement. If ODF is no longer the land manager then ESA coverage provided by this HCP will no longer apply and they will no longer be part of the permit area.
Lands Identified by Land Acquisition and Exchange Plans	84,206	0	In permit area (and covered by HCP) only after being acquired by ODF. Only a fraction of this total is expected to be added to the permit area because ODF in many cases transfers land. In many cases transfers involve no net change in the amount of ODF ownership.
Additional Lands Adjacent to Current ODF Ownership	10,000	0	Lands not yet identified in Land Acquisition and Exchange Plans but that may be acquired by ODF. In permit area (and covered by HCP) only after being acquired by ODF.
Total	**733,695**	**639,489**	

1.2.3 Permit Term

The Western Oregon State Forest HCP and associated ITPs will have concurrent terms of 70 years. The 70-year term was selected to balance the risks associated with shorter and longer terms. A term of less than 70 years would limit ODF's abilities to conduct long-term forest management practices, which are typically conducted on roughly 10-year management cycles. A term of more than 70 years would increase the risk that unpredictable ecological changes could adversely affect the status of the covered species in the plan area and compromise the conservation strategy. The level of certainty associated with a 70-year term enables ODF to make long-term plans and investments with the assurance that they will be able to continue managing the forest in a manner that complies with ESA requirements.

1.2.4 Covered Activities

This HCP and the associated ITPs will cover and provide incidental take authorization for ODF's land management activities in the permit area (Figure 1-1), as well as the activities needed to carry out the conservation strategy, as described in Chapter 4. Broad categories of ODF's covered activities are listed below; detailed descriptions of the selection process and covered activities are provided in Chapter 3.

- Timber Harvest
- Stand Management
- Road System Management
- Recreation Infrastructure Construction and Maintenance
- HCP Conservation Actions

1.2.5 Covered Species

Covered species are those species for which USFWS and NOAA Fisheries will provide take authorization to ODF to conduct the covered activities. The plan area provides habitat for a variety of species, including species listed under state and federal endangered species protection laws, and others that are not yet listed, but may become listed during the permit term. ODF selected the covered species for the HCP based on review of all species of conservation concern known or suspected to occur in the plan area during the permit term. These species were then screened for coverage based on the four selection criteria described in Section 1.2.5.1, *Covered Species Selection Criteria*. A summary of that selection process is provided in Appendix B, *Species Considered for Coverage*. To be covered by the HCP, a species must meet all four criteria.

1.2.5.1 Covered Species Selection Criteria

Range

Species should be known or expected to occur in the plan area based on a review of species locality and range data, a review of species literature, and professional expertise. In addition, species that are not currently known to occur in the plan area but are expected to move into the plan area during the permit term (e.g., through range expansion) were considered to meet this criterion.

Status

The species should be listed under the federal ESA as threatened or endangered, or be proposed for listing (candidate), or have a strong likelihood of being listed during the permit term. Potential for listing during the permit term is based on current listing status; consultation with experts and USFWS, NOAA Fisheries, or Oregon Department of Fish and Wildlife (ODFW) staff; evaluation of species population trends and threats; and best professional judgment.

Impact

The species or its habitat should potentially be adversely affected by covered activities in a manner likely to result in incidental take as defined by the ESA.

Data

Enough scientific data should exist on the species' life history, habitat requirements, and occurrence in the plan area to adequately evaluate potential effects from covered activities, and to develop adequate conservation measures to mitigate those impacts.

1.2.5.2 Proposed Covered Species

The review and selection process found 16 species meeting all selection criteria (Table 1-2). For details on the selection process, see Appendix B, *Species Considered for Coverage*.

Table 1-2. Proposed Covered Species

Species	Listing Status: State	Listing Status: Federal	Federal Agency Jurisdiction
Fish			
Oregon Coast coho (*Oncorhynchus kisutch*)	--	FT	NOAA Fisheries
Oregon Coast spring Chinook (*O. tshawytscha*)	--	--	NOAA Fisheries
Lower Columbia River coho (O. *kisutch*)	SE	FT	NOAA Fisheries
Upper Willamette River spring Chinook (*O. tshawytscha*)	--	FT	NOAA Fisheries
Upper Willamette River winter steelhead (*O. mykiss*)	--	FT	NOAA Fisheries
Columbia River chum (*O. keta*)	--	FT	NOAA Fisheries
Southern Oregon/Northern California Coast coho (*O. kisutch*)	--	FT	NOAA Fisheries
Lower Columbia River Chinook (*O. tshawytscha*)	--	FT	NOAA Fisheries
Eulachon *(Thaleichthys pacificus)*	--	FT	NOAA Fisheries
Birds			
Northern spotted owl (*Strix occidentalis*)	ST	FT	USFWS
Marbled murrelet (*Brachyramphus marmoratus*)	ST	FT	USFWS
Amphibians			
Oregon slender salamander (*Batrachoseps wrighti*)	ST	UR	USFWS
Columbia torrent salamander (*Rhyacotriton kezeri*)	ST	UR	USFWS
Cascade torrent salamander (*R. cascadae*)	--	UR	USFWS
Mammals			
Coastal marten (*Martes caurina*)	--	PT	USFWS
Red tree vole (*Arborimus longicaudus*)	--	--	USFWS

SE = State Endangered; ST = State Threatened; FT = Federal Threatened; PT = Federal Proposed Threatened; UR = Under Review

1.3 Regulatory Setting

1.3.1 Federal and State Species Laws and Regulations

1.3.1.1 Federal Endangered Species Act

The purpose of the ESA is to provide a means whereby the ecosystems upon which threatened and endangered species depend may be conserved, and to provide a program for the conservation of such species. The Services have responsibility for conservation and protection of threatened and endangered species under the ESA. NOAA Fisheries is responsible for enforcing the provisions of ESA for most marine and anadromous species. USFWS is responsible for all other terrestrial and aquatic species.

Section 7

ESA Section 7 requires all federal agencies, in consultation with the Services, to ensure that any action "authorized, funded, or carried out" by any agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of critical habitat (16 USC 1536[a][2]). Before initiating an action, the federal agency must determine whether a proposed project may affect listed or proposed species or their critical habitat. If the agency determines that a project may have an effect, it is required to consult with the Services. If the agency determines, and the Services concur, that the project is neither likely to adversely affect any listed or proposed species or to adversely modify designated critical habitat, the consultation is concluded. If the agency determines that a project is likely to adversely affect a listed or proposed species or designated or proposed critical habitat, a formal consultation process is initiated.

During formal consultation, the Services prepare a biological opinion (BO) in response to information provided by the action agency. The BO analyzes the effects of the proposed action on listed species and determines if the action is likely to jeopardize the continued existence of the species or destroy or adversely modify designated critical habitat. If the BO reaches a jeopardy or adverse modification conclusion, the opinion must include a "reasonable and prudent alternative" that would avoid that result.

If the BO concludes that the project, as proposed, would involve the take of a listed species, but not to an extent that would jeopardize the species' continued existence, the BO includes an incidental take statement and specifies reasonable and prudent measures to minimize the impact of the take. The incidental take statement specifies an amount of take that may occur as a result of the action. The statement may also include conservation recommendations, which are non-binding, such as identifying additional discretionary conservation measures to reduce adverse effects, or identifying additional needed studies, monitoring, or research that might assist species conservation in furtherance of ESA Section 7(a)(1). If the action complies with the BO and the incidental take statement, it may be implemented without violation of ESA, and the take is thereby exempted.

Section 10

Until 1982, state, local, and private entities had no means to acquire incidental take authorization as could federal agencies under Section 7. Private landowners and local and state agencies risked direct violation of the ESA no matter how carefully their projects were implemented. This statutory dilemma led Congress to amend Section 10 of the ESA in 1982 to authorize the issuance of an ITP to nonfederal project proponents upon completion of an approved "conservation plan." The term conservation plan has evolved into "habitat conservation plan," which is in common use today.

Under Section 10(a)(2)(A), a nonfederal party (such as ODF) may apply to USFWS or NOAA Fisheries for an ITP providing authorization to incidentally take listed species, meaning that the activity taking the species "is incidental to, but not the purpose of, otherwise lawful activities." The application for an ITP must include an HCP that describes the impacts that are likely to result from the incidental take and the measures the applicant will carry out to minimize and mitigate such impacts to the maximum extent practicable. In addition, the HCP must demonstrate that adequate funding is available to implement these measures and include a discussion of alternative actions to take that the applicant has considered, and the reasons these alternative actions are not being used. Finally, the HCP must include "such other measures that the Secretary [of the Department of Interior or Commerce] may require as being necessary or appropriate for the purpose of the plan." Each issuance of an ITP by the Services is subject to evaluation via the Section 7 consultation process described previously; thus, incidental take authorized pursuant to an HCP must be quantified, must not jeopardize the continued existence of the species, and must not destroy or adversely modify critical habitat.

1.3.1.2 Oregon Endangered Species Act

Under the Oregon ESA, ODF must coordinate with the ODFW and the Oregon Department of Agriculture in developing plans that comply with the state ESA, and that are consistent with the constitutional mandate for CSFL.

The Oregon ESA was adopted in 1987 and included both plant and animal species. The act was amended in 1995 to outline listed species protection requirements. The northern spotted owl and marbled murrelet were listed as threatened under the Oregon ESA in 1988 and 1995, respectively. For threatened or endangered species listed after 1995, the Oregon Fish and Wildlife Commission must establish quantifiable and measurable guidelines considered necessary to ensure the survival of individual members of the species. These survival guidelines may include take avoidance and measures to protect resource sites (e.g., nest sites and spawning grounds). Because the northern spotted owl and marbled murrelet were listed in or prior to 1995, state survival guidelines were not developed for these species. In the absence of survival guidelines, ODF will rely on measures in this HCP as the means of protecting these state-listed species.

1.3.1.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act prohibits the taking or possession of and commerce in bald and golden eagles with limited exceptions. Under the Bald and Golden Eagle Protection Act, it is a violation to "take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or in any manner, any bald eagle commonly known as the American eagle, or golden eagle, alive or dead, or any part, nest, or egg, thereof." *Take* is defined to include pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, and disturb. *Disturb* is further defined in 50 CFR Part 22.3 as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

Revisions to the Bald and Golden Eagle Protection Act authorize take of bald eagles and golden eagles under the following conditions: (1) where the take is compatible with the preservation of the bald eagle and golden eagle, (2) where the take is necessary to protect an interest in a particular locality, (3) where the take is associated with but not the purpose of an otherwise lawful activity, and (4) for individual instances of take where the take cannot be avoided, or (5) for programmatic take where the take is unavoidable even though advanced conservation practices are being implemented (50 CFR 22.26). Permits issued under this regulation usually authorize disturbance only; however, in limited cases a permit may authorize lethal take that results from but is not the purpose of an otherwise lawful activity.

Bald and golden eagles are not covered species in this Plan.

1.3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA), established in 1969, serves as the nation's basic charter for determining how federal decisions affect the human environment (42 USC 4332). Federal agencies must complete environmental documents pursuant to NEPA before implementing discretionary federal actions. Such documents help ensure that the underlying objectives of NEPA are achieved: to disclose environmental information, assist in resolving environmental problems, foster intergovernmental cooperation, and enhance public participation. NEPA requires evaluation of the potential effects on the human environment related to the proposed action, reasonable alternatives to the proposed action (if any), and a No-Action Alternative.

Any federal agency undertaking a major federal action that is likely to affect the human environment must prepare an environmental assessment. If any impacts on the human environment are found to be significant and cannot be mitigated to the point of insignificance, the federal agency must then prepare an environmental impact statement. The Council on Environmental Quality regulations define major federal actions as those actions with "effects that may be major and which are potentially subject to federal control and responsibility," including "projects and program entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies."

Issuance by USFWS and NOAA Fisheries of ITPs under the ESA Section 10(a)(1)(B) are federal actions subject to NEPA compliance. Although ESA and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by considering impacts of a federal action not only on fish and wildlife resources but also on other resources such as water quality, air quality, and cultural resources. To satisfy NEPA requirements, NOAA Fisheries has prepared a draft environmental impact statement that accompanies this HCP.

1.3.3 Other Relevant State Laws

1.3.3.1 Oregon Forest Practices Act

The Oregon Forest Practices Act and its associated rules sets standards for all commercial activities involving the establishment, management, or harvesting of trees in Oregon forests.[4] The Forest Practices Act declares it public policy to encourage economically efficient forest practices that ensure the "continuous growing and harvesting of forest tree species and the maintenance of forest land for such purposes as the leading use on privately owned land, consistent with sound management of soil, air, water, fish, and wildlife resources and scenic resources in visually sensitive corridors…" (ORS 527.630(1)). The BOF is granted the exclusive authority to develop and enforce rules protecting forest resources and to coordinate with other agencies concerned with state forests.

1.3.3.2 Oregon Plan for Salmon and Watersheds

In 1997, the Oregon Legislature adopted the Oregon Plan for Salmon and Watersheds, which focused on coho salmon. In 1998, the Steelhead Supplement was added to that plan. The purpose of the Oregon Plan for Salmon and Watersheds is to restore Oregon's wild salmon and trout populations and fisheries to sustainable and productive levels that will provide substantial environmental, cultural, and economic benefits, and to improve water quality. The Oregon Plan for Salmon and

[4] Chapter 527 of the ORS and the OAR pursuant to these statutes.

Watersheds addresses all factors affecting at-risk wild salmonids, including watershed conditions and fisheries, to the extent that those factors can be influenced by the state.

The Oregon Plan for Salmon and Watersheds is a cooperative effort of state, local, federal, tribal, and private organizations and individuals. Although the plan contains a strong foundation of protective regulations—continuing existing regulatory programs and expediting the implementation of others—an essential principle of the plan involves moving beyond prohibitions and encouraging efforts to improve conditions for salmon through nonregulatory means. This HCP was prepared to be consistent with the Oregon Plan for Salmon and Watersheds.

1.3.3.3 Oregon Fish Passage

Fish passage barriers are prevalent throughout the Oregon landscape. Over time, despite fish passage rules and regulations, access to native fish habitats has been blocked or impaired by the construction of impassable culverts, dams, tide gates, dikes, bridges, and other anthropogenic infrastructure. Providing passage at these artificial obstructions is vital to recovering Oregon's native migratory fish populations (Oregon Department of Fish and Wildlife 2013).

As of 2001, ODFW requires the owner or operator of any artificial obstruction located in waters where native migratory fish currently or historically occur to address fish passage when certain activities are planned. If a proposed project is within current or historic native migratory fish habitat and if a fish passage trigger identified in the law (Oregon Administrative Rules [OAR] 635-412-0005(9)(d)) will occur, then fish passage must be addressed. Common triggers for fish passage include culvert and bridge construction, removal, replacement or major repair, and/or in-channel work for scour protection or grade control.

A Memorandum of Understanding between ODFW and ODF gives ODF jurisdiction over fish passage on their land so long as fish passage meets the requirements of the Oregon Forest Practices Act.

1.3.3.4 State Forests Enabling Statutes

Most northwest Oregon state forest lands are owned by the BOF. The statutes governing management of BOFL are contained in ORS Chapter 530, and state that they will manage the lands "so as to secure the greatest permanent value of such lands to the state." Oregon Administrative Rules direct that these lands will be actively managed. Active management means applying practices, over time and across the landscape, to achieve site-specific forest resource goals using an integrated and science-based approach that promotes the compatibility of most forest uses and resources over time and across the landscape.

The Forest Trust Land Advisory Committee is charged with advising the Oregon Board of Forestry and State Forester "on the management of lands subject to the provisions of ORS 530.010 to ORS 530.170 and on other matters in which counties may have a responsibility pertaining to forestland." Additionally, ODF has an obligation to "consult with the committee with regard to such matters."

ORS 530 authorizes the BOF to plan and carry out a land acquisition, disposal, and exchange program in accordance with the Real Estate Asset Management Plan or the Land Board's policies. The BOF may acquire, by purchase, donation, devise, or exchange from any public, quasi-public, or private owner lands which by reason of their location, or topographical, geological, or physical characteristics are chiefly valuable for forest crops production, watershed protection and development, erosion control, grazing, recreation, or forest administrative purposes. It is desirable that lands acquired be consolidated in areas wherever possible through exchanges of land. The HCP plan area and permit area were designed to allow this activity to continue consistent with state enabling statutes (Sections 1.2.1, *Plan Area*, and 1.2.2, *Permit Area*).

1.3.3.5 Forestry Administration and Planning

ORS Chapter 526, *Forest Administration,* establishes the general duties of the Board (526.016) and State Forester (526.041), and the mandate to do forest planning. ORS Chapter 530, *State Forests*; *Community Forests* contains the authorities specific to State Forests. The BOF supervises forest policy and management under their jurisdiction and ensures the State Forester enforces state forest laws relating directly to the protecting of forestland and conservation of forest resources.

The statutory mandate for forest planning is found in ORS 526.255. This law requires the State Forester to report to the Governor and legislative committees on "long-range management plans based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region." In 1998, the BOF adopted a set of administrative rules that provide further direction to the State Forester in planning for the management of these lands. OAR 629-035-0030 states:

> In managing forest lands as provided in OAR 629-035-0020, the State Forester shall develop Forest Management Plans, based on the best available science, that establish the general management framework for the planning area of forest land. The Board may review, modify, or terminate a plan at any time; however, the Board shall review the plans no less than every ten years. The State Forester shall develop implementation and operations plans for forest management plans that describe smaller-scale, more specific management activities within the planning area.

A Forest Management Plan update was initiated by the BOF in June, 2013. It is being prepared concurrently with this HCP and the two documents are consistent, where applicable.

1.3.3.6 Scenic Waterways

The Oregon Scenic Waterways (ORS 390) system includes 19 rivers and 1 mountain lake (Waldo Lake) that possess outstanding scenic, fish, wildlife, geological, botanical, historic, archaeologic, and outdoor recreation values of present and future benefit to the public. Activities within scenic waterways cannot affect the free-flowing character of these waters and must be consistent with the maintenance of waters in quantities necessary for recreation, fish, and wildlife uses.

Scenic waterways and adjacent lands are administered by the State Parks and Recreation Department. State Parks and Recreation consults with BOF to adopt rules for management of related adjacent lands. Management principles, standards, and plans protect or enhance the aesthetic and scenic values of the waterway and permit compatible forestry and other land uses. Forest crops adjacent to designated scenic waterways may be harvested in a manner that maintains, to the extent practicable, the natural beauty of the waterway.

There are currently four scenic water designations that occur in or within 1/4 mile of the HCP permit area: Nehalem, Netsucca, Rogue, and the Little North Santiam River. Some scenic water designations associated with these waterways require an additional set of management and policy guidelines.

1.3.3.7 ODFW Scientific Taking Permit

Additional Oregon Scientific Take Permits may be required to implement certain conservation measures, research, and monitoring for this HCP (e.g., barred owl control, fish salvage). Those permits are not part of any ITP issued under this HCP, but will be obtained separately as needed.

1.4 Other Conservation Plans in the Region

Several HCPs are being implemented in western Oregon. These HCPs are potential sources of conservation actions and provide conservation context for the goals, objectives, and strategies included in this HCP. In addition, this plan may, during implementation, overlap with these HCPs if they share covered species and occur on nearby lands.

1.4.1 Oregon Plan for Salmon and Watersheds

The mission of the Oregon Plan for Salmon and Watersheds (State of Oregon 1997) is to restore native fish populations and the aquatic ecosystems that support them to productive and sustainable levels, which will provide substantial environmental, cultural, and economic benefits. The Oregon Plan for Salmon and Watersheds organizes specific actions around factors that contribute to the decline in fish populations and watershed health, and focuses on improvement of water quality and quantity and habitat restoration. Private citizens, community organizations, special interest groups, and all levels of government may organize, fund, and implement the measures in this plan.

The Oregon Plan for Salmon and Watersheds includes four elements, including the following:

- Voluntary restoration actions by private landowners.
- Coordinated state and federal agency and tribal actions.
- Monitoring watershed health, water quality, and salmon recovery.
- Strong scientific oversight by the plan’s Independent Multidisciplinary Science Team.

1.4.2 Oregon Conservation Strategy

The Oregon Conservation Strategy is a state-wide program managed by ODFW that identifies key conservation issues, priorities, and strategies to maintain healthy fish and wildlife populations (ODFW 2016). Information in the Oregon Conservation Strategy was used to inform species-specific strategies, including:

- Ecoregions used in the Oregon Conservation Strategy were used as the geographic basis for conservation planning in the HCP.
- Species and habitat conservation needs were also identified and applied as applicable in developing goals, objectives, and conservation actions for the HCP.

1.4.3 Northwest Forest Plan

The 1994 U.S. Forest Service (USFS) Northwest Forest Plan (NWFP) (USDA and USDI, 1994) drew from best available science at the time (Thomas et al. 1990) and included strategies for conservation and restoration on federal lands, as well as mechanisms for subsequent research, learning, and adaptive management. Key elements of the NWFP include adoption of an ecosystem management approach, land use designations, an emphasis on effective consultation with over 70 federally recognized tribes and consideration of treaty rights, new monitoring programs, and adaptive-management measures.

1.4.3.1 NWFP Land Allocations

The NWFP structure includes the creation of a regional set of land allocations, each with associated management standards and guidelines (Table 1-3). The allocation includes a network of Late Successional Reserves (LSRs) designed to meet the habitat requirements of the northern spotted owl, marbled murrelet, and other species closely associated with late-successional forest, and Riparian Reserves to meet the habitat requirements of salmonids. Of particular importance to this HCP is that no federal lands or associated LSRs or Riparian Reserves are located in the northern portion of the Oregon Coast Ecoregion, meaning that state lands are of more importance to the persistence of covered species in this area. Other portions of the permit area are located adjacent to federal lands, so the conservation strategy has been developed to align with federal conservation efforts in these areas.

Under the standards and guidelines of the NWFP, a management assessment is prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities can be designed and implemented. These LSR assessments were considered when evaluating the conservation strategy for permitted lands near LSRs.

Table 1-3. NWFP Allocations

Land Allocation	Original Acres	Percentage of Federal Lands	Description
Congressionally Reserved Areas	7,320,600	30	Lands reserved by the U.S. Congress such as wilderness areas, wild and scenic rivers, and national parks and monuments.
Late-Successional Reserves	7,430,800	30	Lands reserved for the protection and restoration of Late-Successional/Old-Growth forest ecosystems and habitat for associated species, including marbled murrelet reserves and northern spotted owl activity core reserves.
Managed Late-Successional Areas	102,200	<1	Areas for the restoration and maintenance of optimum levels of old growth stands on a landscape scale, where regular and frequent wildfires occur. Silvicultural and fire hazard reduction treatments are allowed to help prevent older forest losses from large wildfires or disease and insect epidemics.
Administrative Withdrawn Areas	1,477,100	6	Areas identified in local forest and district plans; they include recreation and visual areas, back country, and other areas where management emphasis does not include scheduled timber harvest.
Adaptive Management Areas–reserved	1,521,800 (combined reserved/non-reserved)	6	Identified to develop and test innovative management to integrate and achieve ecological, economic, and other social and community objectives. Emphasis on restoration of late-successional forests and managed as an LSR.
Adaptive Management Areas–nonreserved			Same as reserved Adaptive Management Areas but with some commercial timber harvest expected to occur with ecological objectives.
Riparian Reserves	2,627,500	11	Protective buffers along streams, lakes, and wetlands designed to enhance habitat for riparian-dependent organisms, provide good water-quality dispersal corridors for terrestrial species, and provide connectivity within watersheds.
Matrix	3,975,300	16	Federal lands outside of reserved allocations where most timber harvest and silvicultural activities occur.

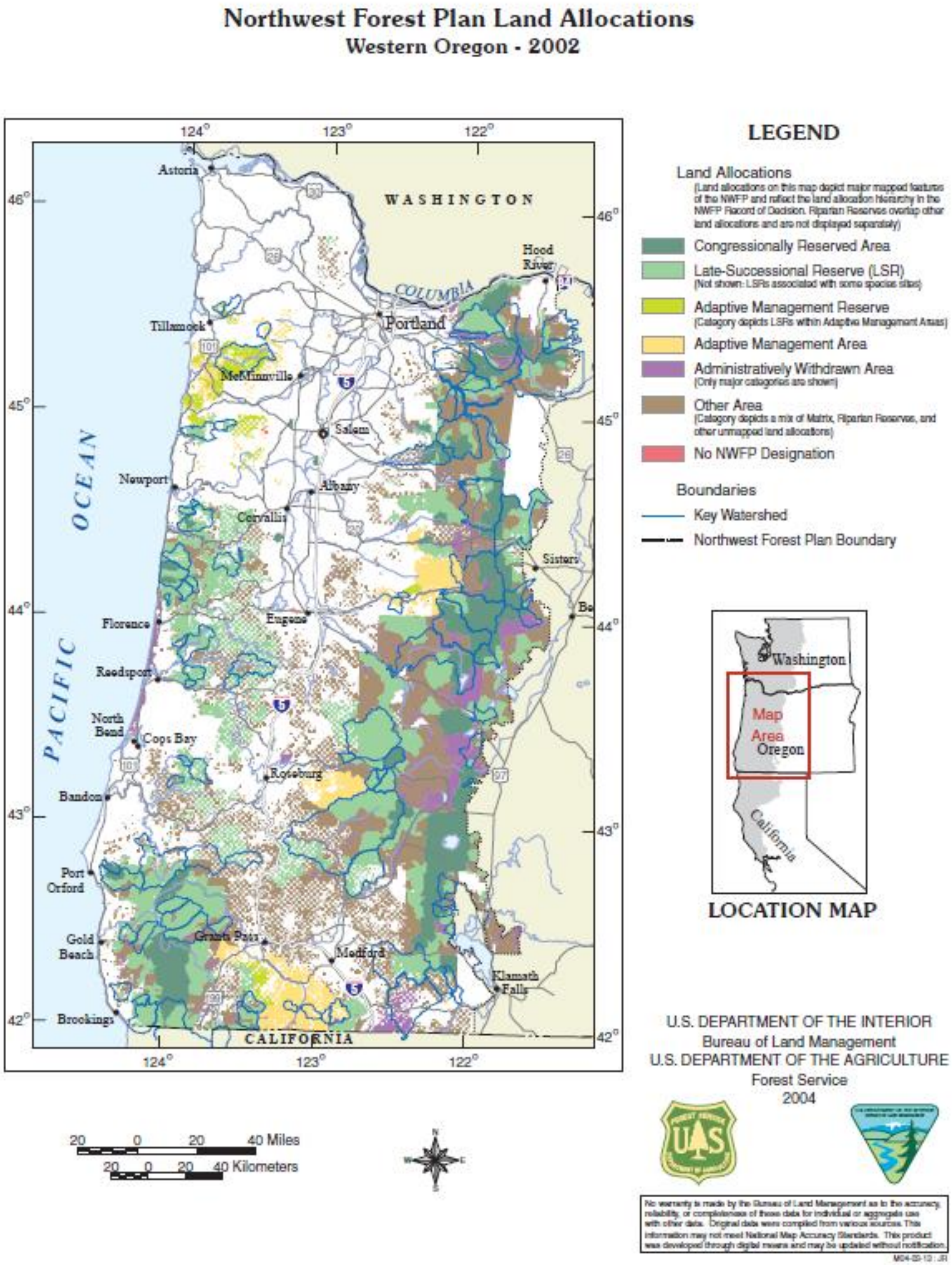

Figure 1-2. Northwest Forest Plan Allocations in Oregon

1.4.3.2 NWFP Effectiveness Monitoring

The Effectiveness Monitoring program initiated by the NWFP is used to assess progress towards meeting habitat requirements for species associated with late-successional forest, including northern spotted owl and marbled murrelets. Because the NWFP is a major component of recovery strategies for species to be covered under the HCP, the effectiveness monitoring provides important information that was used to determine the extent and area-specific needs for this HCP.

The 2018 NWFP Science Synthesis (Spies et al 2018) summarizes the results of effectiveness monitoring and provides a comprehensive overview of the science accumulated in the 24 years since the NWFP was first implemented. The purpose of the NWFP Science Synthesis is to provide resource managers with a scientific basis for assessment and updates to forest plans in the NWFP area. The NWFP Science Synthesis was prepared by request to inform the revision of land and resource management plans for 17 national forests in the footprint of the NWFP in Washington, Oregon, and northern California.

The conservation strategy of the HCP was greatly informed by the science presented in the science-synthesis, including information related to the biological needs, threats, and management recommendations for covered species, particularly covered fish, marbled murrelet, and northern spotted owl.

Effectiveness monitoring for marbled murrelets has included annual at-sea surveys that monitor marbled murrelet populations in the near-shore marine waters of Washington, Oregon, and northern California (McIver 2019).

1.4.4 Elliott State Forest HCP

The Elliott State Forest HCP is currently being developed by the Oregon Department of State Lands (DSL) and Oregon State University. The Elliott State Forest includes two distinct sets of lands, having different ownership and mandates. The Common School Forest Lands (84,120 acres) are overseen by the State Land Board and managed by DSL. The BOFL (8,868 acres) are overseen by the State Board of Forestry and managed by ODF. The Elliott HCP plan area includes both types of land (School Lands and BOFL). The Elliott State Forest HCP and the associated ITPs will cover DSL's land management activities, which include activities similar to those covered in the Western Oregon State Forest HCP.

The Elliott State Forest HCP proposes to cover three species, all of which are proposed for coverage under this plan: Oregon Coast coho salmon, northern spotted owl, and marbled murrelet. DSL is developing the HCP in close collaboration with Oregon State University, which currently intends to acquire the forest and transform it into a research forest. A preliminary decision on Oregon State University's intention is expected by December 2020.

1.4.5 Weyerhaeuser-Millicoma Tree Farm HCP

The Weyerhaeuser-Millicoma Tree Farm HCP includes covered lands located in Coos and Douglas Counties, covering 208,000 acres, and was established in February 1995 under a 50-year permit. The Weyerhaeuser-Millicoma Tree Farm HCP is adjacent to the Elliott State Forest and some ODF lands. This HCP provides protection for existing northern spotted owl nesting sites while also allowing for tree harvest in northern spotted owl home range. Under this HCP approximately 17,000 acres of land may be harvested in northern spotted owl nesting habitat, though with a greater amount of land being maintained in spotted owl dispersal habitat. This plan protects existing northern spotted owl nesting sites and dispersal habitats over a large landscape.

1.4.6 Candidate Conservation Agreement with Assurances for the Fisher in Oregon

A programmatic/template Candidate Conservation Agreement with Assurances (CCAA) was established in April 2017, for the fisher (*Pekania pennanti*) in western Oregon between USFWS and voluntarily participating non-federal landowners and managers. The enrollment areas cover the west coast distinct population segment (DPS) of fisher in Oregon over a 30-year permit term. On September 27, 2019. ODF enrolled approximately 183,932 acres of BOFL within the fisher’s range; the permit expires June 20, 2048. ODF will implement the CCAA conservation measures on all enrolled lands to meet the CCAA standard. This CCAA aims to expand understanding of fisher distribution, densities, and forest-management activities; promote conservation measures and remove threats to the species; provide a voluntary recovery effort; and provide enrolled landowners assurances that they will not be held responsible for additional conservation measures if the fisher becomes ESA listed.

1.5 Recovery Plans for Covered Species

This section provides brief overviews of existing recovery plans relevant to the conservation of the covered species. These plans were used as guidance for the conservation strategy of this HCP in the ways described below.

1.5.1 Recovery Plans for Salmon

Recovery plans for the covered fish identify key limiting factors. These limiting factors are physical, biological, or chemical features that have the greatest impact on a population’s ability to reach a desired status. Improving these factors in the permit area will have a long-term benefit for the covered fish species. Limiting factors, by species, are provided in Table 1-4, these factors were a key component in developing the conservation strategy of the HCP and will help guide implementation of the conservation actions to elicit the greatest benefit for the covered salmonids.

Table 1-4. Key Limiting Factors for the Covered Salmon Species

		Limiting Factor					
Covered Fish Species	**Recovery Plan**	**Reduced Amount and Complexity of Habitat**	**Peripheral and Transitional Habitats: Side Channels, Wetlands, and Floodplains**	**Impaired Riparian Function**	**Degraded Water Quality**	**Blocked/Impaired Fish Passage**	**Adequate Regulatory Mechanisms to Protect Population**
Oregon Coast Coho	NOAA 2016	X			X	X	X
Lower Columbia River Coho	NOAA 2013	X	X	X	X		
Lower Columbia River Chinook	NOAA 2013	X	X	X	X		
Columbia River Chum	NOAA 2013	X	X	X	X		
Upper Willamette River Spring Chinook	ODFW and NOAA Fisheries 2011	X	X	X	X	X	
Upper Willamette River Winter Steelhead	ODFW and NOAA Fisheries 2011	X	X	X	X	X	
Southern Oregon/ Northern California Coast Coho Salmon	NOAA 2014	X	X	X	X	X	X

1.5.2 Recovery Plan for Northern Spotted Owl

The recovery plan for the northern spotted owl was first published in 2008 and revised in 2011 (USFWS 2011). The current recovery plan identifies recovery units essential for the survival and recovery of spotted owls, with five recovery units in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, and Oregon Klamath. The permit area includes lands in all of these recovery units except the Eastern Oregon Cascades.

The 2011 recovery plan relies heavily on recovery of spotted owls on federal lands but also identifies the need to retain a spotted owl distribution across the range where federal lands are lacking, and noted as an example northwestern Oregon, "potentially including parts of the Tillamook and Clatsop State Forests." The recovery plan states that "managing to retain spotted owls at existing sites should be the most effective approach to conserving spotted owls" in these areas.

The 2011 recovery plan defines 33 specific recovery actions. Of those, six recovery actions are applicable to this HCP (Table 1-5).

Table 1-5. Recovery Actions Applicable to the HCP for Northern Spotted Owl (USFWS 2011)

Recovery Action	Summary
Recovery Action 6	In most forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands, and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery.
Recovery Action 10	Conserve spotted owl sites and high-value spotted owl habitat to provide additional demographic support to the spotted owl population.
Recovery Action 14	Encourage applicants to develop Habitat Conservation Plans and Safe Harbor Agreements that are consistent with the recovery objectives.
Recovery Action 19	The Service will request the cooperation of Oregon Department of Forestry in a scientific evaluation of (1) the potential role of state and private lands in Oregon to contribute to spotted owl recovery; and (2) the effectiveness of current Oregon Forest Practices in conserving spotted owl habitat and meeting the recovery goals identified in this Revised Recovery Plan. Based on this scientific evaluation, the Service will work with the Oregon Department of Forestry and other individual stakeholders to provide specific recommendations for how best to address spotted owl conservation needs on Oregon's non-federal lands.
Recovery Action 28	Expedite permitting of experimental removal of barred owls.
Recovery Action 32	Because spotted owl recovery requires well distributed, older, and more structurally complex multilayered conifer forests on federal and non-federal lands across its range, land managers should work with the Service to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees.

1.5.3 USFWS Barred Owl Removal Experiment

As described in the 2011 northern spotted owl recovery plan, barred owls pose perhaps the most significant and immediate threat to spotted owl recovery (USFWS 2011). The recovery plan specified several substantive recovery actions to address this threat, including research on the competition between spotted and barred owls, experimental control of barred owls, and, if recommended by research, removal of barred owls using a combination of lethal and non-lethal methods.

In 2013, the USFWS issued a Final Environmental Impact Statement and Record of Decision for the experimental removal of barred owls to benefit northern spotted owls (USFWS 2013a, 2013b). Under the experimental removal plan, barred owl removals have occurred at one study area in Washington, two in Oregon, and one in California (Figure 1-3).

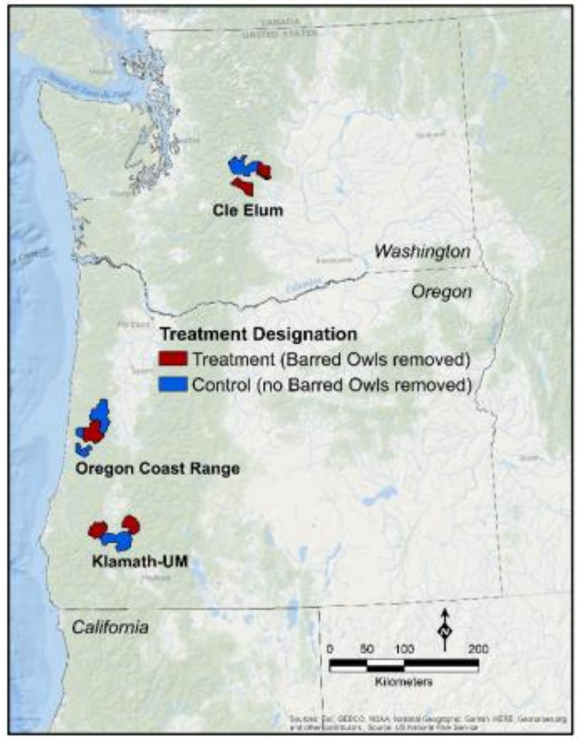

Figure 1-3. Barred Owl Study Areas in Washington and Oregon
(from Wiens et al. 2019)

As of October 2019, a total of 2,435 barred owls have been removed at the four study areas, with area-specific removals as follows (USFWS 2020):

- Cle Elum, Washington : 472
- Oregon Coast Range: 1,018
- Klamath-Union/Myrtle Study Area, Oregon: 536
- Hoopa, California: 409

The experiment has found reduced and declining barred owl populations in the removal areas, while barred owls continue to increase in control areas where no removals have occurred. Across all study areas, the USFWS believes that barred owl removal appears to have stabilized spotted owl populations, although total spotted owl numbers remain low (USFWS 2020).

1.5.4 Safe Harbor Agreements for Barred Owl Removal Experiment

As part of the barred owl removal experiment just described, the USFWS has entered into Safe Harbor Agreements (SHA) with four land management entities.

- Oregon Department of Forestry SHA for the northern spotted owl in the Oregon Coast Ranges Study Area of the Barred Owl Removal Experiment.
- Weyerhaeuser Company SHA for the northern spotted owl in the Oregon Coast Ranges Study Area of the Barred Owl Removal Experiment.

- Roseburg Resources Company SHA for northern spotted owls in Douglas County, Oregon.
- Roseburg Resources Company SHA for northern spotted owls in Union/Myrtle(Klamath) Study Area of the Barred Owl Removal Experiment.

A SHA is a voluntary agreement involving private or other non-federal property owners whose actions contribute to the recovery of species listed as threatened or endangered under the act. In exchange for actions that contribute to the recovery of listed species on non-federal lands, the Service will not require any additional or different management activities by the participants without their consent.

These SHAs provided assurances to permit holders that they would not be prohibited from harvesting areas that may be recolonized by spotted owls due to the USFWS experimental removal of barred owls.

There are no other SHAs in Oregon for species covered under this HCP.

1.5.5 Recovery Plan for Marbled Murrelet

The recovery plan for marbled murrelet (USFWS 1997) identifies six Marbled Murrelet Conservation Zones, five of which are in the coterminous Pacific states: Puget Sound/Strait of Juan De Fuca; Western Washington Coast Range; Oregon Coast Range; Siskiyou Coast Range; and Mendocino (Figure 1-4).

Most of the permit area is in Zone 3, Oregon Coast Range. A portion of the permit area is in Zone 4, Siskiyou Coast Range.

Zone 3 (Oregon Coast Range) includes the majority of known marbled murrelet occupied sites in Oregon. The recovery plan includes the following description of recovery strategies for this zone:

> *Marbled murrelet occupied sites along the western portion of the Tillamook State Forest are especially important to maintaining well- distributed marbled murrelet populations. Efforts should focus on maintaining these occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. Relatively few known occupied sites occur north of the Tillamook State Forest. Recovery efforts should be directed at restoring some of the north-south distribution of marbled murrelet populations and habitat in this zone. Maintenance of suitable and occupied marbled murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, Siuslaw National Forest, and BLM-administered forests is an essential component for the stabilization and recovery of the marbled murrelet.*

Source: USFWS 1997

Figure 1-4. Marbled Murrelet Conservation Zones (Zone 6, Santa Cruz Mountains, not shown)

The 1997 recovery plan also lists the following actions needed for the recovery of the species, which were used to help design the conservation strategy for this HCP.

- Establish Marbled Murrelet Conservation Zones and develop landscape-level management strategies for each zone.
- Identify and protect terrestrial and marine habitat areas in each Marbled Murrelet Conservation Zone.
- Monitor marbled murrelet populations and habitat and survey potential breeding habitat to identify potential nesting areas.
- Implement short-term actions to stabilize the marbled murrelet population.
- Implement long-term actions to stop population decline and increase marbled murrelet population growth.

1.6 Overview of Planning Process

The HCP was led by ODF and advised by a team of regulators and experts who were organized into a Steering Committee and Scoping Team. The final decisions on the HCP were made by the BOF. All other participants were engaged to provide technical and policy advice to ODF. Planning participants provided valuable input during the planning process, as described below.

1.6.1 Steering Committee

The HCP Steering Committee consists of government agency representatives. Members worked together to provide advice on how ODF can achieve a mutually acceptable outcome that satisfies, to the greatest degree possible, the interests of all participants, while still meeting all regulatory requirements of the ESA. The role of the Steering Committee was to provide overall guidance for the HCP process and to provide direction and support to the Scoping Team. The Steering Committee met approximately bi-monthly during HCP development. Member agencies of the Steering Committee were the following.

- Oregon Department of Forestry (convener)
- Oregon Department of State Lands
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon State University
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service

1.6.2 Scoping Team

The HCP Scoping Team was composed of terrestrial and aquatic biologists and technical specialists from state and federal agencies. The role of the Scoping Team was to provide technical expertise and to develop technical recommendations for the Steering Committee to consider when advising ODF in the development of a potential HCP. The Scoping Team met bi-monthly during HCP development. Member agencies of the Scoping Team were the same as those listed for the Steering Committee. Technical experts from Oregon State University provided review of key data and work products.

The Scoping Team provided input, guidance, and feedback on development of all aspects of the HCP. This important feedback included species to be covered, how to analyze effects on those species, and the type and extent of conservation actions described in the HCP. The Scoping Team also reviewed early drafts of the HCP to support ODF's development of a legally compliant, scientifically sound, and successful document.

1.6.3 Stakeholder Engagement

[**Note to ODF**: *Once stakeholder engagement has been determined this section will be included*.]

During the development of the HCP, ODF hosted public informational meetings prior to each BOF meeting to provide an opportunity for the public, stakeholders, department staff and consultants to share concerns regarding HCP development and ideas for improvement. Meeting presentations were posted online on ODF's HCP Initiative website.[5] These informational meetings provided an opportunity for two-way dialogue between the public, stakeholders, department staff, and consultants to share concerns and ideas for improvement regarding conservation strategies and the overall content of the HCP.

1.7 Document Organization

This HCP and supporting information are presented in the following chapters and appendices.

- Chapter 1, *Introduction*, discusses the background, purpose, and objectives of the HCP; reviews the regulatory setting; and summarizes the planning process.
- Chapter 2, *Environmental Setting*, describes the existing conditions of the plan area relevant to the HCP, including overview of covered species.
- Chapter 3, *Covered Activities*, describes the activities covered under the HCP.
- Chapter 4, *Conservation Strategy*, summarizes the conservation strategy and describes the specific conservation actions to be implemented to mitigate the impacts of the covered activities. The chapter also describes the specific surveys and other actions required of all covered activities to avoid and minimize impacts on covered species, consistent with federal regulations.
- Chapter 5, *Effects Analysis and Level of Take*, presents the impacts of the covered activities.
- Chapter 6, *Monitoring and Adaptive Management*, describes the monitoring and adaptive management program.
- Chapter 7, *Assurances*, details the administrative requirements associated with HCP implementation and the roles and responsibilities of ODF and the Services. It also describes the

[5] https://www.oregon.gov/ODF/AboutODF/Pages/HCP-initiative.aspx

regulatory assurances provided to ODF as well as the procedures for modifying or amending the HCP.

- Chapter 8, *Plan Implementation*, details the administrative requirements associated with HCP implementation and the roles and responsibilities of the permittee and Services.
- Chapter 9, *Costs and Funding*, reviews the costs associated with HCP implementation and the funding sources proposed to pay those costs.
- Chapter 10, *Alternatives to Take*, describes the alternatives considered that would reduce take on one or more of the covered species, and why those alternatives were rejected.
- Chapter 11, *References,* lists all of the sources cited in the HCP in alphabetical order.
- Appendix A, *Glossary*, provides definitions for technical terms used in the HCP.
- Appendix B, *Species Considered for Coverage*, provides details on which species were considered for coverage, which were selected, and why.
- Appendix C, *Species Accounts*, provides detailed ecological accounts of all covered species, including models of habitat distribution that were developed for select species.
- Appendix D, *Effects Analysis*, provides detailed modeling data/results to support the effects analysis.

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Chapter 2
Environmental Setting

2.1 Introduction

This chapter describes the existing conditions of the plan area. The plan area encompasses approximately 722,676 acres and includes all Oregon Department of Forestry (ODF)-managed lands, and potential land acquisitions or exchanges in western Oregon identified by ODF district plans. The plan area spans 17 counties; generally, from north to south they are: Clatsop, Columbia, Tillamook, Washington, Yamhill, Polk, Marion, Clackamas, Lincoln, Benton, Linn, Lane, Douglas, Coos, Curry, Josephine, and Jackson (Table 2-1).

The plan and permit area is not evenly distributed among the 17 counties or in different regions of western Oregon. Approximately 65% of the plan area is found in only two counties: Tillamook and Clatsop. Approximately 80% of the plan area is found in only four counties: Tillamook, Clatsop, Washington, and Lane (Table 2-1a and 2-1b).

Table 2-1a. Plan Area by County and Ecoregion (approximate acres)

	Ecoregion				
County	**Coast Range**	**West Cascades**	**Klamath Mountains**	**Willamette Valley**	**Total (Percent)**
Tillamook	312,654	--	--	--	312,654 (43.3)
Clatsop	162,492	--	--	--	162,492 (22.5)
Washington	50,363	--	--	5,641	56,004 (7.7)
Lane	40,320	833	--	1,479	41,799 (5.8)
Linn	--	27,706	--	64	27,770 (3.8)
Lincoln	25,046	--	--	--	25,046 (3.5)
Marion	--	24,610	--	4	24,614 (3.4)
Douglas	2,874	--	11,697	--	14,571 (2.0)
Polk	11,782	--	--	--	11,782 (1.6)
Benton	10,120	--	--	128	10,248 (1.4)
Coos	10,441	--	--	--	10,441 (1.4)
Clackamas	--	8,421	--	--	8,421 (1.2)
Columbia	6,464	--	--	--	6,464 (0.9)
Josephine	--	--	6,489	--	6,489 (0.9)
Jackson	--	--	1,616	--	1,616 (0.2)
Curry	189	--	1,161	--	1,350 (0.2)
Yamhill	80	--		--	80 (<0.1)
Total (Percent)	**632,826 (87.6)**	**61,571 (8.5)**	**20,963 (2.9)**	**7,316 (1.0)**	**722,676**

Table 2-2b. Permit Area by County and Ecoregion (approximate acres)

	Ecoregion				
County	Coast Range	West Cascades	Klamath Mountains	Willamette Valley	Total (Percent)
Tillamook	302,949	--	--	--	302,949 (47.3)
Clatsop	147,064	--	--	--	147,064 (23.0)
Washington	41,408	--	--	5,375	46,783 (7.3)
Lane	23,781	532	--	944	25,257 (3.9)
Linn	--	21,187	--	41	21,228 (3.3)
Lincoln	20,004	--	--	--	20,004 (3.1)
Marion	--	18,985	--	4	18,989 (3.0)
Douglas	2,203	--	8,286	--	10,489 (1.6)
Polk	7,734	--	--	--	7,734 (1.2)
Benton	8,847	--	--	50	8,897 (1.4)
Coos	7,889	--	--	--	7,889 (1.2)
Clackamas	--	7,268	--	--	7,268 (1.1)
Columbia	6,464	--	--	--	6,464(1.0)
Josephine	--	--	6,425	--	6,425 (1.0)
Jackson	--	--	1,616	--	1,616 (0.3)
Curry	189	--	1,161	--	1,350 (0.2)
Yamhill	80	--	--	--	80 (<0.1)
Total (Percent)	**568,614 (89)**	**47,972 (7)**	**17,488 (3)**	**6,413 (1)**	**640,487**

Ecoregions are used as an organizing principle throughout the chapter to describe the plan area. Ecoregions are defined by biotic, abiotic, terrestrial, and aquatic ecosystem components, making them a useful tool to understand the physical and biological setting in different parts of the plan area. The geology, soils, vegetation, climate, land use, amount of solar radiation, and precipitation are all factors that influence how forest develops across western Oregon and what species it supports.

The plan area overlaps four ecoregions: Coast Range, West Cascades, Klamath Mountains, and Willamette Valley (Figure 2-1 and Table 2-1a/b).

- The **Coast Range ecoregion** includes the Oregon coastline and extends east through coastal forests to the border of the Willamette Valley and Klamath Mountains ecoregions.
- The **West Cascades ecoregion** extends from just east of the Cascade Mountains’ summit to the foothills of the Willamette, Umpqua, and Rogue Valleys, and spans the entire north–south length of the state of Oregon, from the Columbia River to the California border.
- The **Klamath Mountains ecoregion** covers much of southwestern Oregon, including the Umpqua Mountains, Siskiyou Mountains, and interior valleys and foothills between these and the Cascade Range.
- The **Willamette Valley ecoregion** is an alluvial plain with scattered groups of low basalt hills that is bound on the west by the Coast Range and on the east by the Cascade Range (Oregon

Department of Fish and Wildlife 2016). The attributes of the western edge of the Willamette Valley ecoregion, where future land acquisitions or exchanges might occur, are similar to those described for the Coast Range ecoregion.

As shown in Table 2-1a, the majority of the plan area (87.6%) occurs in the Coast Range ecoregion. Smaller fractions of the plan occur in three other ecoregions: West Cascades (8.5%), Klamath Mountains (2.9%), and Willamette Valley (1%).

The environmental setting of the plan area summarizes the history of the forest, including pivotal natural events that have shaped the forest that exists today.

2.2 History of the Forest by Ecoregion

Oregon state forests were shaped by a few key natural events, in particular fire and storms. Fire and storm history not only influences the ecology of forests today, but also helps explain the current patterns of forest ownership. A brief history of major fires and other natural events, and the establishment of each state forest, is provided in this section. Additional history of northwestern Oregon state forests and disturbances can be found in Appendix H of the Northwest Oregon State Forests Management Plan (Oregon Department of Forestry 2010a).

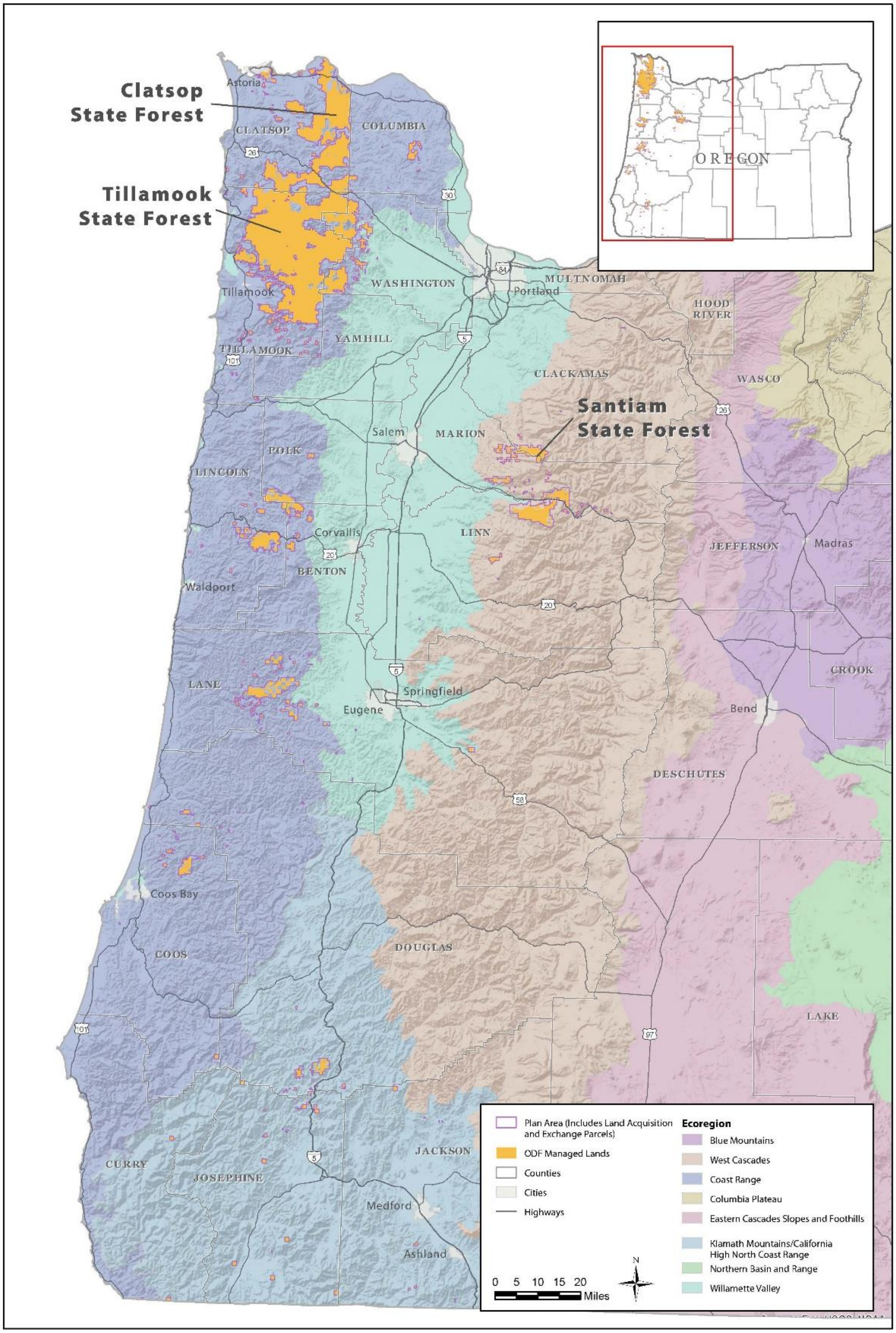


Figure 2-1. Plan Area, Permit Area, and Ecoregions

2.2.1 State Forestlands in the Coast Range Ecoregion

The permit area includes 568,614 acres of lands in the Coast Range ecoregion. Like the ecoregion itself, these state forestlands span almost the entire north–south length of the state, from Clatsop and Columbia Counties in the north to Curry County in the south. There are three notable state forests in the Coast Range ecoregion: the Clatsop State Forest, Tillamook State Forest, and Elliott State Forest. The histories of the Clatsop and Tillamook State Forests are described in more detail in Sections 2.2.1.1, *Clatsop and Columbia Counties*, and 2.2.1.2, *Tillamook and Washington Counties*. The Elliott State Forest is largely excluded from this HCP, except for a few Board of Forestry parcels; thus, the Elliott State Forest is not described in detail. Table 2-1b summarizes state forestlands by county in the coastal range ecoregion. Most of these lands are found in Clatsop and Tillamook Counties in northwest Oregon and are associated with the Clatsop and Tillamook State Forests.

2.2.1.1 Clatsop and Columbia Counties

Clatsop and Columbia Counties contain approximately 153,528 acres of ODF-managed lands in the permit area. Most of the state forestlands in these two counties are part of Clatsop State Forest. The Clatsop State Forest is 98% Board of Forestry lands. The remaining 2% of the Clatsop State Forest is Common School Fund land owned by the Department of State Lands but managed by ODF. These lands were originally privately owned and logged between 1910 and 1940, and then became tax-delinquent. A large portion of the forest in southern Clatsop County burned in one of the Tillamook Burn events. Clatsop and Columbia Counties foreclosed on these lands when landowners could not pay their taxes, and ownership reverted to the county. Many landowners lost their land during the Great Depression. In 1939 Clatsop County became the first county in Oregon to deed its logged and unmanaged forestlands to the Board of Forestry to manage as a state forest. Columbia County first deeded lands to the Board of Forestry in 1942. According to the deed agreement, ODF would replant the lands, protect them from fire, and manage the new forest.

Today, Clatsop State Forest has mostly second-growth Douglas-fir, from 40 to 80 years old. The state forest has been progressively consolidated through a land exchange program that began in the mid-1940s. District staff are still actively pursuing land exchanges, working on a priority list of mutually beneficial exchanges with several private landowners in the area.

2.2.1.2 Tillamook and Washington Counties

Tillamook and Washington Counties contain 344,357 acres of ODF-managed lands in the permit area. Nearly all of that area is associated with the Tillamook State Forest. Much of the area that is now Tillamook State Forest burned in a series of major wildfires during the twentieth century. The first and biggest Tillamook Fire burned 240,000 acres of mostly old growth forest in August 1933. New fires burned across the area every 6 years after that, in 1939, 1945, and 1951. Each fire burned some previously burned area and also consumed unburned forest (Figure 2-2). By the end of 1945, 355,000 acres had been burned at least once and 13.1 billion board feet of timber destroyed. Some areas had burned multiple times. Burned timber and snags were salvaged in an effort to reduce fuels and prevent future burns in the same area, leaving a lack of legacy structure on the landscape. In many places the soil had been so severely burned that nothing grew there for many years. Streams and fisheries in these watersheds were severely affected by the loss of forest cover and the extensive erosion that occurred after the repeated fires.

Before 1933, almost all of the land that became the Tillamook Burn was privately owned. After the fires, many landowners allowed the forestlands to be foreclosed by the counties rather than pay taxes on land that no longer generated any income from timber harvest. Counties began to deed land in the Tillamook Burn to the Board of Forestry in 1940. Eventually, Tillamook and Washington Counties deeded about 255,000 acres to state ownership. Of the remaining 100,000 acres in the Tillamook Burn, most is owned by private timber companies and the Bureau of Land Management. In June 1973, the Tillamook State Forest was dedicated. The 364,000-acre Tillamook State Forest includes 255,000 acres from the Tillamook Burn (70% of the state forest), and other unburned forestland.

Salvage logging began after the 1933 fire and accelerated to meet the lumber demands of World War II. By 1948, 4 billion board feet of fire-destroyed trees had been recovered from the burn on state forestlands. An additional 3.5 billion board feet of fire-destroyed trees were removed from 1949 to 1955.

In 1948, Oregonians approved a bond issue to finance rehabilitation of the Tillamook Burn. ODF carried out a massive rehabilitation project in the burn area between 1948 and 1973. Over the next 24 years, tree planting crews planted 72 million Douglas-fir seedlings. In addition, 36 tons of Douglas-fir seeds were spread on the burn area through aerial seeding, pioneering the first use of helicopters in aerial seeding. Aerial seeding proved to be a mixed success, with large patches of alder still dominating significant portions of the landscape where Douglas-fir did not take hold; however, this effort was successful overall in reforesting a denuded landscape that many thought would never grow trees again.

In recent years, Swiss needle cast (*Phaeocryptopus gaeumannii*), a native fungal disease, has increasingly affected Douglas-fir stands near the coast. The reasons for this are not fully known, but it may be connected to the widespread reforestation of the burn with Douglas-fir from other areas, which introduced a near-monoculture of trees poorly adapted to local coastal conditions. Swiss needle cast stunts the growth of trees, in both diameter and height. Additional factors including climate change and severe damage to soils from the fires may exacerbate the effects of the disease. ODF currently plants Douglas-fir selected for its resistance to Swiss needle cast, and is also exploring management strategies such as replacing severely affected Douglas-fir with other tree species, such as hemlock. ODF is also a member of the Swiss Needle Cast Cooperative, which conducts research and assessments to better understand the disease and potential management options.

The first timber sale by ODF in the former Tillamook Burn, a commercial thinning, took place in 1983. Under the Northwest Oregon State Forests Management Plan, ODF has employed a variety of silvicultural strategies to improve both timber production and habitat. As the forest stands on this landscape continue to grow, there will be increasing opportunities to use silvicultural techniques to develop a diversity of stand structures for forest products and wildlife habitat.

Today, ODF-managed lands in Tillamook and Washington Counties are predominantly Douglas-fir, from 60–80 years old.

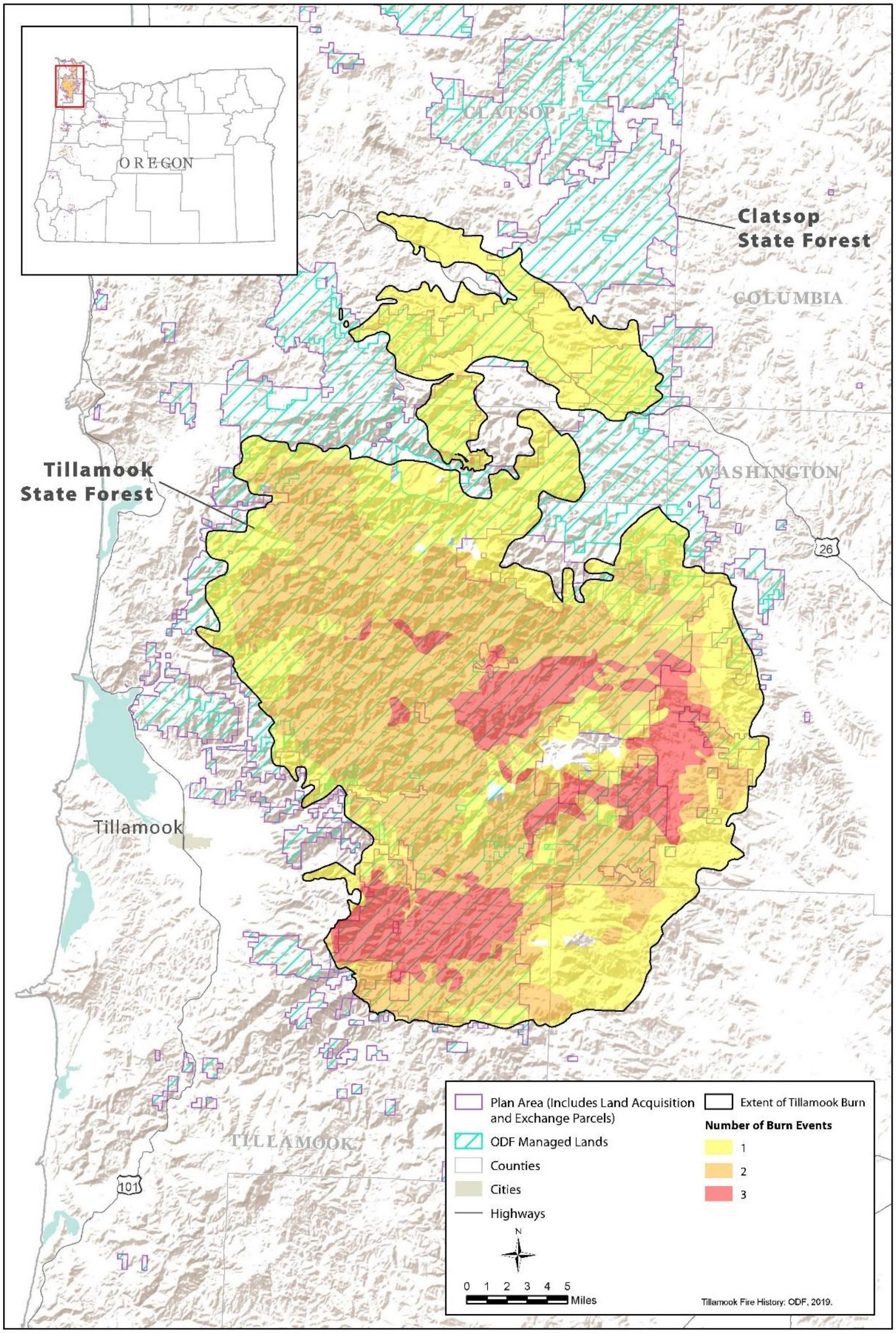


Figure 2-2. Tillamook Burn Fire History

2.2.1.3 Polk, Lincoln, and Benton Counties

Currently, there are approximately 36,585 acres of land in these three counties managed by ODF as the West Oregon District. Of that total, approximately 82% is Board of Forestry lands, and 18% is Common School Forest Lands.

During the Great Depression, most isolated farms in Polk, Lincoln, and Benton Counties were abandoned to the counties in place of back taxes. Some more desirable parcels of land were bought by T. J. Starker, John Thompson, and others who saw the lands' value for timber production. By the late 1930s, however, Benton, Lincoln, and Polk Counties had many parcels of land that they could not sell or manage. Between 1938 and 1948, most of this land was deeded to the Board of Forestry. During that same decade, several small parcels were also purchased by ODF. Between 1947 and 2011, ODF completed several land exchanges with private landowners.

2.2.1.4 Today, ODF-managed lands in Polk, Lincoln, and Benton Counties are predominantly Douglas-fir, from 20–50 years old. Lane County

The Nelson Mountain Fire was one of many large fires in 1910 that motivated the State of Oregon to create ODF. The fire burned most areas that are now state forestlands in western Lane County. Large fires burned again in western Lane County in 1917 and 1922. In 1929, a number of large fires burned much of the central Coast Range in Lane County, covering nearly 80,000 acres. The fires burned some previously burned areas and burned some forests for the first time. With the timber gone, the Great Depression starting, and the land unsuitable for homesteading, many landowners allowed their land to revert to the county in place of back taxes. Lane County deeded its timberlands to the Board of Forestry between 1942 and 1958, managed as the Western Lane District.

The land base remained constant for the next 50 years except for four small land exchanges in the 1950s and one in 1962. In the early 1990s, two larger exchanges reshaped state forestlands in the Western Lane District by exchanging 25% of the acres. These exchanges increased the land base by 10% and started to consolidate state forestlands. Today, the 23,781 acres of state forestlands in the Western Lane District are mostly covered by a 60- to 70-year-old forest dominated by Douglas-fir.

2.2.1.5 Douglas and Coos Counties

There are currently 10,092 acres of ODF-managed lands in the permit area in Douglas and Coos Counties, mostly in scattered parcels around Common School lands that comprise the Elliott State Forest, which is owned and managed by the Department of State Lands. Douglas and Coos Counties donated some of their forestlands to the state. However, southwest Oregon counties also sold forestlands to private timber companies or individuals to keep them on the tax rolls, or kept them to be managed as county forests. Later, parcels of private lands were purchased or donated to become state forests. In 1944, the Windy Creek property along with a few other parcels, for a total of about 3,600 acres, was deeded to the Board of Forestry.

Land exchanges have helped to consolidate some of these lands around the original exchanged Common School Forest Lands that comprised the Elliott State Forest. ODF no longer manages Common School Forest Lands in the Elliott State Forest, but still seeks to consolidate (block up) remaining Board of Forestry lands in Douglas and Coos Counties for more efficient management. State forestlands in these counties have been shaped by fire and wind. The principal wildfire event in this area occurred from September 15 to October 20, 1868. A high-intensity fire began a few miles northeast of Scottsburg, Oregon, and burned the coast from Lakeside to south of Coos Bay. The fire left few intact old-growth stands on the forest, although scattered residual trees and large stumps from this fire are still locally abundant and contribute to forest structure in the post-1868 stands. In addition, the Columbus Day storm on October 12, 1962, blew down an estimated 17 billion board feet of timber in western Oregon and Washington. Wind speeds associated with the storm are shown in Figure 2-3.

Today, ODF-managed lands in Douglas and Coos Counties are predominantly Douglas-fir, with the majority of forests ranging in age from 30–60 and 80–174 years old.

2.2.2 State Forestlands in the West Cascades Ecoregion

2.2.2.1 Clackamas, Marion, Linn, and Lane Counties

There are 47,972 acres of ODF-managed lands in the permit area in Clackamas, Marion, and Linn Counties. Much of the land now in the Santiam State Forest used to be owned by large timber companies, who typically also owned railroad assets for the transportation of logs and wood products. Some individuals and families also owned forestland. From about 1880 until 1930, most lands were logged. These lands were of little value to the owners once the timber was removed, so they were left unmanaged after clearcuts. As a result, forest fires burned large areas of young, dense forests that developed following the extensive logging. During the Great Depression, many landowners allowed their forestlands to be foreclosed by Marion, Clackamas, and Linn Counties in place of back taxes.

The counties eventually deeded these lands to the Board of Forestry. State forestlands in Linn County was acquired by the Board of Forestry between 1939 and 1949, Marion County lands were acquired between 1940 and 1953, and Clackamas County lands between 1942 and 1950. Some land was also acquired from individuals through both charitable donations and purchases between 1943 and 1952. There were additional land exchanges completed between 1945 and 1968 in Linn and Marion Counties. Lands in these counties are managed by the North Cascade District.

Natural regeneration successfully reforested most of the Santiam State Forest. However, a fire in 1951 burned nearly half of the forest, and ODF replanted the most damaged areas. The Santiam State Forest was dedicated in 1974.

Today, ODF-managed lands in Clackamas, Marion, Linn, and Lane Counties are a mix of Douglas-fir and mixed conifer, from 60–90 years old.

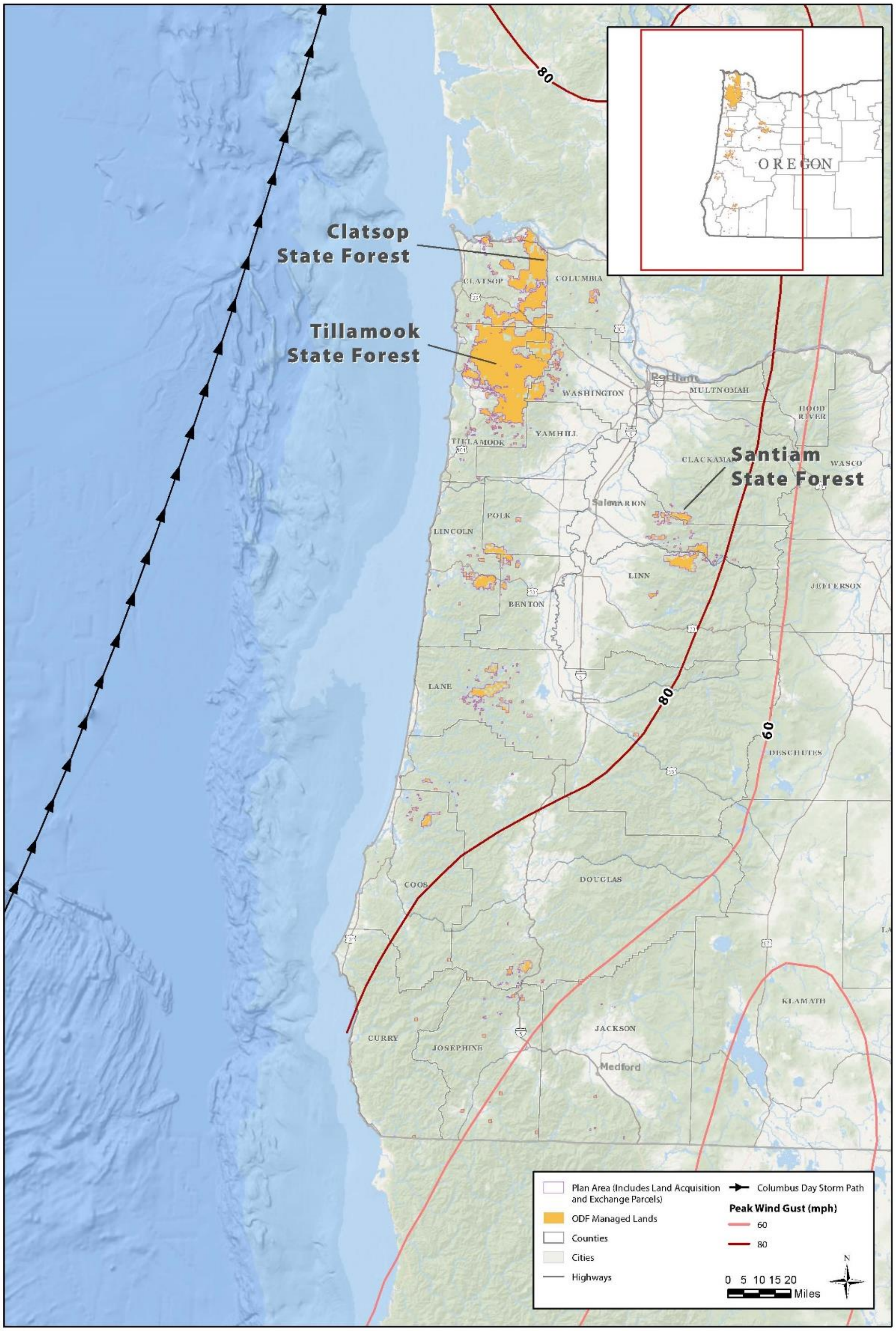


Figure 2-3. Columbus Day Storm

2.2.3 State Forestlands in the Klamath Mountains Ecoregion

2.2.3.1 Curry, Josephine, Jackson, and Douglas Counties

There are 17,488 acres of ODF-managed lands in the permit area in Curry, Josephine, Jackson, and southern Douglas Counties. The lands in southern Douglas and northern Josephine Counties are known as the Glendale block and comprise most of the plan area in these counties. The remaining acreage are in small, scattered parcels throughout the counties. Similar to the lands in other parts of Douglas County and Coos County, some of these lands were donated to the state. Some counties sold forestlands to private timber companies or individuals to keep them on the tax rolls or kept them to be managed as county forests. In southwest Oregon, ODF has a goal to consolidate state forests in the Glendale block through land exchanges or purchases.

Historically this area experienced low-intensity, high-frequency burns. Due to fire suppression these frequent burns were avoided. Today, ODF-managed lands in Curry, Josephine, Jackson, and Douglas Counties are a mix of Douglas-fir and mixed conifer, that are predominantly 80–120 years old.

2.2.4 State Forestlands in the Willamette Valley Ecoregion

There are approximately 6,413 acres (1%) of ODF-managed lands in the permit area in the Willamette Valley ecoregion (Table 2-1b) scattered in small parcels in five counties: Benton, Lane, Linn, Marion, and Washington Counties. The majority of these lands are located along the western border of the Willamette Valley ecoregion adjacent to the Coast Range ecoregion. The remaining acres are along the eastern border of the Willamette Valley ecoregion, adjacent to the West Cascades ecoregion. ODF-owned lands are predominantly Douglas-fir that are 60–80 years old. These lands were acquired during the same time periods as described for the counties in previous sections.

2.3 Physical Setting

This section describes the physical setting of the plan area including topography, geology, soils, hydrology, climate and watersheds by ecoregion. The physical setting descriptions are from the Northwest Oregon State Forests Management Plan (Oregon Department of Forestry 2010a) and the Southwest Oregon State Forests Management Plan (Oregon Department of Forestry 2010b) unless otherwise cited. Table 2-2 summarizes the physical setting of the permit area.

2.3.1 Physical Setting Overview

2.3.1.1 Geology and Topography

The geologic history and formations of Western Oregon continue to shape environmental conditions upon which forests grow. Topography, including elevation, slope, and aspect, have a major influence on forest growth and can affect temperature, sun exposure, soil moisture, and precipitation. Topography also affects the costs and feasibility of timber sales, as steeper slopes can increase costs or even make timber harvest commercially or environmentally infeasible.

2.3.1.2 Soils

Soil is a complex material made of decomposed and fragmented mineral rock, water, plant nutrients, organic material, and air and other gases in the spaces between mineral grains. The organic material consists of living, dead, and decomposed plants and animals. Forest site productivity is controlled by the soil depth, porosity, biology, and the availability of nutrients in the soil. All these factors are influenced by soil type.

Dynamic processes such as forest succession, wind, and fire affect the accumulation of organic matter in the soil. The amount and composition of organic matter affect soil fertility. Small materials such as needles and twigs have the highest concentration of nitrogen. Large materials such as down trees are important because they influence soil nutrient availability and soil moisture.

Landslides are the dominant erosional process in the mountainous terrain of the northwestern state forests in the Coast Range and Klamath Mountains. Debris slides are the most common type of slide. They can originate in headwalls or elsewhere on mountain slopes. Some slides are natural in origin, while some are due to past logging practices or road construction.

2.3.1.3 Climate and Climate Change

Temperatures across much of the plan area are moderated by coastal influence, especially for portions of the plan area on the west slope of the Coast Ranges. Summer temperatures are higher for the eastern slope of the Coast Ranges, Willamette Valley and western slope of the Cascades, and markedly higher for portions of the plan area in the Klamath Mountains Ecoregion (Figure 2-4).

During the twentieth century the average annual temperature in Western Oregon has increased by 1.6°F, with winter experiencing the greatest increase of 3.3°F (Reilly et al. 2018). Oregon is projected to continue to warm between 4 and 9°F by 2100, with an increase in hot days per year across most of the state (Mote et al. 2018). Oregon's coastal areas are expected to warm about 0.4°F per decade, the rest of western Oregon around 0.7°F per decade (Mote et al. 2018). Warming is projected to occur across all seasons, with the greatest increase occurring during summer months (Reilly et al. 2018).

Climate is fairly consistent across the plan area except for precipitation, which varies considerably from north to south and west to east (Figure 2-5) and creates a dramatic influence on forest conditions (Reilly et al. 2018) and habitat value for covered species. In addition to general regional variation in precipitation, summertime storm activity is distinctly different, with the northern Coast Range receiving relatively little lightning activity compared to the Klamath and western Cascades.

The variation in rainfall across the plan area is expected to increase over time with climate change. Projected changes in precipitation are uncertain (Reilly et al. 2018), but models generally project an increase in winter precipitation falling as rain instead of snow and a decrease in summer precipitation (Mote et al. 2018). Extreme precipitation may change more in eastern Oregon than western Oregon by mid-century. Heavy precipitation from warming and shifts in seasonal patterns, as well as rain on snow events, can shift the timing of seasonal streamflows and increase flooding (Reilly et al. 2018). Previously snow-dominated regions are likely to see an increase in winter flooding as a result of rapid rain runoff and reductions in summer flows (by up to 50%) due to the reduction in spring snowmelt (Mote et al. 2018).

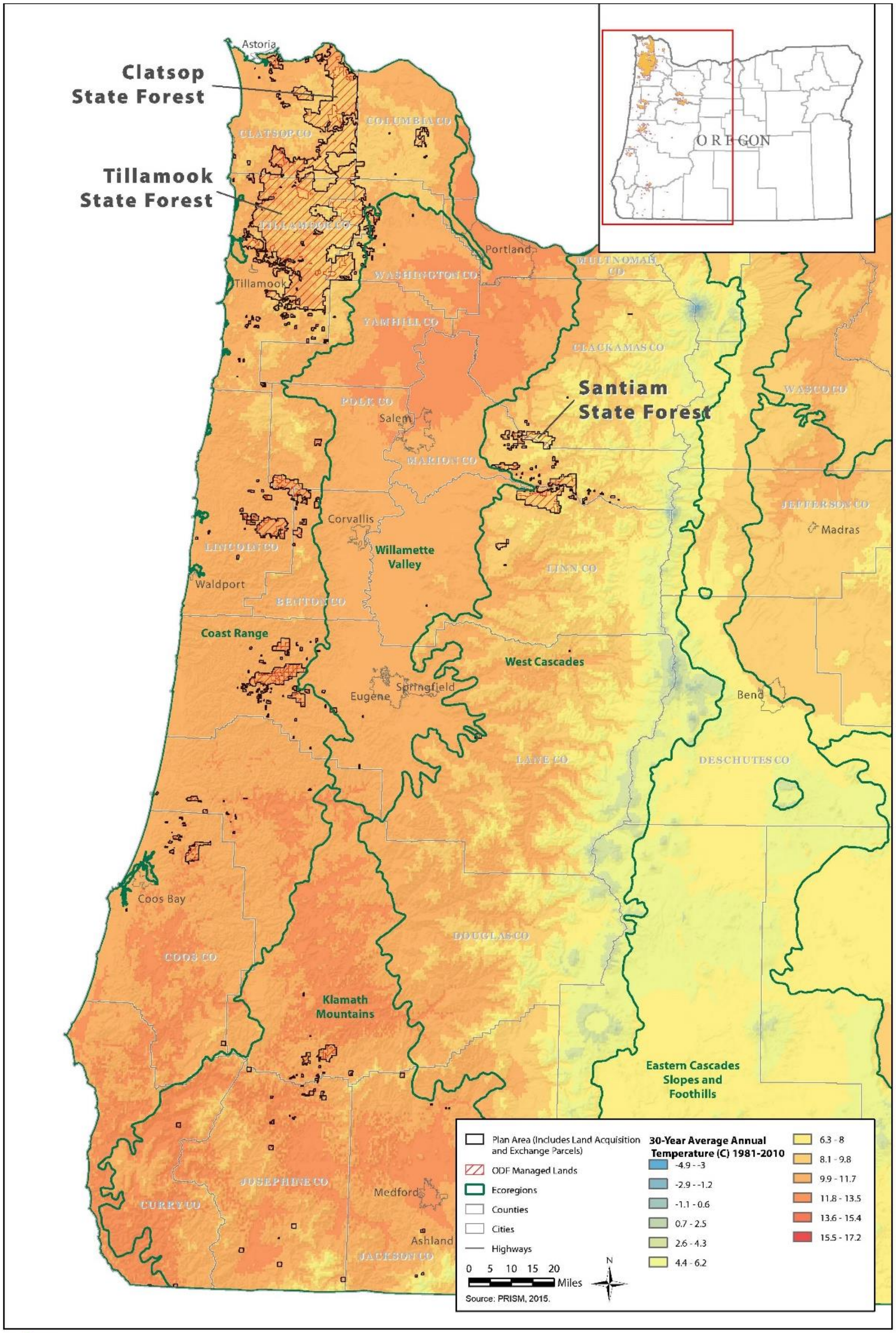


Figure 2-4. 30-Year Average Annual Air Temperature in Plan Area

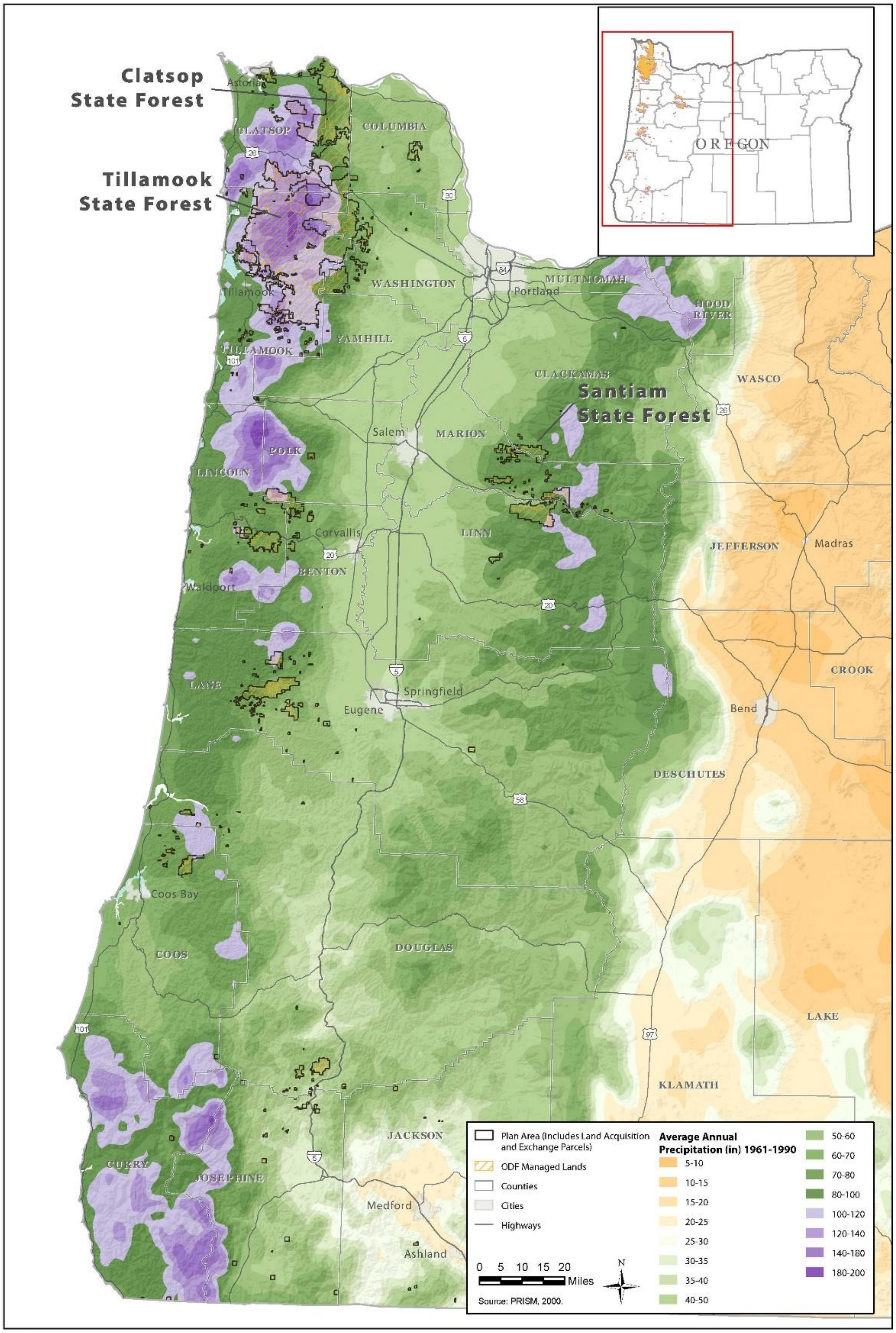


Figure 2-5. Average Annual Precipitation in Plan Area

Temperature and precipitation differences result in different moisture recovery rates for forest fire fuels, especially during summer and early autumn. In addition to this general regime, daytime and nighttime temperature differences between the ocean and eastern Oregon desert create strong, dry afternoon and evening east winds from early to mid-autumn. This can delay nighttime moisture recovery in forest fuels that might be expected in the absence of these winds. These differences in both temperature and precipitation produced starkly contrasting wildfire regimes prior to European settlement. Coast Range wildfire events tended to be infrequent, allowing forest fuel loads to build to levels that supported stand-replacing events over very large areas. Fire regimes in the western Cascades and Klamath ecoregions were more frequent, preventing fuel buildup, with less risk of stand-replacing events.

Climate change could directly and indirectly alter vegetation. The response of tree growth to climate change would vary by species and factors limiting their growth (Reilly et al. 2018). Overall, indirect effects such as frequency, severity, and extent of disturbance (e.g., drought, fire, pathogens) are expected to cause greater change than direct effects (e.g., CO_2 and climate on vegetation [Reilly et al. 2018]). The southern portion of the plan area in the Western Cascades and coastal and inland areas of the Klamath Mountains have the greatest vulnerability to climate change due to the greatest projected increase in the water-balance deficit[1] (Reilly et al. 2018).

2.3.1.4 Major River Basins

The United States Geological Survey has adopted a classification system for water resources over the continental United States. This system defines a nested series of “hydrologic units” that range from a larger “region” (21 total in the United States) to a smaller “sub-watershed.” Each hydrologic unit is identified by a unique hydrologic unit code (HUC). Using this scheme, the plan area falls within four subregions (HUC-6): Lower Columbia, Northern Oregon Coastal, Southern Oregon Coastal, and the Willamette. Streams within these subregions drain directly into either the Pacific Ocean, Columbia River, or Willamette River.

The plan area occurs in the North Coast, Mid Coast, South Coast, Willamette, Umpqua, and Rogue basins. Within each basin are smaller subbasins or HUC areas, which are further described in Section 2.3.2, *Physical Setting by Ecoregion*.

2.3.1.5 Hydrology and Water Quality

Streams in Oregon are grouped by the Forest Practices Act into the following categories based on their beneficial use (Oregon Administrative Rules 629-600-0100 and 629-635-0200).

- **Type F:** Fish-bearing streams. These are streams and waterbodies that are known to be used by fish or meet the physical criteria to be potentially used by fish. Fish-bearing streams may or may not have flowing water all year; they may be perennial or seasonal. Type F streams also include a subcategory of “SSBT use” designations, which means a stream with salmon, steelhead or bull trout present or otherwise used by salmon, steelhead, or bull trout at any time of the year as determined by the State Forester (Rule 629-600-0100 Definitions).

[1] The difference between the atmospheric demand for water from vegetation and the amount of water actually available to use.

- **Type N:** Not a fish-bearing stream.
  - Perennial streams (defined as a stream that normally has surface flow after July 15) are streams that have flow year-round and may have spatially intermittent dry reaches downstream of perennial flow. These streams do not meet the physical criteria of a Type F stream. This also includes streams that have been proven not to contain fish.
  - Seasonal streams (defined as a stream that normally does not have summer surface flow after July 15) are streams that do not have surface flow during at least some portion of the year, and do not meet the physical criteria of a Type F stream.

Additionally, for the purposes of this HCP, Type N: non-fish-bearing streams are further classified as small, medium, or large based on estimated average annual flow. The following definitions apply to these size categories.

- **Small:** Average annual flow of 2 cubic feet per second (cfs) or less.
- **Medium:** Average annual flow greater than 2 cfs, but less than 10 cfs.
- **Large:** Average annual flow of 10 cfs or greater.

Water that flows through state forestlands sustains ecosystems and provides for out-of-stream uses such as irrigation, domestic use, and municipal use. The Oregon Water Resources Department monitors stream flows, issues permits for water withdrawals from streams, and regulates water rights. Forest management activities influence water supply by affecting the age, species, and density of tree cover and other vegetation; the location and condition of roads; and the condition of the soil.

The Oregon Department of Fish and Wildlife (2019) (Appendix X) examines the status and trends of physical instream habitat conditions in across major land ownerships in western Oregon, including Board of Forestry Lands, from 1998 to 2018. The results of the Oregon Department of Fish and Wildlife's assessment elucidate habitat trends on Board of Forestry lands and helped to inform the aquatics analysis. The analysis compares trends on private forestland, agricultural land, and federal forestland, with trends on state forestlands across the following variables.

- Active channel width.
- Pool frequency.
- Channel shade.
- Fine sediment and fine sediment in riffles.
- Gravel.
- Large wood frequency and volume.
- Coho winter parr capacity (modeled—Habitat Limiting Factors Model).
- Substrate (%): Fine sediments, gravel, and bedrock.
- Channel morphology and pool habitat: % secondary channel, % pool, % deep pools.
- Wood: Volume, number of pieces, number of key pieces.
- Riparian: Shade, density of conifers by size class, as well as hardwoods by size class.

2.3.2 Physical Setting by Ecoregion

This section describes the physical setting of the plan area including location, topography, geology and soils, hydrology, climate and watersheds by ecoregion. The physical setting descriptions are from the Northwest Oregon State Forests Management Plan (Oregon Department of Forestry 2010a) and the Southwest Oregon State Forests Management Plan (Oregon Department of Forestry 2010b) unless otherwise cited. Table 2-2 summarizes the physical setting of the permit area.

2.3.2.1 Coast Range Ecoregion

Geology and Topography

Topography in the Coast Range ecoregion is moderately steep to gentle with frequent evidence of medium to large-scale ancient slide features. The Tillamook State Forest is particularly steep, with approximately half of state lands in that area greater than 60% slope (ODF 2019). Earthflows, slumps, and rock block slides are scattered through the landscape. There is also a wide distribution of low strength decomposed rock material that serves to produce potential landslide slip surfaces. There is moderately high potential for debris slides originating from headwalls and other points.

Soils

The soils in the Coast Range ecoregion are derived from sandstones, siltstones, weathered basalts, and volcanic breccias. Soils have developed in residual (in place) colluvial and alluvial materials, and range from deep, rock-free materials to shallow, stony soil profiles.

The Coast Range soils vary from highly productive (Site Class I[2]) for Douglas-fir to moderate potential productivity (low Site Class III), depending largely on profile depth, stoniness, topographic position, and to some extent, soil parent material. However, in general, the parent materials of these soils all provide a potential basis for highly productive soils.

In areas where severe fires burned previous forests, as in 70% of the Tillamook State Forest, the productive potentials of some soils are likely degraded due to burning, loss of organically rich forest floors, and extended exposure to erosion. In places where the loss of organic materials and topsoil resulted from fires of 50 to 100 years ago, productive potentials may still be limited because soil-forming processes are not rapid enough to have rebuilt soils to productive states.

[2] Site class is a measure of an area's relative capacity for producing timber or other vegetation. It is measured through the site index. The site index is expressed as the height of the tallest trees in a stand at an index age (King 1966). In this document, an age of 50 years is used. The five site classes are defined below:
Site Class I = 135 feet and up
Site Class II = 115–134 feet
Site Class III = 95–114 feet
Site Class IV = 75–94 feet
Site Class V = Below 75 feet

Table 2-2. Summary of Physical Setting

Province	Geology	Soils	Climate	Hydrology
Coast Range	Steep to gentle slopes; frequent slides	Sandstone, siltstone, weathered basalts and breccias. Generally potential for highly productive soils. Intense fires have affected productivity in some areas. Reforestation may be difficult on steep slopes.	The wet and mild maritime climate supports highly productive temperate rainforests. Rain dominated with 50–200 inches of precipitation annually.	Drains to Pacific Ocean, Willamette, and Columbia. Steep in headwaters and flat in lower reaches. High stream density (2–3 miles of stream/square mile). 8,220 acres of wetlands (75% riverine, 13% freshwater forest/shrub) and 8,759 miles of streams in the plan area (26% fish bearing, and 96% of Type F streams have perennial flow). Combination of shallow soils and rain dominated precipitation leads to rapid runoff with high flows during winter storms and low flows during the summer dry season.
West Cascades	Steep slopes with volcanic soils. Less dissected slopes than the coast. Less probability of slides than the coast, but still considerable number of slides.	Mostly derived from andesites; other volcanics may cap some soils.	Snow dominated with 80–300 inches of precipitation annually.	High gradient streams that drain to Willamette, Santiam, Sandy and Clackamas. Stream densities range from 1.5- to 2-mile stream per square mile. Approximately 20% of the 491 miles of streams in the plan area are fish-bearing and 79% of those have perennial flow. 373 acres of wetlands (75% riverine, 13% freshwater forest/shrub). Hydrology strongly influenced by climate and soils. At higher elevations much of the precipitation falls as snow and a significant portion filters into highly permeable soil and rock.
Klamath	Mountainous. Metamorphic mosaic; serpentine bedrock rich in heavy metals.	Weathered soils interspersed with peridotite or serpentine which are unproductive for tree growth.	Mediterranean climate with hot dry summers and moderate rainfall in winter; 25–118 inches of precipitation annually.	Rugged terrain with 190 miles of stream in the plan area. Of these, 10% of identified streams are fish-bearing and 99% of type F streams are perennial. 366 acres of wetlands (97% riverine).
Willamette	Broad, lowland valley.	Relatively deep alluvium, colluvium and glaciolacustrine deposits that overlie basalt and sandstone. Soils are productive.	Mediterranean climate with warm dry summers and mild wet winters; 35–63 inches of precipitation annually.	Surface water dominated by large rivers with a wide variety of ecosystems and habitats. 70 miles of streams in plan area with 36% of streams identified as fish-bearing. Virtually 100% of type F streams are perennial. 70 Acres of wetlands (98% riverine).

Climate

The Coast Range ecoregion has a maritime climate that is influenced by cool, moist air from the ocean, and is the wettest and mildest in the state. The ecoregion's mild, moist climate creates conditions for highly productive temperate rainforests. Precipitation occurs mainly as rainfall, averaging between 50 and 90 inches annually along the coast and east of the Coast Range crest, but totaling as much as 200 inches at higher elevations in the mountains (Beschta et al. 1995). The plan area within the Coast Range ecoregion occurs at all elevations, so it experiences the full range of average annual rainfall, from 50 inches to almost 200 inches at the highest elevations.

Major River Basins

The Coast Range Ecoregion includes three major basins:

- **North Coast:** The North Coast basin extends from the Columbia River to the southern Tillamook County line and is bound by the Pacific Ocean to the west and the crest of the Coast Range to the east. The basin consists of six watersheds: Necanicum, Nehalem, Tillamook Bay, Nestucca, Netarts/Sand Lake, and Neskowin. The three largest bays in the basin are Tillamook, Nehalem and Netarts. The outflow from rivers with headwaters in the Coast Range form estuaries along the North Coast. The North Coast basin drains to the Pacific Ocean and is within the Coast Range ecoregion.
- **Mid Coast:** The Mid-Coast basin encompasses four subbasins on Oregon's central coast: Alsea, Siletz-Yaquina, Siltcoos, and Siuslaw. The basin encompasses approximately 9,458 square miles. It is bound by the North Coast basin to the north, the crest of the Coast Range to the east, the South Coast basin to the south, and the Pacific Ocean to the west. The Mid Coast drains to the Pacific Ocean and is within the Coast Range ecoregion.
- **South Coast:** The South Coast basin is located in southwestern Oregon. The basin encompasses over 2,973 square miles and consists of four subbasins—Chetco, Coos, Coquille, and Sixes—as well as a portion of the Smith subbasin. These subbasins are located on the west side of the Siskiyou Mountains. At the northern end of the basin, the Coos and Coquille Rivers headwater in the Coast Range and flow across relatively flat, low gradient, marine terraces to the Pacific Ocean. In the southern portion of the basin, numerous coastal frontal streams headwater primarily in the Klamath Mountain Province and discharge directly to the ocean (Oregon Department of Environmental Quality 2013). The outflow from rivers with headwaters in the Coastal Ranges, which form estuaries along the south coast. The South Coast basin is within the Coast Range ecoregion.

Hydrology and Water Quality

Coast Range ecoregion streams and rivers generally have steep gradients in their headwater sections and very flat gradients in their lower reaches. Stream densities are high in this region, ranging from 2 to 3 miles of stream per square mile of land. Streams originating on the west slopes generally flow into the Pacific Ocean, and streams that drain the east slopes are tributaries to the Willamette River. On the North Coast, several streams drain north directly into the Columbia River. The combination of shallow soils and rain-dominated precipitation leads to flashy, rapid runoff with high flows during winter storms and low flow during the summer dry season.

There are approximately 8,759 miles of streams in the plan area of the Coast Range ecoregion. Of those, approximately 1,338 miles are fish bearing (15%; Type F) streams with 96% of these Type F streams having perennial flow, meaning they contain water throughout of the year, except during infrequent periods of severe drought. There are approximately 3,850 miles of non-fish-bearing streams (Type N) in the plan area. These streams do not meet the physical criteria of Type F streams but still provide downstream salmonid habitat values by contributing large wood and cooler stream temperatures through shading as well as habitat for other aquatic species, including torrent salamanders. The stream type of the remaining 3,571 miles is unknown.

There are approximately 8,220 acres of wetlands that occur in the plan area of the Coast Range ecoregion. Using the National Wetland Inventory (NWI) classifications, the majority acreage is represented by riverine (75%), which includes all wetlands and deepwater habitats contained within a channel and are analogous with the streams described previously. The remaining acreage is composed largely of freshwater forested/shrub (13%) where trees are the dominate life form, with at least 30% overall coverage. This wetland type occurs only in the Palustrine and Estuarine systems and normally possesses an overstory of trees, an understory of young trees or shrubs, and an herbaceous layer (Federal Geographic Data Committee 2013). Forested and smaller stream associated wetlands are not as well documented in the NWI, but are identified, and protections established, in the planning phases of management activities.

2.3.2.2 West Cascades Ecoregion

Geology and Topography

The topography of the West Cascades ecoregion has been shaped dramatically by its volcanic past. Geologically, the West Cascades ecoregion has two distinct areas: the younger volcanic crest (approximately 3 million years old) and the “old Cascades” to the west of the crest (at least 30 million years old). The topography is steep, i.e., the ecoregion is very long and has somewhat less dissected slopes than the Coast Range mountains. The probability of debris slides is less than the Coast Range ecoregion. There are significant numbers of medium to large rock block slides, slump blocks, slump earthflows, and some very large earthflows scattered over the landscape. Loading and undercutting, including for waste-storage areas, landings, and roads, can trigger renewed movement in these features. The risk of slope instability associated with timber harvest and road building is somewhat less than that of the Coast Range ecoregion.

Soils

Soils of the Santiam State Forest, which is where the bulk of the plan area occurs in the West Cascades ecoregion, are mostly derived from ancient andesites and their alluvial deposits. Other volcanic deposits may cap some soils. The soils are mostly gravelly with clay, clay loam, and sandy loam textures. They vary from shallow and skeletal on some slopes to deep and moderately well developed on gentle terrain. Rock volumes of 40 to 60% are common.

Site quality varies from high Site Class II for Douglas-fir to Site Class V for both Douglas-fir and western hemlock. Forest stands may range from being relatively windfirm to being highly susceptible to windthrow, depending on steepness of slopes and soil depth.

Reforestation may be difficult on some steep slopes. Silvicultural and harvesting systems must be thoughtfully designed and implemented to ensure the long-term productivity of these sites.

Climate and Climate Change

The western slopes of the Cascades receive most of their precipitation as snow, from November through March. At higher elevations up to 300 inches of precipitation may fall annually, and the lower slopes get at least 80 inches annually (Beschta et al. 1995). Temperatures in the West Cascades ecoregion are still influenced by the ocean but are more varied than the Coast Range ecoregion. The plan area is located in the western portion of the West Cascades ecoregion and extends from mid-to-high elevations and experiences higher precipitation levels associated with these higher elevations.

Major River Basins

The West Cascades ecoregion is part of the Umpqua basin, which also includes portions of the Coast Range and Klamath Mountains ecoregions. The basin comprises approximately 5,063 square miles of southwest Oregon. It is bound on the east by the Cascades and extends west to the Pacific Ocean. Three subbasins are contained within the Umpqua Basin: North Umpqua, South Umpqua, and Mainstem Umpqua/Smith. The headwaters of the North Umpqua River are located in the Umpqua National Forest and it flows generally west until it meets the South Umpqua River downstream from Roseburg. The South Umpqua River also has headwaters in the Umpqua National Forest, and generally flows west. It flows north after its confluence with Cow Creek, a major tributary. Downstream from the confluence with the North Umpqua is the Umpqua mainstem, which flows generally west until it meets the Smith River at the Umpqua-Smith estuary before emptying into the Pacific Ocean. The mainstem of the Umpqua River is within the Umpqua subbasin, which receives drainage from the other two subbasins as well as from smaller tributaries. It includes the drainages of the South Umpqua River, North Umpqua River, mainstem Umpqua River, and Smith River.

Hydrology and Water Quality

West Cascades ecoregion streams and rivers usually have high gradients. Stream densities range from 1.5 to 2 miles of stream per square mile of land (Beschta et al. 1995). West Cascades ecoregion streams west of the crest flow westward and eventually join one of the major rivers draining the area (Santiam, Sandy, Willamette, and Clackamas). The hydrology of the West Cascades is strongly influenced by elevation, climate and soils. At higher elevations much of the precipitation falls as snow and a significant portion filters into highly permeable soil and rock.

There are approximately 491 miles of streams in the plan area of the West Cascades ecoregion. Of those, approximately 84 miles are fish bearing (15%; Type F) streams with the majority (79%) having perennial flow, meaning they contain water throughout of the year, except during infrequent periods of severe drought. There are approximately 359 miles of non-fish-bearing streams (Type N) in the plan area. The stream type of the remaining 48 miles are unknown.

There are approximately 373 acres of wetlands that occur in the plan area of the West Cascades ecoregion. Using the NWI classifications, the majority acreage is represented by riverine (75%), which includes all wetlands and deepwater habitats contained within a channel and are analogous with the streams described previously. The remaining acreage is composed largely of freshwater forested/shrub (13%). Forested and smaller stream-associated wetlands are not as well documented in the NWI, but are identified, and protections established, in the planning phases of management activities.

2.3.2.3 Klamath Mountains Ecoregion

Geology and Topography

ODF-managed lands in the Klamath Mountain ecoregion are mountainous, with little land located on the valley floors. The underlying bedrock is metamorphic on most of the lands and includes some of the oldest rock formations in Oregon.

The Klamath Mountain ecoregion has not been significantly shaped by volcanism. The geology of the Klamath Mountains can be better described as a mosaic rather than the layer-cake geology of most of the rest of the state. In the Klamath Mountains, serpentine mineral bedrock has weathered to a soil rich in heavy metals, including chromium, nickel, and gold, and in other parts, mineral deposits have crystallized in fractures (Oregon Department of Fish and Wildlife 2016).

Soils

Upland soils in the western half of the Klamath Mountains ecoregion are moderately deep reddish-brown silt loam or silty clay loam underlain by silty clay (Franklin and Dyrness 1988). These soils are interspersed with scattered areas of peridotite or serpentine, which are shallow and stony and underproductive for tree growth. There is a variety of valley soils, mostly dark-colored, well-drained silt loam underlain by a silty clay loam subsoil. Poorly drained streamside soils also occur.

In the eastern part of the ecoregion, principal upland soils are dry for most of the year and are generally reddish-brown with bedrock within approximately 3 feet of the surface (Franklin and Dyrness 1988). The texture tends to be loam underlain by clay loam subsoils. Shallow, gravelly soils of low fertility occur but are less widespread. Soils on flood plains and alluvial fans in the eastern half of the Klamath Mountains are principally well-drained prairie soils.

Climate and Climate Change

The Klamath Mountains ecoregion has a Mediterranean climate that is typified by hot, dry summers and moderate rainfall occurring abundantly in the winter months, making it unique from the rest of western Oregon. Snow occurs mostly above the 3,000-foot elevation and is generally short-lived. Average annual precipitation varies from 25 inches per year (near Rogue River and Shady Cove) to 118 inches per year (near the Cave Junction). Nearly 80% of the precipitation occurs in the winter months. Temperatures range from 9–116°F. The plan area is the central portion of the Klamath Mountains ecoregion and experiences lower precipitation levels associated with this dryer portion of the state.

Major River Basins

Most state forest lands within the Klamath Mountains ecoregion are located within the Rogue River Basin. The basin contains 5,156 square miles in southwestern Oregon and northern California. The Rogue River Basin includes five subbasins: Lower Rogue River, Middle Rogue River, Upper Rogue River, Illinois, and Applegate. The basin is bound by the Siskiyou Mountains to the south and the Cascade Mountains to the east. The hydrology of the basin is strongly influenced by the climate and the soils. At higher elevations much of the precipitation falls as snowfall and a significant portion infiltrates into the highly permeable soil and rock. As a result, higher flows are seen in May due to snow melt. In contrast, the flow of the Illinois River is more typical of the coast range where most of the precipitation falls as rainfall and shallow soils lead to rapid runoff with high flows during winter storms and low flows during the summer dry period. The Rogue basin is within the Coast Range and Klamath Mountains/California High North Coast Range ecoregions.

Hydrology and Water Quality

Southwest Oregon state forest lands occur in the Klamath Mountains hydrologic region, which occupies most of southwestern Oregon and extends southward into northern California. They are rugged, have 2,000 to 5,000 feet of relief, and receive more than 120 inches of precipitation annually (McFarland 1983). The southwest Oregon state forests are in the Rogue and Umpqua drainage basins. The Rogue and Umpqua drainage basins are significant watersheds that are directly influenced by state forestlands in southwest Oregon.

There are approximately 190 miles of streams in the plan area of the Klamath Mountains ecoregion. Of those, approximately 17 miles are fish bearing (8%; Type F) streams with almost all (99%) having perennial flow, meaning they contain water throughout of the year, except during infrequent periods of severe drought. There are approximately 152 miles of non-fish-bearing streams (Type N) in the plan area. These streams do not meet the physical criteria of Type F streams but do provide habitat for other aquatic species including torrent salamanders. The stream type of the remaining 21 miles is unknown.

There are approximately 366 acres of wetlands that occur in the plan area of the Klamath Mountains ecoregion. Using the NWI classifications, almost all of the acreage is represented by riverine (97%), which includes all wetlands and deepwater habitats contained within a channel and are analogous with the streams described previously. The remaining acreage is composed of freshwater forested/shrub. Forested and smaller stream-associated wetlands are not as well documented in the NWI, but are identified, and protections established, in the planning phases of management activities.

2.3.2.4 Willamette Valley Ecoregion

Geology and Topography

The Willamette Valley ecoregion is mostly a rolling, broad, lowland valley. Elevations range from about 20 feet to over 1,970 feet on higher peaks, which are located along the western and eastern borders of the ecoregion. Landforms consist of terraces and floodplains that are interlaced and surrounded by rolling hills (Griffith 2010). The limited lands within the plan area are located outside of the valley floor along the eastern and western borders of the Willamette Valley ecoregion.

Soils

Soils in the Willamette Valley ecoregion include relatively deep alluvium, colluvium, and glacio-lacustrine deposits that overlie Miocene volcanic basalt and marine sandstone. Soils along the valley floor are productive, have a mesic temperature regime, and have a variety of texture and moisture characteristics (Griffith 2010). Soils associated with the plan area, which is situated in the foothills outside of the valley floor, consist of Ultisols and Alfisols.

Climate and Climate Change

The Willamette Valley ecoregion has a Mediterranean-type climate, with warm, dry summers and mild, wet winters. Average temperatures range from 50–55°F. The frost-free season is 5–7 months long. Average annual precipitation is 48 inches. In the mountainous foothills, which is where the plan area is located, precipitation ranges from 35 to 63 inches (Griffith 2010).

Major River Basins

State forestlands within the Willamette ecoregion are within the Willamette River Basin. Draining an area greater than 11,200 square miles, the Willamette basin is the state's largest. The basin begins south of Cottage Grove and extends approximately 187 miles to the north where the Willamette River flows into the Columbia River. It encompasses 12 subbasins: Lower Willamette, Tualatin, Molalla-Pudding, Yamhill, Clackamas, South Santiam, North Santiam, Middle Willamette, McKenzie, Coast Fork Willamette, Middle Fork Willamette, and Upper Willamette. The basin contains the broad Willamette River valley, which is flanked by the forested slopes of the Coast and Cascade mountain ranges. The Willamette River and its tributaries support a wide variety of ecosystems and habitats. The Willamette River stretches nearly 300 miles from its headwaters at Waldo Lake near Eugene to the confluence with the Columbia River in North Portland (Oregon Department of Environmental Quality 2020 and U.S. Army Corps of Engineers 2017). The Willamette basin is within the Willamette Valley ecoregion.

Hydrology and Water Quality

Surface water in the Willamette Valley ecoregion is dominated by large rivers and numerous streams flowing from the adjacent mountainous regions (Griffith 2010). Large rivers in the ecoregion include the Willamette, McKenzie, Santiam, Sandy, Mollala, Clackamas, Tualatin, Yamhill, Luckiamute, and Long Tom. There are also numerous seasonal wetlands and ponds along with a few reservoirs.

There are approximately 70 miles of streams in the plan area of the Willamette Valley ecoregion. Of those, approximately 14 miles are fish bearing (17%; Type F) streams with almost all (100%) having perennial flow, meaning they contain water throughout of the year, except during infrequent periods of severe drought. There are approximately 25 miles of non-fish-bearing streams (Type N) in the plan area. The stream type of the remaining 43 miles is unknown.

There are approximately 70 acres of wetlands that occur in the plan area of the Willamette Valley ecoregion. Using the NWI classifications, almost all the acreage is represented by riverine (98%), which includes all wetlands and deepwater habitats contained within a channel and are analogous with the streams described previously. The remaining acreage is composed of freshwater forested/shrub and freshwater emergent. Freshwater emergent wetlands maintain the same appearance year after year and are dominated by perennial plants (Federal Geographic Data Committee 2013). Forested and smaller stream-associated wetlands are not as well documented in the NWI, but are identified, and protections established, in the planning phases of management activities.

2.4 Forest Conditions

This section describes the history of past disturbances in the permit area and associated forest conditions, including forest type, age, structure, and health. The 2010 Forest Management Plans (Oregon Department of Forestry 2010a, 2010b) and 2018 Forest Resource Assessment (Magby et al.

2018) describe forest conditions in the plan area and served as the basis of the following discussion, except as otherwise cited. Table 2-3 summarizes the ecological setting of the permit area.

2.4.1 Forest Data

ODF's forest inventory data characterize forest composition and structure in the permit area. Inventory data include site-specific data on trees, snags, downed woody debris, and understory vegetation. These data are based on a field-measured sampling of selected representative portions of forested inventory stands. The number of stands sampled varies from year to year, depending on budgets and specific needs. Overall, approximately 50% of stands have been measured. Data from measured stands are used to extrapolate inventory information to stands that do not have field-measured data. ODF regularly maintains and updates inventory data, which serve as the information source on forest conditions for all lands managed by the State Forests Division. ODF uses inventory data to inform forest management analyses, assessments, activity planning, and status reporting.

2.4.2 Forest Conditions Overview

2.4.2.1 Historic Context

The forests in the plan area have been greatly influenced by historic landscape-scale disturbance events, as well as forest management. These overriding and important factors are summarized below.

Fires and Storms

- **Large fires.** The fires of the Tillamook Burn (1933–1951) greatly influenced the soil and forest trees of the Tillamook and Clatsop State Forests. This series of massive fires led to large-scale loss of timber and subsequent salvage harvest of what remained. Similar large-scale fires and subsequent salvage harvest occurred in Lane County with the Nelson Mountain Fire (1910), in the Santiam State Forest (1951), and in Douglas and Coos Counties (1868).
- **Fire suppression**. Fire-suppression activities were prevalent throughout much of the twentieth century and have helped create forests of relatively uniform age and high fuel biomass. Fire suppression has led to an increased frequency of large, catastrophic fires.
- **Windstorms**. The plan area, primarily in the Coast Range ecoregion, is subject to winter storms from the Pacific Ocean. Severe storms occasionally feature high wind velocities, the effects of which can be exacerbated by heavy rainfall that saturates soils, reducing tree resistance to windthrow. In northwest Oregon, periodic severe windstorms typically occur between October and March. Both the Hanukkah Eve Storm of 2006 and the Great Coastal Gale of 2007 exhibited extreme wind speeds and duration and blew down large stands of timber, resulting in the salvage of 17 million and 35 million board feet of timber on the Astoria District, respectively. The Columbus Day storm on October 12, 1962, which was powerful but relatively short in duration, blew down an estimated 17 billion board feet of timber in western Oregon and Washington. Other major windstorms in the last century occurred on January 9, 1880, in northern Oregon; December 4, 1951, in western Oregon; and the winter of 1995–1996 in western Oregon. The winters of 1949–1952 and 1955–1956 also had heavy winds.
- **Winter rainstorms.** Western Oregon, especially the Coast Range, has frequent, intense winter rainstorms. Severe floods usually result from rain-on-snow events, when heavy rain falls on

snow, swelling the streams with melted snow and rain. Heavy rains also saturate soils, particularly where other disturbances such as fires have exposed the ground. The saturated soils can give way and start landslides and debris flows. Floods are more common in the cool, wet periods of climate cycles. Landslides and major flooding cause small, localized disturbances that are important for forest regeneration, especially in riparian zones.

Harvest

- **Extensive logging.** Logging for timber production has occurred in Oregon beginning with early settlement and trade activities in the early to mid-1800s. Much of the forestland now managed by ODF was inaccessible to these early activities, but the development of railroads around the turn of the twentieth century allowed for access and logging of mountainous areas on an industrial scale. In the early decades of the twentieth century, significant portions of what are now the Tillamook and Clatsop State Forests were logged using railroads and steam-powered yarding equipment. By the 1940s, forest roads and log trucks replaced railroads, and chainsaws replaced crosscut saws, and diesel-powered yarding equipment replaced steam donkeys. Logging practices over the last century combined with extensive fires has resulted in few remaining old growth forests.

  In recent decades, timber harvest has been the primary agent of change in the plan area. Based on historic timber sale records from July 1979 to June 2018, approximately 150,000 acres of regeneration harvest and 215,000 acres of partial cut harvest have occurred in the plan area.

- **Intensive and selective forest management.** Plantation forestry began in Oregon on a very limited scale as early as 1901 but was only employed on 49,000 acres statewide over the next 40 years. Artificial reforestation was first encouraged by the Oregon Forest Conservation Act of 1941, with the recognition that Oregon forestlands should continuously grow timber into the future. Over the next 30 years, reforestation through the planting of seedlings became more economically feasible. Many of Oregon's largest reforestation efforts (both planting and seeding) were conducted on lands under ODF's management, primarily focused on rehabilitating lands deforested by wildfire and early industrial logging. The 1971 Oregon Forest Practices Act strengthened the mandate for reforestation after harvest, and modern plantation forestry centered on Douglas-fir became standard practice. There are now many acres of uniform stands, mostly of the commercially valuable Douglas-fir.

- **Reforestation.** Most reforestation has included planting Douglas-fir because of its relatively high commercial value and ability to rapidly grow in even-aged stands. Tree improvement programs and nursery technology advanced rapidly for Douglas-fir, so it also became the easiest and least expensive tree to plant and manage. The long-term effect, particularly in the Coast Range, was an increase in the quantity and density of Douglas-fir, often from non-local seed sources in the early years of restoration. Current ODF reforestation practices include the predominant use of Douglas-fir that has been improved through selective breeding for a variety of conditions at local and landscape scales. In addition to Douglas-fir, planting regimes also incorporate a component of other native conifers and hardwoods, including western hemlock, western redcedar, Sitka spruce, and red alder. Sites are closely evaluated for an appropriate mix of these other species to include, based on physical site characteristics, such as soil moisture and elevation. In addition, thinning prescriptions in recent years have tended to favor opening stands up more, encouraging more diverse understory development.

Insects and Disease

A comprehensive inventory of pest and disease agents active in the plan area is presented in the 2010 Forest Management Plan (Oregon Department of Forestry 2010a, 2010b). Several diseases have reached noticeable levels of damage in recent decades and are discussed in this section. Climate change introduces additional uncertainty around the potential future extent of insects and disease. For instance, increased summer drought stress makes trees more vulnerable to these agents, and a lack of hard winter freezes may disrupt natural regulation of insect populations.

Most insect damage on state forests is caused by the Douglas-fir bark beetle (*Dendroctonus pseudotsugae*), which tends to affect low-vigor trees weakened by other factors. Beetle population buildup occurs on freshly downed Douglas-fir trees after significant disturbance events and can cause damage to healthy trees. Outbreaks typically last 2 to 4 years, though they can be prolonged when conditions are favorable.

Swiss needle cast, a native fungal disease, has increasingly affected Douglas-fir stands near the coast. The reasons for this are not fully known, but it may be connected to the widespread reforestation of the burn with Douglas-fir seed from other areas, which introduced trees poorly adapted to coastal conditions. Swiss needle cast causes premature dropping of needles, with severely infected trees retaining only the current year's needle growth. This reduces tree growth. The combination of off-site seed, Swiss needle cast and other factors has stagnated tree growth, particularly height growth. The geographic scope and severity of the disease complicates forest management activities due to reduced harvest volume and poor response to prescriptions intended to enhance habitat and stand growth.

Laminated root rot (*Phellinus weirii*), a native disease of conifers, has damaged Douglas-fir on some sites, but current management practices can stabilize or reduce unwanted effects of this disease. Black stain root disease (*Leptographium wageneri*) has reached epidemic proportions in some locations in southwest Oregon, and now can be found at low levels throughout young Douglas-fir stands in northwest Oregon forests. Armillaria root disease (*Armillaria* sp.) is far less abundant and damaging than laminated root rot but occasionally causes significant damage in young Douglas-fir plantations. Root disease surveys have shown that in the northwest Oregon state forests, armillaria is widely scattered and occurs in very small patches, usually affecting only a few trees.

Disease and insects combine with wind damage to create patchy stands. The interactions of wind, root disease, and bark beetles create canopy gaps, mix soils during tree uprooting, and increase structural and biological diversity in stands.

Legacy Forest Roads

Legacy road conditions from historical logging practices, especially old (sometimes abandoned) hauling and skid roads that were built before current Best Management Practices were in effect, have increased the probability of slope failure in some locations. The Tillamook State Forest has legacy road conditions throughout the forest. In some areas, the legacy conditions pose serious threats to water quality, fish, and aquatic habitats.

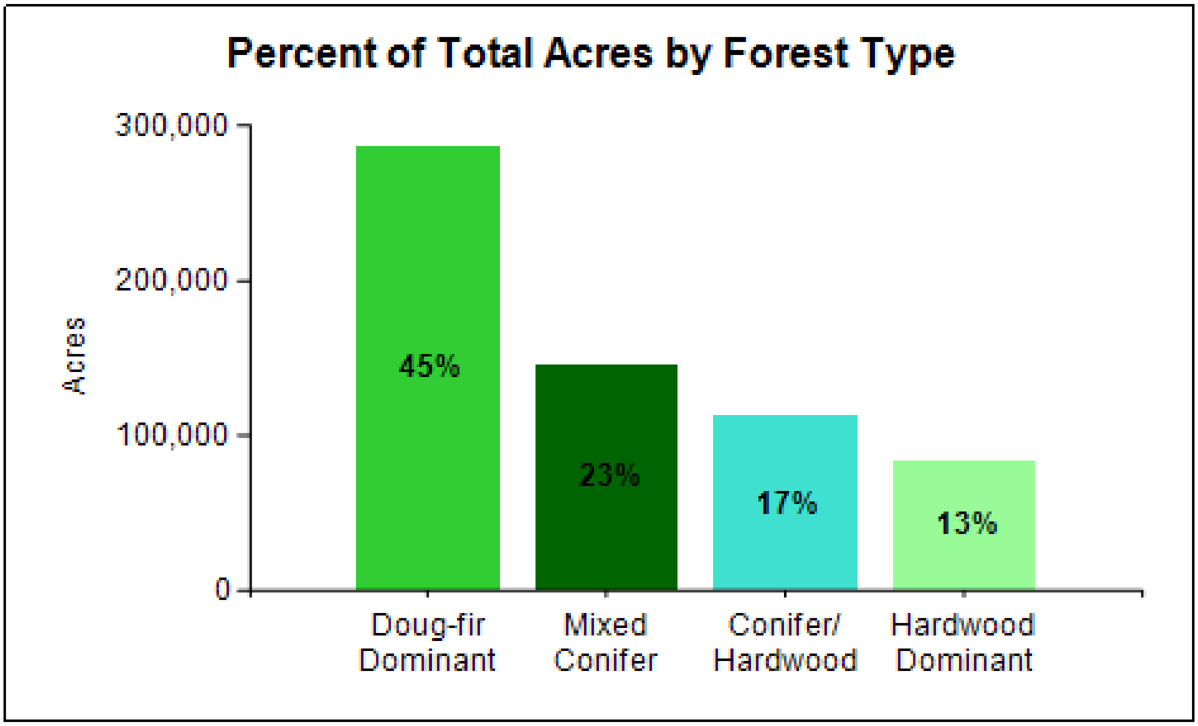
2.4.2.2 Forest Types

Grouping stands into forest types based on species composition is a useful tool that facilitates the observation of natural patterns that are exhibited across a complex landscape. These forest types provide information about a stand's potential future condition, and then stand age and management history can reveal where a stand lies on its developmental curve. The forest stands are predominantly conifer, although some portions of the landscape are dominated by hardwood stands, and many stands across the landscape have some hardwood component. Forest types can be broadly classified into four types:

- **Douglas-fir dominant stands.** Douglas-fir accounts for more than two-thirds of the standing volume on Oregon state forests (Figure 2-6). Overall, less than half of the total state forest acreage fits the definition of a single-species Douglas-fir-dominant stand.
- **Mixed conifer stands** typically include some combination of western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), and noble fir (*Abies procera*).
- **Hardwood dominant stands** are usually dominated by either red alder (*Alnus rubra*) or bigleaf maple (*Acer macrophyllum*).
- **Conifer-hardwood mix stands** are most commonly Douglas-fir or western hemlock mixing with red alder.

The four different forest types vary from one another with respect to their potential for wildlife habitat development. Complex forest habitat conditions uniquely benefit many native wildlife species. Compositional diversity, structural complexity, and spatial heterogeneity that benefit native wildlife are provided in forest stands with a diversity of tree species; an understory of trees, shrubs, and herbs; and ample amounts of snags and downed wood.

On Oregon state forests roughly 25% of the mixed conifer acres currently provide complex structure, as compared with less than 10% of the Douglas-fir-dominant acres. By definition, mixed conifer stands tend to be multispecies stands that are more prone to developing layered canopies. For similar reasons, the conifer/hardwood mix forest type also contributes disproportionately to the total acres with complex habitat conditions. Due to a variety of geographic and historic factors, these four forest types are not distributed evenly across the plan area.

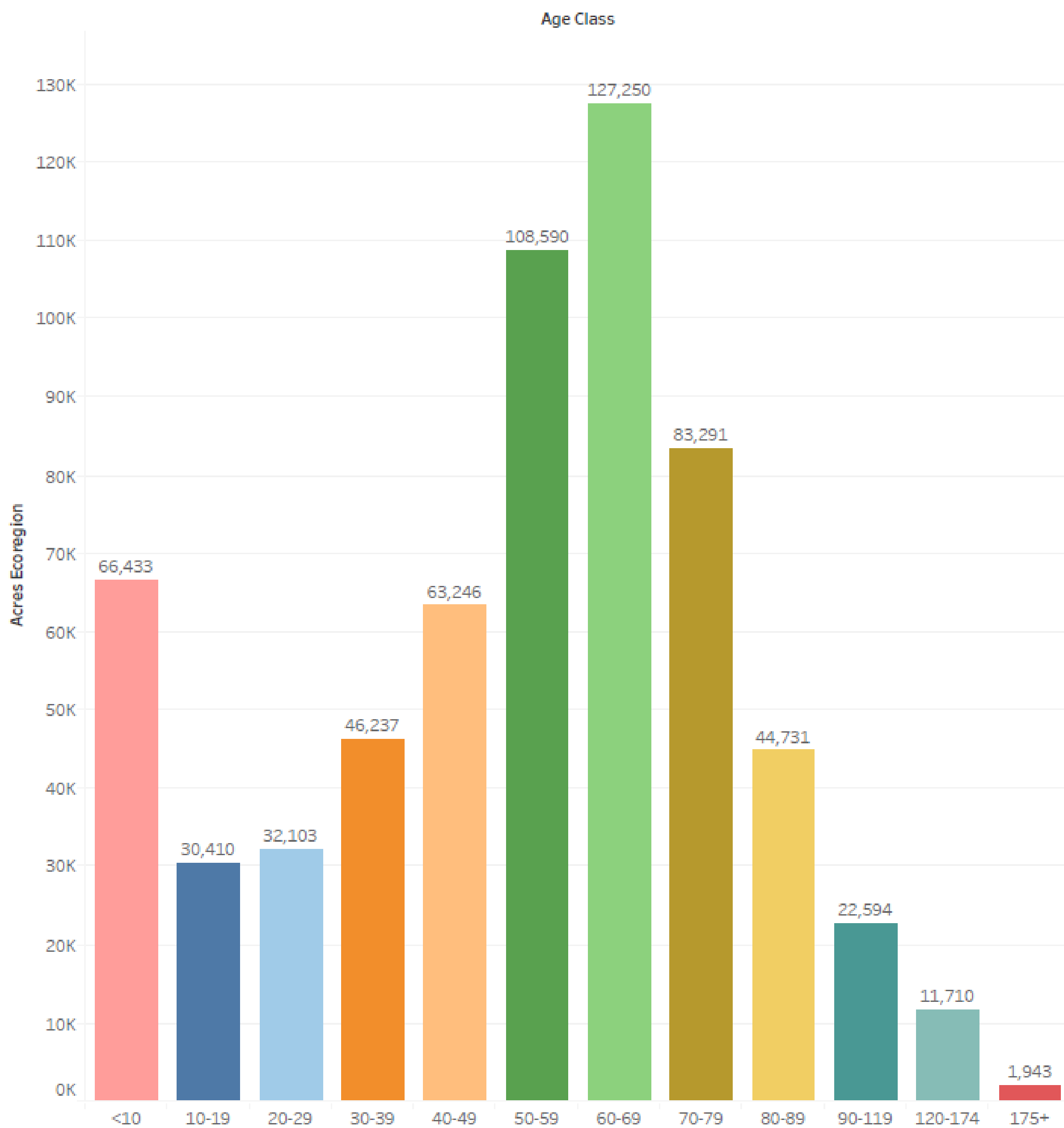


Source: ODF in prep.

Figure 2-6. Overview of Western Oregon Forest Types within State Forests (Permit Area Only)

2.4.2.3 Forest Age

Forest age generally refers to the time elapsed since the last major disturbance that eliminated much of the previous forest and allowed regeneration of a new stand. As a result of their history of large fires, extensive logging prior to state ownership, and subsequent forest management, the current age distribution of Oregon state forests lands is not uniform (Figure 2-7). Stand age is a major indicator of current forest condition and this non-uniform age distribution has significant implications related to forest management planning. Forest stands in the 50- to 79-year-old range are the most abundant across the plan area and account for half of the total acreage and more than 60% of the standing volume. On portions of the Tillamook and Forest Grove districts, these acres coincide with periods of aggressive salvage logging and subsequent reforestation efforts that occurred after the Tillamook Burn. However, stand age is not the only factor that influences a current stand's condition. Site productivity, past management practices, and disturbance history have all interacted with one another to produce the forests that ODF manages today.



Source: ODF file information

Figure 2-7. Age Distribution of Forests on State Forestlands (Permit Area Only)

2.4.2.4 Forest Structure

In addition to age, forests can be described in terms of structure. Forest structure refers to the vertical and horizontal distribution of trees, presence of snags (standing dead) and logs (downed dead), structural diversity and spatial heterogeneity in the understory, and structural complexity of trees. Structure complexity of trees includes factors such as whether they have broken tops, large secondary limbs, cavities, and other features. Stand structural characteristics are important components of northern spotted owl (*Strix occidentalis*), marbled murrelet (*Brachyramphus* *marmoratus*), slender salamander (*Batrachoseps wrighti*), coastal marten (*Martes caurina*), and red tree vole (*Arborimus longicaudus*) habitat, as described in Appendix C.

The permit area has a broad range of forest stand and structure types. The forest stands are predominantly conifer, although some portions of the landscape are dominated by hardwood stands, and many stands across the landscape have some hardwood component. Forest stands typically move through different structural stages as they age. ODF uses various silvicultural strategies to influence the development of forest stands and achieve desired forest structure across the landscape.

Structure types that occur in the permit area are classified as follows[3]:

- **Early seral forest structure:** Early seral forests are young forests where the overstory has been removed through either harvest activity or natural disturbance. They begin at stand initiation and continue into canopy closure and subsequent suppression mortality. The degree of biodiversity and structural complexity in these stands varies greatly, depending on pre-disturbance conditions, the degree of post-disturbance legacy structure that remains, species diversity, and landscape context. Early seral stands generally fall into the stages of ecosystem reorganization and competitive exclusion as described by Carey (2007).

  Ecosystem Reorganization:

  - Simple early seral forests have little legacy structure, low tree species diversity, little shrub or herbaceous vegetation, and little downed wood. Clearcuts that have received intensive site preparation and planted to a high-density monoculture are a prime example. Conditions across the stands are relatively homogeneous.
  - Complex early seral forests have greater retention of remnant overstory trees and snags, a regenerating tree cohort with multiple native species at low to moderate density, and moderate to abundant shrub and herbaceous vegetation. Downed wood retained from the prior stand, or from retention of hard logs from harvested trees, may exist in various sizes and decay classes. Spatial heterogeneity in vertical and horizontal complexity and diversity are higher relative to more simplified stand conditions.

  Competitive Exclusion:

  - Simple structure results from high tree stocking and intense competition for light, water and nutrients. Dominant trees achieve full crown closure and shade out understory species and shorter trees. Shade tolerant trees and shrubs may persist below the dominant canopy, but not show significant growth. Dominant and co-dominant trees may self-thin, with surviving trees able to maintain relatively healthy crown ratios. Where self-thinning does not occur, overstory trees may become tall and spindly, with poor crown and height to diameter ratios.
  - Complex structure in this stage is still limited, as sapling and pole size trees compete for resources. Spatial heterogeneity provided by openings around legacy structures or brushy patches help maintain a greater degree of understory shrubs and herbaceous vegetation. Multiple young tree species with different growth rates and shade tolerance allow for greater canopy diversification which may result in a greater variety of diameters and

[3] The use of seral stage to define forest structure is a new approach by ODF and differs from what is described in the Northwest and Southwest Forest Management Plan.

heights across the stand. Legacy structures (large trees, snags, and downed wood) contribute to structural complexity.

- **Mid-seral forest structure:** Mid-seral stands are generally 30 to 80 years old, but can be as old as 120 years, depending on disturbance history and stand density. They can vary greatly in structural diversity, depending on their site conditions, silvicultural entries and self-thinning. Several prescriptive options exist for stands in this general age range (e.g. rotation harvest, multiple commercial entries, variable retention harvest), and stand trajectories are heavily influenced by small-scale natural disturbance events. Structural stages for these stands fall in the biomass accumulation, understory reinitiation and understory development (Carey 2007).

  Biomass Accumulation:

  - Simple structure results from the competitive exclusion stage, where co-dominant trees continue to fully occupy the site and accumulate wood biomass. Inter-tree competition is high, and understory vegetation is further reduced, primarily due to a lack of sunlight penetrating the fully closed canopy.
  - Complex structure also has reduced diversity compared to the competitive exclusion stage, as dominant tree crowns reduce understory species growth. Dominant tree species diversity is generally maintained. Legacy structures still provide some openings that allow for persistence of understory vegetation.

  Understory Reinitiation:

  - Simple structure typically consists of an overstory of uniformly spaced codominant trees with little species diversity. Uniform self-thinning has left the site fully occupied, and the understory is reduced to shade tolerant species such as salal and swordfern.
  - Complex structure is marked by overstory canopy heterogeneity produced by variable density thinning or small-scale natural disturbance. Legacy components continue to contribute to this patchiness across the stand, which allows for a more diverse suite of understory species to persist. Conifer species that will eventually form a midstory compete with other trees and shrubs in the understory, but there is little vertical layering in the canopy.

  Understory Development:

  - Simple structure is defined by an increase in understory species, where self-thinning of larger trees creates more persistent gaps that allow sunlight to reach the forest floor. These gaps are still relatively uniform throughout the stand, and little vertical diversity has developed in the understory or tree canopy layering.
  - Complex structure stands have a variety of canopy closure, resulting from management or natural disturbance that has created and maintained a variable density of dominant and codominant trees. This horizontal diversity allows for a rich and varied understory, which has begun to develop vertically, with species such as vinemaple growing several feet high. Where gaps in the forest canopy are large enough, additional tree species begin to seed in naturally. Vertical canopy layering has begun, with shade tolerant species having deeper crowns than their shade-intolerant codominant neighbors. Breakage in tree tops, loss of larger limbs, and other damage agents begin to produce cavities and other nesting and roosting structures.

- **Late seral forest structure:** Forest stands begin to move into a late seral condition between 80 and 120 years old. The structural characteristics of these stands varies vary greatly, depending on previous management activity and exposure to natural disturbance events. Localized, within stand disturbance events and individual tree mortality likely has occurred to some degree by this time, resulting in damage at the tops or in the boles of some trees, creating potential sites for cavity nesting. Large trees are present, and significant downed woody debris has begun to accumulate. Very large trees, snags and downed logs associated with old growth are not yet present. A diverse understory has vertical development sufficient to meet the lower crown of shade tolerant tree species in some places. This phase is referred to as niche diversification (Carey 2007), and has the necessary structural and species diversity to support a variety of wildlife species.

  As these stands persist, disturbance (either natural or through active management) begins to play a larger role in maintaining diversity in the stand. During this gap dynamics phase (Carey 2007), high intensity disturbances such as landslides and debris torrents create new openings for understory and tree seeding, and move large wood from upslope to riparian areas. Larger collections of downed trees create denning sites for larger mammal species, and increased decadence in general affords increased foraging opportunities for many bird species. The forest floor is diverse and supports healthy herbaceous and fungal communities.

2.4.2.5 Adjacent Ownership

Land ownership and management of parcels adjacent to the permit area have the potential to affect conditions in the permit area. Adjacent ownership, by ecoregion, is characterized below and depicted in Figure 2-16a through 2-16s at the end of this chapter.

2.4.3 Forest Conditions by Ecoregion

This section describes in forest conditions by ecoregion. Table 2-3 summarizes forest type, age, structure and adjacent ownership, by ecoregion.

Table 2-3. Summary of Ecological Setting by Ecoregion

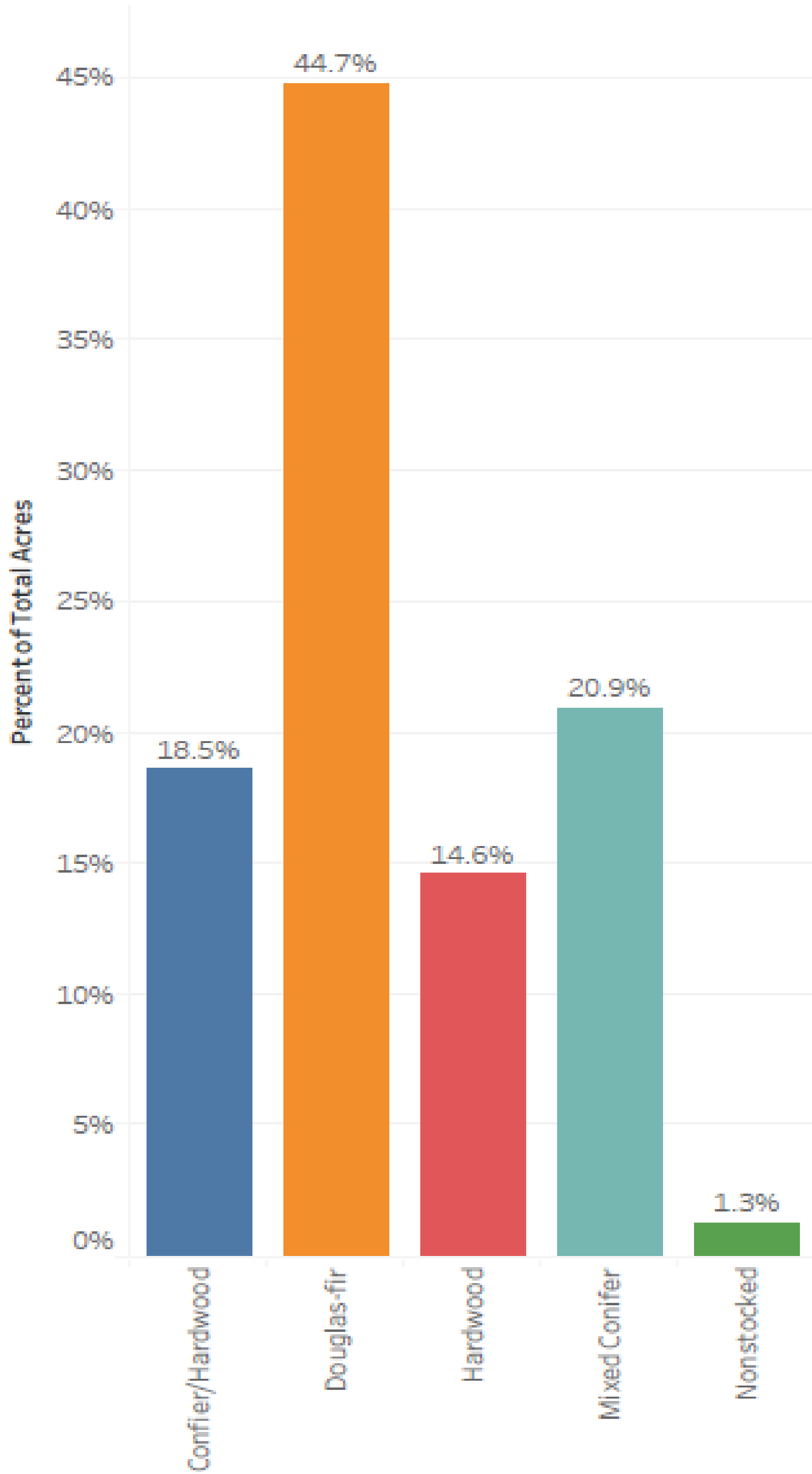
Ecoregion	Forest Type	Forest Age	Forest Structure	Adjacent Ownership
Coast	Dominated by conifers, especially Douglas-fir, along with a variety of hardwoods	Dominated by 50- to 69-year-old trees, with approximately 220,000 acres in this age range. Approximately 70,000 acres under ODF management in this ecoregion are 80 years and older	Mostly mid-seral stands with developing understories. Significant layering of tree crowns has not yet developed but many stands have good potential for increasing structural diversity. Some older stands may already have high structural diversity.	Approximately 1,539 miles of adjoining land ownership perimeter. The primary adjoining landowner type is private.
West Cascades	Almost entirely coniferous and dominated by Douglas-fir	More even spread across age classes compared to the Coast Range ecoregion, with the highest proportion occurring in 60- to 89-year-old trees	Mid-seral stands similar to other ecoregions	Approximately 251 miles of adjoining land ownership perimeter. The primary adjoining landowner type is private
Klamath	Almost entirely coniferous and dominated by Douglas-fir	Generally range between 20- and 119-year-old trees	Mid-seral stands similar to other ecoregions	Approximately 145 miles of adjoining land ownership perimeter. The primary adjoining landowner is the Bureau of Land Management
Willamette	Almost entirely coniferous and dominated by Douglas-fir	Dominated by 60- to 69-year-old trees	Mid-seral stands similar to other ecoregions	Approximately 63 miles of adjoining land ownership. The primary adjoining landowner type is private

2.4.3.1 Coast Range Ecoregion

Forest Types, Age, and Structure on State Forestlands

Forests in the Coast Range ecoregion[4] are dominated by conifers, especially Douglas-fir, along with a variety of hardwoods (Figure 2-8). State forest stands are dominated by the 50- to 69-year-old trees (Figure 2-9). The forest structure is largely composed of mid-seral stands with understory characteristics, such as diverse shrub and herb layers. Tree canopies may range from a single species, single-layered, main canopy with associated dominant, codominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed. In these stands, the shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. These stands offer good potential to develop into highly diversified vegetative communities. Depending on the intensity and timing of density-management activities, stands could continue in this condition, grow back into a closed single canopy state, or develop into late seral complex stands. Approximately 70,000 acres under ODF management in this ecoregion is in stands aged 80 years and older. These stands have a range of structural complexity dependent on management history, disturbance, and local growing site conditions.

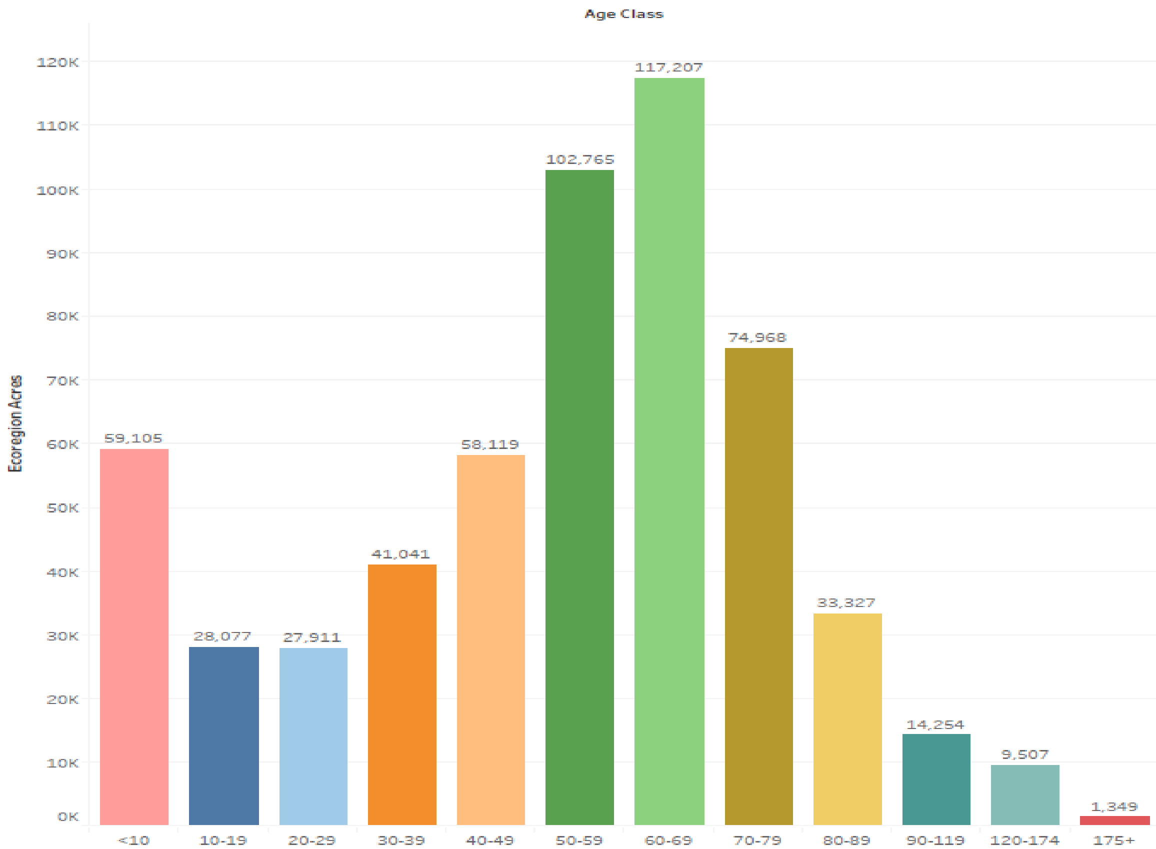
[4] Forest age data are only available for Board of Forestry lands and Common School Forest Lands lands (i.e., the permit area). Data are not available for private or federal lands in the plan area.



Source: ODF file information

Note: percentages do not total 100% as non-forested vegetations types are not shown.

Figure 2-8. Forest Type in the Permit Area in the Coast Range Ecoregion



Source: ODF file information

Figure 2-9. Stand Age in the Permit Area in the Coast Range Ecoregion

Adjacent Ownership

There are approximately 1,539 miles of adjoining land ownership perimeter in the permit area of the Coast Range ecoregion. The primary adjoining landowner type is private (Table 2-4). A mapbook at the end of this chapter illustrates adjoining land ownership throughout the permit area (Figure 2-16a through 2-16s)

Table 2-4. Adjacent Land Ownership of the Permit Area in the Coast Range Ecoregion

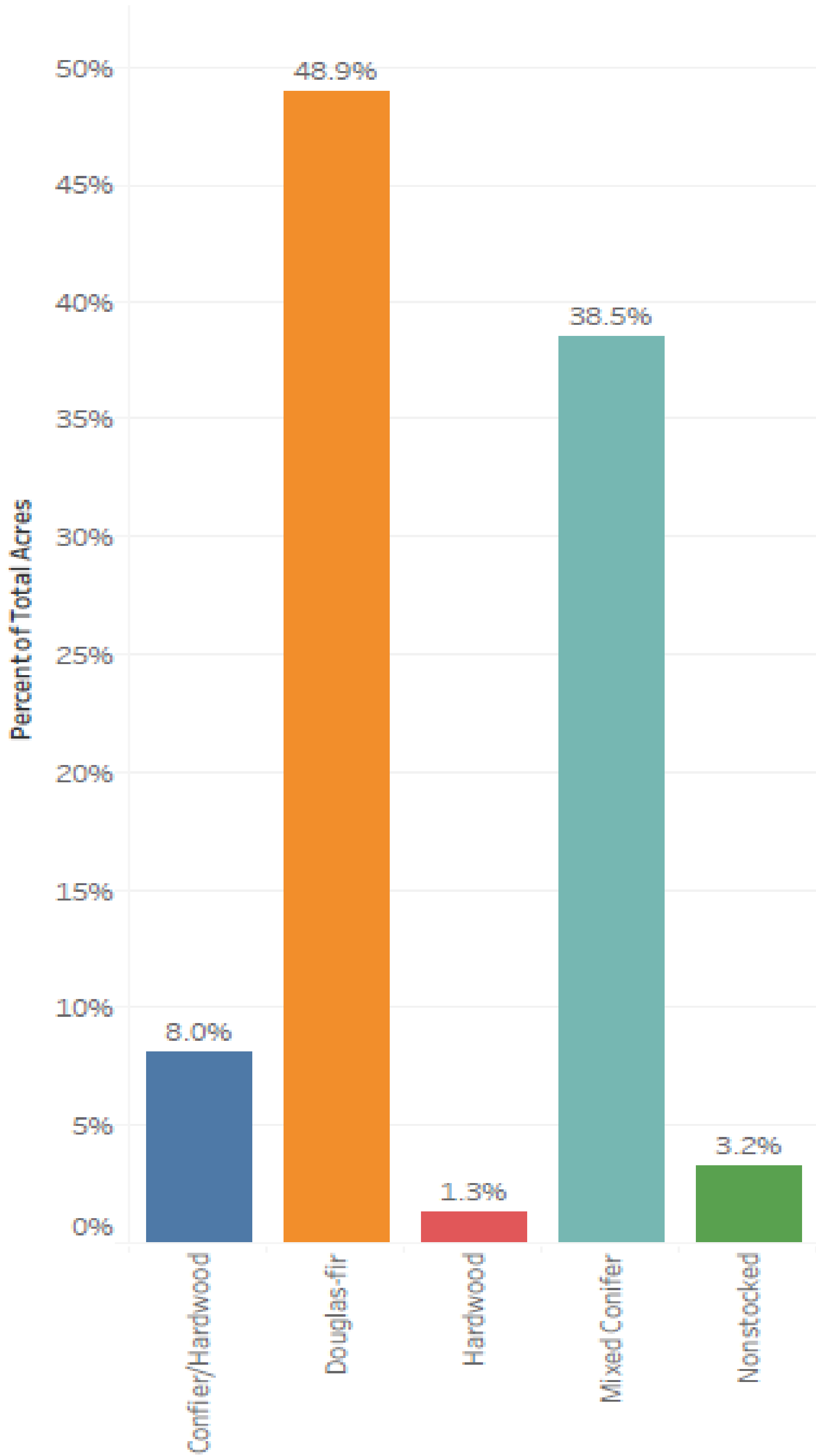
Adjacent Landowner	Miles	Proportion (%)
Private	848	55
Other State Lands	429	28
Bureau of Land Management	213	14
U.S. Forest Service	46	3
Other Federal Agency	3	0
Total	**1,539**	**100**

2.4.3.2 West Cascades Ecoregion

Forest Type, Age, and Structure on State Forestlands

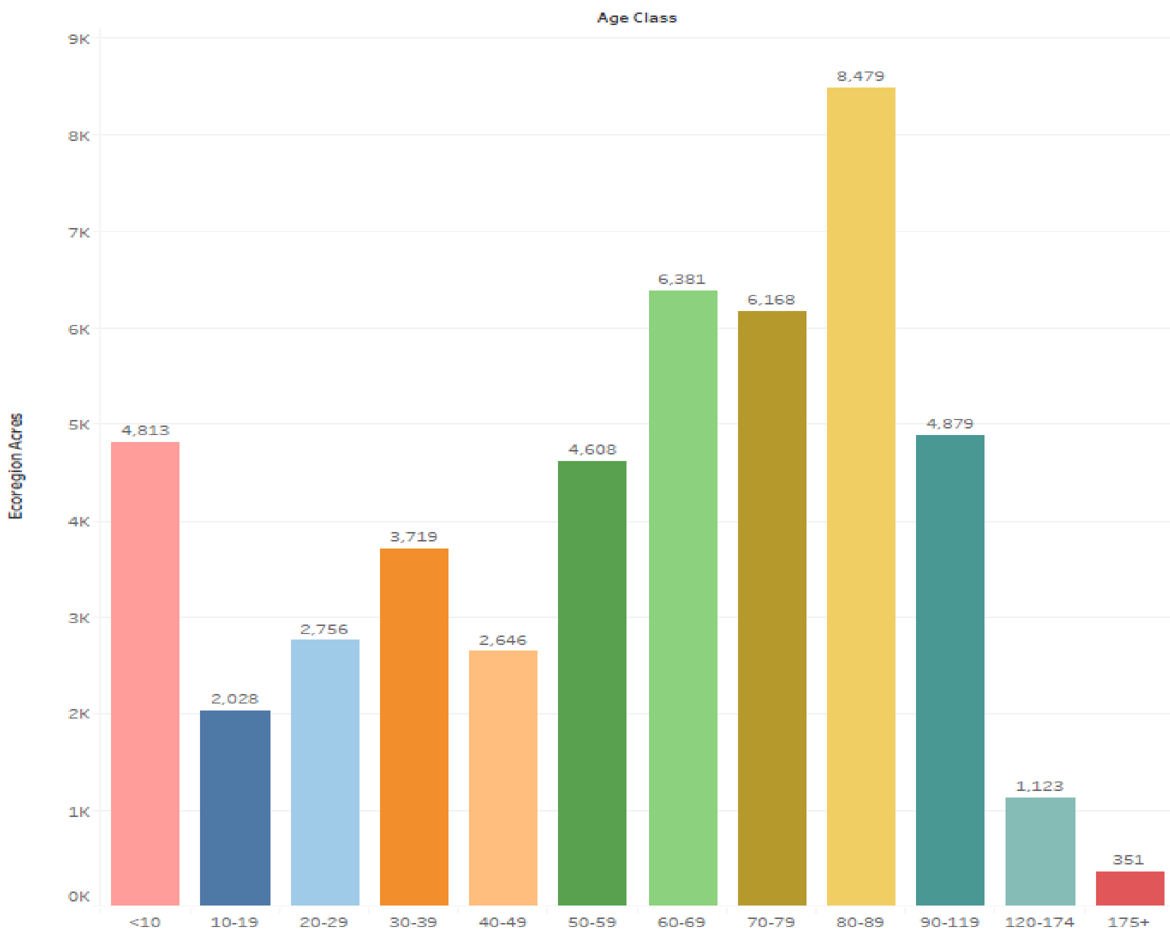
State forests in the West Cascades ecoregion[5] are almost entirely coniferous and dominated by Douglas-fir (Figure 2-10). Forest stands have a more even spread across age classes compared to the Coast Range ecoregion, with the highest proportion occurring in 60- to 89-year-old trees (Figure 2-11). Forest structure is composed of primarily mid-seral stands with a diverse herb or shrub layer and contains trees larger than sapling size. Tree canopies may range from a single species, single-layered, main canopy with associated dominant, codominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed. The shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. These stands offer good potential for developing into highly diversified vegetative communities.

[5] Forest age data are only available for Board of Forestry Lands and Common School Forest Lands (i.e., the permit area). Data are not available for private or federal land in the plan area.



Source: ODF file information
Note: Percentages do not total 100% as non-forested vegetations types are not shown.

Figure 2-10. Forest Type in the Permit Area in the West Cascades Ecoregion



Source: ODF file information

Figure 2-11. Stand Age in the Permit Area in the West Cascades Ecoregion

Adjacent Ownership

There are approximately 251 miles of adjoining land ownership perimeter in the permit area of the West Cascades ecoregion. The primary adjoining landowner type is private (Table 2-5). A mapbook at the end of this chapter illustrates adjoining land ownership throughout the permit area (Figure 2-16a through 2-16s).

Table 2-5. Adjacent Land Ownership of the Permit Area in the West Cascades Ecoregion

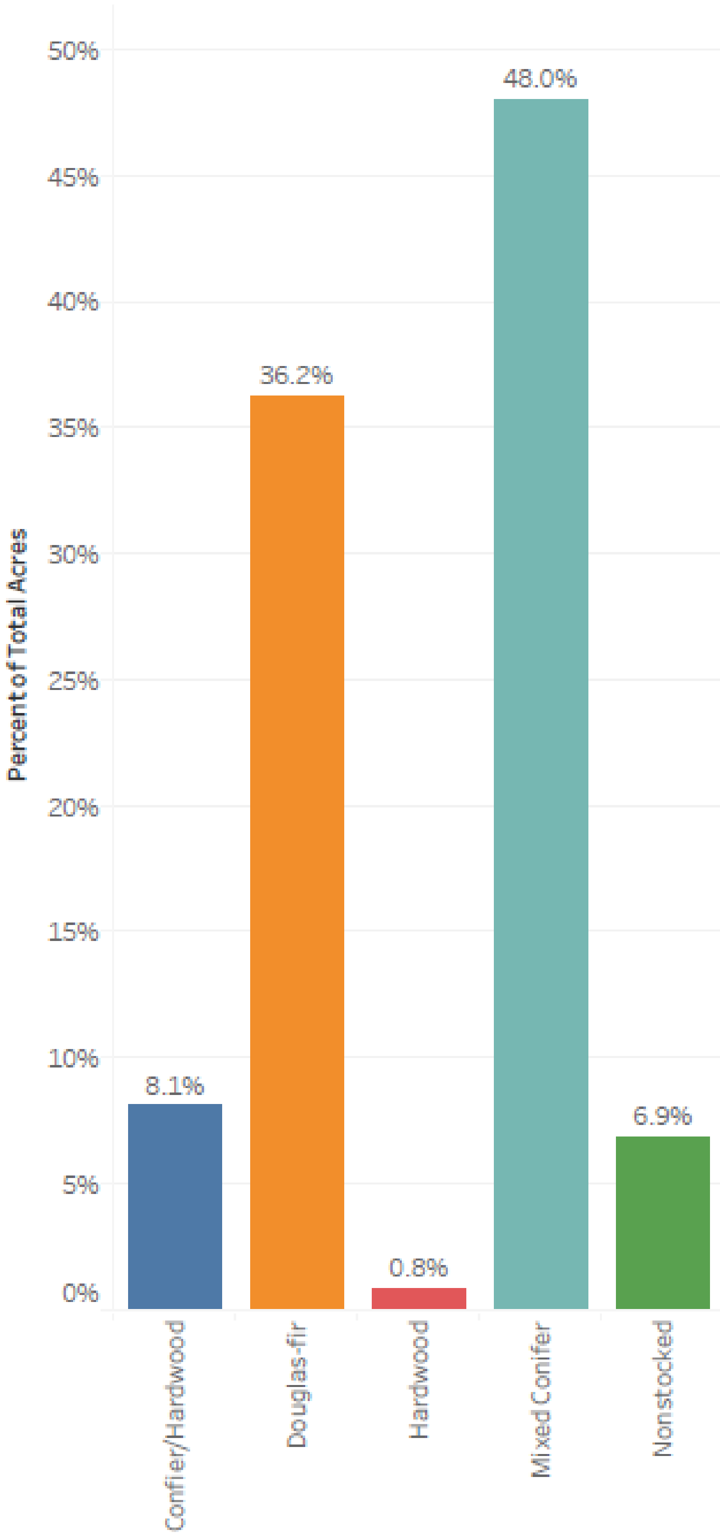
Adjacent Landowner	Miles	Proportion(%)
Private	152	61
Bureau of Land Management	63	25
U.S. Forest Service	22	9
State Lands	13	5
Other Federal Agency	1	0
Total	**251**	**100%**

2.4.3.3 Klamath Mountains Ecoregion

Forest Age and Structure on State Forestlands

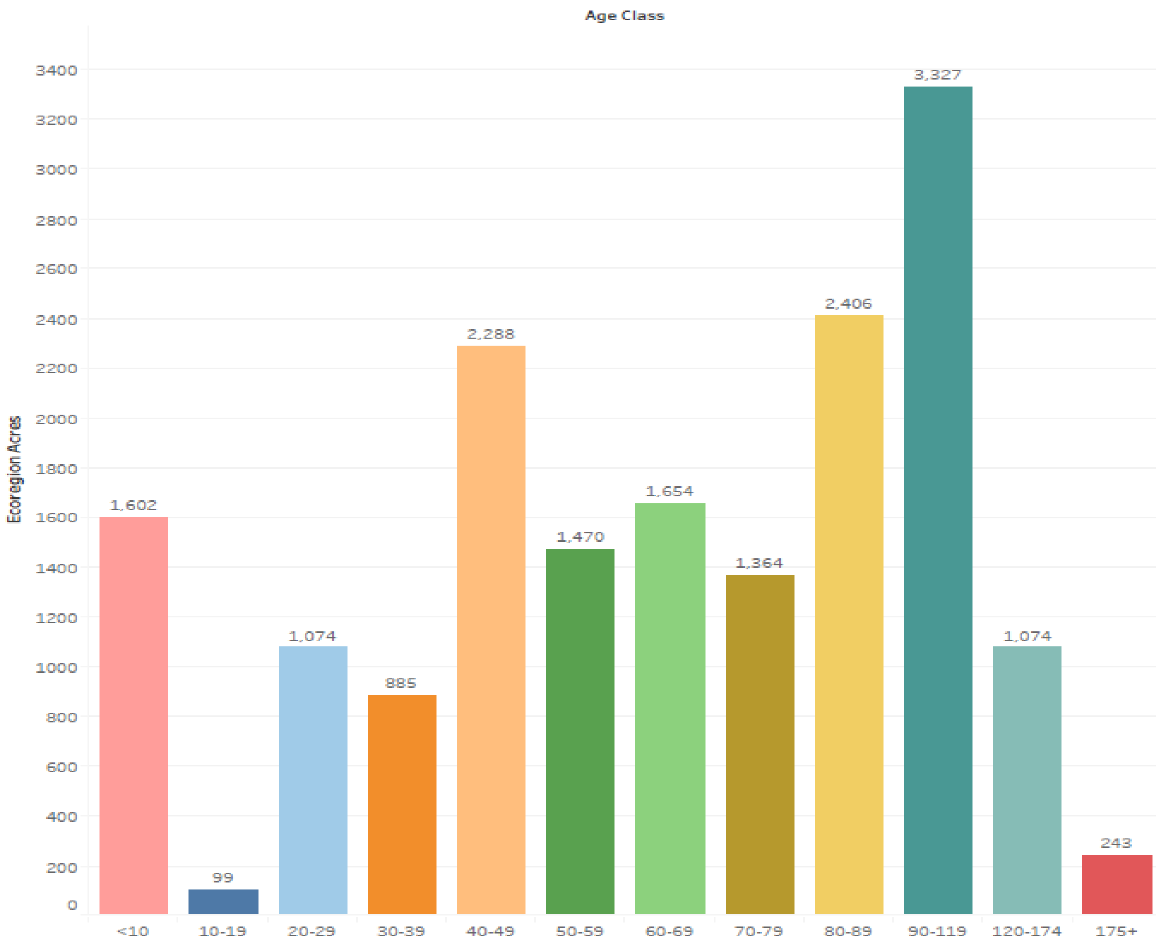
State forests in the Klamath Mountains ecoregion[6] are dominated almost exclusively by Douglas-fir (Figure 2-12). Forest stands generally range between 20- and 119-year-old trees (Figure 2-13). Forest structure is composed primarily of mid-seral stands whose structure is similar to what is described for the Coast Range and West Cascades ecoregions. In addition, forests in the Klamath Mountains ecoregion form a single, main canopy layer with little or no understory development. Where understory vegetation exists, there is low shrub and herb diversity. The shrub and herb layers may be completely absent or may be short and dominated by one or two shade-tolerant species, such as sword fern (*Polystichum munitum*), Oregon grape (*ahonia aquifolium*), oxalis, or salal (*Gaulthoria shallon*).

[6] Forest age data are only available for Board of Forestry Lands and Common School Forest Lands (i.e., the permit area). Data are not available for private or federal land in the plan area.



Source: ODF file information
Note: Percentages do not total 100% as non-forested vegetations types are not shown.

Figure 2-12. Forest Type in the Permit Area in the Klamath Mountains Ecoregion



Source: ODF file information

Figure 2-13. Stand Age in the Permit Area in the Klamath Mountains Ecoregion

Adjacent Ownership

There are approximately 145 miles of adjoining land ownership perimeter in the permit area of the Klamath Mountains ecoregion. The primary adjoining landowner is the Bureau of Land Management (Table 2-6). A mapbook at the end of this chapter illustrates adjoining land ownership throughout the permit area (Figure 2-16a through 2-16s).

Table 2-6. Adjacent Land Ownership of the Permit Area in the Klamath Mountains Ecoregion

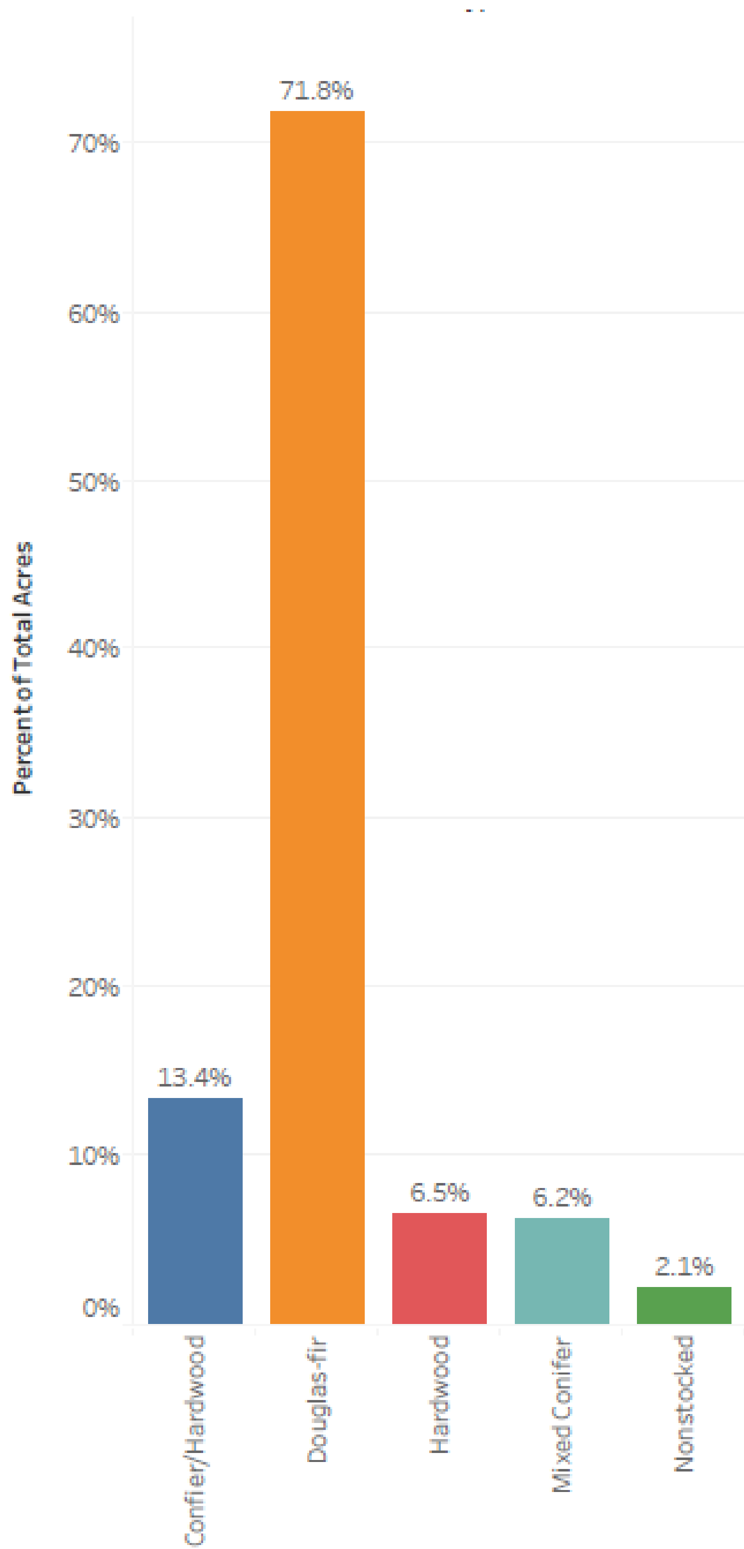
Adjacent Landowner	Miles	Proportion (%)
Bureau of Land Management	69	47
Private	47	32
U.S. Forest Service	26	18
Other State lands	3	2
Total	**145**	**100%**

2.4.3.4 Willamette Valley Ecoregion

Forest Type, Age, and Structure on State Forestlands

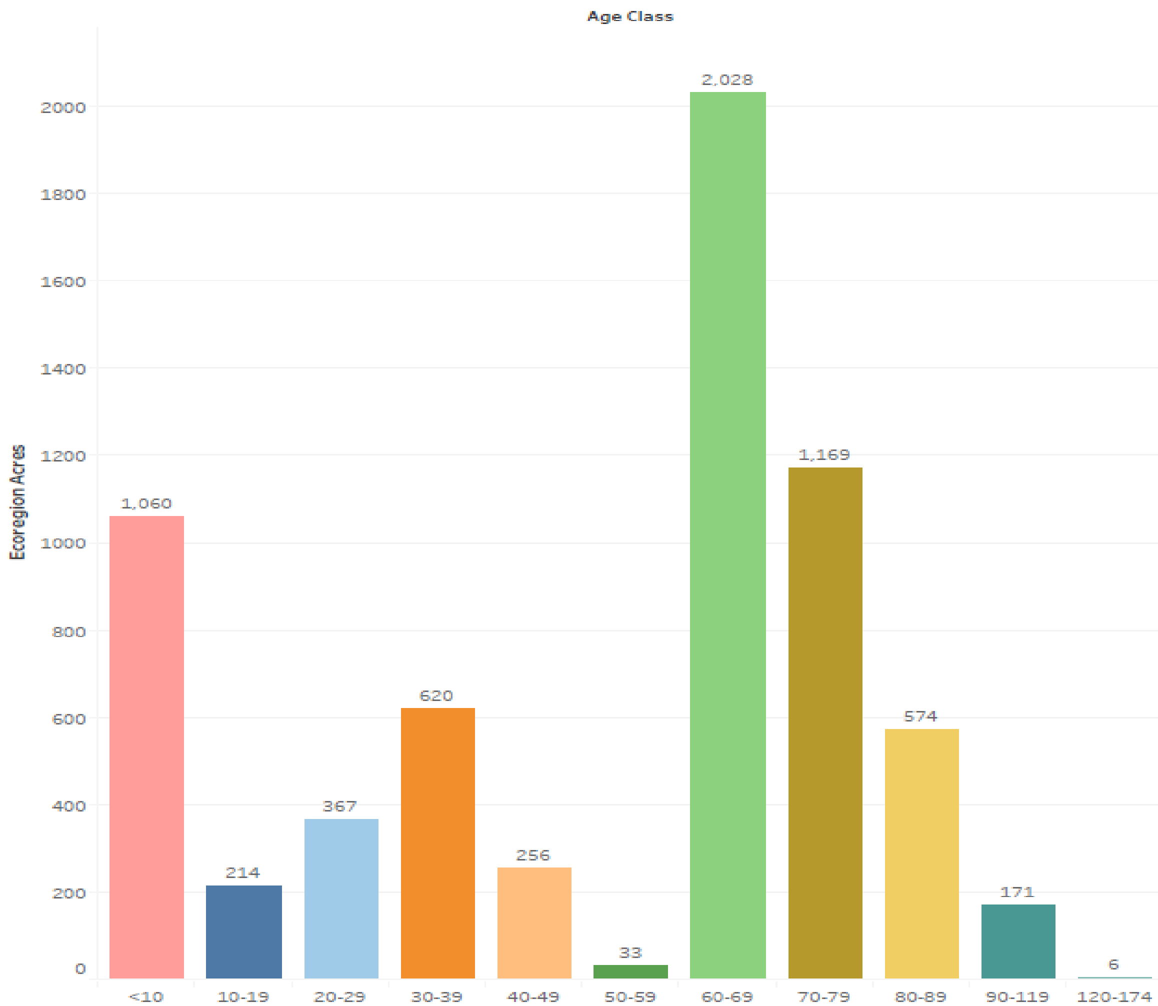
State forests in the Willamette Valley ecoregion[7] are dominated almost exclusively by Douglas-fir (Figure 2-14). Forest stands are dominated 60- to 69-year-old trees (35%; Figure 2-15). Forest structure is composed of mid-seral stands with a diverse herb or shrub layer and trees larger than sapling size. Tree canopies may range from a single species, single-layered, main canopy with associated dominant, codominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed. The shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. These stands offer good potential for developing into highly diversified vegetative communities.

[7] Forest age and structure data are only available for Board of Forestry Lands and Common School Forest Lands (i.e., the permit area). Data are not available for private or federal land in the plan area.



Source: ODF file information
Note: Percentages do not total 100% as non-forested vegetations types are not shown.

Figure 2-14. Forest Type in the Permit Area in the Willamette Valley Ecoregion



Source: ODF file information

Figure 2-15. Stand Age in the Permit Area in the Willamette Valley Ecoregion

Adjacent Ownership

There are approximately 63 miles of adjoining land ownership perimeter in the permit area of the Willamette Valley ecoregion. The primary adjoining landowner type is private (Table 2-7). A mapbook at the end of this chapter illustrates adjoining land ownership throughout the permit area (Figure 2-16a through 2-16s).

Table 2-7. Adjacent Land Ownership of the Permit Area in the Willamette Valley Ecoregion

Adjacent Landowner	Miles	Proportion of Ecoregion (%)
Private	40	64
Other State lands	17	27
Bureau of Land Management	5	8
Other federal agency	1	1
Total	**63**	**100%**

2.5 Covered Species

As described in Chapter 1, ODF selected the covered species for the HCP based on review of all species of conservation concern known or suspected to occur in the plan area during the permit term. These species were then screened for coverage based on four selection criteria described in Section 1.2.5.1, *Covered Species Selection Criteria*. A summary of that selection process is described in Appendix B, *Species Considered for Coverage*. Table 2-8 lists covered species and habitat associations.

Detailed species accounts of each of the 15 covered species are provided in Appendix C. These accounts summarize ecological information, distribution, status, threats, population trends, and conservation and management activities in the plan area. The accounts represent the best available scientific data for each species on which this HCP is based. The species accounts are not intended to summarize all biological information known about a species. Rather, each account summarizes scientific information that is relevant to the analysis in the HCP. The biological data in these accounts form the basis for the conservation strategy (Chapter 4) and effects analysis (Chapter 5).

Table 2-8. Covered Species and Habitat Associations

Covered Species	Habitat Associations[a]
Fish	
Oregon Coast coho (*Oncorhynchus kisutch*)	Clean and relatively stable gravel streambeds for spawning and egg incubation, complex channel features, cool temperatures during juvenile rearing, access to backwater and off-channel features for winter rearing, access for anadromous migration.
Oregon Coast spring chinook (*O. tshawytscha*)	Clean and relatively stable gravel streambeds for spawning and egg incubation, complex channel features, cool temperatures during adult holding and juvenile rearing, access for anadromous migration.
Lower Columbia River coho (*O. kisutch*)	Clean and relatively stable gravel streambeds for spawning and egg incubation, complex channel features, cool temperatures during juvenile rearing, access to backwater and off-channel features for winter rearing, access for anadromous migration.
Upper Willamette River spring chinook (*O. tshawytscha*)	Clean and relatively stable gravel streambeds for spawning and egg incubation, complex channel features, cool temperatures during adult holding and juvenile rearing, access for anadromous migration.
Upper Willamette River winter steelhead (*O. mykiss*)	Clean and relatively stable gravel streambeds for spawning, egg incubation, and juvenile overwinter, cool temperatures during rearing, access for anadromous migration.
Columbia River chum (*O. keta*)	Clean gravel streambeds in primary and side channels near tidewaters for spawning and egg incubation.
Southern Oregon/Northern California Coast coho (*O. kisutch*)	Clean gravel streambeds in primary and side channels near tidewaters for spawning and egg incubation. Juvenile overwinter, cool temperatures during rearing, access for anadromous migration.
Lower Columbia River chinook (*O. tshawytscha*)	Clean and relatively stable gravel streambeds for spawning and egg incubation, complex channel features, cool temperatures during juvenile rearing, access for anadromous migration.

Covered Species	Habitat Associations[a]
Eulachon (*Thaleichthys pacificus*)	Spawn in lower reaches of coastal rivers and Columbia River tributaries. Streamflow and tides carry larva to ocean soon after emergence.
Birds	
Northern spotted owl (*Strix occidentalis*)	Late seral forest or younger forest with residual late seral components, including moderate to high canopy closure, multi-layered, multi-species canopy with large overstory trees, open space among lower branches to allow for flight, large standing and downed trees, and trees with deformities that create structural diversity.
Marbled murrelet (*Brachyramphus marmoratus*)	Much of their lives spent on the ocean, but nest in late seral (specific nest characteristics) forests close to marine habitat (up to approximately 35 miles in Oregon) characterized by large trees, with large limbs for nesting platforms, multi-layered canopy, and moderate to high canopy closure. Can nest in younger forest with remnant large trees.
Amphibians	
Oregon slender salamander (*Batrachoseps wrighti*)	Late seral forest and second-growth closed canopy forests where there are abundant mid- to advanced-decay Douglas-fir logs and bark debris mounds at base of snags. Talus and lava fields that retain moisture.
Columbia torrent salamander (*Rhyacotriton kezeri*)	Cold mountain streams, seeps, and springs. Requires loose gravel stream beds with specific geologic characteristics (gradient).
Cascade torrent salamander (*R. cascadae*)	Cold, fast-flowing, clear, permanent headwater streams, seeps and waterfall splash zones in forested areas. Gravel or small cobble substrate with continuous but shallow water flow for larvae and adults foraging and hiding. Continuous access to cold water. Requires moist adjacent forest and micro-habitat features, such as basalt rock.
Mammals	
Coastal marten (*Martes caurina*)	Associated mostly with late seral, structurally complex mixed conifer forest with multi-layer stands but found in other forests providing there is a high density of snags and logs for denning and foraging.
Red tree vole (North Coast DPS) (*Arborimus longicaudus*)	Late seral, structurally complex conifer forest, prefers large stand size.

[a] See species accounts in Appendix C for the literature sources of habitat associations.

2.5.1 Survey Occurrence Data

Data on the occurrence of each species in the plan area and permit area are an important input to the HCP. The following summarizes the data sources compiled for this HCP and used for the development of conservation actions in Chapter 4 and for the evaluation of adverse effects in Chapter 5.

- **Northern Spotted Owl.** ODF has surveyed suitable habitat for northern spotted owls in state forests since 1992. Most recently, surveys for northern spotted owls were conducted on 80% or more of each district between 2014 and 2018 (Magby et al. 2018). Survey data includes the designation of activity centers, following the ODF Northern Spotted Owl Guidance document (ODF 2017). Activity centers are based on the most biologically significant observation during the nesting season (March through August), and are centered on daytime locations of pairs and, optimally, the nest tree, if found (Sovern et al. 2019).

- **Marbled Murrelet.** ODF has conducted over 32,000 individual surveys at more than 1,300 unique sites since 1992. This represents the largest survey efforts for marbled murrelets by any land manager in Oregon, Washington, or California. Marbled murrelet nest sites are extremely difficult to locate, so this HCP uses “occupied behavior” observations made during U.S. Fish and Wildlife Service–approved surveys (Evans Mack et al. 2003) as a surrogate for nest sites as the best available science (ODF 2019).
- **Red Tree Vole.** Red tree vole occurrences are also based on ODF data that has been compiled from various sources, including surveys conducted by ODF and the U.S. Forest Service (USFS) and review of museum samples. ODF conducted surveys for red tree vole from 1996 through 2016. The USFS data begins in 2017. Museum samples start from 1895 and continue up to 1994.
- **Oregon Slender Salamander.** Oregon slender salamander occurrences are based on Bureau of Land Management data collected from 1980 to 2016 and on a 5-year cooperative study conducted by Oregon State University, ODF, and private landowners, including lands within the Santiam State Forest.
- **Torrent Salamanders**
- **Fish Species.** Fish occurrences are based on fish distribution data from the StreamNet cooperative information management and data dissemination project (https://www.streamnet.org/). This analysis includes all fish distributions for any subbasins (hydraulic unit codes [HUC-8]) that are at least partially in the plan area. The analysis also considered available information from ODF regarding stream blockages and associated upstream intrinsic potential fish habitat.

Table 2-9 lists covered species and habitat associations. Species occurrence by ecoregion is provided in Table 2-10. Maps showing occurrence data in the plan area can be found in each covered species account (Appendix C). Because surveys for species occurrence have not been completed across the entire plan area, some assumptions were made about where species might occur and the quality of habitat in those locations. To overcome those data limitations on species occurrence, the covered species accounts include species distribution models to predict species occurrence across the entire plan area. These species distribution models are described in more detail in Section 2.5.2, *Species Accounts and Habitat Models*.

Species presence is dynamic and always changing, and all potentially suitable habitat has not been recently surveyed for all species, so covered species occurrences may have changed, and species may be present within habitat that has not yet been surveyed. To address this, this HCP uses also forest and habitat data and species-specific habitat models to estimate the extent of species distribution, and the locations of likely suitable habitat. Based on these surrogate data, the conservation strategy defines the types and magnitude of conservation actions needed to fully offset the impacts of take on the species and ensure their continued presence in the permit area.

Table 2-9. Data Sources for Species Occurrence Data

Covered Species	Data Source
Fish	
Oregon Coast coho (*Oncorhynchus kisutch*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Oregon Coast spring chinook (*O. tshawytscha*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Lower Columbia River coho (*O. kisutch*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Upper Willamette River spring chinook (*O. tshawytscha*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Upper Willamette River winter steelhead (*O. mykiss*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Columbia River chum (*O. keta*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Southern Oregon/Northern California Coast coho (*O. kisutch*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Lower Columbia River chinook (*O. tshawytscha*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Eulachon (*Thaleichthys pacificus*)	StreamNet 2019; Pacific States Marine Fisheries Commission 2019
Birds	
Northern spotted owl (*Strix occidentalis*)	Oregon Department of Forestry 2017; U.S. Fish and Wildlife Service 2019
Marbled murrelet (*Brachyramphus marmoratus*)	Oregon Department of Forestry 2017; U.S. Fish and Wildlife Service 2004
Amphibians	
Oregon slender salamander (*Batrachoseps wrighti*)	U.S. Forest Service 2009
Columbia torrent salamander (*Rhyacotriton kezeri*)	Good & Wake 1992; GBIF 2019; Oregon Department of Forestry 2019
Cascade torrent salamander (*R. cascadae*)	GBIF 2019; Howell and Maggiulli 2011
Mammals	
Coastal marten (*Martes caurina*)	U.S. Fish and Wildlife Service 2018
Red tree vole (North Coast DPS) (*Arborimus longicaudus*)	Oregon Department of Forestry 2019; U.S. Fish and Wildlife Service 2019

Table 2-10. Covered Species Occurrence by Ecoregion

Covered Species	Ecoregion[a]			
	Coast Range	West Cascades	Klamath Mountains	Willamette Valley
Fish				
Oregon Coast coho (*Oncorhynchus kisutch*)	✓	✓	✓	
Oregon Coast spring chinook (*O. tshawytscha*)	✓	✓	✓	
Lower Columbia River coho (*O. kisutch*)	✓	✓		✓
Upper Willamette River spring chinook (*O. tshawytscha*)		✓		✓
Upper Willamette River winter steelhead (*O. mykiss*)	✓	✓	✓	✓
Columbia River chum (*O. keta*)	✓			✓
Southern Oregon/Northern California Coast coho (*O. kisutch*)	✓	✓	✓	
Lower Columbia River chinook (*O. tshawytscha*)	✓	✓		✓
Eulachon (*Thaleichthys pacificus*)	✓			
Birds				
Northern spotted owl (*Strix occidentalis*)	✓	✓	✓	✓
Marbled murrelet (*Brachyramphus marmoratus*)	✓		✓	✓
Amphibians				
Oregon slender salamander (*Batrachoseps wrighti*)		✓		✓
Columbia torrent salamander (*Rhyacotriton kezeri*)	✓			
Cascade torrent salamander (*R. cascadae*)		✓		✓
Mammals				
Coastal marten (*Martes caurina*)	✓		✓	
Red tree vole (*Arborimus longicaudus*) (North Coast DPS)	✓			✓

[a] See species accounts in Appendix C for the literature sources range.

2.5.2 Species Accounts and Habitat Models

ODF has developed species accounts and habitat models for species to be covered under the HCP. The species accounts in Appendix C, *Species Accounts,* summarize habitat model parameters developed for the species and the modeled habitat distribution in the permit area. The species accounts also document key information regarding each covered species, including taxonomy, distribution, habitat requirements, population status, and threats.

Data on species occurrence are generally limited or poor for most of the covered species. Surveys for northern spotted owl and marbled murrelet are conducted prior to harvest sales if potentially suitable habitat is present. However, preharvest surveys have not been conducted in a systematic or randomized fashion throughout the permit area or in regular intervals, except for operational surveys for northern spotted owl and marbled murrelet, which are surveyed using established protocols (Evans Mack et al. 2003, U.S. Fish and Wildlife Service 2012). Focused surveys have been conducted in portions of the permit area for red tree vole (Price et al. 2015) and Cascade and Columbia torrent salamanders (Thurman et al. 2019), and Oregon slender salamander (BLM 2019) for scientific purposes. Similar to northern spotted owl and marbled murrelet, surveys for red tree vole, the torrent salamanders, and Oregon slender salamander have not been conducted in a systematic or randomized fashion throughout the permit area or in regular intervals.

While surveys for covered species have been patchily distributed across the permit area unsurveyed, and not done consistently from year-to-year, these occurrence data provide valuable information on where these species occur in the permit area. As such, these occurrence data are used to inform the conservation strategy and take assessment. In addition, some species surveys only report positive results and not negative results (negative results are often equally important to determine habitat suitability). And finally, in some cases species detection is very difficult, relying on indirect indices that may introduce substantial uncertainty into survey results. Because of the large size of the permit area and the lack of consistent species surveys across this landscape, the HCP must also rely on predictions of species presence based on predictive models of habitat distribution and habitat suitability. Such models are commonly used in large-scale habitat conservation planning (ICF International 2012, ICF 2018).

Habitat distribution and suitability models were developed for the HCP for most terrestrial covered species to predict where they could occur, based on habitat requirements known from field studies and identified in published habitat suitability models as being important predictors of habitat suitability. The models were used to assist in quantifying impacts of covered activities on covered species and to assist in developing the conservation strategy. Details of how the habitat distribution and suitability models (also called "habitat models") were developed, including model parameters and data sources, are described below and in each species account (Appendix C). Habitat models were developed for the following six terrestrial covered species.

- Columbia torrent salamander
- Cascade torrent salamander
- Oregon slender salamander
- Northern spotted owl
- Marbled murrelet
- Red tree vole

A habitat model was not developed for coastal marten because there is not enough known about current coastal marten habitat relationships and distribution in the types of forests that occur within the permit area. Most information on coastal marten habitat relationships is from studies in the Central Coastal Oregon Dunes, Southern Coastal Oregon, and Northern Coastal California Extant Population Areas (U.S. Fish and Wildlife Service 2015). All of these areas have habitat characteristics different enough from the forests in the plan area to make extrapolating habitat relationships from these two Extant Population Areas to the permit area unreliable.

For fish, a NetMap watershed analysis was prepared by TerrainWorks (2020) for the permit area. This analysis includes any subbasin (HUC-8) that is at least partially in the permit area. NetMap will provide a consistent synthetic stream layer that covers the permit area and will allow for the classification of stream reaches by vulnerability to increased stream temperatures. The six habitat models described in the species accounts were designed to estimate the extent and suitability of habitat in the permit area. The models are spatially explicit, geographic information system (GIS)-based “expert opinion models” that use the best scientifically available information on the habitat relationships of covered species to predict habitat distribution and suitability. These models are intended to be repeatable and scientifically defensible, while remaining as simple as possible.

ODF’s Stand Level Inventory data on forest tree species composition and forest structure were used to characterize key habitat relationships for the terrestrial covered species. Stand Level Inventory data include attributes such as number of large trees per acre, density of trees, number of snags, and amount of downed wood, among other attributes, within a stand. The Stand Level Inventory data allow ODF to model covered species’ habitat suitability using the same data that ODF uses to characterize its landscape for forest management and timber harvest. This approach will facilitate HCP implementation by integrating species habitat models with forest management planning and growth/harvest projection models.

The six species for which habitat is modeled are strongly associated with late-seral conifer forests. As such, the models include parameters that characterize attributes of late-seral forests, particularly those that provide key habitat features, such as downed wood for Oregon slender salamander or large, old trees used by marbled murrelet for nest platforms.

2.5.2.1 Methods

The following approach was used to develop the habitat models for the four terrestrial covered species. Methods used to develop habitat models for Columbia torrent salamander and Cascade torrent salamander are described in Appendix C. Additional details on model parameters unique to each species are found in Appendix C.

1. **Identify Parameters.** Identify from the scientific literature key habitat features to include as parameters in each species’ model. Important sources of information include studies on habitat relationships, particularly existing habitat suitability models. Parameters were selected for the model that are reliable and consistent indicators of species presence in habitat found in the permit area and for parameters that are already mapped at a landscape scale by ODF. Parameters could not be used that are based on small-scale habitat features that cannot be feasibly mapped at a landscape scale, such as tree limbs that provide nest platforms for marbled murrelet. Models include 3–4 parameters.

   Spatial and landscape-level parameters such as patch size and distance to other patches were not included the models. The intent of the models is to characterize habitat suitability at the stand-level using Stand Level Inventory data. Rather, the conservation strategy seeks to improve important spatial and landscape-level habitat conditions by conserving, expanding, and connecting habitat patches. Important spatial and landscape-level features were assessed in combination with the habitat suitability models, occurrence data, and other sources of information when identifying habitat patches to conserve for the focal species.

2. **Select Data.** Select the Stand Level Inventory stand structure parameter that best characterizes each species' habitat parameter. For example, northern spotted owl needs multilayered, multispecies canopies with large (at least 20- to 30-inch diameter at breast height [DBH]) overstory trees for nesting and roosting (U.S. Fish and Wildlife Service 2012). The number of trees per acre with a DBH of 30 inches or greater was selected as the stand structure parameter to characterize stands with large overstory trees. Other stand structure parameters, such as Diameter Diversity Index, were used to characterize multilayered canopies. For covered species that occur in only a portion of the permit area, habitat data were clipped to the published range of the species, as described in each species account.

3. **Develop Logistic Models.** Model the relationship between each stand structure parameter and habitat quality. Logistic models were used to model the probability of suitability across a range of values for each stand structure parameter, with probability between 0 and 1 (with an increasing probability corresponding with increasing habitat suitability for that stand structure parameter). Logistic models were built by first assigning habitat suitability probabilities to a stand structure parameter value where there is support in the literature for these assignments. Habitat suitability parameters were assigned to stand structure parameter values to correspond with thresholds for the following habitat suitability categories: highly suitable, suitable, marginally suitable, and unsuitable. This was done to convert the continuous habitat suitability values to biologically meaningful categories.

   A logistic equation was then created to connect those established data points and provide habitat suitability values for the range of possible stand structure parameter values. The shape of the logistic curve for each stand structure parameter illustrates the relationship between a range of habitat structure parameter values and habitat suitability probabilities.

   The Microsoft Excel solver function was used to fit the logistic equation to match the assigned habitat suitability probability to selected stand structure parameter values by minimizing error. Assigned habitat suitability probabilities served as targets for the solver. The actual habitat suitability value computed by the solver function generally differed from the assigned target by less than ±0.1.

   Habitat suitability probabilities for stand structure parameter values were assigned depending on data from the scientific literature from ecological field studies, habitat models, and the expert opinion of ODF biologists and species experts external to ODF. For example, red tree vole generally requires a structurally diverse, multicanopy conifer forest with large trees (Forsman et al. 2016, Rosenberg et al. 2016). Diameter Diversity Index (DDI) provides a quantitative index of canopy layering. DDI describes the relative similarity of a given stand to an old growth stand in terms of the number of trees per acre in each of 4 diameter classes. Stands can range from a DDI of almost 0 up to a maximum of 10, with 0 representing the least layering and 10 representing the most layering. Forsman et al. (2016) found that red tree vole habitat suitability increased sigmoidally with increasing DDI. Habitat suitability probabilities were assigned to correspond to mean DDI values for four modeled suitability classes from the Forsman et al. (2016) model: highly suitable, suitable, marginal, unsuitable (Table 3-4 in Forsman et al. 2016). Mean DDI for highly suitable habitat in the Forsman et al. model is 6.6 (± 0.1 standard error [SE]), 6.0 (± 0.1 SE) for suitable habitat, 4.9 (± 0.1 SE) for marginal, and 3.7 (± 0.1 SE) for unsuitable. For this Plan's model, a DDI of 7.0 was assigned a habitat suitability probability of

0.8; a DDI of 6.0 was assigned a habitat suitability probability of 0.6; a DDI of 5.0 was assigned a habitat suitability probability of 0.4; and a DDI if 4.0 was assigned a habitat suitability probability of 0.2.

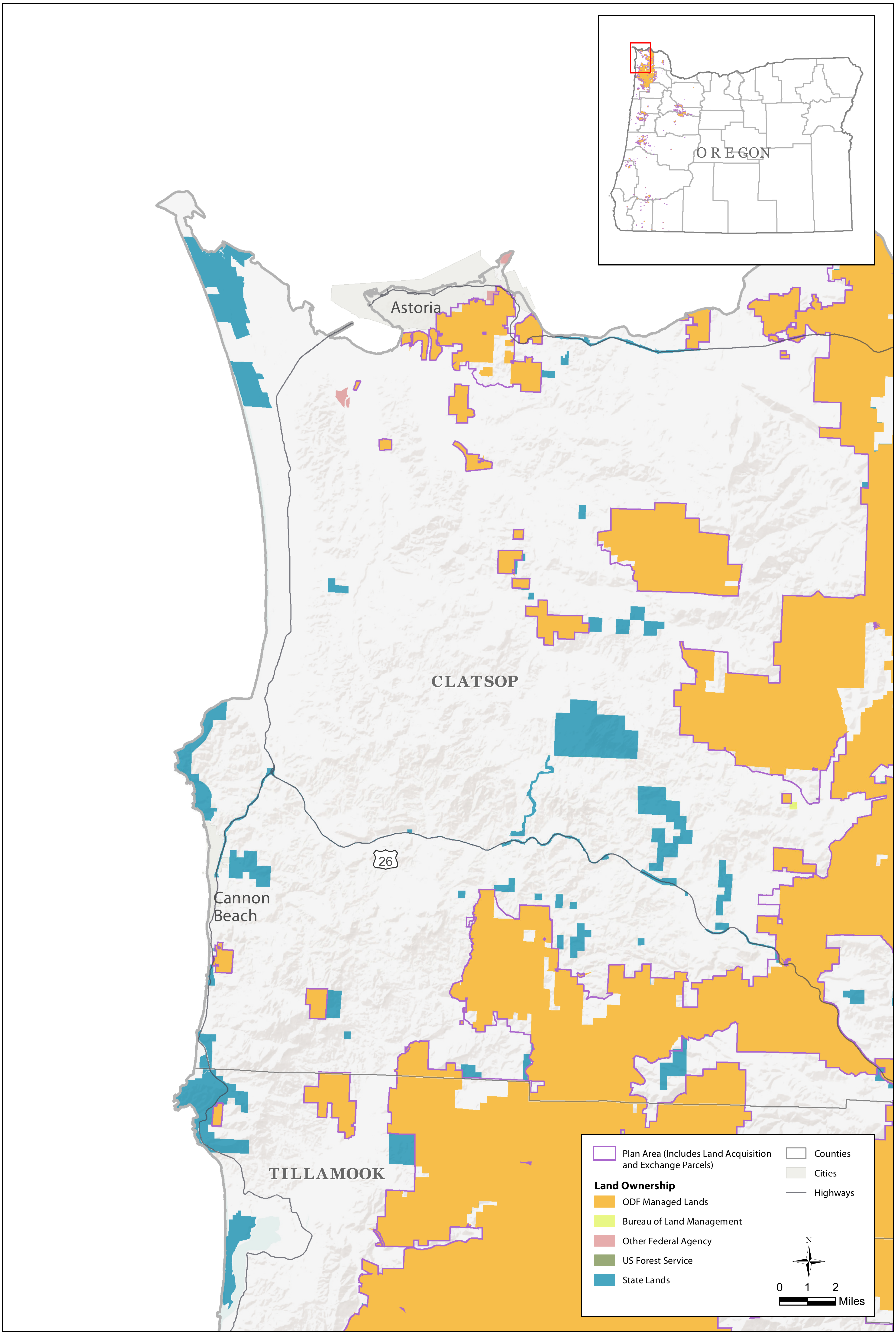
Rationales for assigning habitat suitability probabilities to parameter values are provided in Appendix C. Stand structure parameter values, corresponding habitat suitability probabilities, logistic equations, and figures expressing the logistic equations for each parameter are presented in Microsoft Excel workbooks in Appendix C.

4. **Weight parameters.** For some species, certain habitat characteristics are more important than others in determining habitat suitability and probability of occurrence. In cases where the scientific literature supports weighting of an available habitat parameter, that parameter was given more weight in the model than other parameters. Weight of one parameter is relative to the other parameters in each model. Parameters were weighted equally if there wasn't strong indication in the scientific literature to weight one value more than others. Professional judgement by ODF biologists and species experts was used to weight one or more values more than others when supported by the scientific literature. For example, Oregon slender salamander are typically associated with late seral forests, and large decayed downed wood in those forests is vital for providing cover and refuge (Bury 1988, Gilbert and Allwine 1991, Vesely et al. 1999, Clayton and Olson 2009, Kroll et al. 2015). Oregon slender salamander also occur in younger forests with legacy large decayed downed wood (Rundio and Olson 2007, Garcia et al. 2020.). In the Oregon slender salamander model, the parameter that characterizes large downed wood is weighted more heavily than other parameters that characterize late-seral forests, such as tree height.
5. **Calculate habitat suitability.** Habitat suitability index is the weighted product of all of the model parameter suitability probabilities for a given stand. The total habitat suitability index is on a scale of 0 (lowest suitability) to 1.0 (highest suitability). The habitat suitability index is interpreted as the probability that the forest stand provides suitable habitat for that species.
6. **Test and refine models.** Each model was refined and tested by comparing model results to a variety of other data, including known occurrence records, existing habitat models based on other datasets such as LiDAR mapping, and ODF's mapping of forest structure in the permit area. Habitat suitability scores and parameter weights in this Plan's model were adjusted to improve overlap between the Plan's model and comparative data and models. The habitat models were also reviewed by wildlife agency staff and external species experts and refined in response to their feedback.

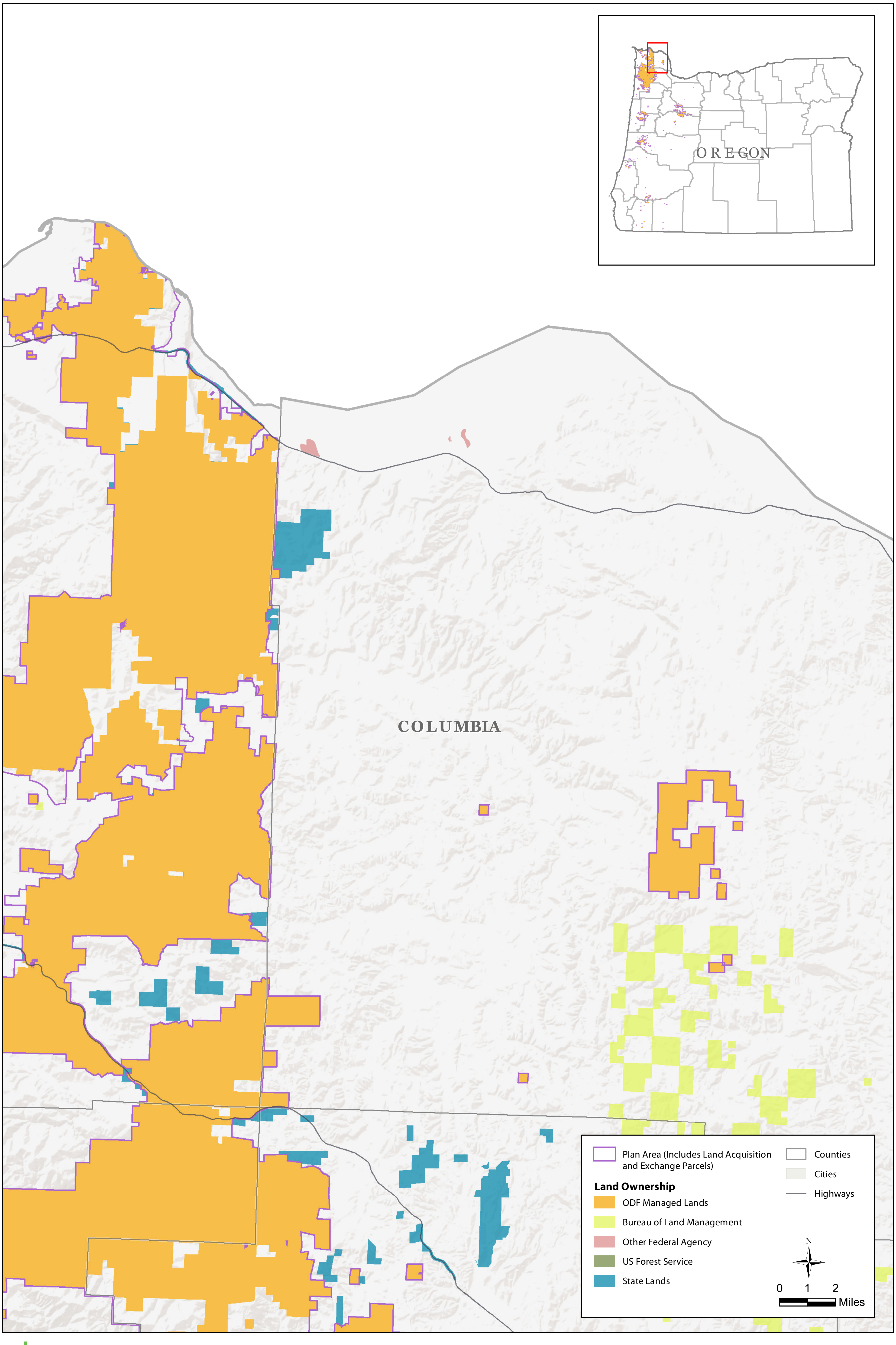
See Appendix C for tables that summarize habitat features modeled for each species, the corresponding Stand Level Inventory variable used to model that habitat feature, habitat suitability probability assignments for parameter values, and rationales for the selection of each parameter and assignment of habitat suitability probabilities.

2.5.2.2 Model Uses and Limitations

The habitat suitability models are intended to be used only for planning purposes at the scale of the permit area. For example, the modeled suitability of habitat in an area does not necessarily mean that the species will be present or absent or that the habitat is fully developed or suitable. Rather, modeled suitability means that a stand has a certain probability of being suitable for that species and therefore occupied by the species. Habitat suitability models were used to estimate the amount and location of take (i.e., loss of suitable habitat) and identify areas with high conservation value for each covered species. The habitat models were also used to project habitat development over time, through growth and implementation of habitat enhancement actions. The monitoring program, described in Chapter 6, *Monitoring and Adaptive Management*, includes the process to determine whether the important habitat parameters are present in areas identified as habitat for covered species using habitat models. The monitoring program will also assess how those habitat parameters change over time.



Draft Figure 2-16a: Adjacent Land Ownership



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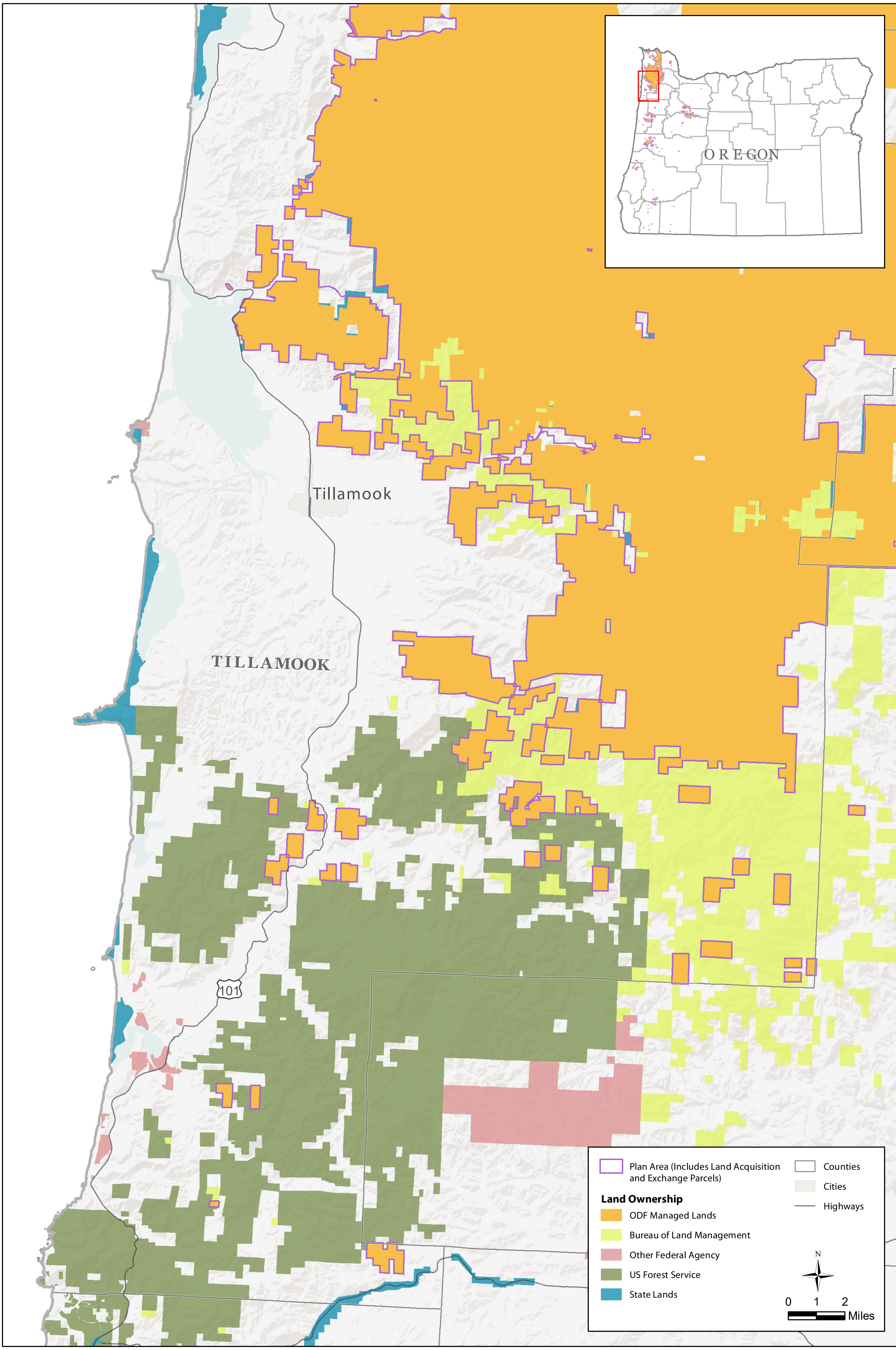

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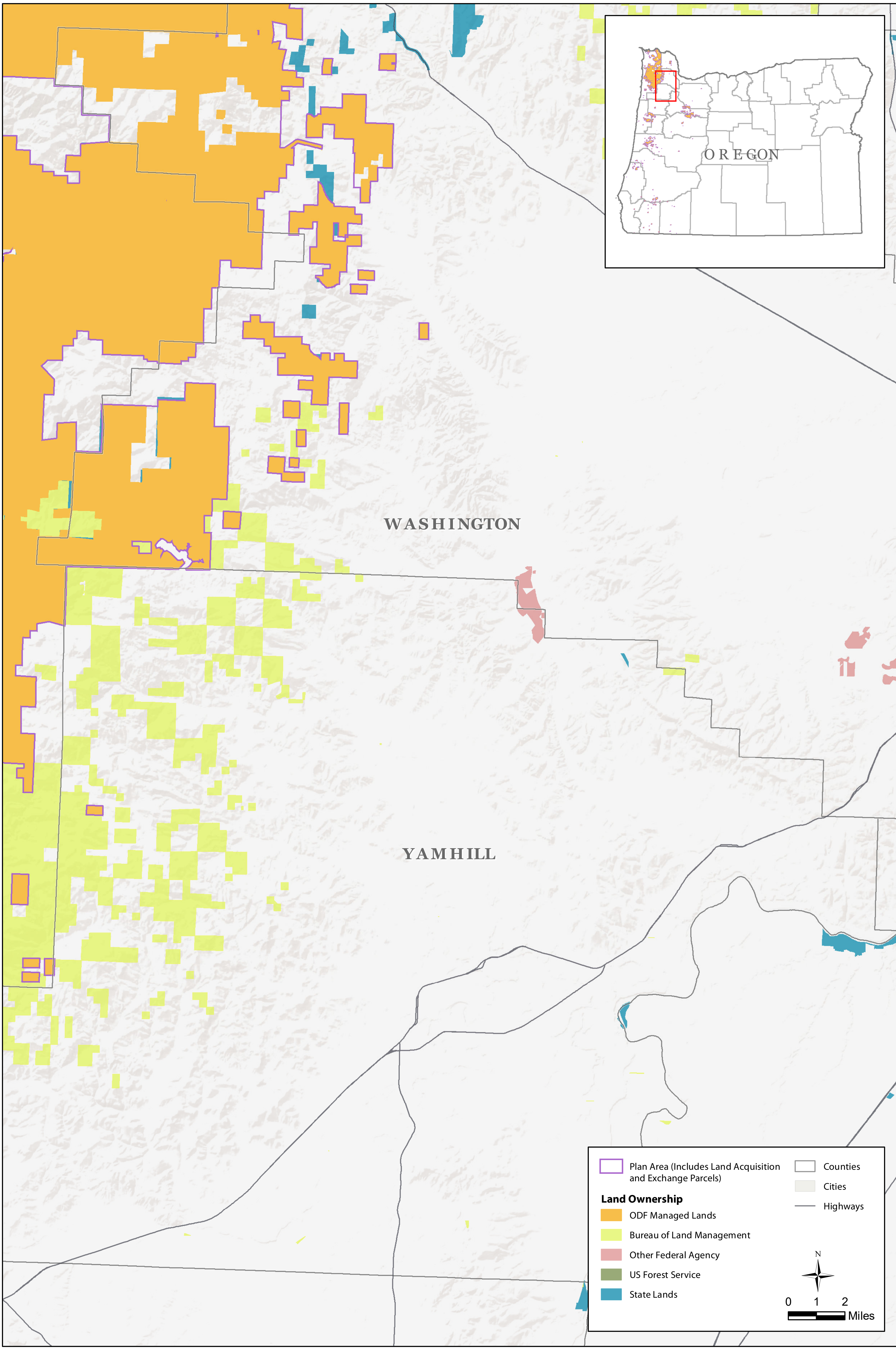

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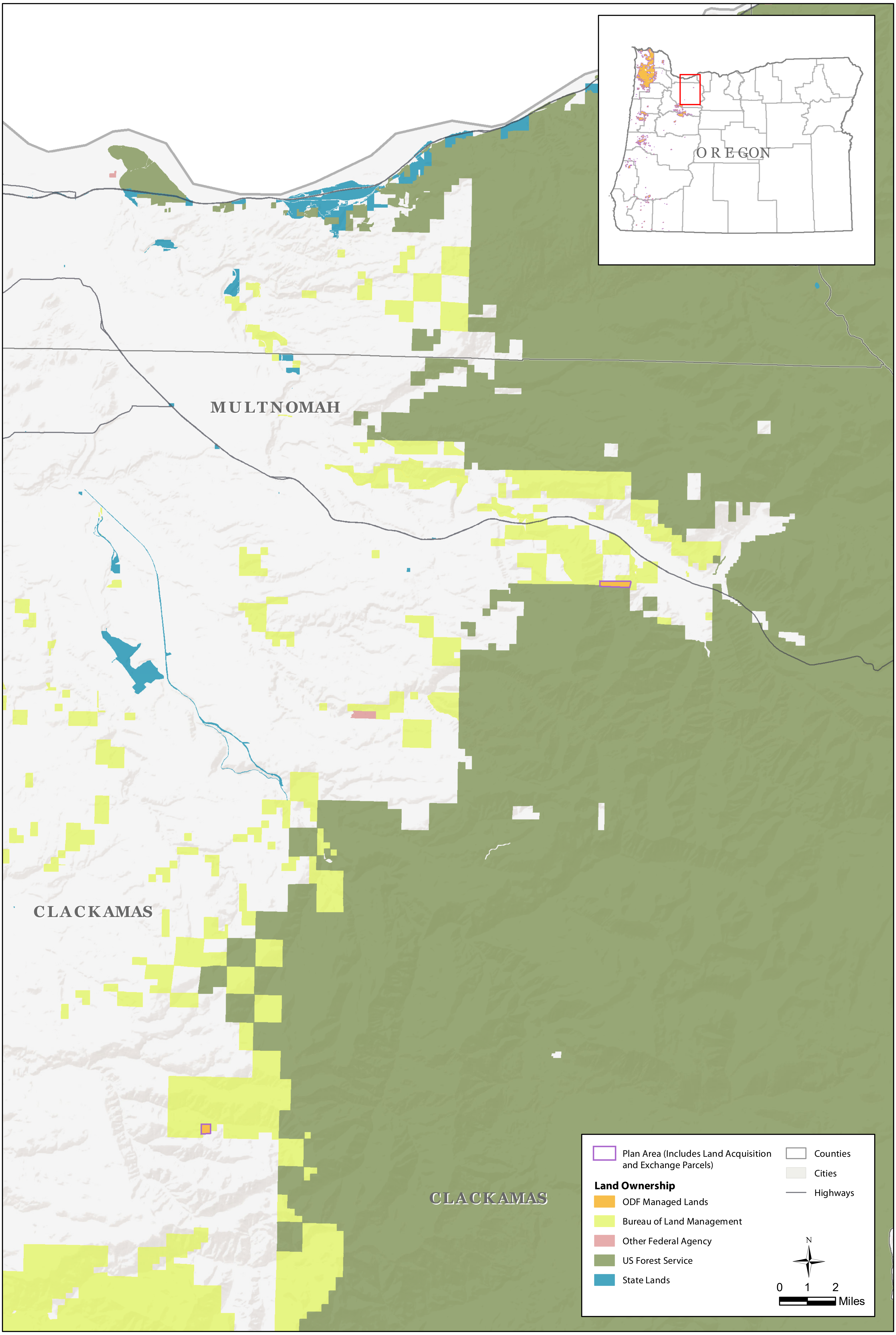
Draft Figure 2-16d: Adjacent Land Ownership



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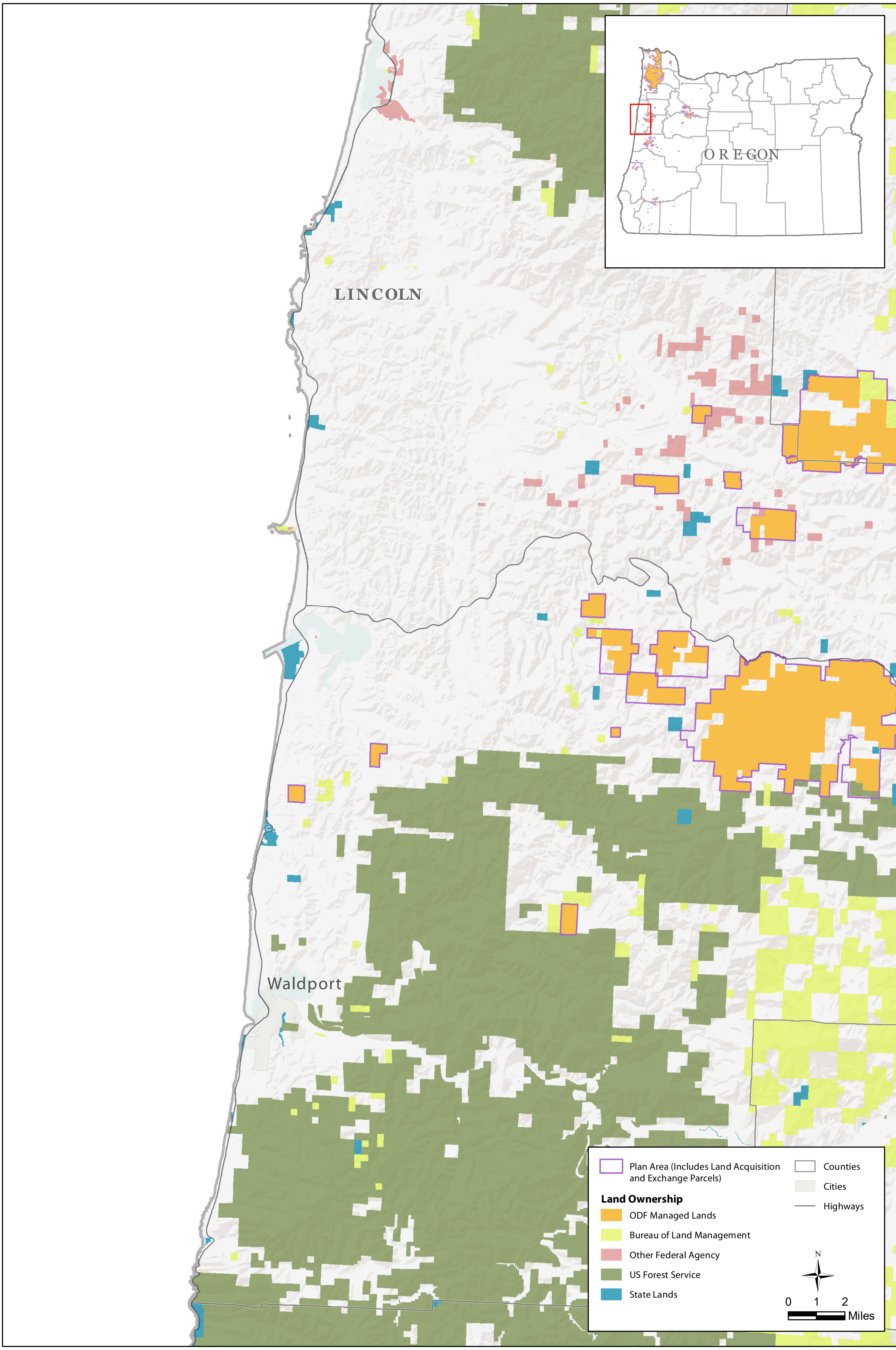

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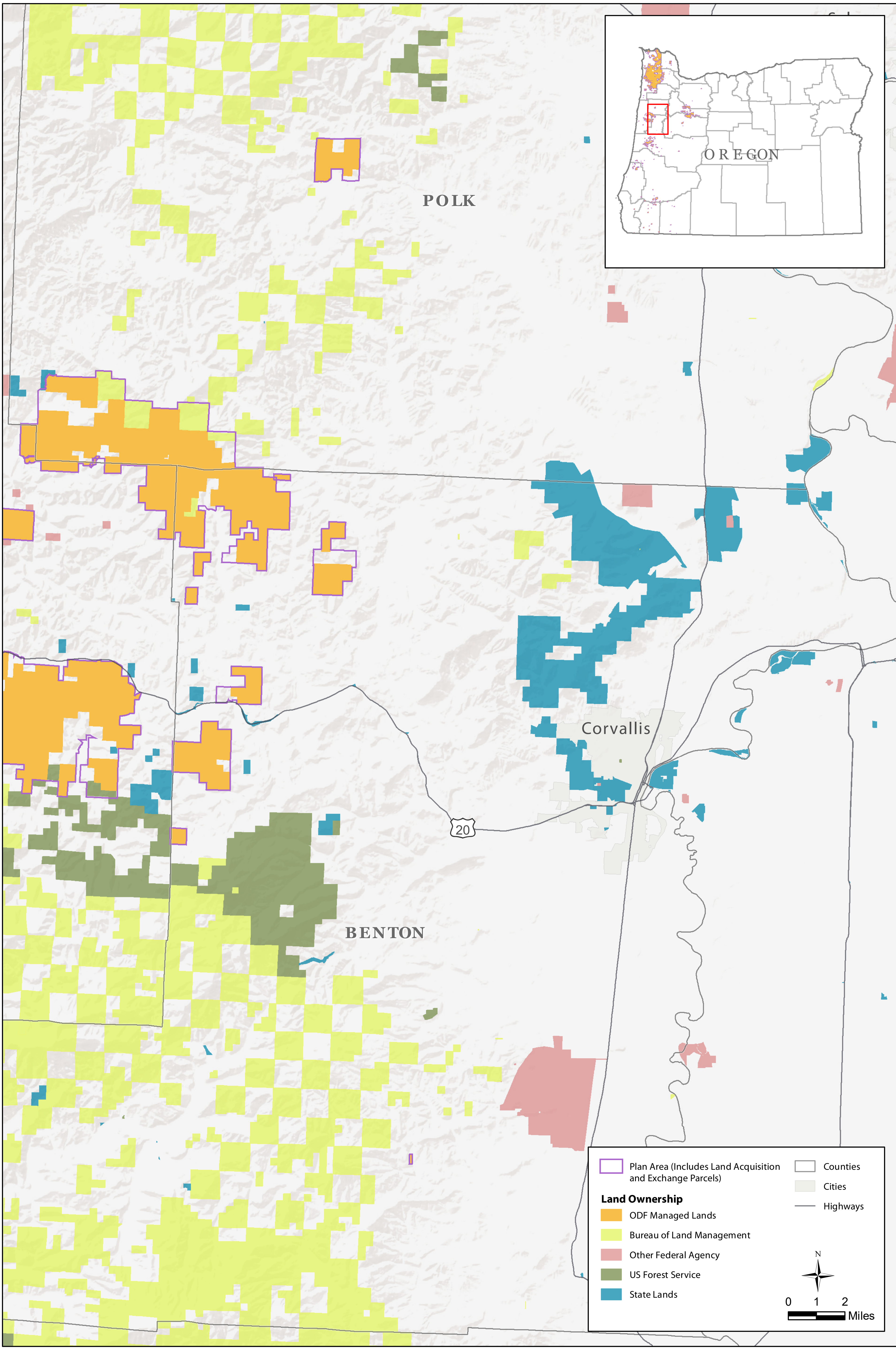

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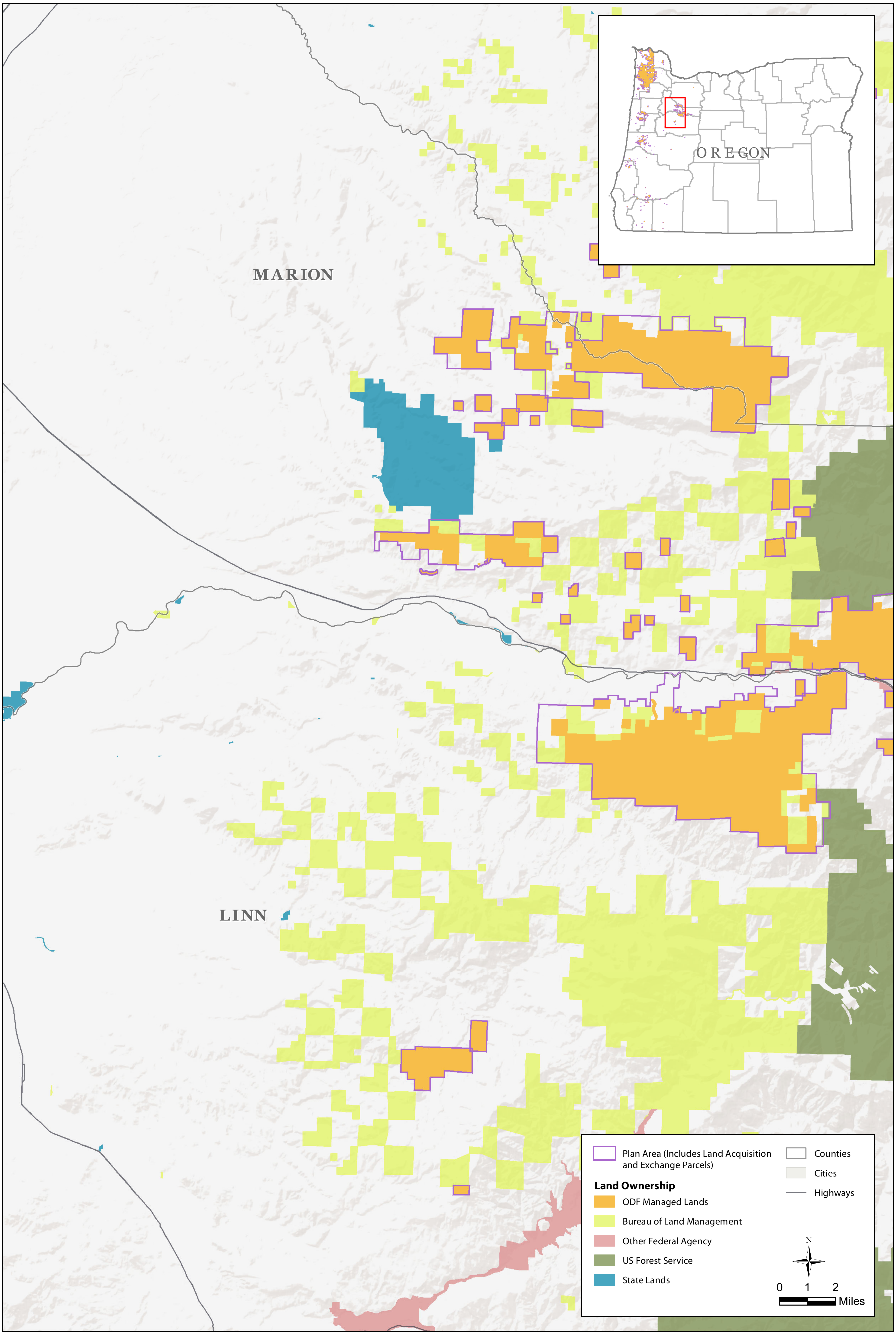

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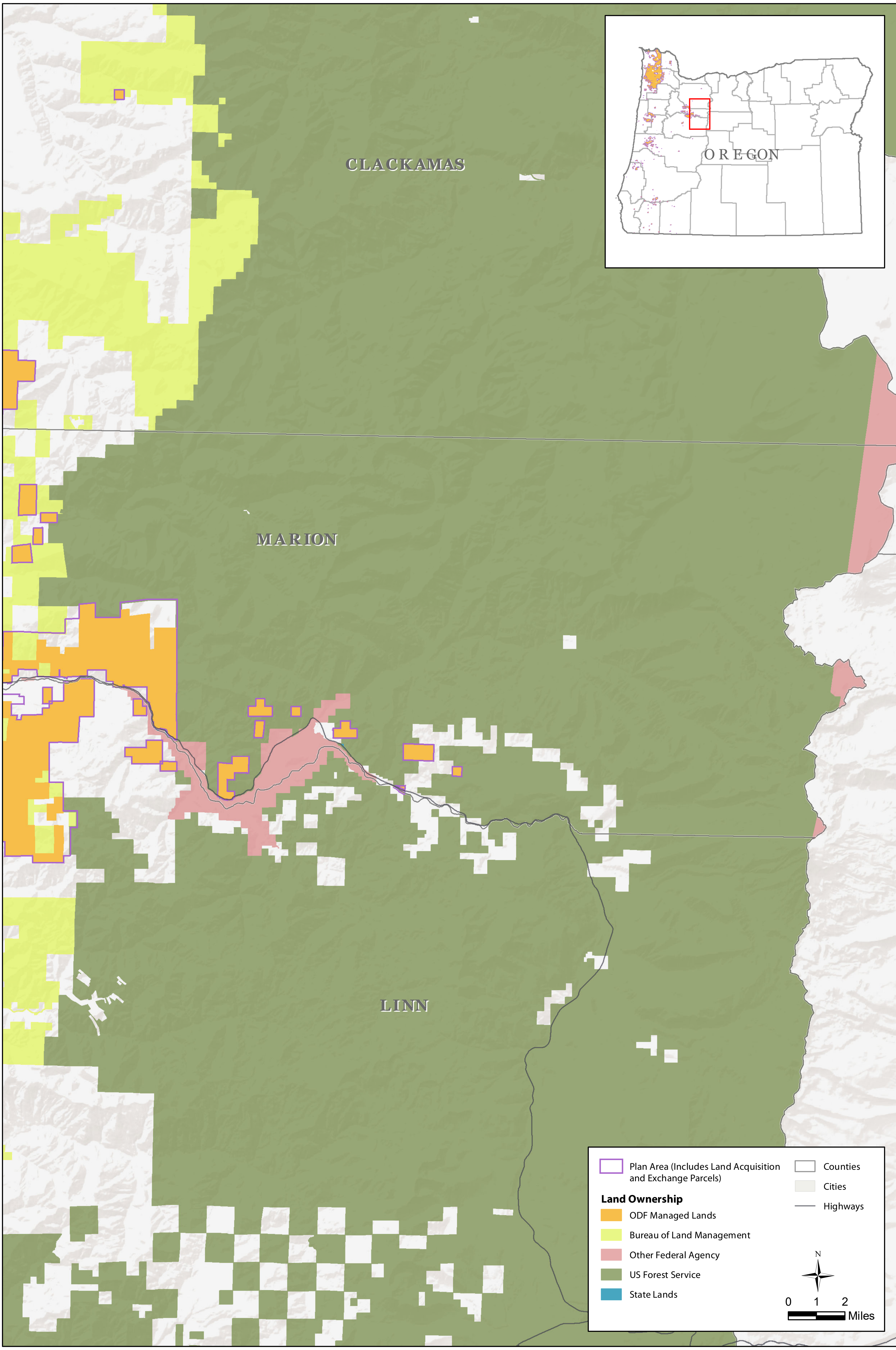
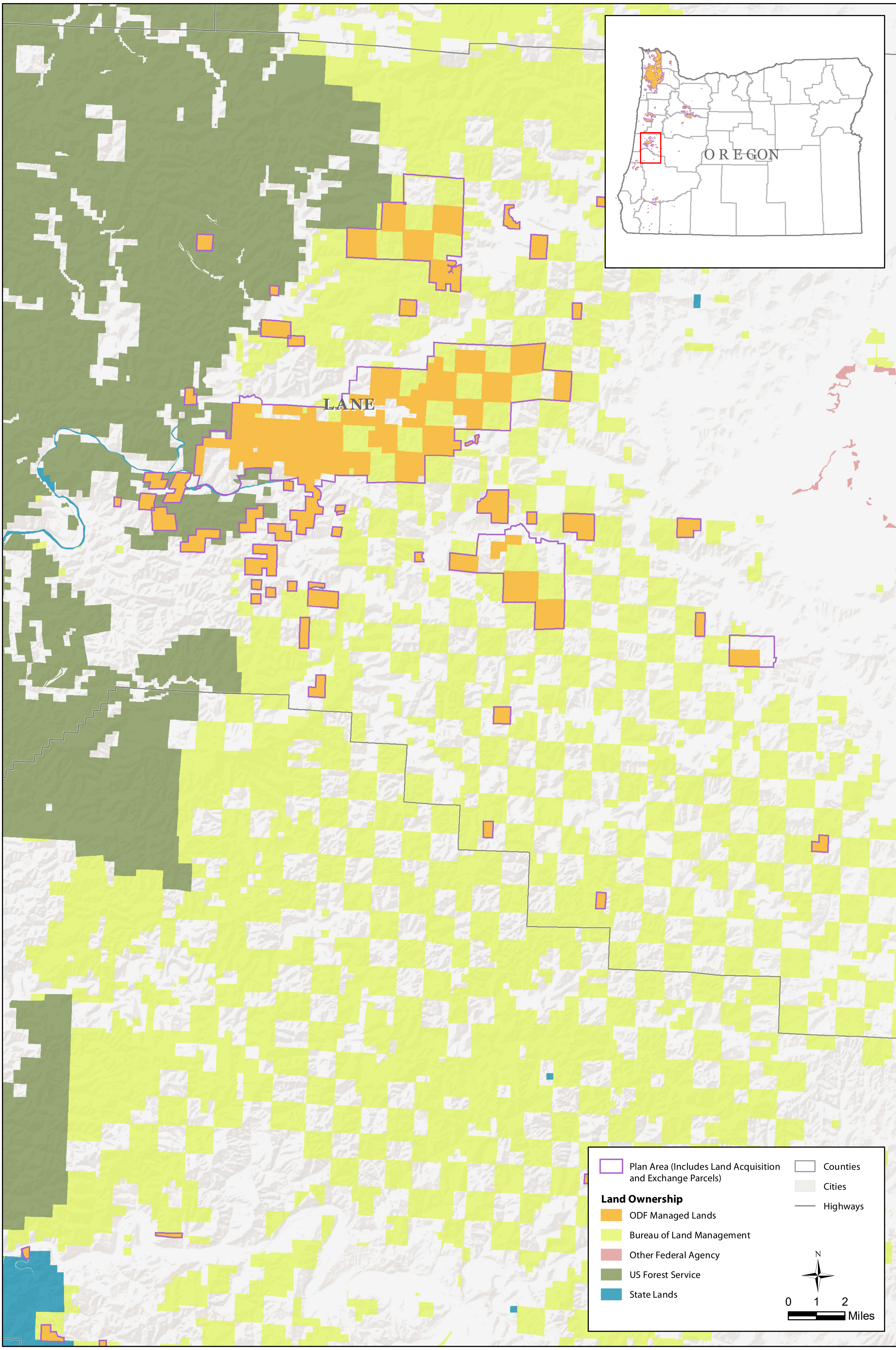
Draft Figure 2-16h: Adjacent Land Ownership



Draft Figure 2-16i: Adjacent Land Ownership



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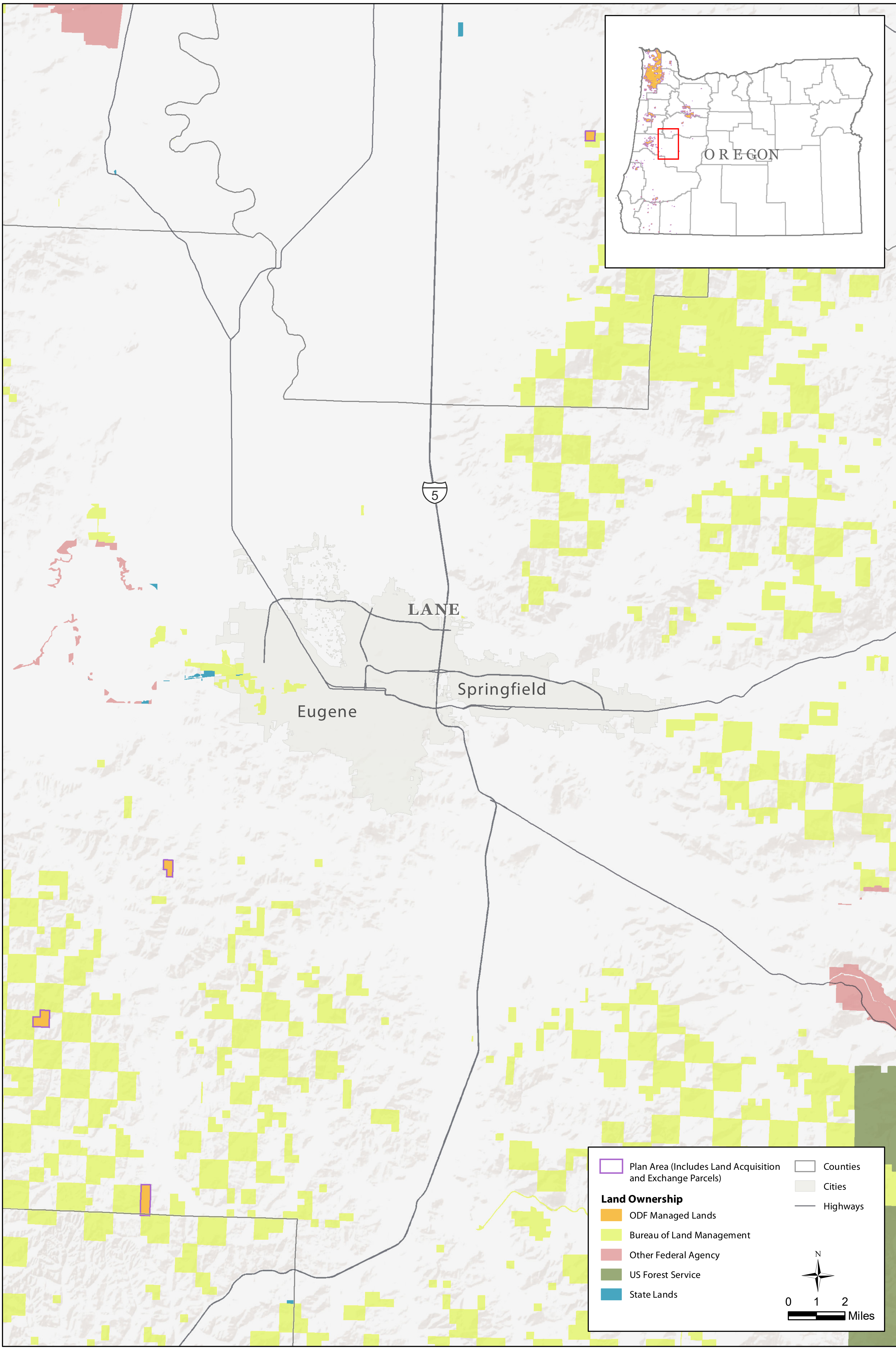

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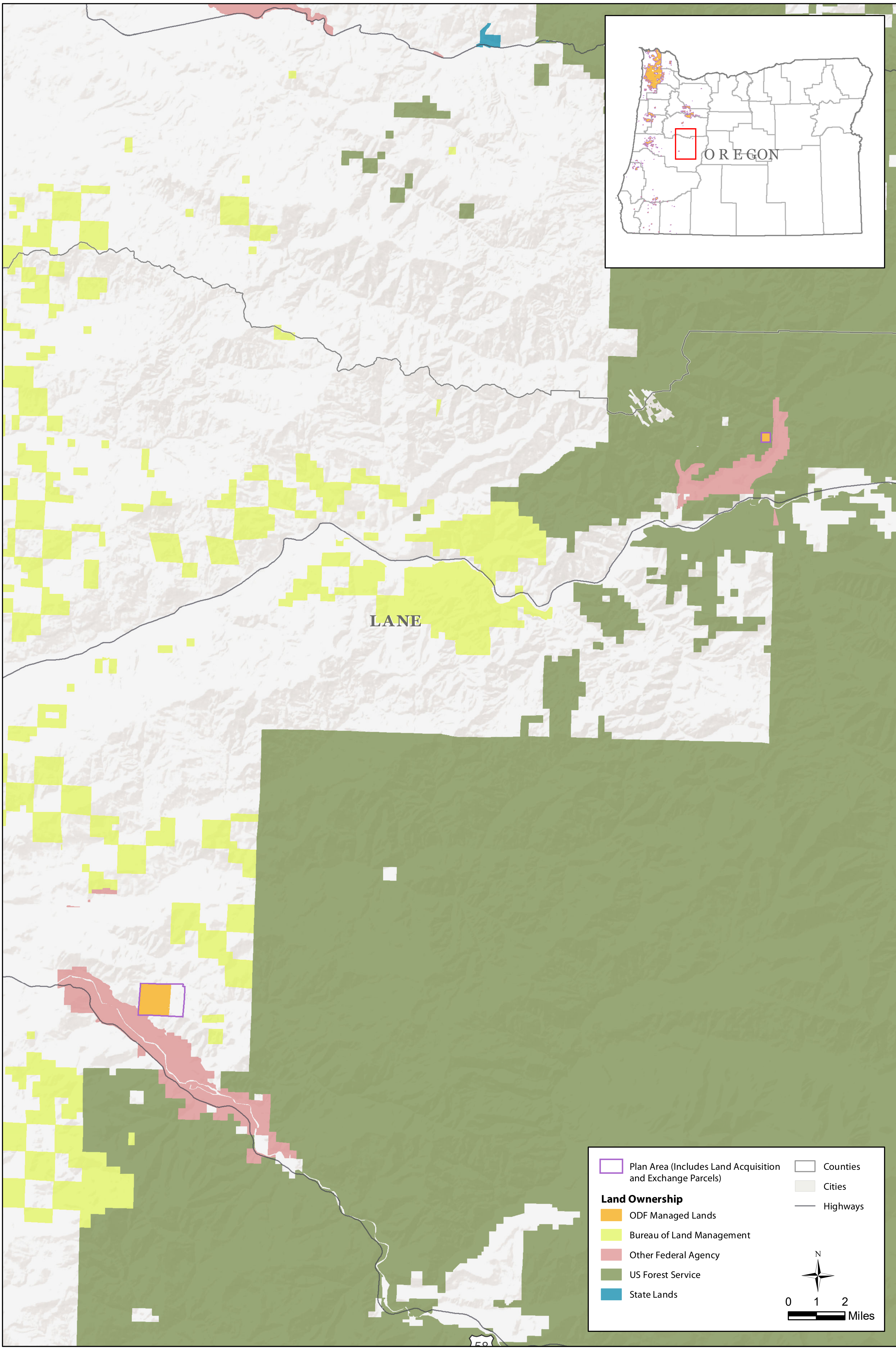

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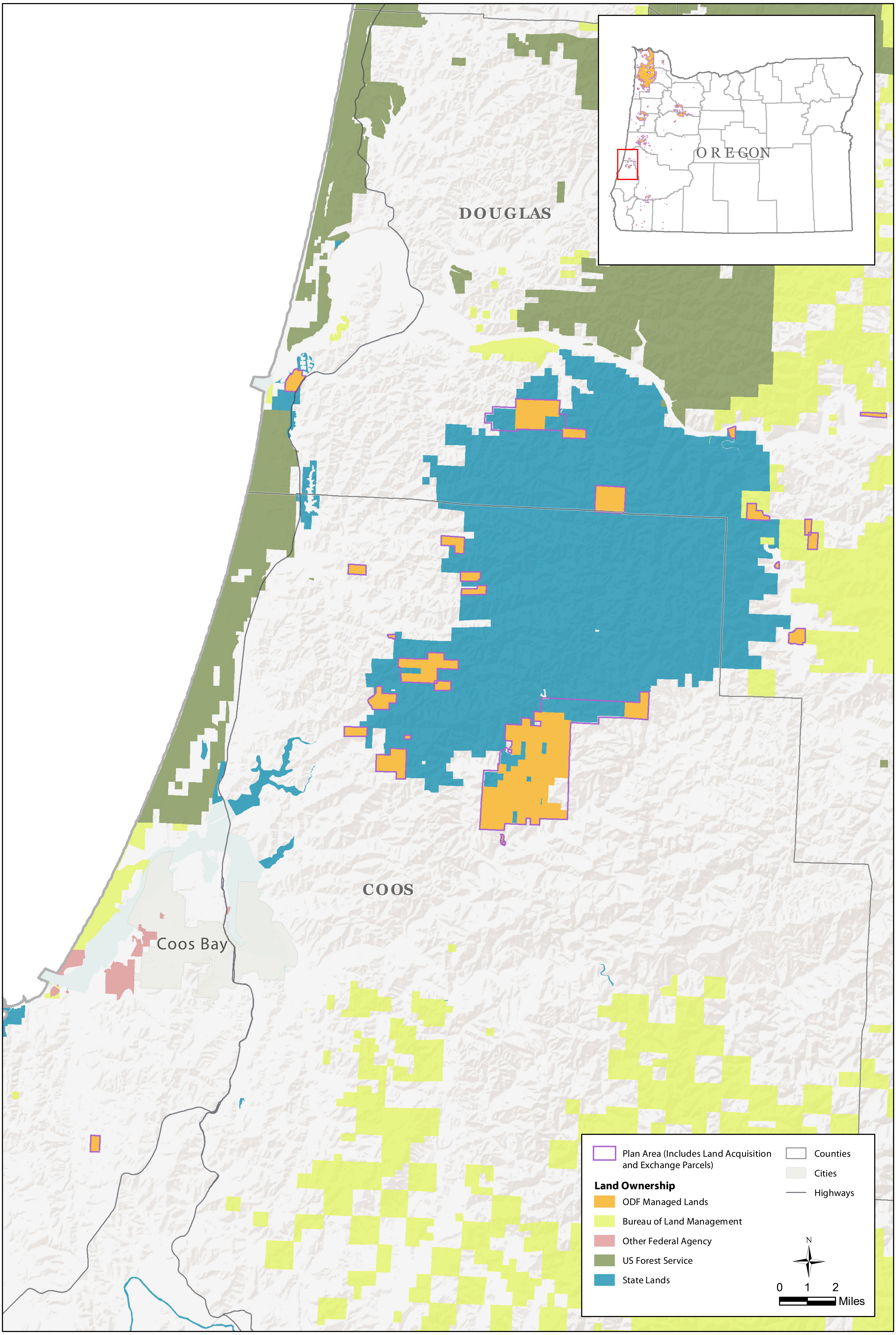
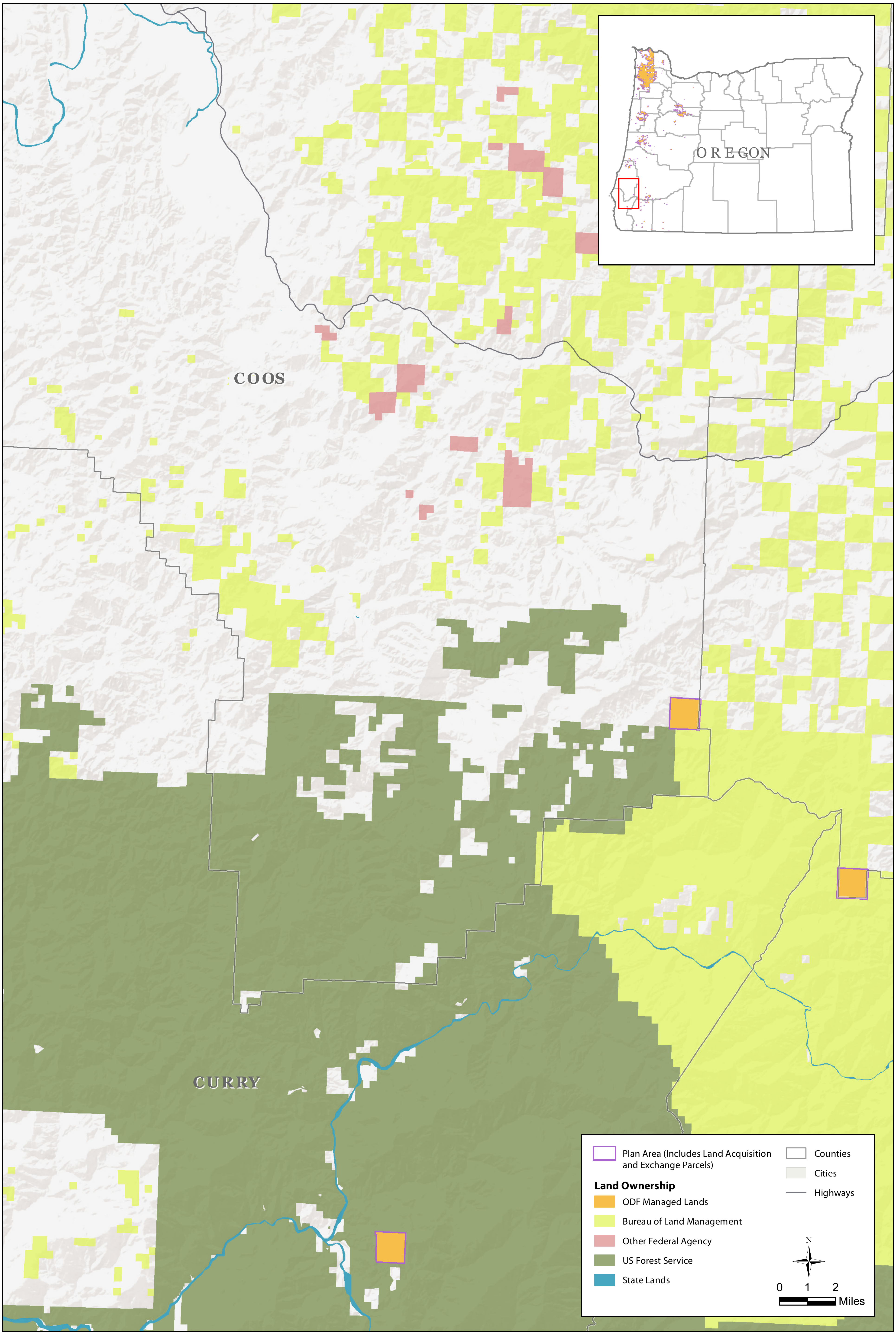
Draft Figure 2-16l: Adjacent Land Ownership



Draft Figure 2-16m: Adjacent Land Ownership



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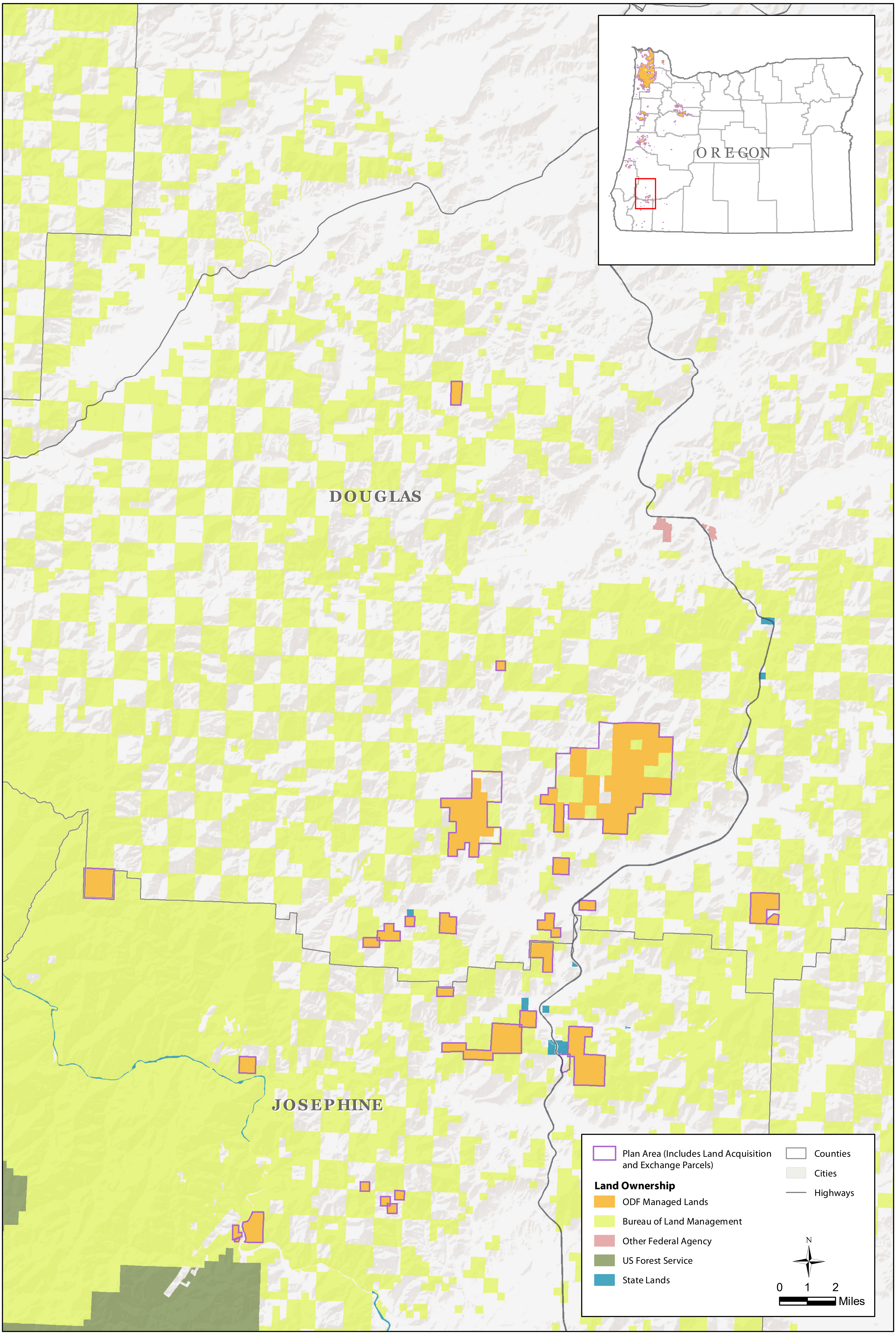

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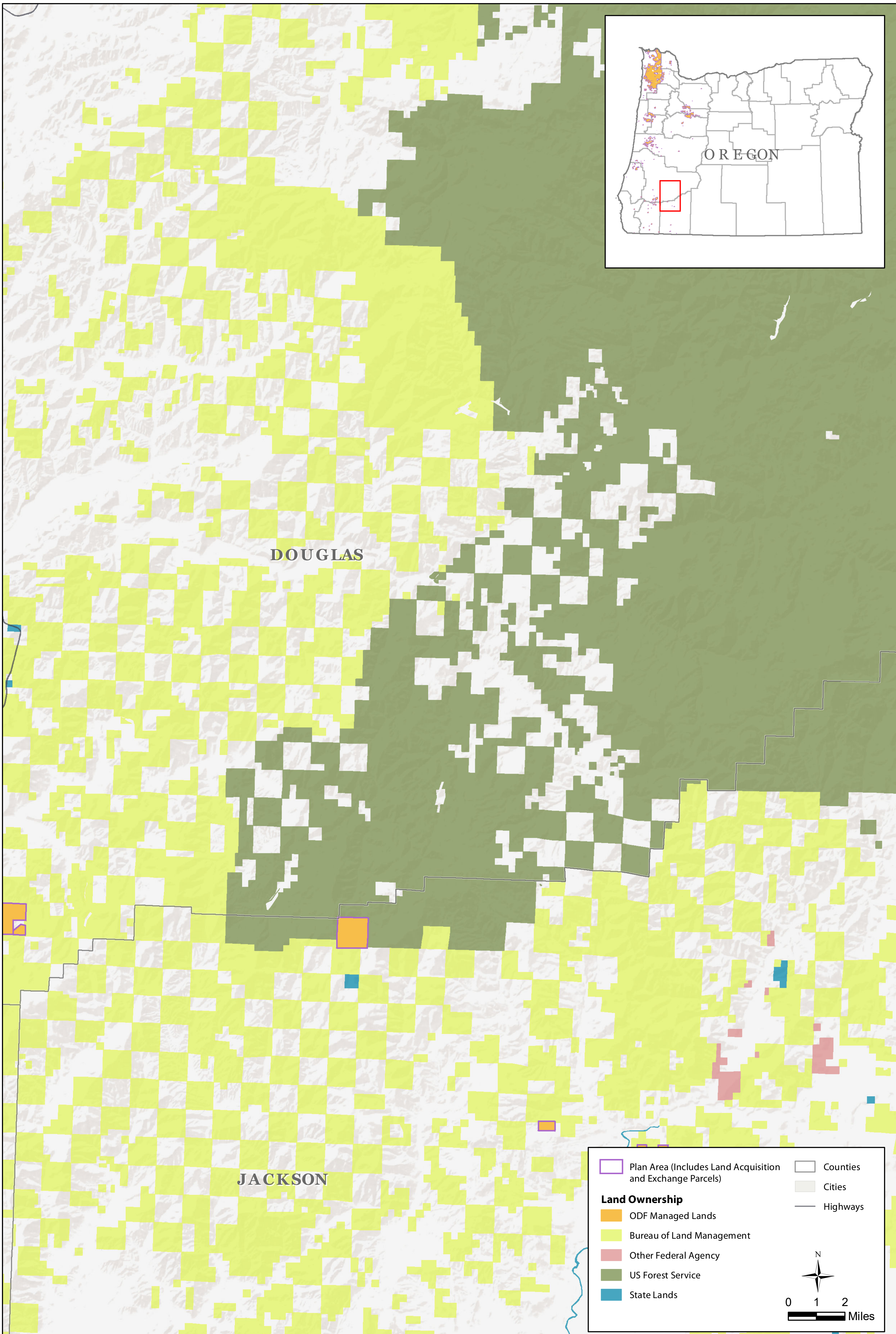

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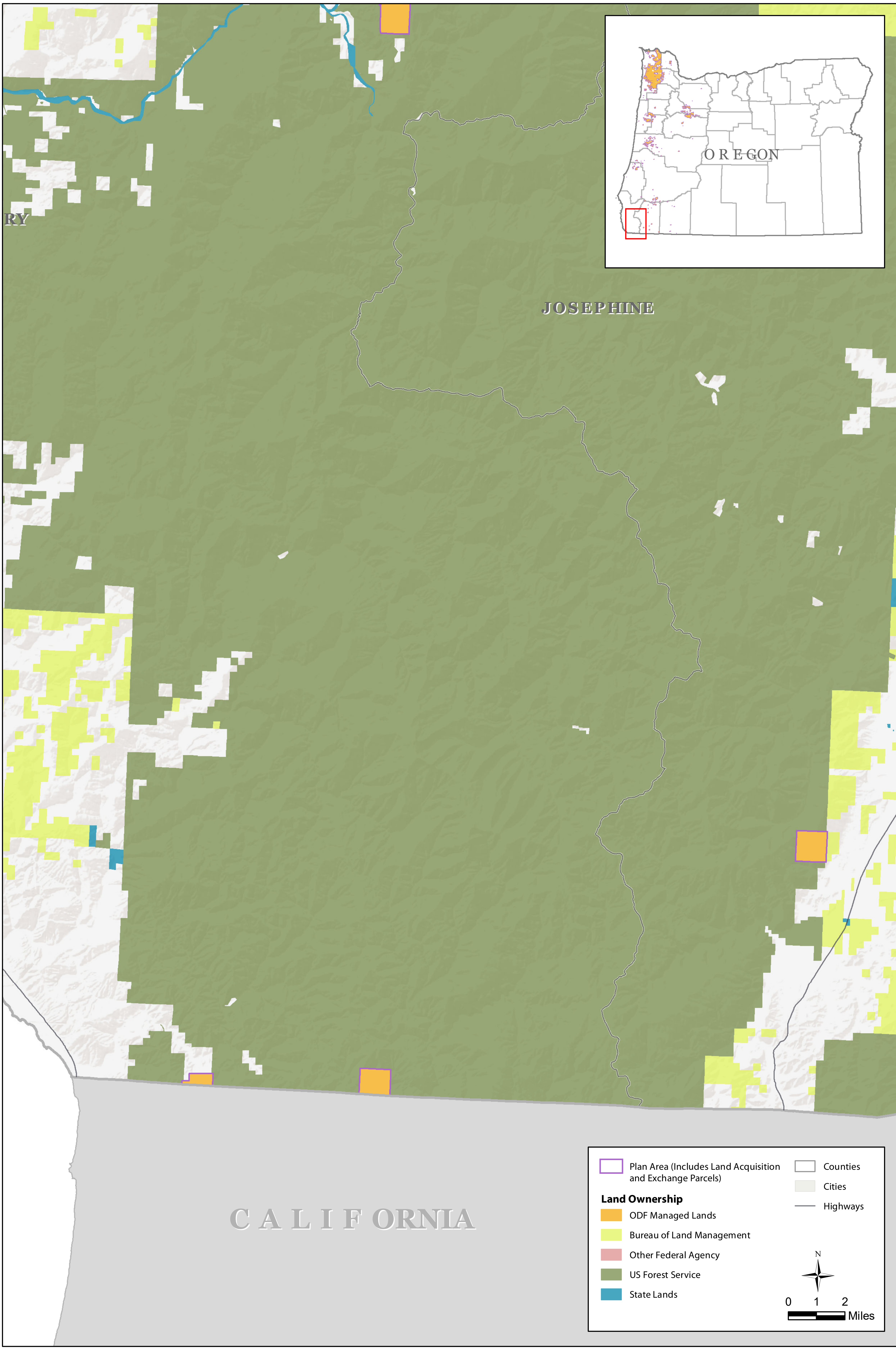
Draft Figure 2-16p: Adjacent Land Ownership



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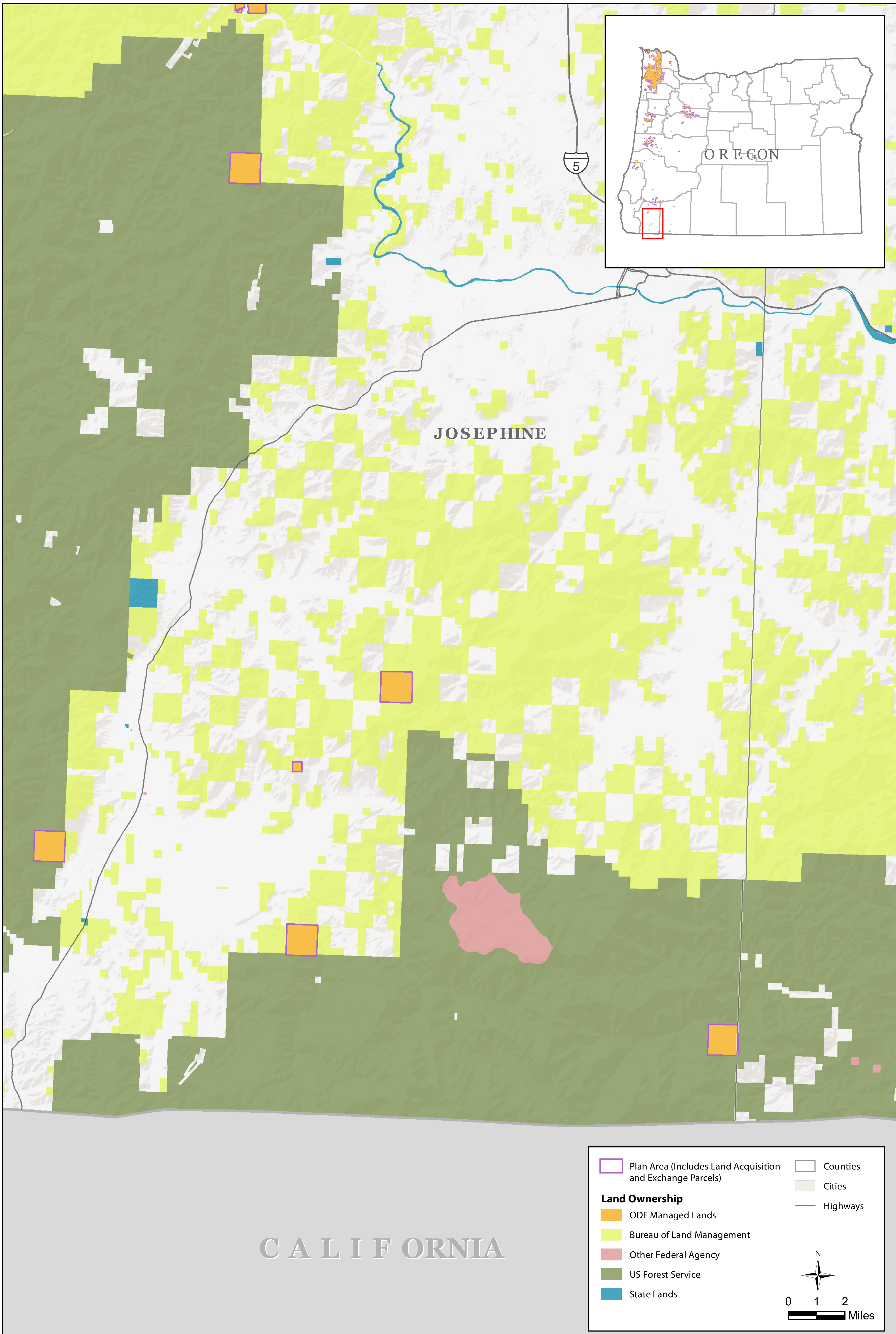
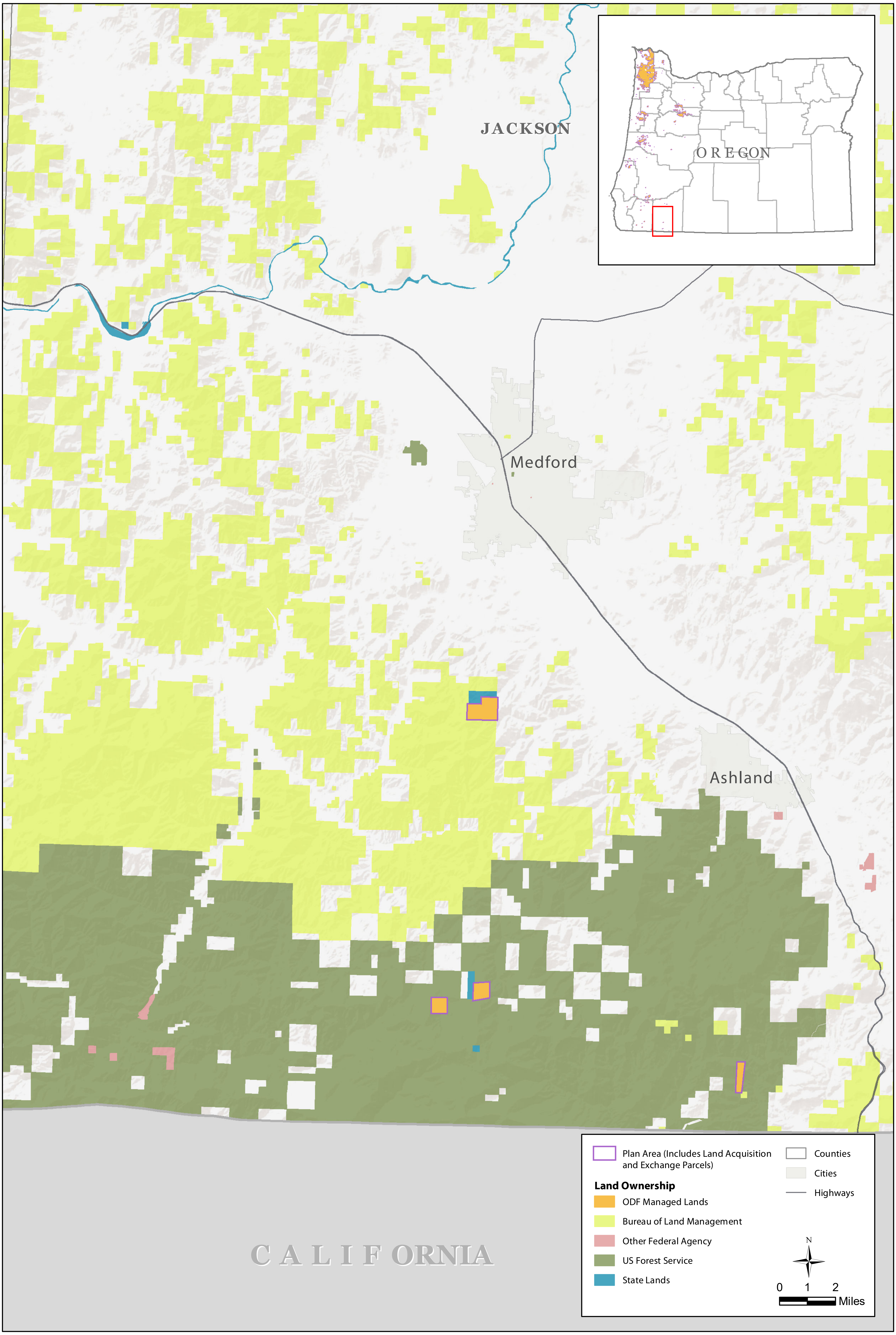


Draft Figure 2-16r: Adjacent Land Ownership



Draft Figure 2-16s: Adjacent Land Ownership

Chapter 3
Covered Activities

3.1 Introduction

This chapter describes the projects and activities for which the Oregon Department of Forestry (ODF) proposes to receive take coverage, which are collectively called *covered activities*. This chapter describes ODF's forest and recreation management activities in the permit area, as well as the activities needed to carry out the conservation strategy as described in Chapter 4, *Conservation Strategy*. The descriptions in this chapter of the proposed covered activities are of sufficient detail to support the conservation strategy and the analysis of the effects described in Chapter 5, *Effects Analysis and Level of Take*.

Covered activities were determined using a systematic screening process. First, a list of screening criteria was developed. The draft list of potential covered activities was then evaluated against the following criteria to determine the need for coverage by the Habitat Conservation Plan (HCP). Activities must meet all five criteria to be identified as a covered activity in the HCP.

- **Control or Authority:** The covered activity must be under the direct control of the permittee (ODF) as a project or activity it implements directly, implements through contracts or leases, or controls through regulation (e.g., a permit or other authorization).
- **Location:** The covered activity must occur in the HCP permit area, as defined at the time the activity is executed.
- **Timing:** The covered activity must occur during the proposed permit term.
- **Impact:** The covered activity must have a reasonable likelihood of resulting in take of one or more covered species.
- **Project Definition:** The location, footprint, frequency, and types of impacts resulting from the activity must be reasonably foreseeable and able to be evaluated in the HCP.

Broadly speaking, the covered activities described here correspond to activities regulated through the existing Oregon Forest Practices Act (FPA) (Oregon Revised Statues [ORS] 527 and Oregon Administrative Rules [OAR] 629). In addition, the covered activities include HCP implementation actions, such as habitat restoration and covered species monitoring that have the potential to cause incidental take.

The covered activities described in this chapter are intended to be as inclusive as possible of the activities currently occurring or expected to occur in the permit area and that may result in take of the covered species. Future activities not described in this chapter may be covered by the HCP if the activity or project:

- Is under the direct control of ODF as defined in the first criterion above.
- Does not preclude achieving the biological goals and objectives of the HCP (see Chapter 4) as determined by ODF at the time the covered activity is proposed.

- Is within the bounds and types of impacts and take limits evaluated in the effects analysis of the HCP (see Chapter 4).

Covered activities are described in this chapter using seven broad categories by type: harvest activities, stand management activities, road system management activities, minor forest-product harvest, quarries, recreation infrastructure and maintenance, and conservation strategy implementation. The descriptions of covered activities are based on existing plans and reports by ODF, as well as on similar activities described in forestry-related HCPs within the ranges of the covered species. Existing plans that were used to develop covered activities in the HCP include the following.

- *Northwest Oregon State Forests Management Plan, Revised Plan* (Oregon Department of Forestry 2010a).
- *Southwest Oregon State Forests Management Plan, Revised Plan* (Oregon Department of Forestry 2010b).
- *Astoria District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019a).
- *Forest Grove District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019b).
- Draft Klamath Lake District, 2020 Annual Operations Plan (Oregon Department of Forestry. 2019c).
- *North Cascade District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019d).
- *Tillamook District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019e).
- *Western Lane District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019f).
- *West Oregon District, 2020 Annual Operations Plan* (Oregon Department of Forestry 2019g).

3.2 Timber Harvest Activities

Harvest activities are associated with the harvest of timber and other forest products. Harvest activities would be performed in accordance with rules described by the current Forest Management Plans (FMPs) (Oregon Department of Forestry 2010a, 2010b) and the Oregon FPA, specifically including those identified in ORS 629 Division 630, *Harvesting*, but also including all other applicable rules.

3.2.1 Harvest Volumes

Timber sales to lumber and other wood products mills have been the primary commodity output sold from state forests in western Oregon. Table 3-1 presents harvest and revenue data for the last 9 years to illustrate the variability in year-to-year harvest levels and the resulting revenue that is both a function of harvest level and stumpage[1] price. Thinnings and regeneration harvests produce a supply of timber and revenue. Smaller-diameter wood is produced from thinnings in the early stages

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[1] The price paid for the right to harvest timber from a given land base. It is paid to the current owner of the land. Historically, the price was determined on a basis of the number of trees harvested, or “per stump.”

of stand development. High-quality timber is produced through silvicultural techniques and harvested through later thinnings and regeneration harvests.

Table 3-1. 2010–2018 Harvest and Revenue Summary for Lands in the Permit Area

Year	Total Harvest (million board feet)	Average Stumpage Price (1,000 board feet)[a]	Total Revenue Generated[b]	Revenue Retained by ODF	Total ODF Costs	Total Number of ODF staff (number of FTEs)
2018	319	$408	$130,203,778	$48,496,211	$33,655,179	193
2017	267	$356	$95,169,183	$35,862,713	$34,348,943	188
2016	242	$401	$97,072,585	$35,712,861	$33,755,555	211
2015	266	$335	$88,993,923	$32,965,350	$32,172,533	218
2014	225	$345	$77,487,200	$28,660,675	$31,232,986	216
2013	236	$320	$75,479,129	$29,905,510	$27,376,168	214
2012	234	$257	$59,982,506	$23,536,011	$27,818,782	211
2011	244	$249	$60,774,964	$23,895,103	$24,690,524	202
2010	277	$252	$69,648,088	$27,936,988	$24,961,200	208

[a] Average stumpage is total revenue divided by harvest volume.

[b] Does not include project work (e.g., road construction and maintenance, brushing) associated with the sale.

FTE = full-time employees

3.2.2 Harvest Methods

Harvest activities include the felling, bucking, yarding, processing, and loading of timber. *Felling* means cutting down trees. *Bucking* means cutting felled trees in the field into predetermined log lengths specified by the timber owner to maximize tree value. Trees may also be felled and yarded to be processed and manufactured into logs on a landing or road. The following techniques are used to fell and buck trees.

- On steep terrain, contractors fell and sometimes buck trees with hand-held chain saws.
- Mechanical felling is done by a feller-buncher to fell trees when terrain is not steep. These machines are structurally similar to trackhoes and use an articulated attachment to grab, fell, and bunch the trees with other trees or logs for subsequent skidding (transporting) to the landing.
- A more complex machine, the cut-to-length, is used to grab, fell, delimb, and buck trees into logs using processor heads. These machines can operate on moderate slopes and have no blade or attachments capable of moving soil, which minimizes soil disturbance and compaction.
- All ground-based felling and skidding machines can be equipped with winches that allow for use on steep slopes. Tethered assist equipment and other advances in technology allow for ground-based harvest on steeper terrain.

Yarding or *skidding* means moving logs from where they are felled to a landing using cable systems, ground-based equipment, helicopters, or other means. *Landings* are cleared areas where logs are stored (yarded, swung, skidded, lowered, or forwarded) for subsequent loading onto trucks for transport. The following techniques are used for yarding or skidding.

- Cable yarding employs wire ropes to move logs to a truck road or log landing, and are most often used to move logs uphill over steep terrain. Yarders use powered drums filled with rope and a vertical tower or leaning boom to elevate the cables as they leave the machine. On the opposite end the wire rope is anchored into a tree, known as a tail hold. These locations are often across a canyon or on another hillside that provides the proper deflection and lift to make cable yarding possible. Wire rope guy lines hold the tower in position while the machine is in operation. Aerial drones are often used to fly haywire (synthetic rope) above the canopy to tail hold points, after which wire rope is pulled through.
- A common technique employed is ground-based yarding. Ground-based yarding involves tracked or rubber-tired tractors (skidders) skidding logs to the landing. Machines are able to grasp the log using powered grapple attachments or wire rope winch lines. Skid trails are required to operate on terrain generally under 35% slope.
- Ground-based yarding can also be done by loader logging. A tracked hoe log loader physically picks up and swings the whole tree toward the landing. The tree may be picked up several times as the loader gets the trees to the landing for processing.
- Cut-to-length logs are skidded with a Forwarder, a rubber-tired machined that is equipped with a grapple and bunks. This skidding system carries logs clear of the ground to the landing, this method minimizing ground disturbance. Aerial yarding may use a helicopter. This more costly techniques typically occur on very steep or unstable terrain where more ground-based yarding is infeasible or too dangerous. In helicopter yarding, a cable extending from the helicopter is attached to the logs and used to suspend and move them to the landing area. This technique generally does not disturb soil, although large, separate, cleared landing areas are required for helicopter touchdown.

Processing includes limbing and bucking into logs. Some processing can occur on site where the tree is felled by chain saw or cut-to-length, though most is done at the landing or road. Processing is mainly done by stroke delimbers or dangle head processors mounted on trackhoes.

Loading means loading logs from the landing area to a truck for transport. Logs are loaded onto trucks using equipment such as hydraulic tracked hoe log loaders or heel-boom loaders, which may be used without leaving the road grade. Wheeled loaders have more limited mobility and functionality than tracked machines. Some log trucks are self-loading and are equipped with a log loader on the truck to both load and transport logs.

Salvage harvest is the removal of timber in the aftermath of a disturbance event that affects forest health, such as insects, disease, wildfire, or severe weather such as wind or ice. Salvage harvest uses the same equipment and methods as other types of harvest and ranges from selective harvest of individual trees to clearcut harvest depending on the magnitude of the disturbance event. During timber harvest and site preparation, many techniques are used to protect soils from compaction or from ponding water and causing excessive erosion. Common techniques include limiting ground equipment activity to gentle slopes and to time periods when soil moisture is low and limiting the amount of area on which ground equipment may operate. Cable and ground equipment operations must minimize gouging and soil displacement. Logging systems that minimize disturbance to existing duff, litter, and woody debris, except where disturbance is desirable to facilitate regeneration, may be used during timber harvest. Logging residue (limbs, tops, cull logs, etc.) are retained to levels that do not prohibit reforestation and do not creating an unacceptable fire hazard.

3.2.3 Harvest Types

Silvicultural approaches described in this chapter are used when site-specific conditions warrant the need and would be applied in future harvests under similar circumstances. For example, clearcutting[2] provides for efficient harvest and regeneration of forest stands, and helps young trees reach a "free-to-grow" state that is not compromised by competition from a residual overstory of older trees or by the possibility of damage from the repeated site disturbance that is implicit in the application of other silvicultural systems. When applied, clearcutting would follow the rules described under *Clearcut* below.

3.2.3.1 Regeneration Harvest

The intent of a *regeneration harvest* is to develop a new stand. In general, residual trees left after a regeneration harvest are intended to remain on the site through the life of the new stand and subsequent stands. All types of regeneration harvests retain less than 80 square feet of basal area per acre (based on trees greater than 11 inches in diameter at breast height [DBH[). The Harvest Types (within the Regeneration Harvest Goals) are best defined using residual trees per acre or square feet of basal area per acre; in either case, only trees greater than 11 DBH are counted.

Clearcut

A *clearcut* removes all (or nearly all) trees in a stand; however, the FMP and the FPA require that at least a few live trees be retained in each unit. Clearcuts will provide the best conditions for successful plantation establishment on almost all sites on state forests.

Requirements for the clearcut harvest type:

- Retains between 2 to 5 green trees or snags per acre.
- Subject to the FPA Rules for Type 3 Harvest (maximum size is 120 acres with green-up requirements).
- Results in a Regeneration Stand Structure.

Retention Cut

Retention cuts look more like a partial cut or the first stage of a shelter wood harvest than a clearcut; however, the focus of future management will be on the new/young trees in the stand, rather than the residual trees. At its highest density, a retention cut leaves nearly as much basal area as a heavy thinning, and the management focus may be on the existing cohort, the new cohort, or both.

In the retention cut harvest type, regeneration is more difficult, but still achievable, while complex stand structures are likely to develop much more quickly than after a clearcut. A retention cut will result in a stand with two distinct age classes that are well-distributed across the stand.

Requirements for the retention cut harvest type:

[2] Clearcutting removes most trees in a stand with the exception of landscape-level residual components of reserved trees, snags, and downed wood. Clearcutting is one of several types of regeneration harvests, where a forest treatment is applied to a stand in order to improve its regeneration potential. Additional regeneration harvest treatments are described in Section 3.3, *Stand Management Activities*.

- Retains between 33 and 80 square feet of basal area per acre (on Site Class I, II, or III).
- Subject to the FPA Rules for Type 1 Harvest.
- Designed to meet or exceed the landscape goals for structural components in the FMP.
- Results in a Regeneration or Understory Stand Structure.

3.2.3.2 Partial Cut Harvest

The intent of a *partial cut* harvest is to manage the growth and density of an existing stand. A prescription for a partial cut may be designed to increase the structural complexity of a stand, maximize volume growth, or capture tree mortality. A stand may be partial cut several times throughout its life. All partial cut harvest types retain at least 80 square feet of basal area per acre of trees greater than 11 inches DBH.

There are several forms and intensities of partial cuts; however, the most common form is *thinning*. Thinning prescriptions are often designed using measures of Stand Density Index (SDI) or Relative Density and remove a portion of the trees from a stand in a generally uniform pattern. Sometimes thinning prescriptions are developed to increase the horizontal diversity within a stand; a diameter limit prescription often results in a stand with variable density.

The structure of a stand immediately after a partial cut (1 to 3 years) is very dependent on both the harvest prescription and the structure of the stand prior to harvest. Generally, the stand structure will remain the same or become more complex.

Heavy Thinning

A *heavy thinning* approaches the harvest intensity of a retention cut, and the management focus will be on developing a new cohort of trees to speed up understory development, which leads to a new cohort throughout the thinning area. A heavy thinning results in the fast growth of individual trees, but reduces the total volume growth of the stand.

Heavy thinning retains an SDI% of less than 30.

Moderate Thinning

A *moderate thinning* provides for optimal stand growth and allows vigorous growth of the individual trees. Stand structure will continue to develop with a moderate thinning, and depending on species composition and site index, a new cohort of trees may be initiated.

Moderate thinning retains an SDI% of greater than or equal to 30 and less than 40.

Light Thinning

A *light thinning* focuses on maintaining stand growth and health, however in order to achieve these goals, it must occur more frequently than a heavy or moderate thinning in the same stand. More complex stand structure may not be developed with a light thinning, and a new cohort of trees may not be initiated. Early commercial thinning falls under a light thinning.

Light thinning retains an SDI% of greater than or equal to 40 and less than 50.

3.3 Reforestation and Young Stand Management

Stand management activities are those performed between the time when a stand has just been harvested and the time when the stand is ready for another harvest. This section describes these activities as well as certain other conservation actions, such as snag creation, that may be performed within a stand to enhance stand utility for covered species. These activities tend to be performed at certain times following stand removal (usually by clearcut harvest), as shown in Table 3-2.

Table 3-2. Typical Timing of Harvest and Stand Management Activities

Treatment	Stand Age When Treatment Typically Occurs
Site preparation	0–1 years
Tree planting	0–2 years
Release treatments	0–10 years
Fertilizer application	30–60 years[a]
Animal damage control	3–6 months prior to planting, 1–3 years post-planting[b]
Precommercial thinning and pruning	10–20 years

[a] Fertilizer application occurs approximately 9 years before harvest so the timing would vary with harvest practices.

[b] Only refers to mountain beaver control.

Stand management includes silvicultural practices designed to control the establishment, composition, growth, health, and quality of stands to achieve forest management objectives. Silvicultural activities include slash management, commercial and precommercial thinning, vegetation control, seed tree management, and active snag development using top cutting, girdling, or inoculation methods. Stand management activities are described in this section in the order in which they are typically performed.

3.3.1 Site Preparation

Site preparation is any planned measure to prepare a site for the favorable conditions for newly planted seedlings. Site preparation should not cause detrimental or excessive soil disturbance, and should be carried out in a cost-effective manner. Through site preparation, factors that are limiting for seedling survival and growth may be overcome. Such factors may include limited soil moisture, low light levels, and compacted soil. Logging slash can have positive and negative benefits and should be evaluated on a site by site basis. The three main site preparation techniques are mechanical, chemical, and broadcast burning, which are described below.

3.3.1.1 Mechanical

Mechanical site preparation is the use of mechanized equipment to rearrange or alter forest slash and/or disturb the forest surface layer and vegetation to create seedbeds or planting spots. Mechanical site preparation reduces competition of other vegetation with crop trees for light, water and nutrients. It can alter wildlife habitat, both positively and negatively, and this should be taken into consideration before use at each site. It can also be used to treat the adverse effects of past activities, such as compaction.

3.3.1.2 Chemical

[**Note to Reader**: *This section continues to be under development by ODF and the Scoping Team. Additional details about this covered activity, including what is covered and how the activity will be implemented, will be described in a future draft.*]

Chemical site preparation, which involves the application of herbicides, controls competing vegetation before planting or natural regeneration and during the early stages of seedling establishment. Applications occur by two primary methods, aerially by helicopter or ground based with the use of backpack application equipment. In general, herbicides are effective in suppressing most undesirable vegetation and are well suited for use on many sites.

3.3.1.3 Prescribed Burning

When properly applied on appropriate sites, prescribed burning can achieve many site preparation objectives. Fire can be used on steep terrain, does not compact the soil, and improves access for planting. Fire impacts can also improve seedling survival and growth by reducing competing vegetation. Prescribed burning is also used to remove slash piles throughout the site and on landings.

However, it also has disadvantages. The biggest disadvantage is the risk of escape, and intense fire can reduce the amount of soil nutrients. Prescribed burning can also reduce the amount of downed wood in a unit, decreasing the amount of suitable habitat for a number of species of concern. Burning can also increase the amount of unwanted vegetation, such as ceanothus and senecio, in certain parts of the permit area.

3.3.2 Tree Planting

3.3.2.1 Initial Planting

Initial planting occurs after a regeneration harvest. Planted seedlings will be well suited and adapted to the reforestation site, and, where appropriate, a mixture of species will be planted to increase diversity across the permit area. Density will vary from 250–536 trees per acre (TPA). Stock type will be site specific and consider factors such as soil type, soil quality, and animal browse potential. Species selection will be on a site-by-site basis with the goal of increasing diversity across the landscape to increase resiliency in the uncertainty of climate change. In areas of disease, such as Swiss needle cast or laminated root rot, planted species will be of tolerant stock or from a resistant species with an emphasis on resistant species

3.3.2.2 Interplanting

Interplanting will occur when stocking levels fall below FPA minimums. In certain instances, interplanting will occur to increase stocking on high quality sites to fully capture the site. In other areas, lower stocking will be acceptable as it will provide high quality early seral habitat while still meeting FPA requirements. Density will be site dependent, but range from 200–400 TPA.

3.3.3 Release Treatments

Release treatments usually occur in young stands and are designed to reduce competition for desirable tree species. They can also be used to alter species composition under pressure from insect and disease and favor species that are tolerant or resistant to threat. There are two types of release treatments, manual and chemical, and they are described below.

3.3.3.1 Manual

Manual release treatments are used to reduce competition from unwanted vegetation, usually, but not limited to other tree species. The two main release treatments are precommercial thinning (PCT) and hardwood release.

A common manual release treatment is PCT. This silviculture activity is used to manipulate the density, structure or species composition of overstocked young forest stands. Generally, the purpose of a PCT operation is to release the biggest and best growing trees so they can maintain their growth. PCT decisions are not made at the planting planning process, as planting density should not require PCT. This tool is used when ingrowth from natural regeneration, both conifer and hardwood, occurs reducing the growth and vigor of planted saplings. PCT is normally conducted in a stand between the ages of 10 and 20 years. Remaining density should be appropriate for the site, and range from 250–350 TPA. In areas of disease, such as Swiss needle cast, PCT can be used to favor western hemlock and other resistant species over Douglas-fir to help ensure a healthy future stand.

Hardwood release is used when ingrowth of hardwoods, mainly red alder in the northwest and madrone and tanoak in the southwest, threaten to change the stand from conifer dominate to hardwood dominate. While hardwoods are important on the landscape and for local mills, long term conifer production is the goal for many stands across the planning area. In this treatment, hardwoods are removed leaving all conifer. This differs from a PCT in the fact that conifer spacing and species are not manipulated.

3.3.3.2 Chemical

[**Note to Reader**: *This section continues to be under development by ODF and the Scoping Team. Additional details about this covered activity, including what is covered and how the activity will be implemented, will be described in a future draft*.]

Chemical release treatments involve the application of herbicides to control undesirable vegetation. Typical application methods are broadcast, directed spray, and hack and squirt, and are described below.

Broadcast application treatments are sprayed over the top of seedlings and undesirable vegetation. These applications usually occur in the first 1 to 2 years after planting and are designed to reduce competition from annual forbs and grasses. Broadcast applications can also occur later in the stand as a release treatment from hardwoods that have overgrown the planted conifer; however, this is rarely used.

The two main application methods are aerial and backpack. Directed spray (spot spray) applications are made with a backpack and target individual plants. This treatment is often used to remove invasive species, such as Scotch broom, from young stands. Hack and squirt (basal or stem-injection) is typically applied as way to release conifers from hardwood competition. This method selects certain species, such as red alder, bigleaf maple, madrone, myrtle, tanoak, and chinquapin for treatment.

Insecticides will only be used in conjunction with the Oregon Department of Agriculture or other lead agencies to combat outbreaks of invasive pests that threaten long-term forest health. Rodenticides will not be used in the permit area.

3.3.4 Animal Damage Control

Animal damage on newly planted seedlings reduces their overall size, health, and vigor. Extensive damage can lead to interplanting, extend the time to achieve free to grow, potentially violating the Forest Practice Act. Animal damage occurs in many forms, but the most common is from ungulates (deer and elk) and mountain beaver.

Ungulate browse ranges from minor to severe. Minor browse damage usually has little impact on growth and survival. Repeated severe browse damage to seedlings, sometimes seen with western redcedar, can have major impacts on growth and occasionally lead to mortality.

Mountain beavers clip the seedling at its base, causing mortality. As the seedling ages, the diameter becomes too large and the animal climbs the stem and clips branches. Mountain beaver browse will occur in most stands in the northern part of the planning area with little damage in the southern part.

Control measures are used when the negative impacts are expected to cross threshold limits. Common control methods include vexar tubing and controlled hunts for ungulates and trapping for mountain beaver.

3.3.5 Fertilizer Application

Fertilization is a seldom-used treatment on some stands which are deficient in nitrogen. Douglas-fir and true fir stands have been shown to respond to nitrogen fertilization by increased volume of growth for 4 to 12 years after fertilization. Fertilization typically includes the aerial helicopter broadcast application of urea pellets. Fertilizer application, if used, occurs approximately 9 years before harvest, so the timing would vary with harvest practices. Fertilizer application would be performed in accordance with restrictions placed by the Oregon FPA, specifically including those identified in ORS 629 Division 620, *Chemical and Other Petroleum Product Rules*, and ORS 527.672, *Aerial Spray Buffers*, but also including all other applicable rules.

3.3.6 Precommercial Thinning and Pruning

Precommercial thinning involves thinning dense, young forest trees by mechanical means, including felling individual trees or mechanically sawing or chipping rows or groups of trees. For planted stands between 10 and 20 years old, precommercial thinning may occur to remedy overstocked conditions in which trees exceed target densities. Thinning reduces tree density so that crop trees achieve optimum diameter growth. Thinning can also be done to reduce insect and disease issues and increase overall forest health. Trees felled during a precommercial thin are typically left on the ground because they are too small to meet current merchantable standards. This operation is performed only once in the life of a stand and only in those stands with an excess number of trees per acre. Although chainsaws are used to cut the noncrop trees, feller-bunchers machines are capable of executing this operation more efficiently and with less risk of injury to workers. Alternatively, improvements in markets for small wood and in the machinery used to harvest small stems may allow economic harvesting of the excess trees, in which case precommercial thinning would become less common and the manipulation would become commercial thinning as described in Section 3.2.3.2, *Partial Cut Harvest*.

Pruning removes the lower limbs of desirable tree species to increase the eventual product value of the pruned trees. Pruning is a rarely used activity, optimally performed when the trees are small enough to minimize the size of the knotty core in the center of the tree, and maximize the production of high-grade, knot-free wood at the time of anticipated harvest. Pruning can also be done for forest health—in western white pine stands removing the lower limbs decreases the white pine blister rust pathogen. Pruned trees must maintain a minimum of 50% of their live crowns. To maintain the live crown and minimize the core, pruning is typically done several times as the tree grows. Pruning is typically conducted by hand with hand tools or a chainsaw.

Precommercial thinning and pruning would be performed in accordance with restrictions placed by all applicable rules under the Oregon FPA.

3.3.7 Salvage

Natural disturbance events can have severe effects on forest health and require salvage harvesting to occur to accomplish overall management objectives. Natural events such as insect or disease outbreaks, wildfire, and severe weather events like windstorms or ice storms may require salvage. Significant natural events can present forest health and management challenges, and these events are occasionally at a large scale that would broadly affect the permit area.

Salvage activities would vary from selective harvest of individual trees to clearcut harvest, depending on the magnitude of the disturbance event. Roadside salvage occurs at a specific distance from one or more roads, rather than in a specific unit or area. Riparian area salvage is used to balance the long-term needs of the aquatic system with the short-term forest health risk presented by the sudden introduction of a significant amount of down material. Significant salvage acreages are grouped into harvest units that are treated similar to other timber harvests. Salvage harvest will not occur in riparian conservation areas unless it is for fuels management or to alleviate safety concerns. Even in those cases every attempt will be made to leave wood in the riparian conservation area so that it can eventually be recruited into the stream to benefit covered species.

3.3.8 Unmanned Aircraft Systems

Unmanned Aircraft Systems (UAS), also known as drones, are an emerging technology that will likely become more commonly used over the term of this HCP. As with any developing technology, new uses will be discovered as use becomes more common. ODF anticipates that UAS will be used to conduct a variety of field surveys including free-to-grow surveys, rock stockpile estimates, harvest unit closeout, contract administration and inspection, 3D modeling (LiDAR and Phodor), stream surveys, animal damage assessment, and adaptive management monitoring. UAS may also be used in harvest operations and research projects to fly tools, equipment, and ropes to set up projects or equipment.

3.3.9 Livestock Grazing

Grazing on Board of Forestry Lands is permitted by ORS 530.010, 530.030, and 530.050. These statutes allow the State Forester to permit domestic livestock grazing in order to secure the greatest permanent value to the state, as long as this use is not detrimental to the best interest of the state.

There are no administrative rules to regulate livestock grazing on Board of Forestry Lands. The Department of Forestry manages any grazing that occurs on Board of Forestry Lands, and shares any income from grazing leases with the county where the land is located. Grazing leases are typically considered on a case-by-case basis and issued when they are compatible with managing for greatest permanent value of the lands and do not conflict with other resources. Grazing activity has been insignificant on state forests in both northwest and southwest Oregon and is expected to remain so (Oregon Department of Forestry 2010a, 2010b).

3.4 Road System Management Activities

Road system management activities are those associated with construction, use, and maintenance of forest roads and associated facilities—chiefly landings, drainage structures such as bridges and culverts, and quarries. This category of covered activities also includes the abandonment or decommissioning of such facilities.

3.4.1 Existing Road System

ODF has largely inherited an extensive road network that was built in the 1940s, 1950s, and 1960s to access and service large-scale timber salvage operations in northwest Oregon following four catastrophic wildfires between 1933 and 1951 (see Chapter 2, *Environmental Setting*). Over the years since then, ODF has, when funding allows, decommissioned or improved roads that did not meet current environmental standards, particularly when these roads intersect new timber sales.[3]

ODF maintains approximately 4,151 miles of road within the permit area (Table 3-3). Much of these roads were constructed under the Oregon FPA rules. This system is stable, with nominal mileages added or removed each year. The road system for the permit area is mostly in place, with most new road construction being short spurs for accessing individual harvest units or reroutes to better locations when roads have been decommissioned. The principal foreseeable changes to the system would consist of construction of temporary roads to access new timber harvest units. Spur roads are regularly decommissioned once the unit has been replanted and the stand is free to grow. As culverts are removed, fills are stabilized and proper drainage is installed to minimize potential damage to resources, particularly waters of the state. It is estimated that up to 40 miles per year of primary or secondary road construction would occur under the HCP (Table 3-3). In addition, it is estimated that on average 5 miles per year of roads would be decommissioned during the permit term (Table 3-3).

[3] ODF funding from timber sales makes it economically feasible to improve roads that are directly related to the timber sale generating the revenue.

Table 3-3. ODF Road System Construction and Decommissioning in the Permit Area

Ecoregion	Total Road Miles (Existing)	Average Yearly Road Construction Estimate (miles)	Average Yearly Road Decommission Estimate (miles)
Coast Range	3,845	23	5
West Cascades	306	2.5	1
Total	**4,151**		

3.4.2 Road Management

ODF manages its road system consistent with the FMP to do the following (Oregon Department of Forestry 2010a).

- Keep as much forest land in a natural, productive condition as possible.
- Prevent water quality problems and associated impacts on aquatic resources.
- Minimize disruption of natural drainage patterns.
- Provide for adequate fish passage where roads cross fish-bearing streams.
- Minimize exacerbation of natural mass-wasting processes (e.g., landslides).

All road construction, use, maintenance, and vacating will be performed in accordance with the Oregon FPA (OAR 629) and other applicable statutes and described in detail in the *Forest Roads Manual* (Oregon Department of Forestry 2000). The Oregon FPA prescribes measures covering the following.

- Written Plans for Road Construction (OAR 629-625-0100)
- Road Location (OAR 629-625-0200)
- Road Design (OAR 629-625-0300)
- Road Prisms (OAR 629-625-0310)
- Stream Crossing Structures (OAR 629-625-0320)
- Drainage (OAR 629-625-0330 and 629-625-0420)
- Waste Disposal Areas (OAR 629-625-0340)
- Road Construction (OAR 629-625-0400)
- Disposal of Waste Materials (OAR 629-625-0410)
- Stabilization (OAR 629-625-0440)
- Vacating Forest Roads (OAR 629-625-0650)
- Wet Weather Road Use (OAR 629-625-0700)

Additional implementation guidance for ODF management of roads within the permit area is provided in the following ODF operational manuals and guides:

- *Forest Engineering Roads Manual* (ODF 2000).
- *Fish Passage Guidelines for New and Replacement Stream Crossing Structures*. Forest Practices Technical Note Number 4. Version 1.0: Effective May 10, 2002.
- *Determining the 50-Year Peak Flow and Stream Crossing Structure Size for New and Replacement Crossings*. Forest Practices Technical Note Number 5. Version 1.0: Effective May 10, 2002
- *Avoiding Roads in Critical Locations.* Forest Practices Technical Note Number 7. Version 1.0 Effective June 20, 2003.
- *Installation and Maintenance of Cross Drainage Systems on Forest Roads*. Forest Practices Technical Note Number 8. Version 1.0. Effective June 20, 2003.
- *Wet Weather Road Use*. Forest Practices Technical Note Number 9. Version 1.0 June 20, 2003.
- *Wet Weather Haul, Snow Removal/Plowing Operations and Freeze Thaw Cycles Requirements.*
- Seasonal road restrictions (defined at the District level).

3.4.3 Road Construction

Roads in the permit area are most commonly constructed by felling and yarding timber along a predetermined road alignment. This activity is followed by excavating or filling hillslope areas using tractors or excavators. Road construction also commonly involves construction of watercourse crossings that use culverts and bridges. At times road construction requires blasting of rock features and/or removal of excess material to offsite waste areas to ensure slope stability. Roads also include vehicle turnouts and timber harvest landings. Road construction may also involve surfacing soil roads with rock, lignin, pavement, or other surface treatments.

Typically, spur roads would be constructed with a subgrade width of approximately 16 feet and a 3-foot-wide ditch, for a total typical width of 19 feet. If the road is out-sloped, a minimum width of 16 feet would be needed. The total disturbance area of the road, including cut slopes and fill slopes, would depend on the steepness of the terrain, as well as the type of construction used.

3.4.4 Road Use

The road system provides access for all management activities, fire suppression, and public use. Roads in the permit area are primarily used by utility vehicles accessing parts of the forest(s), heavy equipment (log trucks and heavy equipment trailers hauled by similar tractors), and recreational users in vehicles licensed for use on public roadways, along with off-highway vehicles (OHVs) that are not licensed for public roadways. All such use is a covered activity under this HCP. Such use is a year-round activity and is unrestricted except in cases where roads are gated and locked. The use of gates is limited to only those areas that require restricted access—such as to capital facilities (e.g., transmission towers), off season recreation sites, and walk in hunting locations—or to minimize vandalism to natural resources.

3.4.5 Road Maintenance

Road maintenance is the maintenance and repair of existing roads that are accessible to motorized use. Road maintenance typically includes surface grading, clearing bank slumps, falling trees or snags that are safety hazards, repairing slumping or sliding fills, clearing ditches, repairing or replacing culverts and bridges, adding surface material, performing dust abatement, and installing or replacing surface drainage structures. Road maintenance for fire prevention, public access, and timber management may include mechanical control or herbicide application of roadside vegetation. Mechanical control may include grading, hand cutting, using a brush hog-type mechanical device, and other experimental methods.

3.4.6 Road Vacating

Road vacating refers to the process of making a road impassable and effectively closed, including stabilizing the roadbed surface and removing culverts and other drainage structures. The road prism remains otherwise intact. Roads are abandoned if deemed non-essential to near-term future management plans or where unrestricted access would cause excessive resource damage. ODF determines which roads to abandon or reclaimed during project-level analysis. Abandoned roads and reclaimed roads are left in a condition that is stable and provides for adequate drainage.

3.4.7 Drainage Structure Construction and Maintenance

This activity includes the installation, maintenance, and removal of drainage structures on roads. Such structures are normally associated with roadways and include channel-spanning structures (culverts and bridges), roadside drainage ditches, and cross-slope drainage culverts. All such structures are installed and maintained in accordance with all applicable laws and regulations.

3.4.8 Landing Construction and Maintenance

Landings are wide spots in the road that are used during harvest to yard felled logs and load them on trucks. Construction, maintenance, and decommissioning of landings is performed using the same techniques, is subject to the same regulatory constraints, and typically occurs at the same times as road construction, maintenance, use, and abandonment.

During the permit term, approximately 275 landing sites would be constructed within the plan area, generally during road construction. Landing construction would be performed in accordance with restrictions placed by the Oregon FPA, specifically including those identified in ORS 629 Division 630, *Harvesting Landings*, but also including all other applicable rules. Landings would be constructed at the minimum size necessary for safe operation, and average three-quarter acre in size.

3.5 Minor Forest-Product Harvest

Many people collect or harvest special forest products for commercial income or personal use. These special or minor forest products within the permit area include a variety of plant products other than timber, including but are not limited to firewood, burls, stumps, boughs, edible fungi, and greenery such as western sword fern (*Polystichum munitum*), salal (*Gaultheria shallon*), and red huckleberry (*Vaccinium parvifolium*).

Within the permit area, ODF has issued forest product harvest permits for beargrass, boughs, Christmas trees, cascara bark, cedar products, cones, ferns, firewood, moss, mushrooms, vine maple for transplants, poles, Oregon grape root, salal, and yew bark. The amount of harvest of these items varies from year to year based on public demand.

Christmas trees have been grown sporadically in conjunction with tree plantations or on land under power lines. Due to market conditions and the number of Christmas trees grown in the Willamette Valley, there has been little demand for Christmas tree leases on state forest lands. Currently, there is one Christmas tree lease in Forest Grove District.

3.6 Quarries

There are 212 rock quarries located within the permit area, which are used as a source of rock to produce various sizes of crushed rock for placement on road systems and slope protection material. There are currently 82 operational quarries in habitat conservation areas (HCAs) and 19 within riparian conservation areas (RCAs). Up to 35 additional quarries could be built and operational during the 70-year permit term. Quarry development includes the use of drills, explosives, bulldozers, loading equipment, and trucks. Quarries typically remain active for several years. Quarry siting and operations are compliant with requirements of the Oregon FPA rules (OAR 629-625-0900) and other applicable statutes.

3.7 Fire Management

3.7.1 Controlled Burning

ODF and its state agency partners conduct controlled burns under specified conditions in order to accomplish stand management and other objectives. Burning is conducted under controlled conditions with little or no risk of catastrophic fire damage. As such, burning is considered fire hazard abatement because it greatly diminishes the available concentration of fuel sources. Fire season restrictions placed each year by ODF prohibit burning from May/June until the beginning of the rainy season in approximately November. Types of controlled burns conducted within the permit area include the following. The average number and size of these types of burns are summarized in Table 3-4.

- **Prescribed burning.** Prescribed burns are by definition pre-planned and done under strict environmental and personnel safety conditions that are meant to keep the fire confined to a predetermined area and occur under specific conditions. A prescribed burn improves seedling survival and growth while emulating natural processes. A prescribed burn is also intended to remove slash (see Section 3.3.1.3, *Prescribed Burning*) and other wildland fuels to reduce the risk of catastrophic wildfire.
- **Pile burning.** Following harvest operations, slash is machine piled along roads and around landings, may be scattered throughout harvest unit, covered with plastic, and then burned when weather conditions permit.

- **Underburn.** A controlled fire under a timber or brush overstory which serves as a method for removing wildland fuels and improving overall forest health.

Table 3-4. Yearly Average (2008–2018) Controlled Burn Acres, by Type in the Permit Area

Controlled Burn Type	Times Conducted per Year	Average Size (acres)
Prescribed Burning	0–1	80
Pile Burning	70	20
Underburn	0	100

3.7.2 Water Drafting and Storage

There are water developments throughout ODF lands, such as small water catchments, basins, and impoundments, which provide a water source for firefighting or for filling water trucks that may be on standby during controlled burning. Some water is used for chemical mixing to be used on forest management sites. Water is also used as dust abatement during forests road rocking and maintenance work. Water developments are mainly located at creeks and rivers, with some at springs. Many have been in place for years. Up to 35 new water drafting sites could be built and operational during the 70-year permit term. Maintenance of existing water developments, including brushing for access, maintaining the integrity of the basin, and removing debris or sediment, are covered activities. All water development, maintenance, and abandonment would be performed in accordance with restrictions placed by the Oregon FPA (OAR 629) and other applicable statutes regarding water quality protections.

3.8 Recreation Infrastructure and Maintenance

Recreational activities by the public are not covered activities in this HCP, as described in Section 3.10, *Activities Not Covered.* There are diverse recreation activities in the permit area, with dispersed use throughout the forest. Activities include camping, group camping, fishing, hunting, target shooting, hiking, OHV uses, horseback riding, mountain biking, nature study, and sightseeing. Public use rules for state lands (Recreational Use of State Forest Land, Chapter 629, Division 25) establish standards for recreational use. The rules regulate OHV use, camping, firearm use, disposal of garbage and human waste, and other activities associated with recreational activity.

The HCP does cover ODF's management of recreational facilities, including maintenance and improvement of existing facilities and standards and guidelines for new developments. Facilities include but are not limited to the following.

- Campgrounds
- Day-use (e.g., picnicking)
- Parking
- Trailhead facilities
- Notorized and non-motorized trails (equestrian, mountain bike, foot)
- Boat launches

- Designated shooting lanes
- Restroom facilities
- Target shooting lanes
- Interpretive centers
- Administrative buildings

ODF staff maintain these facilities and patrol the recreation trail networks, striving to protect trail investments, provide for safety, address trail issues, and protect water quality. This is typically done on foot or via established roads within state forests using vehicles such as light trucks.

Most recreation trails and facilities in the permit area occur in the coast range ecoregion (98 and 90%, respectively; Table 3-5). It is estimated that all recreational facilities will increase over time in response to an increase in recreational use and due to changes in the type of user groups. The largest increase is expected to occur in the Tillamook, Astoria, and Forest Grove districts due to their relative proximity to the greater Portland area and the Willamette Valley.

More specifically the recreation program is anticipating the following.

- The Salmonberry Trail will be implemented, and use will level off after initial high use and impacts (Forest Grove/Tillamook districts).
- The number of hunters and fisherman will plateau or decrease over time.
- Dispersed (unregulated) camping will occur on every district and forest and increase over the planning period.
- Districts will receive application and issue permits for events, guiding activity, filming, etc.

Further, ODF expects changes to the type of use and user during the permit term to include the following.

- Larger family and friend groups.
- More diversity of uses or permitted uses.
- More cultural diversity of users.
- Need for facilities to accommodate large group gathering areas or events venues.
- Change of motorized use – larger and faster OHV equipment.

Table 3-5. Recreational Infrastructure in the Permit Area (2019)

Ecoregion	Miles of Recreation Trail[a]	Number of Other Recreation Facilities[b]
Coast Range	1,125	763
West Cascades	24	83

[a] Includes hiking, biking, OHV, and horse trails.
[b] Includes trailheads, day use areas, campsites, horse use, interpretative sites, fee stations and kiosks, and boat launches.

Due to the assumptions outlined above regarding an increase in recreational users over time and an expansion of the recreation program in response, ODF expects an increase in all facilities in all districts. The level of increase varies, primarily dependent on the location of each district relative to existing and future population centers (Table 3-6).

Table 3-6. Estimated Increase in Recreation Use and Related Facilities During the Permit Term

	ODF District					
Recreational Use	**Western Lane**	**Western Oregon**	**North Cascade**	**Astoria**	**Forest Grove**	**Tillamook**
Facilities (Non-Motorized), campgrounds, day use, designated dispersed (acreage)	10%	20%	30%	75%	100%	100%
Facilities (Motorized), staging areas, event sites, motorized camping (acres)	5%	10%	10%	50%	100%	100%
Trails (Non-Motorized) (miles)	10%	20%	30%	30%	100%	100%
Trails (Motorized), single track, quad, side-by-side, jeep (miles)	5%	10%	10%	50%	50%	50%
Education	--	--	--	--	--	100%
Special Use Permits/Activities	10%	10%	20%	20%	40%	40%

More specifically these changes over time will manifest is various ways across each district. The following is a summary of expected changes in each district during the permit term.

Western Lane District (Western Lane, Southwest and Coos Districts) – Opportunities in the Southwest and Coos County portion remain dispersed or seasonal opportunities. Large surrounding federal ownership offers more formal/developed opportunities. The Western Lane portion of the district has controlled access and scattered parcels. Control of roads is in partnership with a private landowner. Dispersed camping will increase and hunting opportunities will persist but there are no plans for formal site development. There will be pressure from population growth in the Eugene area.

West Oregon District – Due to scattered parcels there is limited opportunity for formal sites or development. There will be continued non-motorized destination development of the Black Rock riding area and an expected increase in users over time. Further day use/parking development is expected. Motorized use has historically been limited due to threatened and endangered species' issues and has occurred only due to adjacent private landowners allowing use and only minimal growth in the use. Under the HCP uses may be expanded while still observing necessary seasonal restrictions around known nesting areas. Dispersed camping will continue to occur seasonally. Opportunities will stay the same or decrease but will see pressure from the growing population of the Corvallis area.

North Cascade District – Similar to West Oregon District, state land ownership is scattered and does not provide opportunities for large development of sites. Surrounding federal ownership provides opportunities not available or compatible with a state forest. Existing sites will see high growth of users from the Willamette Valley. Some sites will be expanded or newly developed to address use levels. The district currently has established trails and campgrounds and is located close to federal lands and state parks; therefore, the district will see use increase with those landowners.

Astoria District – The proximity to the Southwestern Washington and Portland Metro area will see high demand into the future for more development and expansion of existing facilities. Motorized and Non-Motorized use will both grow in current sites, and there will be additional pressure to develop new sites.

Forest Grove District – The proximity to the Portland Metro area will see demand and use grow the most during the permit term. Demand will be high for types of use, number of users, and likely requests for new uses and developments. The district will also need to address the development of the Salmonberry Trail as a regional trail system, which is expected to have a high number of users initially and then stabilize over time. Target shooting sites will need development in order to control unlawful shooting. This use is expected to continue to grow. Historic use of the district has focused on the motorized trail system, and much of the infrastructure for that use is currently in place.

Tillamook District – Due to its proximity to the Portland Metro area Tillamook District will see an increasing demand in number of users and types of use. The developments of Forest Grove and Astoria Districts will influence Tillamook and vice versa. ODF is the largest landowner in the North Coast and has the largest contiguous areas. Demand for summer river access will continue to grow. Historic use of the district has focused on the motorized trail system, and much of the infrastructure for that use is currently in place.

3.8.1 Target Shooting Lanes

Currently ODF maintains four designated target shooting lanes in the permit area, and there are two more under development. Over the course of the permit term it is expected that the need to establish more designated target shooting lanes will be needed in order to direct users to areas where there is no conflict with other uses and a reduced fire risk. ODF estimates the potential to establish approximately 40 new designated shooting lanes across the permit area by the end of the permit term. Most of these lanes are likely to be concentrated on state forest lands in northwestern Oregon due to the proximity to larger population centers. Shooting lanes will be located outside of HCAs.

3.9 Conservation Strategy Implementation Activities

Conservation strategy implementation activities are those activities that are required as part of the HCP's conservation strategy (including the monitoring and adaptive management program) and have potential to result in take of one or more of the covered species. Some activities associated with the conservation strategy, such as stand management to accelerate development of late successional features and abandonment and decommissioning of roads and associated facilities, have been described in the preceding sections. This section summarizes other plan implementation activities associated with the conservation strategy. For a complete description of these actions, see Chapter 4.

3.9.1 Aquatic Habitat Restoration

Riparian areas are the aquatic ecosystem and portions of the adjacent terrestrial ecosystem that directly affect or are affected by the aquatic environment. These areas include streams, rivers, and lakes, and their adjacent side channels, floodplains, and wetlands, as well as portions of hillslopes that serve as streamside habitats for wildlife.

Stream restoration projects within the plan area may include placement of logs or whole trees in streams to create pools and to retain spawning gravels, replacement or removal of stream crossing structures (i.e., culverts) that block fish passage, relocation or redesign of improperly located roads, stabilization of sediment sources (i.e., cut bank improvement of road drainage systems), road closure, and/or road decommissioning. Larger scale restoration projects could include widening or deepening channels and side channel reconnection or reconfiguration.

3.9.2 Upland Restoration Activities

Upland restoration activities will be completed using the silvicultural techniques described in Section 3.3, *Reforestation and Young Stand Management*.

3.9.3 Barred Owl Removal

To better understand the effects of barred owl presence on northern spotted owls, ODF cooperates with barred owl management research conducted by the U.S. Fish and Wildlife Service and U.S. Geological Survey within the permit area. Barred owl management activities may include lethal and nonlethal removal techniques, or a combination of the two approaches. The lethal approach involves attracting territorial barred owls with recorded calls and shooting birds that respond when they approach closely. The nonlethal approach involves attracting territorial barred owls with a recorded call and catching the responding birds in nets or other trapping devices. The birds are then transported to temporary holding facilities, checked for injuries or other health concerns, stabilized, and transported to permanent facilities or release locations.

3.9.4 Research Activities

ODF has identified four research priorities.

1. Research that is a necessary part of a conservation strategy.
2. Research needed to:
    a. assess or improve conservation strategies that are in place; or
    b. increase management options and commodity production opportunities for lands managed pursuant to the HCP, including testing of new technologies and experimental application of silvicultural techniques.
3. Research needed to improve general understanding of the wildlife, habitats, and ecosystems addressed by the HCP.
4. Research projects requested and lead by external scientists on Board of Forestry lands. These are authorized with special-use permits.

Research and monitoring projects would be implemented to better understand the effects of forest management activities on forest resources and provide information for the adaptive management process. ODF research and monitoring staff would work with a team of scientists, biologists, and field staff from ODF and other state and federal agencies to develop experimental study designs.

3.10 Activities Not Covered

Recreational hunting and fishing are not a covered activity under this HCP because recreational hunting and fishing activities in the plan area are regulated by the Oregon Department of Fish and Wildlife. Other legal recreational activities are also not covered. ODF assumes that these activities in the permit area would follow state regulations (when applicable) and would not result in take of covered species.

Certain parties have easements providing access and use of lands within the plan area. Use of lands within the permit area by easement holders or other parties who are not ODF representatives or contractors is not a covered activity. Third parties who access ODF lands consistent with easement terms are responsible for their own compliance with the federal Endangered Species Act.

[***Note to Reader:*** *ODF currently has many types of easement holders on their land and are evaluating if any should be covered under this HCP]*

Chapter 4
Conservation Strategy

This chapter describes the conservation strategy the Oregon Department of Forestry (ODF) will use to avoid, minimize, and mitigate impacts of *take*[1] on listed species as required under Section 10(a)(2)(A) of the Endangered Species Act (ESA) and its implementing regulations. Chapter 5, *Effects Analysis and Level of Take*, specifies the take that is predicted to occur by carrying out the proposed covered activities (Chapter 3, *Covered Activities*), the impacts of such taking, and the net effects following consideration of the proposed conservation actions described in this chapter. Chapter 6, *Monitoring and Adaptive Management*, specifies the monitoring and adaptive management program that will be implemented to help ensure the intended benefits of the conservation strategy are realized.

This chapter contains the following sections.

- Section 4.1, *Conservation Approach and Methods*, describes the overall conservation approach, data, species habitat models used, and the basis for developing proposed conservation actions.
- Section 4.2, *Data Sources*, describes the sources and types of information used to develop the conservation strategy.
- Section 4.3, *Developing Avoidance and Mitigation Measures*, describes how conservation measures were developed.
- Section 4.4, *Determining Mitigation Needs and Strategies*, describes how additional mitigation needs and strategies were identified.
- Section 4.5, *Considering Climate Change Effects*, describes how climate change was incorporated into the conservation strategy.
- Section 4.6, *Biological Goals and Objectives*, describes the long-term biological goals and measurable biological objectives for each covered species.
- Section 4.7, *Conservation Actions for Covered Species*, describes how ODF will meet the biological goals and objectives (i.e., the actions to be implemented to achieve the goals and objectives).

4.1 Conservation Approach and Methods

The conservation approach was developed in the context of a forested landscape that has been modified from historical conditions across the permit area. When the state acquired these lands, the majority of them had a history of early twentieth century railroad logging and repeated, large-scale wildfires, coupled with extensive salvage logging (Magby et al. 2018). This is particularly notable in the northwest portion of the permit area (i.e., the Tillamook and Clatsop State Forests). This land use and disturbance history dramatically altered forest development and associated forest structure, composition, and distribution. Most older forest stands were lost in the repeated fires and

[1] "Take" is defined by the Endangered Species Act (ESA) as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species.

extensive salvage operations that followed. As a result, many forest stands are now dominated by densely spaced, young conifer and mixed deciduous forest (for a detailed description of current conditions and their history, see Chapter 2, *Environmental Setting*).

Over the last few decades, ODF has worked to shift forest trajectories (primarily by thinning, regeneration cuts, and planting) to develop state forests into a landscape that contains a more natural forest structure, composition, and distribution that is resilient to disturbance such as fire, insects, disease, and drought (ODF 2010a, 2010b). The conservation approach of this habitat conservation plan (HCP) builds upon ODF's commitment to restore healthy, resilient, and sustainable forest ecosystems across western Oregon's state forest lands.

Responding to past disturbance, the conservation approach of this HCP prioritizes conserving remnant habitat occupied by the covered species, maintaining high-quality unoccupied habitat (as needed to augment occupied habitat), ensuring habitat connectivity across the landscape, and enhancing habitat where habitat quality can be improved effectively through forest management activities. The conservation approach is balanced with other management activities across the permit area to help ensure social, economic, and environmental benefits provided by ODF lands in the permit area.

4.2 Data Sources

As presented in Chapter 2, covered species occurrence and habitat data used for this HCP are based on the following.

- Survey occurrence data for covered species, as collected by ODF and others, including Oregon Department of Fish and Wildlife (ODFW), U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), U.S. Forest Service (USFS), and private landowners.
- Published distribution data, such as presented for covered fish species through the StreamNet cooperative (https://www.streamnet.org/).
- ODF forest inventory data that document the age class distribution and provide insight into the range of habitat types available in state forests.
- Species-specific habitat models for terrestrial species, used to estimate the extent of species distribution, and the locations of likely suitable habitat in locations where survey data are limited or missing.

See Section 2.5, *Covered Species*, for details on these data sources.

As presented in Chapter 1, *Introduction*, other sources used to inform the conservation strategy include the following.

- Recovery plans, species status assessments, and related documents and plans (Section 1.5, *Document Organization*).
- Other conservation plans in Oregon (Section 1.4, *Overview of Planning Process*).
- Critical habitat designations.

4.3 Developing Avoidance and Minimization Measures

Avoidance and minimization measures are central to the conservation strategy and are aimed at reducing effects on habitat occupied by the covered species, maintaining suitable unoccupied habitat, and minimizing incidental disturbance of or harm to covered species. Avoidance and minimization measures were developed and refined based on input and recommendations from USFWS, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and ODFW; the consulting team; and ODF foresters and biologists with institutional knowledge of ODF forest lands and ODF forest-management practices. In addition, avoidance and minimization measures have been informed by other similar HCPs, including the Washington State Department of Natural Resources *HCP for State Trust Lands* (WDNR 1997), Montana Department of Natural Resources and Conservation *Forested State Trust Lands HCP* (MDNRC 2010), and the *Green Diamond Resource Company Forest HCP* (Green Diamond 2018).

The avoidance and minimization measures outlined in the conservation actions of this HCP also build on existing practices by ODF. As stated previously, ODF has made a long-term commitment to restoring forest habitats and associated ecosystem/watershed functions across ODF lands in western Oregon (Magby et al. 2018). Oregon Administrative Rule (OAR) 629-035 (Management of State Forest Lands) provides direction that allows ODF to develop policies and other measures that serve to avoid and minimize effects on terrestrial, aquatic, and riparian habitat important to ESA-listed and other sensitive species.

4.4 Determining Mitigation Needs and Strategies

Although the conservation strategy is largely designed to avoid or minimize incidental take of most known covered species sites, mitigation strategies will be used to offset the impacts of the taking of covered species that cannot be avoided. For example, over the life of the HCP, habitat for the covered species may be lost through timber harvest or other covered activities; however, habitat lost to covered activities will be offset by implementing conservation actions throughout the permit area that will increase habitat quality and, in some cases, quantity. For the terrestrial covered species, this will primarily occur in Habitat Conservation Areas (HCAs), as described in Conservation Action 6: Establish Habitat Conservation Areas, and Conservation Action 7: Manage Habitat Conservation Areas (Attachment A). For aquatic covered species, this will primarily be achieved through stream restoration and enhancement activities as described in Conservation Actions 3: Stream Enhancement, 4: Remove or Modify Artificial Fish-Passage Barriers, and 5: Standards for Road Improvements and Vacating.

The conservation strategy is intended to be considered in totality when assessing how conservation benefits will offset effects on covered species. In other words, the conservation program as whole, comprising avoidance, minimization, and mitigation actions, is designed to achieve the biological objectives for each covered species. These biological goals and objectives are described in Section 4.6, *Biological Goals and Objectives*.

4.5 Considering Climate Change Effects

Increases in atmospheric concentrations of greenhouse gases have exacerbated increases in global temperatures, contributing to changes in precipitation and disturbance regimes (e.g., fire, insects, pathogens, and windstorms) that have already begun to affect the health of western Oregon forests and their associated ecosystems. These changes may have profound effects on covered species in the permit area over the next century (Reilly et al. 2018). Likely climate change effects in the permit area include the following.

- Reduced tree growth and increased tree mortality due to drought.
- An increase in nonnative invasive species.
- Increased potential for wildfire.
- Potential loss of some native species.
- Potential loss of native habitat.
- Increased competition between nonnative and native species.

The HCP's conservation strategy considers the potential effects of climate change on state forest lands through management strategies at stand and landscape scales to reduce ecosystem vulnerability to the effects of climate change. The HCP is intended to build on the resilience that ODF addresses through strategies contained in its forest management plans to actively manage for a diverse and healthy forest ecosystem that is resilient to biotic and abiotic factors. The HCP conservation strategy is designed to increase resistance and resilience to disturbances caused by drought, pest infestations, and fire, all of which are expected to be more frequent and severe in the future (Spies et al. 2018).

The designation and active management of HCAs are designed to provide adaptation opportunities for the covered species against the expected effects of climate change, such as silvicultural treatments to reduce risks of habitat loss due to drought, fire, wind, insects, or disease. The HCAs emphasize the establishment and accelerated development of large blocks of late-seral forest habitat across a diversity of environmental gradients that will, over time, reduce habitat fragmentation, improve landscape connectivity, and improve carbon sequestration. Increasing the amount of late-seral forests and enhancing species corridors across the permit area will facilitate movement of covered species to future habitat, providing resilience to potential habitat shifts in response to climate change.

Concentrating HCAs in one or a few locations can reduce the resilience of conservation over time, because, when catastrophic disturbance occurs (i.e., fire) in these HCAs, their conservation values could be severely degraded or lost temporarily. To avoid this, the conservation strategy includes maintaining, enhancing, and increasing the amount and distribution of habitat for covered species over time to distribute risk and provide additional resiliency for covered species habitat to the effects of climate change. The conservation strategy achieves this by ensuring HCAs are distributed across the landscape within the permit area to ensure representation across latitudinal and elevational gradients. Ensuring connectivity of habitat across these latitudinal and elevational gradients will enhance the ability of the covered species to respond to habitat shifts in response to climate change.

Enhancing adaptive capacity is essential to mitigate for the increasing threat of climate change (Siegel and Crozier 2019). Bottom et al. (2009) suggest that strengthening resilience for salmon populations to express their maximum life history variations will require expanding habitat opportunities. Changes in climate alter aquatic conditions across all life stages; however, the effects are not equally distributed. Changes have spatial and temporal variation depending on how the climatic regimen interacts with local conditions (Bottom et al. 2009). The HCP includes conservation actions that support long-term, natural stream processes to provide for salmon habitat, with special attention to wood recruitment, minimization of sediment delivery, and temperature protection. This is primarily accomplished through the designation of Riparian Conservation Areas (RCAs). Approximately 47% of RCAs are located within HCAs for terrestrial species, allowing upland conservation actions to complement the overall hydrologic regime across the permit area, by helping to moderate overall stream flow regimes, especially summer low flows. In addition, the HCP includes conservation actions that result in the enhancement of salmon habitat for all life history stages through stream and riparian habitat enhancement.

4.6 Biological Goals and Objectives

This section describes the biological goals and objectives that guide the HCP's conservation strategies for covered species. Biological goals and objectives for covered species are required to be included in HCPs by the *HCP Handbook* (USFWS and NOAA Fisheries 2016).[2] Biological goals are broad guiding principles based on the conservation needs of the resources. Biological objectives are expressed as conservation targets or desired conditions. Objectives are measurable and quantitative when possible; they clearly state a desired result that collectively will achieve the biological goals and that can be monitored over the permit term.

The biological goals and objectives were developed collaboratively with the Scoping Team in a series of workshops. These goals and objectives were refined over time with stakeholder and public input and as the conservation actions supporting each objective were developed. Biological goals and objectives are provided in Table 4-1, followed by sections for each species or species group that provides the rationale for each biological objective. The biological goals and objectives are given unique numeric codes to enable easier tracking during implementation. For all of the covered fish, four biological objectives are grouped under a single goal because of the similarity in the fish species habitat needs. Subsequent tables detail specific population objectives where appropriate. The remaining covered wildlife species each have distinct biological goals and objectives.

Conservation actions designed to meet all biological objectives are found in Section 4.7*.* The contributions towards meeting the biological objectives will primarily come from areas defined as RCAs and HCAs (Attachment A), although lesser contributions will also come from the matrix outside of RCAs and HCAs, primarily from additional operationally limited areas and legacy component retention such as green trees, snags, and downed wood.

[2] The requirement for biological goals and objectives in HCPs was first published by USFWS and NOAA Fisheries in 2001 in what was then called the "5-Point Policy" (65 FR 35242).

4.6.1 Definitions of Terms Used in Biological Goals and Objectives

The following terms are used in the biological goals and objectives and are defined below.

- **Persist:** To continue in existence.
- **Conserve:** To protect from harm and destruction.
- **Maintain:** Management, both active and passive, that enables favorable habitat conditions to continue at the current level of functionality.
- **Enhance:** Actions implemented in suitable habitat for a covered species that improve quality of certain habitat features.

Table 4-1. Biological Goals and Objectives for the Western Oregon State Forests Habitat Conservation Plan

Fish
Oregon Coast Coho, Oregon Coast Spring Chinook, Lower Columbia River Coho, Lower Columbia Chinook, Columbia River Chum, Upper Willamette River Steelhead, Upper Willamette River Chinook, Southern Oregon/Northern California Coast Coho, and Eulachon
Goal 1: Support the persistence and climate change resilience of Oregon Coast coho, Oregon Coast spring Chinook, Lower Columbia River coho, Lower Columbia Chinook, Columbia River chum, Upper Willamette River steelhead, Upper Willamette River Chinook, Southern Oregon/Northern California Coast coho, and eulachon in the permit area.
Objective 1.1: Conserve, maintain, and enhance native riparian conditions that promote long-term wood recruitment in streams as measured by three sets of metrics: a) riparian forest structure, b) wood volume on unstable slopes that have potential to deliver to fish-bearing streams, and c) long-term trends of instream large woody material (key pieces, size, frequency). See Table 4-2 for objectives for each evolutionarily significant unit (ESU).
Objective 1.2: Conserve, maintain, and enhance overall stream channel complexity through targeted stream enhancement projects to address limiting factors for covered fish.
Objective 1.3: Maintain or enhance water quality and quantity conditions most important to covered fish as measured by current conditions and long-term trends in temperature, fine sediments in riffles, pool temperature and depth, and summer low-flow on ODF-managed lands. See Table 4-2 for objectives for each ESU.
Objective 1.4: Maintain or enhance fish passage to suitable spawning and rearing habitat by removing or modifying artificial barriers during the course of routine construction, emergency road repair, or maintenance work. See Table 4-2 for objectives for each ESU.
Amphibians
Columbia Torrent Salamander
Goal 2: Support the persistence of Columbia torrent salamanders in the Clatsop and Tillamook State Forests.
Objective 2.1: Conserve and maintain riparian habitat along 677 stream miles where Columbia torrent salamanders are likely to persist (high-gradient perennial streams with an adequate supply of downed wood, adequate water temperatures, and access to moist adjacent forests) through implementation of RCAs as shown in Table 4-3 and Table 4-4.
Cascade Torrent Salamander
Goal 3: Support the persistence of Cascade torrent salamanders in the Santiam State Forest.
Objective 3.1: Conserve and maintain riparian habitat along 76 stream miles where Cascade torrent salamanders are likely to persist (high-gradient perennial streams with an adequate supply of downed wood, adequate water temperatures, and access to moist adjacent forests) through implementation of RCAs as shown in Table 4-3 and Table 4-4.
Oregon Slender Salamander
Goal 4: Support the persistence of Oregon slender salamander in the Santiam State Forest.
Objective 4.1: Conserve, maintain, and enhance 16,000 acres of occupied habitat or habitat modeled as suitable or highly suitable for Oregon slender salamander.
Objective 4.2: Maintain or enhance the abundance of large decayed downed wood in occupied or suitable but unsurveyed habitat.

Birds	
Northern Spotted Owl	
Goal 5: Support the persistence of northern spotted owl in the permit area.	
Objective 5.1: Conserve, maintain, and enhance at least 30,000 acres of existing northern spotted owl nesting, roosting, and foraging habitat.[a]	
Objective 5.2: Maintain at least 40% of the permit area outside of HCAs as dispersal habitat to allow diffuse movement across a permeable landscape.	
Objective 5.3: Increase the quantity of nesting, roosting, and foraging habitat[1] by at least 100,000 acres for a total at the end of the permit term of at least 130,000 acres.	
Marbled Murrelet	
Goal 6: Support the persistence of marbled murrelet in the permit area.	
Objective 6.1: Conserve, maintain, and enhance at least 15,000 acres of habitat where occupancy has been previously documented and other suitable or highly suitable habitat of unknown occupancy.	
Objective 6.2: Increase the amount of suitable or highly suitable habitat by at least 80,000 acres in locations that minimize patch edge: interior habitat ratios.	
Mammals	
Red Tree Vole (North Oregon Coast Distinct Population Segment)	
Goal 7: Support the persistence of red tree vole in the permit area.	
Objective 7.1: Conserve, maintain, and enhance at least 20,000 acres of habitat where occupancy has been previously documented and other suitable or highly suitable red tree vole habitat of unknown occupancy.	
Objective 7.2: Increase the amount of suitable and highly suitable habitat by at least 70,000 acres for red tree vole.	
Coastal Marten	
Goal 8: Support the persistence of coastal marten in the permit area.	
Objective 8.1: Conserve, maintain, and enhance at least 25,000 acres of denning, foraging, and dispersal habitat (Appendix C).	
Objective 8.2: Increase the quality of denning, resting, foraging, and dispersal habitat (Appendix C) within the 25,000 acres.	

[a] Nesting, roosting, foraging habitat is equivalent to habitat modeled as suitable or highly suitable, as described in the Chapter 2 and Appendix C.

4.6.2 Goal 1: Support the Persistence of Covered Fish

Support the persistence and climate change resilience of Oregon Coast coho, Oregon Coast spring Chinook, Lower Columbia River coho, Lower Columbia Chinook, Columbia River chum, Upper Willamette River steelhead, Upper Willamette River Chinook, Southern Oregon/Northern California Coast coho, Oregon Coast spring Chinook, and eulachon in the permit area.

4.6.2.1 Objective 1.1: Wood Recruitment

Objective

Conserve, maintain, and enhance native riparian conditions that promote long-term wood recruitment in streams as measured by three sets of metrics: a) riparian structure, b) wood volume on unstable slopes that have potential to deliver to fish-bearing streams, and c) long-term trends of instream large woody material (key pieces, size, frequency).

Rationale

Healthy riparian forests provide important stream functions such as large wood recruitment, shading, nutrient input, bank stability, and sediment filtration. Recruitment of large woody material has multiple ecosystem benefits for fish and other aquatic species. Its presence in stream systems forms pools for juvenile rearing, and it can create or enhance thermal refugia for salmon to use as migratory or holding habitat. It promotes the habitat complexity required by juvenile salmon for successful rearing and emigration. In addition, large woody material increases ecosystem diversity across trophic levels, enhancing foraging opportunities for fish of all life stages (Thompson et al. 2018). Increased large woody material in permit area streams will benefit covered fish species, as well as other covered aquatic vertebrates.

A common issue in fish-bearing streams in western Oregon is a lack of instream wood. Reduced instream wood is the result of historical and widespread logging practices within the riparian zone around streams and rivers, as well as the long-standing practice of clearing debris and logjams from river channels (Bryant 1983). In addition, many watersheds in the permit area are naturally dynamic, with riparian areas subject to frequent disturbance events. In these watersheds, the natural development of large conifer trees is difficult to achieve. The resulting lack of instream large woody material is a limiting factor in many locations within the permit area (Appendix C). To remedy the scarcity of instream wood, riparian areas around streams will be managed to favor wood recruitment over time (Wooster and Hilton 2004). Specific measures will include riparian setbacks around streams and rivers, maintaining tree buffers along unstable slopes, and providing deliberate large woody material inputs through targeted restoration projects.

The mix of land ownership, land cover, and management regimes that overlap the covered fish species distribution (Appendix D) means that there is a dynamic mosaic of habitat conditions that continue to change over time. The permit area represents a small portion of the overall distribution of covered species (Appendix C). Within the permit area, the conservation, maintenance, and enhancement of RCAs[3] along fish- and non-fish-bearing streams during timber harvest will promote

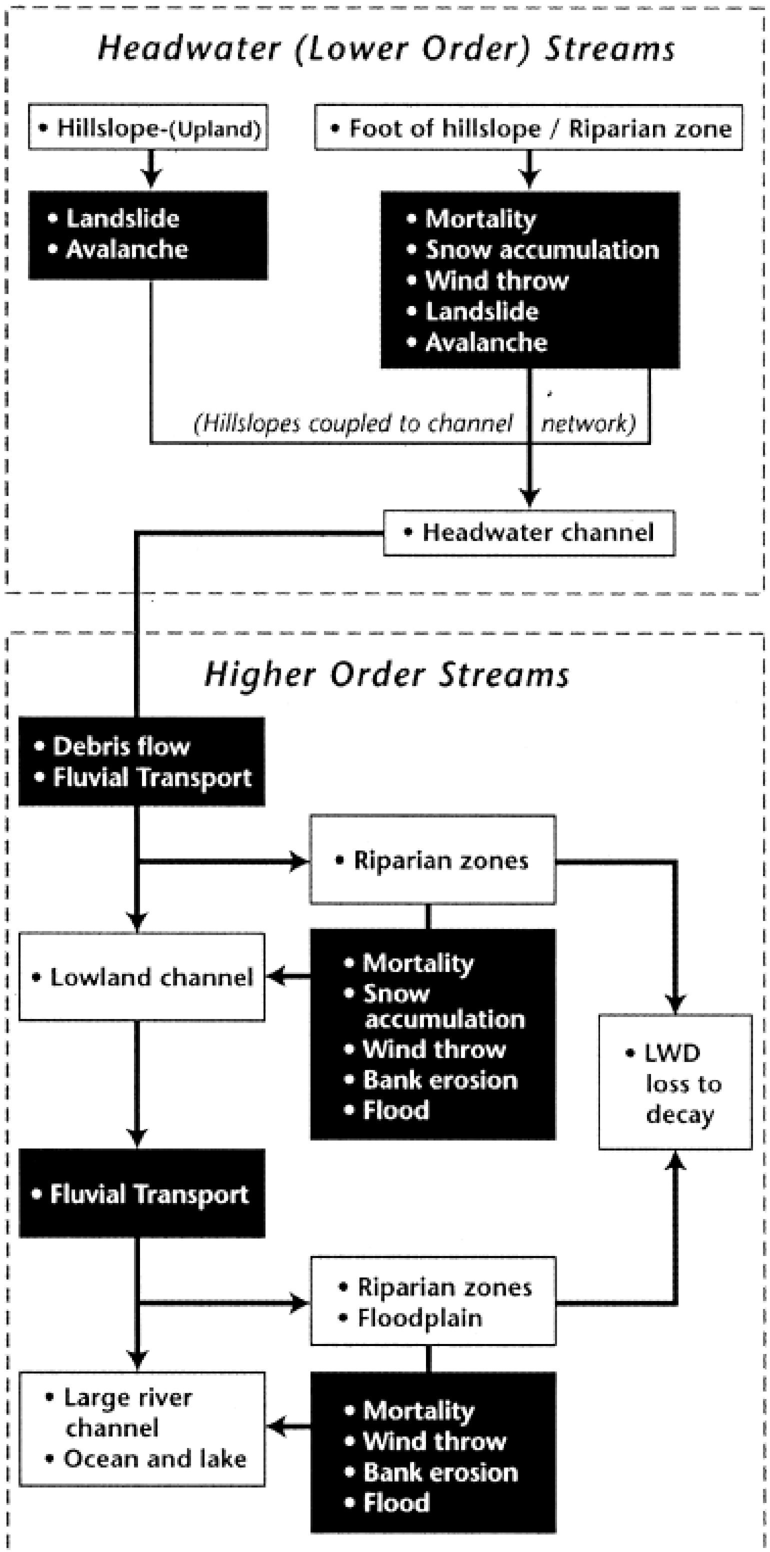
[3] Riparian Conservation Areas are defined and described in Conservation Action 1: Establish Riparian Conservation Areas.

the development of larger coniferous trees. Large trees recruited from RCAs provide the most stable and key functional pieces of wood to streams (Montgomery et al. 1996, Wing and Skaugset 2002). Large conifer trees recruited from natural processes that retain their root and branch structure are more stable and persistent in stream environments and are associated with the creation and maintenance of important pool habitats (Rosenfeld and Huato 2003).

Landscape characteristics, such as riparian forest conditions, affect large wood recruitment and alter the habitat conditions of covered fish species (Beechie et al. 2000, Steele et al. 2003 as cited by Burnett et al. 2007). Per Spies et al. (2013), 95% of near-stream wood inputs come from the area between the streambank and 82 to 148 feet (horizontal distance) of the edge of the stream, with shorter input distances occurring in younger stands and longer distances in older, taller stands.

Headwater streams may comprise up to 80% of the overall length of a stream network. These headwater streams are important for collection and transport of material into higher-order downstream habitats that support the covered fish species (Bryant et al. 2007). Maintaining riparian forests on headwater streams allows channels to accumulate and store sediment and wood for future delivery to lower-gradient reaches of the river. In addition, actions performed in lower-order streams will benefit the covered amphibian species that use the habitat in and around these water bodies.

Figure 4-1 provides an overview of sources of a wood budget in a watershed. The open squares represent geomorphic areas related to the location for the sources and storages of wood, and filled squares represent the processes that affect wood transport. Landslides are a key component of wood delivery in large portions of the permit area; however, avalanche activity has not been noted.



Source: Hassan et al. 2005

Figure 4-1. Flow Diagram for Wood Budget in a Watershed

4.6.2.2 Objective 1.2: Stream Enhancement Projects

Objective

Conserve, maintain, and enhance overall stream channel complexity through targeted stream enhancement projects to address limiting factors for covered fish.

Rationale

Stream complexity (e.g., presence of wood, pools, sinuosity, floodplain connection), which contributes to slow-moving water and sheltered conditions for juvenile rearing and overwinter habitat, is a limiting factor[4] for many of the covered fish species (NOAA Fisheries 2013, 2014; ODFW and NOAA Fisheries 2011). Stream enhancement projects, such as wood and boulder placement, can provide rapid improvements to physical habitat and fish production before conservation efforts detailed in Objective 1.1 enhance the underlying processes that deliver wood to streams in the permit area (Beechie et al. 2012).

The use of targeted enhancement projects to add large woody material to streams and rivers will provide structured channel morphology[5] and influence the formation of pools, sort sediments, and provide food and cover for covered aquatic species in much the same way that natural large woody material inputs do (Jones et al. 2014). The purposeful introduction of channel wood will help with pool development and sediment retention, provide cover and spawning habitat, potentially increase floodplain connection, and promote nutrient cycling. These stream enhancement projects will immediately improve local habitat conditions in the permit area, benefiting the covered species. However, in isolation such actions are unlikely to increase life history diversity or resilience of salmon populations (Beechie et al. 2012). Stream enhancement projects will be strategically located to efficiently provide the most comprehensive benefits to the covered species, such as in areas where species' intrinsic potential[6] is high or in proximity to previous projects. Riparian management actions, as described in Objective 1.1, will allow forests to become a long-term source of large woody material for the aquatic systems within and downstream of the permit area. Stream enhancement will be completed as described in Conservation Action 3: Stream Enhancement.

4.6.2.3 Objective 1.3: Water Quality and Quantity

Objective

Maintain or enhance water quality and quantity conditions most important to covered fish as measured by long-term trends in temperature, fine sediments in riffles, and summer low-flows on ODF-managed lands.

Rationale

Stream ecosystems are dynamic and typically experience large fluctuations in water quality due to changing flow regimes (Armstrong and Schindler 2013). Protection of existing functional riparian systems and restoration of degraded systems can address water quality issues. Riparian areas

[4] Limiting factors are factors that constrain a populations size and slows or stops a populations growth.
[5] Channel morphology influences river shape and directions.
[6] Intrinsic potential is the measure of a stream's capacity to provide high-quality habitat.

maintain ecological processes, such as regulating stream temperature, streamflow, cycling nutrients, providing organic matter, filtering chemicals and other pollutants, trapping and redistributing sediments, stabilizing stream channels and banks, absorbing and detaining floodwaters, maintaining fish habitats, supporting the food web for a variety of biota, and regulating stream temperature (Buffler 2005).

Degraded water quality, especially elevated stream temperature (NOAA Fisheries 2013, 2014, ODFW and NOAA Fisheries 2011), is one of the primary threats to many of the covered fish species. The restoration of riparian function, through the implementation of RCAs in the permit area, will help reduce stream temperature increases by increasing shading (Beechie et al. 2012). This will benefit the covered species and provide longer-term climate change resilience.

In forested environments, sediment delivery is often increased through surface erosion on unpaved roads or landslides from roads or clearcuts (Beechie et al. 2012). A review of landslides in the permit area associated with the 1996 storm indicate the majority of landslides were not associated with roads; rather, they occurred in recent clearcuts (0 to 10 years after harvest) with steep slopes (over 70%). However, where road-associated landslides did occur, they were about four times larger in volume than non-road-associated slides (ODF 2017). The implementation of stand and road management conservation actions will reduce the risk of landslides and the associated effects of sedimentation in the permit area and benefit the covered fish species.

Beechie et al. (2012) estimate that reduction in summer low-flows due to climate change will be greatest west of the Cascade Mountains, with monthly flow decreasing by 10% to 70% over the course of the twenty-first century. Forests have an effect on water yield through the interception of precipitation and transpiration by trees. Increased coarse sediment following logging can increase the effect of low flows by shallowing and widening stream channels (Hicks et al. 1991). Summer low-flows can negatively affect the covered salmon species by reducing the availability of rearing habitat in the permit area. The implementation of conservation actions will limit sedimentation, benefiting the covered species by increasing habitat availability in the permit area. In addition, habitat restoration actions, such as the removal of nonnative plants, creation of deep pools, and floodplain reconnection could be used to improve summer low flows (Beechie et al. 2012).

Water quality and quantity will be protected through the designation and management of RCAs as described in Conservation Action 1: Establish Riparian Conservation Areas, and Conservation Action 2: Riparian Equipment Restriction Zone.

4.6.2.4 Objective 1.4: Fish Passage

Objective

Maintain or enhance fish passage to suitable spawning and rearing habitat by removing or modifying artificial barriers during the course of routine construction, emergency road repair, or maintenance work.

Rationale

The removal or modification of artificial barriers in the permit area will increase fish passage to upstream areas that could be used by salmonids for spawning and rearing and release gravels that have accumulated behind barriers to downstream locations. The access to additional, previously inaccessible habitat will increase the carrying capacity of the system, potentially increasing populations of covered fish. Barrier removal that increases longitudinal connectivity[7] and provides the covered species access to varied physical and thermal conditions can increase habitat diversity and allow expression of alternative life history strategies (Beechie et al. 2012). Increased fish passage will benefit the covered species as water warms during climate change by expanding available habitat, potentially increasing population resilience of the covered species (Beechie et al. 2012).

4.6.3 Goal 2: Support the Persistence of Columbia Torrent Salamander

The following objective is to support the persistence of Columbia torrent salamanders in the Clatsop and Tillamook State Forests.

4.6.3.1 Objective 2.1: Riparian Habitat within Species Range

Objective

Conserve and maintain riparian habitat along 677 stream miles where Columbia torrent salamanders are likely to persist (high-gradient perennial streams with an adequate supply of downed wood, adequate water temperatures, and access to moist adjacent forests) through implementation of RCAs as shown in Table 4-3 and Table 4-4.

Rationale

The Columbia torrent salamander is an aquatic, stream-adapted salamander that occurs in seeps, springs, small perennial high-gradient streams, and the margins of large streams with cold water (Hammerson 2004, Russell et al. 2004). Protecting such habitat that occurs in the permit area within the range of Columbia torrent salamander will support population persistence and provide room for population expansion. In the permit area, lands in and around the Clatsop and Tillamook State Forests support populations of Columbia torrent salamander. Implementing RCAs as shown in Table 4-3 and Table 4-4 will maintain stream environments where torrent salamanders are likely to occur, ensuring that they persist on the landscape, even following implementation of covered activities.

Torrent salamanders are sensitive to forest practices in riparian areas that can degrade microhabitats though sediment deposition and elevated stream temperatures due to reduced stream shading (Vesely and McComb 2002, Russell et al. 2004). Due to the species' sedentary nature (Nussbaum and Tait 1977, Welsh and Lind 1996, Nijhius and Kaplan 1998) and limited dispersal capabilities, the torrent salamander exhibits limited movement and has small home ranges (Nussbaum et al. 1983). Retaining RCAs on perennial streams and seasonal streams immediately upstream from perennial streams allows for seasonal movements of salamanders within the riparian corridor.

In logged environments, riparian forests that are 20 meters (65.6 feet [slope distance]) wide have been found to contain approximately 80% of detectable torrent salamanders, with frequency of detection highest from 0–10 meters (0–33 feet) (Vesely and McComb 2002). Within the permit area, maintaining riparian forests in perennial, high-gradient streams close to the initiation of

[7] Increase migratory pathways and restore natural streamflow, sediment, and organic matter transport (Beechie et al. 2012).

perenniality will help minimize the impacts of timber harvest on torrent salamanders (Steele et al. 2003, Howell and Maggiulli 2011). On seasonal streams that do not otherwise have a treed buffer, grouping leave trees around the junction of seasonal streams and perennial streams during timber harvest will retain locations where torrent salamanders are most likely to occur, even following harvest. This would not occur on every junction of this nature, but would occur as part of the normal variation of upland leave tree practices and be more prevalent within HCAs.

4.6.4 Goal 3: Support the Persistence of Cascade Torrent Salamander

Support the persistence of Cascade torrent salamanders in the Santiam State Forest.

4.6.4.1 Objective 3.1: Riparian Habitat within Species Range

Objective

Conserve and maintain riparian habitat along 76 stream miles where Cascade torrent salamanders are likely to persist (high-gradient perennial streams with an adequate supply of downed wood, adequate water temperatures, and access to moist adjacent forests) through implementation of RCAs.

Rationale

As with the Columbia torrent salamander, the Cascade torrent salamander is a stream-dwelling amphibian that can be found along the edges of high-gradient, cold, rocky reaches and near seeps. Adults may also be found along streambanks, and during wet periods they may venture into upland areas (Howell and Maggiulli 2011). Protecting such habitat that occurs in the permit area within the range of Cascade torrent salamander will support population persistence and provide room for population expansion. In the permit area, lands in and around the Santiam State Forest are known to support populations of Cascade torrent salamander.

As described under Objective 2.1, torrent salamanders are sensitive to forest practices in riparian areas. In logged environments, riparian forests that are 20 meters (65.6 feet [slope distance]) wide have been found to contain approximately 80% of detectable torrent salamanders, with frequency of detection highest from 0 to 10 meters (0 to 33 feet) (Vesely and McComb 2002). The maintenance of riparian forests in perennial, high-gradient streams close to the stream origin in the permit area will help minimize the impacts of timber harvest on torrent salamanders (Steele et al. 2003, Howell and Maggiulli 2011).

4.6.5 Goal 4: Support the Persistence of Oregon Slender Salamander

Support the persistence of Oregon slender salamander in the Santiam State Forest.

4.6.5.1 Objective 4.1: Existing Oregon Slender Salamander Habitat

Objective

Conserve, maintain, and enhance 16,000 acres of occupied habitat or habitat modeled as suitable or highly suitable.

Rationale

Due to the restricted distribution and limited dispersal capabilities of Oregon slender salamander (Clayton and Olson 2009, Garcia et al. 2020), it is important to conserve occupied habitat, or habitat that is likely to be occupied, to provide for population persistence. Contiguous suitable habitat will promote dispersal and reduce genetic isolation in a fragmented landscape. While larger HCAs will provide significant blocks of habitat, smaller HCAs distributed across the permit area can serve as refugia for neighboring, more intensively managed stands.

4.6.5.2 Objective 4.2: Downed Wood

Objective

Maintain or enhance the abundance of large decayed downed wood in occupied or suitable Oregon slender salamander habitat.

Rationale

Retaining and creating downed wood at the appropriate decay class is necessary to ensure appropriate microhabitat conditions are present for Oregon slender salamander (Clayton and Olson 2009, Garcia et al. 2020). Leaving this substrate will allow for the Oregon slender salamander to persist through harvest and ameliorates the disturbance effects on the species, thereby supporting the occurrence or abundance of the species. Management within HCAs will provide the greatest opportunity for the development of large downed wood within older stands. ODF will also implement silvicultural actions outside of HCAs, such as thinning, to enhance growth of trees to ensure a supply of future large woody material.

4.6.6 Goal 5: Support the Persistence of Northern Spotted Owl

Support the persistence of northern spotted owl in the permit area.

4.6.6.1 Objective 5.1: Existing Northern Spotted Owl Habitat

Objective

Conserve, maintain, and enhance at least 30,000 acres of existing northern spotted owl nesting, roosting, and foraging habitat.

Rationale

Conserving existing nest sites and associated habitat is the most effective method to avoid further declines in northern spotted owl populations (USFWS 2011). Northern spotted owl was listed under the ESA in 1990 (USFWS 1990) because of widespread habitat loss across the range of the species. Past habitat and current habitat loss and increasing barred owl populations continue to threaten the spotted owl, and populations of spotted owl have continued to decline (Davis et al. 2016, Lesmeister et al. 2018).

Within the permit area, late-seral habitat used by spotted owls for nesting is limited in many areas due to past natural and anthropogenic disturbances (Chapter 2). Because of this, retaining existing habitat is essential to supporting the persistence of northern spotted owls. Moving north from the southern end of the Tillamook State Forest there is less federal land to provide habitat for demographic or dispersal support for northern spotted owls, making the conservation, maintenance, and enhancement of spotted owl habitat in the Tillamook and Clatsop State Forests particularly important.

Protecting northern spotted owl habitat in the permit area will help sustain the reproduction of northern spotted owls in currently occupied habitat, support and potentially improve persistent low densities in the northern Coast Ranges, and retain sufficient unoccupied habitat to accommodate potential future recolonization. Additionally, conserving, maintaining, and enhancing existing habitat will help offset threats from loss or alteration of habitat from stand-replacing fire, loss of genetic diversity, and climate change (USFWS 2011, Forsman et al. 2011).

4.6.6.2 Objective 5.2: Northern Spotted Owl Dispersal Habitat

Objective

Maintain at least 40% of the permit area outside of HCAs as dispersal habitat to allow diffuse movement across a permeable landscape.

Rationale

Maintaining sufficient dispersal habitat at the landscape level is vital to sustaining populations of northern spotted owl by allowing juveniles to disperse to temporary or permanent territories (Davis et al. 2016). Juvenile spotted owls disperse within their first year of leaving the nest. While northern spotted owls can disperse through highly fragmented forest landscapes, highly fragmented forest can reduce survival (Forsman et al. 2002). For example, dispersing birds are exposed to higher risk of predation (Forsman et al. 2002). The quality and distribution of dispersal habitat within a forested matrix can help reduce predation risk. The conservation strategy will reduce those risks by providing “dispersal-capable” lands across the permit area.

Dispersal habitat may also support movement of adult owls between suitable foraging habitat and inter-territory movement by adult spotted owls in response to the colonization of barred owls (Dugger et al. 2011, Olson et al. 2004).

HCAs are expected to develop significant amounts of nesting, roosting, and foraging habitat over the permit term. Area within HCAs that do not have all the components of nesting, roosting, and foraging habitat are still expected to develop into stands that will support dispersal. Outside of HCAs, dispersal-capable landscapes that support northern spotted owl movement will be maintained by having a significant amount of the landscape in stands 60 years and older, areas of older trees that cannot be harvested for operational reasons, and retention standards that emphasize leaving the oldest or largest legacy components during harvest (i.e., green trees, snags, and downed wood.

4.6.6.3 Objective 5.3: Northern Spotted Owl Habitat Enhancement

Objective

Increase the quantity of nesting, roosting, and foraging habitat by at least 100,000 acres, for a total at the end of the permit term of at least 130,000 acres.

Rationale

The 2011 recovery plan (USFWS 2011) encourages active management actions that restore, enhance, and promote development of high-value habitat, which, for this HCP, includes nesting, roosting, and foraging habitat. Habitat for late-seral species—including northern spotted owls—can be increased through both passive management (i.e., allowing the stand to develop over time naturally) or through active management, including "ecological forestry," which primarily involves partial cutting prescriptions that encourage the growth of larger trees while maintaining key habitat components to reduce short-term negative impacts (Kuehne et al. 2015). Specific standards for silvicultural activities to enhance northern spotted owl habitat are described under Conservation Action 6: Establish Habitat Conservation Areas.

Therefore, in addition to conserving known nesting, roosting, and foraging habitat as described in Objective 5.1, ODF will increase the amount of nesting, roosting, and foraging habitat that is available over the permit term. The areas that will be managed to enhance development and maintenance of northern spotted owl habitat will primarily be adjacent to existing habitat or in locations where northern spotted owls once persisted but have not been detected recently. This expansion of available habitat will be necessary to achieve Goal 5.

Growth of large trees and the development of snags, multilayered canopies, and other key elements of forest structure takes decades, particularly in stands that have little residual legacy structure and that lack large trees (Lindenmayer and Franklin 2002, Dodson et al. 2012), which is the case over much of the permit area. In addition, some stands may require multiple treatments over time. Therefore, this objective is intended to provide benefits during the middle to later periods of the permit term.

Improving the quality of existing northern spotted owl habitat will expand the availability of suitable habitat for the species and provide support for reducing key threats faced by northern spotted owls. This net increase in owl habitat is intended to result in a potentially wider and less-fragmented distribution of the species' habitat across the permit area.

4.6.7 Goal 6: Support the Persistence of Marbled Murrelet

Support the persistence of marbled murrelet in the permit area.

4.6.7.1 Objective 6.1: Existing Marbled Murrelet Nesting Habitat

Objective

Conserve, maintain, and enhance at least 15,000 acres of habitat where occupancy has been previously documented, or is modeled as suitable or highly suitable.

Rationale

Conserving existing occupied habitat is the most effective method to avoid further declines in marbled murrelet populations (USFWS 1997). As with the northern spotted owl, the marbled murrelet was listed as threatened due to widespread habitat loss. Past disturbance within the permit area has limited marbled murrelet nesting habitat and distribution. Conserving, maintaining, and enhancing existing marbled murrelet nesting habitat within the permit area will help support or increase populations. Known marbled murrelet nests are rare, and the most likely nesting habitat is often hard to delineate from the surrounding forest stand. As a result, forest stands where observations of murrelets suggest potential nesting (i.e., occupied stands) are protected and may encompass some actual nest locations or patches of likely nesting habitat.

Conservation of existing nesting habitat will provide particular conservation benefits in the Tillamook and Clatsop State Forests, which support small clusters of marbled murrelet nesting sites believed to be important to maintaining marbled murrelet in the northwest Oregon Coast (USFWS 1997). In other parts of the permit area, focusing conservation efforts on existing nesting habitat and on state forest lands that are adjacent to protected federal nesting habitat will support recovery efforts under the *Northwest Forest Plan* (USDA and USDI 1994) and BLM's *Western Oregon Resource Management Plans (*BLM 2016a, 2016b).

In addition, much of the remaining marbled murrelet nesting habitat occurs in relatively small patches, resulting in increased risks to marbled murrelet chicks and eggs being lost to predation (ODF 2019). Therefore, HCAs that support marbled murrelet habitat will include nonhabitat adjacent to habitat to serve as a buffer and increase effective interior habitat area to reduce predation risks and increase nest site productivity over time and are critical.

4.6.7.2 Objective 6.2: Marbled Murrelet Nesting Habitat Enhancement

Objective

Increase the amount of suitable or highly suitable habitat by at least 80,000 acres in locations that increase interior forest and minimize hard-edge effects.

Rationale

The intention of this objective is to expand marbled murrelet habitat over time through management actions that accelerate development of late-seral forest characteristics and, in particular, nest platforms. Management will be strategically focused in areas adjacent to occupied stands or stands that have a high probability of being occupied based on habitat suitability modeling to reduce fragmentation within patches of late-seral forests. This eventual expansion of existing nesting areas will allow for colonization of new habitat and support the potential expansion of the nesting population over time. It will also improve the value of existing habitat by reducing edge effects through the creation of larger blocks of suitable nesting habitat.

Marbled murrelets nesting near "hard edges" created by clearcuts are vulnerable to increased risk of windthrow, potential degradation of microclimate, and nest predation by corvids and other edge-associated predators (Raphael et al. 2018; Malt and Lank 2007, 2009). In addition, edges can create microclimates that limit development of the moss-covered branches used by nesting murrelets (Van Rooyen et al. 2011).

Under this objective, conservation actions will maintain and enhance early or mid-seral forest adjacent to occupied nesting habitat within HCAs to increase the distance between nest sites and hard edges, which is expected to reduce predation risk, encourage the development of moss and associated nesting platforms, and increase overall value and productivity of occupied habitat being conserved under the HCP. HCAs that support marbled murrelets were designed to support sufficient interior habitat area to reduce predation risks and increase nest site productivity over time, allowing expansion of nest locations into adjacent areas.

4.6.8 Goal 7: Support the Persistence of Red Tree Vole

Support the persistence of red tree vole (North Oregon Coast Distinct Population Segment [DPS]) in the permit area.

4.6.8.1 Objective 7.1: Occupied Red Tree Vole Habitat

Objective

Conserve, maintain, and enhance at least 20,000 acres of habitat where occupancy has been previously documented, or is modeled as suitable or highly suitable.

Rationale

Conserving stands where red tree voles have been documented is a key first step in supporting the persistence of red tree voles within the permit area. Red tree voles occur at low densities distributed irregularly across landscapes of suitable habitat (Rosenberg et al. 2016). Although population size estimates are not available to estimate trends, data and anecdotal information strongly suggest that current North Oregon Coast red tree vole DPS populations are considerably lower than historical numbers (USFWS 2011). Therefore, conserving the few occupied sites confirmed within the permit area is a priority to be implemented in the HCP. Enhancement of red tree vole habitat would be limited to using silvicultural actions to develop larger trees with more habitat structure over time, including an overall increase in canopy connectivity within the range of the species. Habitat enhancement activities will occur in HCAs where the permit area is adjacent to mature habitat on federal lands, where red tree voles are known or likely to exist.

Most ODF lands in the range of the North Oregon Coast DPS have not been surveyed. In addition, determining red tree vole occupancy of a given forest is time-consuming, and detection rates are extremely low (Rosenberg et al. 2016, Marks-Fife 2016). If conservation is limited to occupied habitat identified by species presence at a given point of time, suitable habitat of unknown occupancy may be removed or modified, further contributing to population declines or inhibiting future recovery (Camaclang et al. 2015). Therefore, conservation of unsurveyed or unoccupied suitable habitat is important for supporting the persistence of red tree vole within the permit area.

4.6.8.2 Objective 7.2: Red Tree Vole Habitat Enhancement

Increase the amount of suitable and highly suitable habitat by at least 70,000 acres for red tree vole.

Rationale

Red tree voles are associated with large blocks of late-seral conifer forests (Martin and McComb 2002, USFWS 2011). They also have very poor dispersal capabilities and are sensitive to habitat fragmentation. The probability of red tree vole occurrence in a given forest patch decreases with distance to suitable habitat (Rosenberg et al. 2016, Linnell et al. 2017). Increasing the number and size of patches of late-seral interior forest habitat between and adjacent to occupied habitat will reduce dispersal distances between late-seral forest patches, facilitate dispersal, and encourage colonization of unoccupied suitable habitat (Linnell et al. 2017). Enhancement of red tree vole habitat would be limited to using silvicultural actions to develop larger trees with more habitat structure over time, including an overall increase in canopy connectivity within the range of the species. Many of these benefits will be realized from the silvicultural prescriptions implemented for northern spotted owls and marbled murrelets.

4.6.9 Goal 8: Support the Persistence of Coastal Marten

Support the persistence of coastal marten in the permit area.

4.6.9.1 Objective 8.1: Existing Coastal Marten Habitat

Objective

Conserve, maintain, and enhance at least 25,000 acres of denning, foraging, and dispersal habitat.

Rationale

Coastal marten exist in three isolated populations: north coastal California, south coastal Oregon, and central coastal Oregon. Although coastal martens have not been observed on ODF lands to date, the Southern Coastal Oregon Extant Population Area delineated by Slauson et al. (2019) (Appendix C) overlaps with ODF lands in Curry and Josephine Counties, and coastal martens have been detected in the vicinity of Common School Forest Lands managed by ODF (Moriarty et al. 2019: Figure 1). Vegetation in this area is composed of mixed conifer forest (i.e., dominated by Sitka spruce, western hemlock, and Douglas-fir) interspersed with unique plant communities adapted to serpentine soils, including forests of widely spaced pines (*Pinus* spp.) with an understory of grasses and more mesic areas with dense and diverse shrub layer including tan oak (*Notholithocarpus densiflorus*) and huckleberries (*Vaccinium* spp.) (Moriarty et al. 2019).

Moriarty et al. (2019) found martens using young forests in this area with interconnected, dense patches of shrubs. Based on this finding, it is assumed that timber harvest practices that do not dramatically alter the dominant overstory cover (combination of both overstory and understory cover of at least 65%) while encouraging dense shrub growth, particularly salal and evergreen huckleberry, and retain or increase large woody material will benefit coastal marten populations. Moriarty et al. (2019) also found both spotted owls and martens in areas with many large and tall trees and suggest that retention and recruitment of large structures will benefit both species. Conservation of coastal marten habitat on ODF lands will, therefore, focus on identifying stands that currently provide, or could be enhanced to provide, these conditions.

4.6.9.2 Objective 8.2: Coastal Marten Habitat Enhancement

Objective

Increase the quantity of denning, resting, foraging, and dispersal habitat within 25,000 acres over the permit term.

Rationale

The viability of coastal marten depends on maintaining the three existing isolated populations and potentially establishing new populations to restore connectivity between populations (Slauson et al. 2019). Current and projected future resiliency of the Southern Coastal Oregon Extant Population Area that overlaps the permit area is considered low because of small population size (less than 100 individuals), limited connectivity to the California–Oregon border population, and limited habitat for predatory avoidance (USFWS 2018).

4.7 Conservation Actions for Covered Species

This section describes the conservation actions that ODF will implement to achieve the biological goals and objectives described in Section 4.6, and to minimize and mitigate the impacts of covered activities on the covered species (Chapter 5). Most conservation actions are intended to benefit multiple species, including aquatic and terrestrial species.

The conservation actions to be implemented under the HCP fall into four general groups.

- Conservation Actions 1 through 5 target measures that ODF will implement to protect and enhance aquatic systems to primarily benefit covered fish and aquatic amphibians.
- Conservation Actions 6 through 9 are focused on the preservation and enhancement of the terrestrial environment to primarily benefit the covered birds, terrestrial amphibians, and mammals.
- Conservation Actions 10 and 11 address the minimization measures that ODF will implement throughout the permit area to minimize effects from timber harvest and road construction and maintenance on covered species.
- Conservation Action 12 establishes a conservation fund that will be used to fund activities in Conservation Actions 3, 4, 7, and 9.

Each conservation action will help to achieve more than one biological objective. The expected relationship of how conservation actions will achieve the aquatic biological goals and objectives is shown in Figure 4-2. The relationship of conservation actions and terrestrial biological goals and objectives is shown in Figure 4-3. A summary of relationships between biological goals and objectives and conservation actions is provided in Table 4-2. Note that objectives are generalized; see Table 4-1 for species-specific goals and objectives.

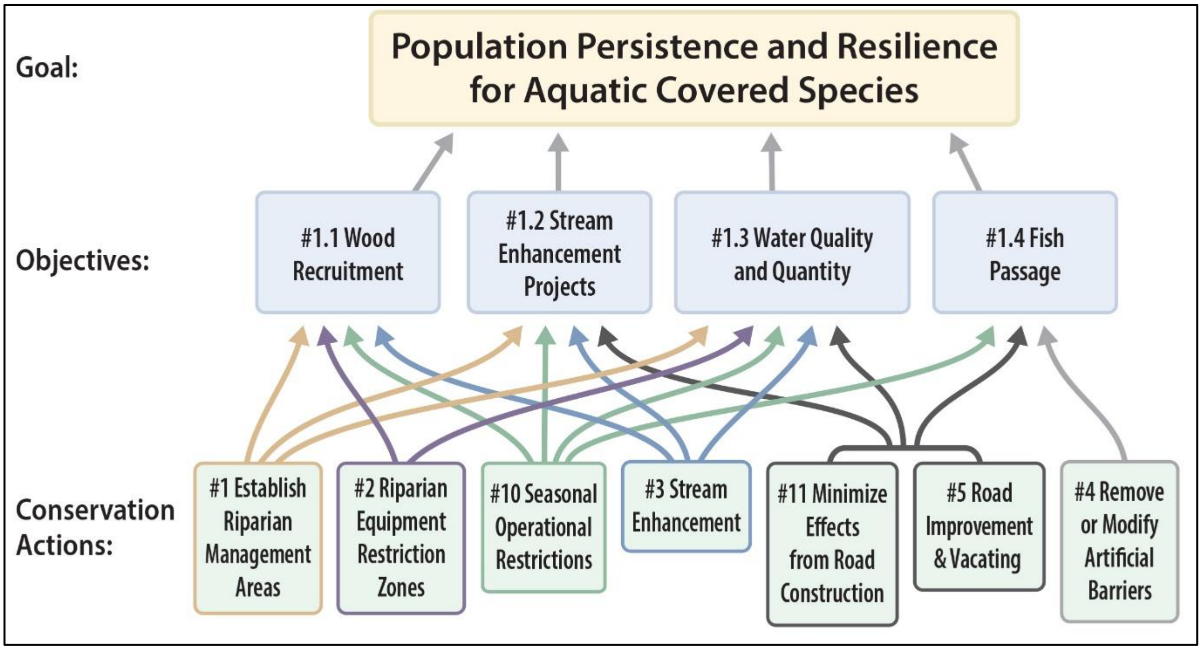


Figure 4-2. Aquatic Biological Goals and Objectives and Their Associated Conservation Actions

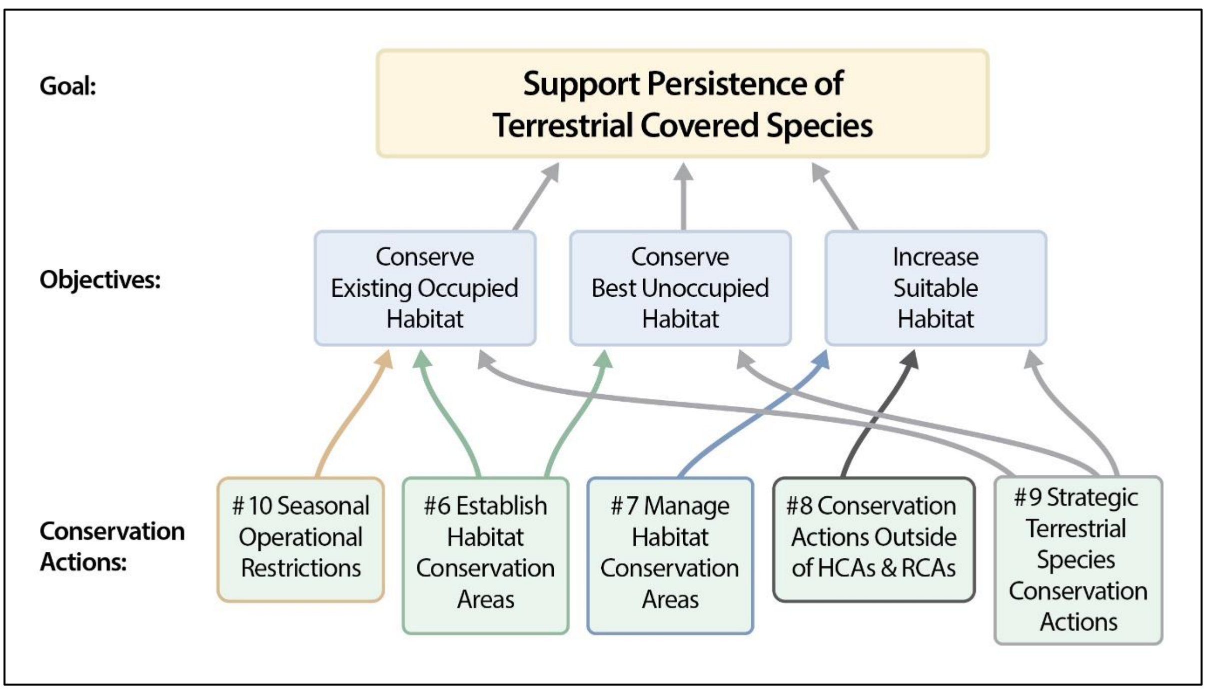


Figure 4-3. Terrestrial Biological Goals and Objectives and Their Associated Conservation Actions

Table 4-2. Relationship Between Biological Goals and Objectives and Conservation Actions

Biological Goal	Biological Objectives	Conservation Actions	Specific Actions
Goal 1: Support the Persistence and Climate Change Resilience of Covered Fish	1.1 Wood Recruitment	1[*]: Establish Riparian Conservation Areas	Establish and maintain RCAs
		2: Riparian Equipment Restriction Zones	
		3: Stream Enhancement	Enhance wood in select stream reaches
		11: Road Construction and Management Measures	Limit new road construction in RCAs to situations where upland road placement options do not exist or are infeasible
	1.2 Stream Enhancement Projects	3: Stream Enhancement	Identify and prioritize stream reaches with high intrinsic potential for implementation of enhancement projects (rapid benefit)
	1.3 Water Quality and Quantity	1: Establish Riparian Conservation Areas s	Establish and maintain RCAs
		2: Riparian Equipment Restriction Zones	Manage unstable slopes
			Minimize effects immediately adjacent to streams by restricting ground-based equipment
		5: Standards for Road Improvement and Vacating	Identify roads in the permit area that are high risk of sedimentation for improvement and/or vacating
		11: Road Construction and Management Measures	Follow road design specifications and best management practices to reduce inputs of fine sediment
	1.4 Fish Passage	4: Remove or Modify Artificial Fish-Passage Barriers	Conduct fish-passage inventory and prioritization and identify projects to meet HCP targets
			Design new and replacement stream crossings to meet NOAA Fisheries (2011) passage criteria to maintain passage for covered fish species
		5: Standards for Road Improvement and Vacating	Identify roads in the permit area that do not meet fish-passage requirements
		11: Road Construction and Management Measures	Apply NOAA Fisheries and ODFW Fish-Passage Requirements to ODF-maintained roads
		2: Riparian Equipment Restriction Zones	Limit work adjacent to streams
		3: Stream Enhancement	Increase the amount of accessible habitat

Biological Goal	Biological Objectives	Conservation Actions	Specific Actions
Goal 2: Support the Persistence of Columbia Torrent Salamander in the Clatsop and Tillamook State Forests	2.1 Riparian Habitat within Species Range	1*: Establish Riparian Conservation Areas 2: Riparian Equipment Restriction Zones	Establish and maintain RCAs Minimize effects immediately adjacent to streams by restricting ground-based equipment
Goal 3: Support the Persistence of Cascade Torrent Salamander in the Santiam State Forest	3.1 Riparian Habitat within Species Range	1: Establish Riparian Conservation Areas 2: Riparian Equipment Restriction Zones	Establish and maintain RCAs Minimize effects immediately adjacent to streams by restricting ground-based equipment
Goal 4: Support the Persistence of Oregon Slender Salamander in the Santiam State Forest	4.1 Existing Oregon Slender Salamander Habitat	6: Establish Habitat Conservation Areas 8: Conservation Actions Outside Habitat Conservation Areas and Riparian Conservation Areas	Include modeled high-quality habitat in HCAs Establish downed-wood targets and leave tree strategies
	4.2 Downed Wood	10: Seasonal Operational Restrictions	Avoid damage to legacy structures (i.e., downed wood) to the maximum extent practicable Retain green tree, snag, and downed wood in the Santiam State Forest to maintain and enhance downed wood recruitment
Goal 5: Support the Persistence of Northern Spotted Owl in the Permit Area	5.1 Existing Northern Spotted Owl Habitat	6: Establish Habitat Conservation Areas 7: Manage Habitat Conservation Areas 8: Conservation Actions Outside Habitat Conservation Areas and Riparian Conservation Areas	Include currently active (i.e., <6 years with no response) activity centers on ODF lands in HCAs
			Include activity centers in HCAs strategically that had a previous history of consistent occupancy or reproduction Include habitat in HCAs in support of activity centers on adjacent (nonpermit) lands where ODF manages a significant amount of habitat within the provincial circle Include suitable and highly suitable habitat in HCAs Include marginal habitat or unsuitable areas in HCAs in strategic locations for future development

Biological Goal	Biological Objectives	Conservation Actions	Specific Actions
		9: Strategic Terrestrial Species Conservation Actions	Cooperate with USFWS regional barred owl research and management activities
		10: Seasonal Operational Restrictions	Prohibit activities near active nest sites during critical breeding period.
	5.2 Northern Spotted Owl Dispersal Habitat	8: Conservation Actions Outside Habitat Conservation Areas and Riparian Conservation Areas	Establish seasonal restrictions for covered activities around known nesting locations of Northern Spotted Owl and Marbled Murrelet.
			Prioritize downed wood and leave tree strategies to benefit covered species.
	5.3 Northern Spotted Owl Habitat Enhancement	7: Manage Habitat Conservation Areas	Manage to accelerate development of late-seral habitat
Goal 6: Support the Persistence of Marbled Murrelet in the Permit Area	6.1 Existing Marbled Murrelet Nesting Habitat	6: Establish Habitat Conservation Areas	Include occupied stands in HCAs
			Include unoccupied or unsurveyed, suitable, and highly suitable habitat in HCAs in strategic locations of historically high murrelet activity
			Include habitat of marginal and low suitability unoccupied habitat in HCAs strategically to improve habitat quality and connectivity over time
		10: Seasonal Operational Restrictions	Prohibit activities near known occupied habitat during the critical breeding period. Prohibit activities near highly suitable habitat of unknown occupancy within HCAs during critical breeding period.
	6.2 Marbled Murrelet Nesting Habitat Enhancement	6: Establish Habitat Conservation Areas	Include suitable and highly suitable habitat in HCAs
		7: Manage Habitat Conservation Areas	Enhance unsuitable habitat within strategic locations to increase overall contiguity among suitable and highly suitable habitat patches
			Manage strategically located young forest stands to favor development of large trees and nesting platforms

Biological Goal	Biological Objectives	Conservation Actions	Specific Actions
Goal 7: Support the Persistence of Red Tree Vole in the Permit Area	7.1 Occupied Red Tree Vole Habitat	6: Establish Habitat Conservation Areas	Include known occupied sites in HCAs
	7.2 Red Tree Vole Habitat Enhancement	6: Establish Habitat Conservation Areas 7: Manage Habitat Conservation Areas	Include highly suitable or suitable habitat unoccupied/ unknown occupancy in HCAs Manage habitat to increase habitat quality over time
Goal 8: Support the Persistence of Coastal Marten in the Permit Area	8.1 Existing Coastal Marten Habitat	6: Establish Habitat Conservation Areas	Include suitable habitat in HCAs
	8.2 Coastal Marten Habitat Enhancement	7: Manage Habitat Conservation Areas	Manage to accelerate development of late-seral habitat including specific habitat features known to be important to the species (e.g., shrubs)

* See Figure 4-3 to interpret numeric headings.

4.7.1 Conservation Action 1: Establish Riparian Conservation Areas

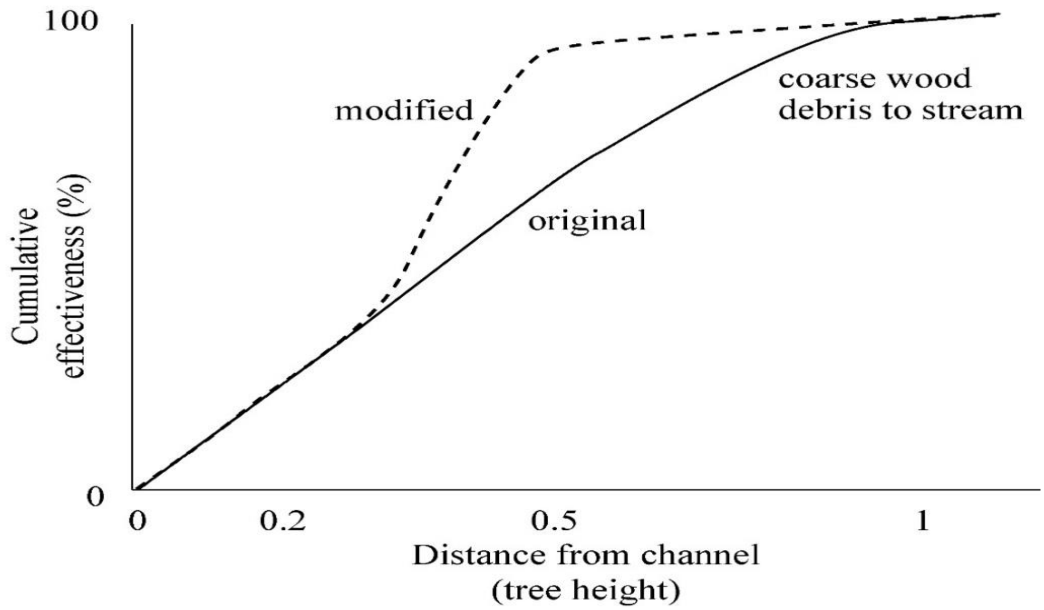
As shown in Table 4-2, Conservation Action 1 is intended to support the following biological objectives.

- 1.1 Wood Recruitment
- 1.3 Water Quality and Quantity
- 2.1 Riparian Habitat within Species Range

This conservation action describes how ODF will implement a riparian management strategy to ensure important riparian functions are maintained in the permit area to provide suitable habitat for the aquatic species covered under this HCP (covered fish and torrent salamanders). Riparian functions addressed in this action are large wood and gravel recruitment, stream shading, nutrient input, and streambank integrity, many of which are limiting factors identified for the covered species. Maintaining intact RCAs in the permit area will increase ecosystem resilience by buffering ecological function against changes in streamflow (Beechie et al. 2012). Stand-management activities will not occur in the RCAs.

Large woody material contributes to natural processes and promotes instream channel complexity by adding wood cover to streams and influencing channel form and function. Large woody material deposited in streams facilitates the creation and maintenance of hydrologic features, such as pools, gravel bars, and backwater areas, all of which provide essential habitat features for various life-history stages of the covered aquatic species. Large woody material changes sediment routing through the aquatic system, slowing the movement of bedload sediments and causing an increase in storage of sands and gravels. Field research and modeling demonstrate that approximately 95% of the total instream wood inputs from adjacent riparian areas to fish-bearing streams come from distances of 82 to 148 feet (slope distance) from the edge of the stream channel. This distance represents 0.6 to 0.7 of site-potential tree height[8] (Reeves et al. 2016; Figure 4-4) based on the modified effectiveness curve that has been developed since the original 1993 Forest Ecosystem Management Assessment Team (FEMAT) curve. The effectiveness curve shows the percent of instream wood delivery that would be expected based on the distance the riparian area extends from the stream channel.

[8] Site-potential tree height refers to the average maximum height of the tallest dominant trees (200 years or older) for a given site class.



Source: Reeves et al. 2016

Figure 4-4. Modified Effectiveness Curve for Wood Delivery to Streams as a Function of Distance from Stream Channel

Streamside riparian harvest reduces the number of trees available for large wood recruitment, because those trees are removed from the riparian zone. The implementation of RCAs in fish- and non-fish-bearing streams that are wider than what is present currently and that limit harvest activities in RCAs will increase large wood input and benefit the covered species by increasing instream habitat complexity, channel stability, and channel form and function. This increase in large wood input and instream habitat complexity will occur because, as riparian stands mature unharvested, they will produce larger-diameter wood and a greater diversity of wood sizes and wood shapes. Large woody material also provides nutrients to streams, as well as substrate for aquatic invertebrate (e.g., food for covered fish and torrent salamanders) production.

Tree harvest in the riparian forest adjacent to streams can reduce canopy cover, which affects stream shading. Solar radiation is the main source of heat for small mountain streams. The implementation of an RCA will maintain and/or increase streamside canopy cover and shading to improve stream water temperatures for the covered aquatic species (covered fish and torrent salamanders). The riparian conservation actions described here will be complemented by management direction within designated HCAs (Conservation Action 6: Establish Habitat Conservation Areas), where appropriate, to benefit covered species in the permit area. This will include larger areas of passive management adjacent to many RCAs, as well as additional legacy retention for silvicultural prescriptions within HCAs, such as additional clustering of green trees at the junction of seasonal and perennial streams.

Delineation of Riparian Conservation Areas

ODF will establish RCAs adjacent to the aquatic zone, which includes the stream channel(s) and associated aquatic habitat features (beaver ponds, stream-associated wetlands, side channels, and the channel migration zone; Figure 4-5). The RCAs will benefit the covered fish species by conserving, maintaining, and enhancing riparian processes that create aquatic habitat. The functions of these streams will be maintained by retaining vegetation in riparian areas during adjacent harvest activities. No harvest or thinning will occur within the RCAs.

Minimum RCA buffer widths will be applied to stream reaches, dependent on the presence of fish, stream size (determined by annual flow), flow period (perennial versus seasonal), and the potential for landslides (potential debris flow tracts) or fluvial transport during high-energy seasonal flow events. RCA buffer widths are reported in horizontal distance unless otherwise noted. Once the initial management area is determined, a field delineation will occur. During this delineation, field foresters will walk the site and identify any sensitive areas that may require further refinement or consultation. An aquatic biologist or geomorphologist will review these areas and conduct site visits, as necessary, to provide technical assistance in delineating sensitive areas and applying riparian management area strategies.

The RCA width is applied and measured in the field horizontally, regardless of slope. It is measured beginning at the average high-water level of the water body, or the edge of the stream-associated wetland, side channel, or channel migration zone,[9] whichever is farthest from the waterway, and extended toward the uplands. As slope increases, width of the conservation area in the field, therefore, also increases. For example, a 120-foot management area has an actual effective width as measured on the ground (i.e., along the slope) of 120 feet at 0% slope and 170 feet at 100% slope (Figure 4-6). Similarly, a 35-foot management area has an actual effective width of 35 feet at 0% slope and 49 feet at 100% slope (Figure 4-7). The width of these areas will be expanded, if necessary, to encompass sensitive sites (e.g., inner gorges) that occur.

[9] The area where the active channel of a stream or river is prone to move, and the movement results in a potential near-term loss of riparian function and associated habitat adjacent to the stream.

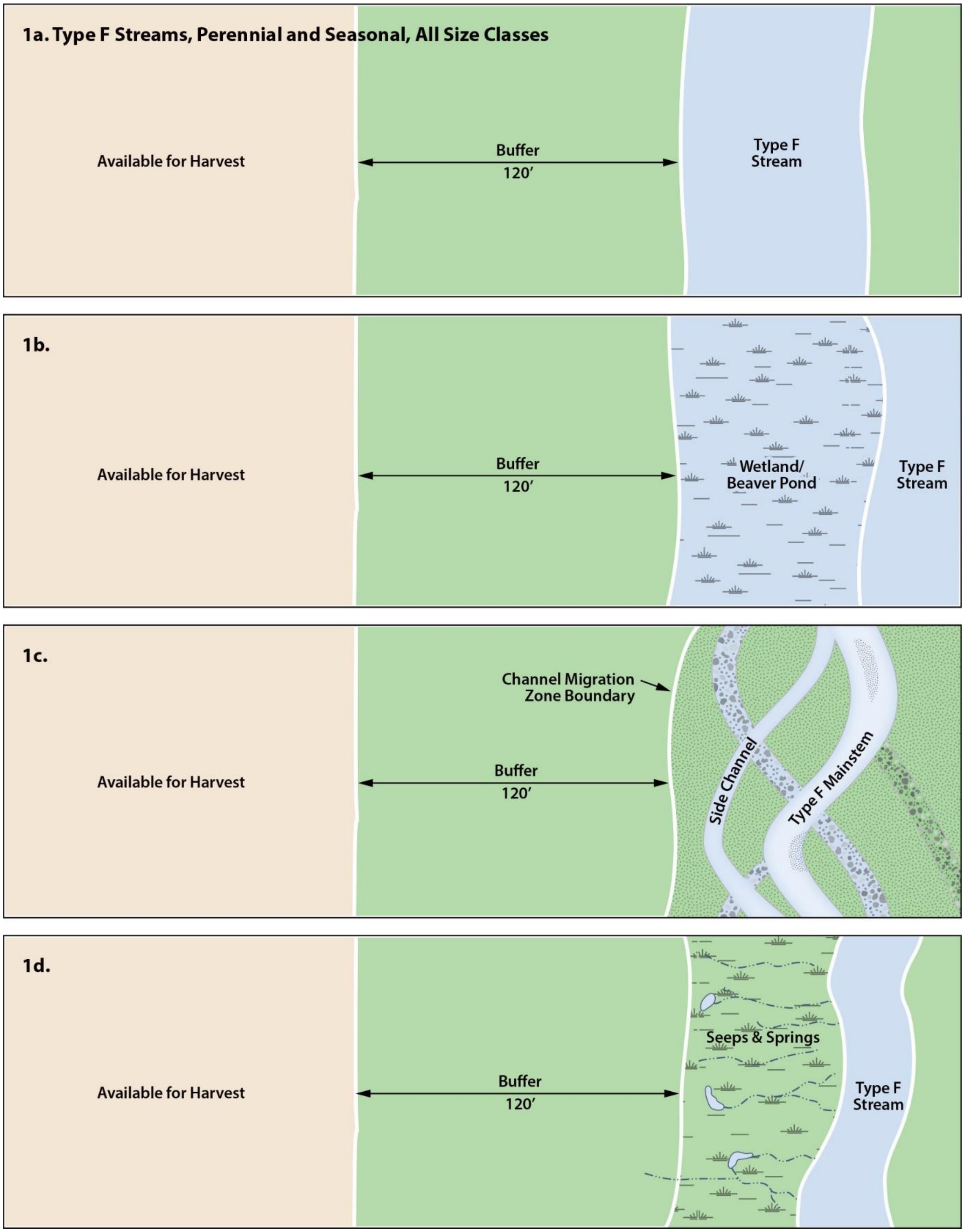


Figure 4-5. Effects of Aquatic Zone Designations on Riparian Conservation Areas

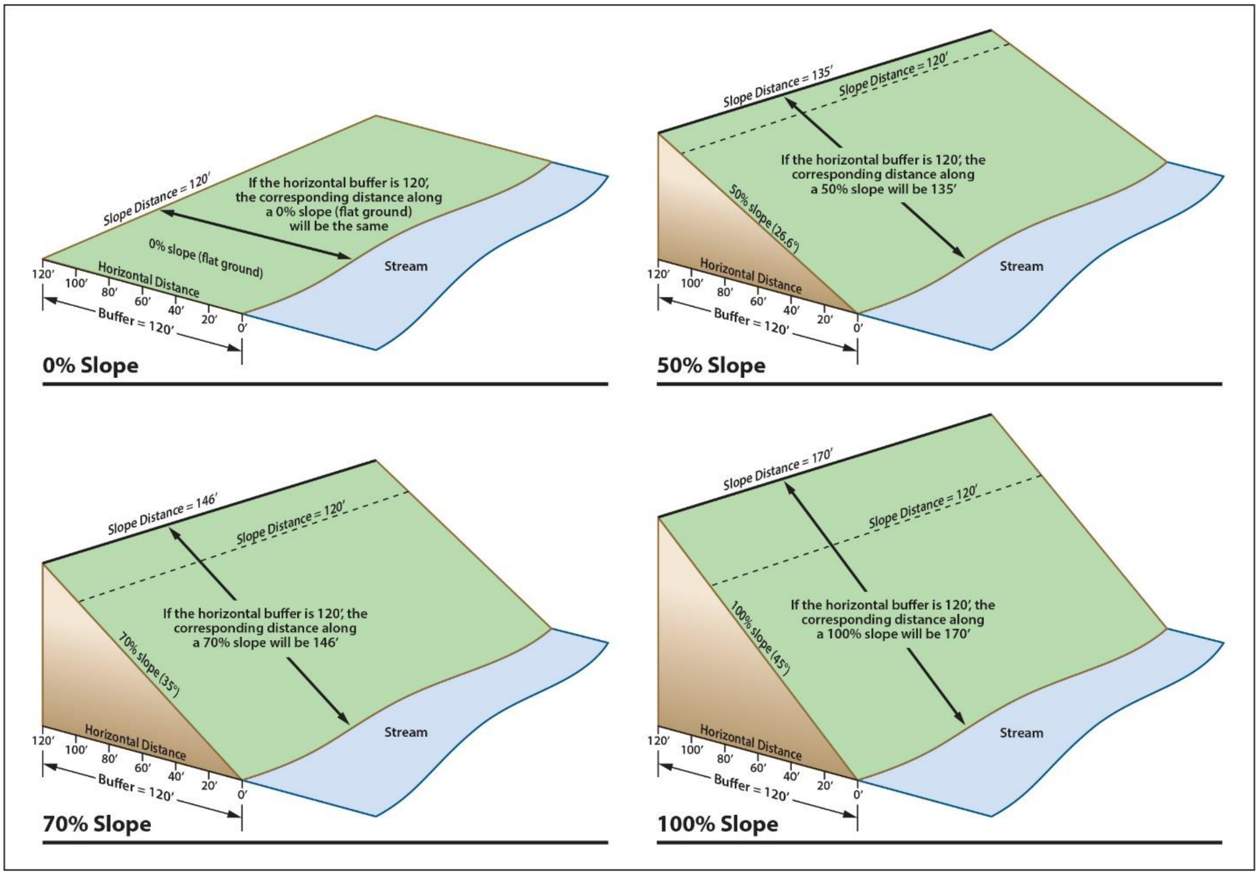


Figure 4-6. Examples of the Horizontal Distance Measurement of a 120-foot Riparian Conservation Area

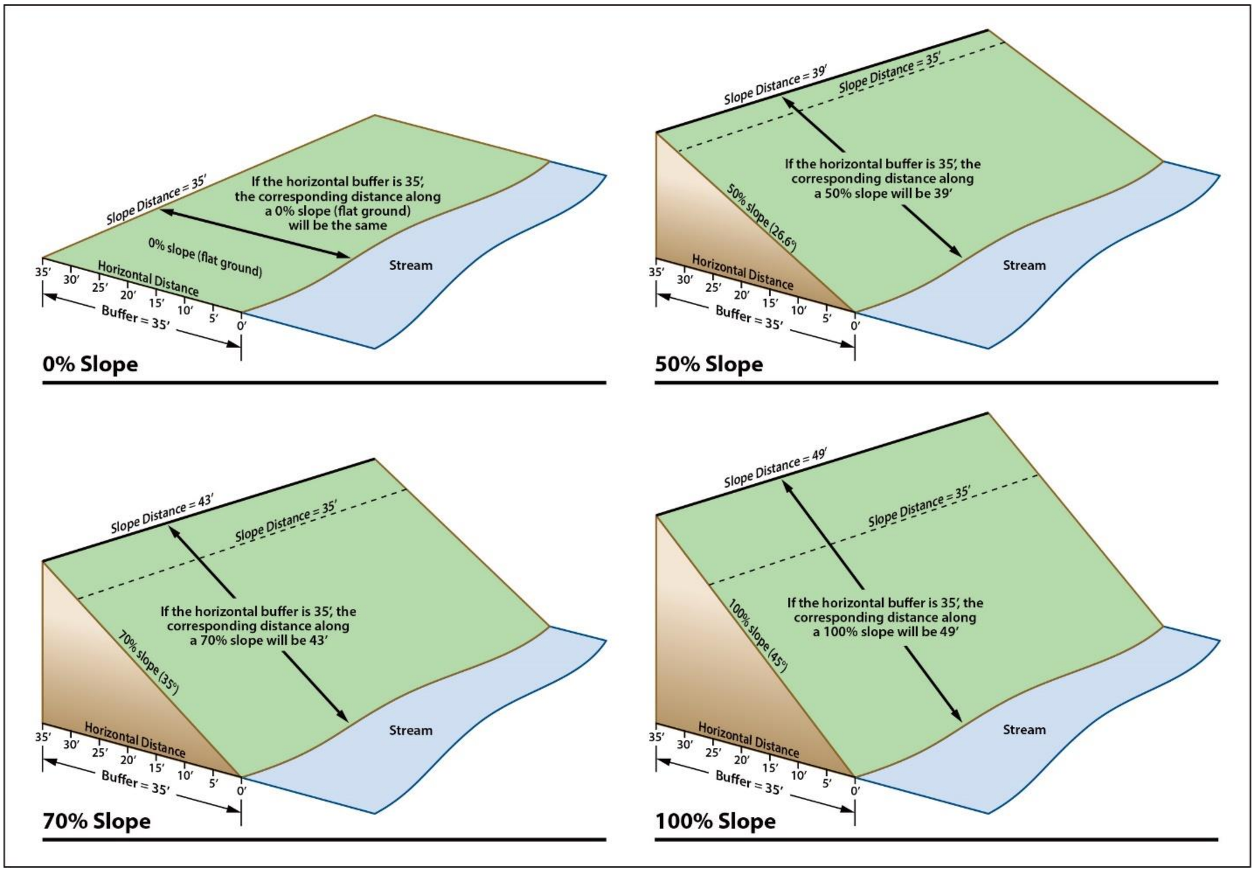


Figure 4-7.Examples of the Horizontal Distance Measurement of a 35-foot Riparian Conservation Area

Structure of Riparian Conservation Areas

The width of RCAs will vary based on stream size, stream type, and fish presence (fish versus non-fish) (Table 4-4 and Table 4-5; Figure 4-8). The structure of the RCAs is as follows:

- Large and medium non-fish-bearing streams will be treated the same as fish-bearing streams; all will have a 120-foot (horizontal distance) RCA that extends from the aquatic zone.
- Seasonal fish-bearing streams will have a 120-foot (horizontal distance) RCA for the entire stream segment (Table 4-3).
- Small, perennial non-fish-bearing streams will retain a 120-foot RCA (horizontal distance) for the first 500 feet upstream from the end of fish use on perennial fish-bearing streams, to create a temperature protection zone. The temperature protection zone will ameliorate the rise of stream temperature to less than 0.5°C above baseline prior to mixing with fish-bearing stream waters.
- Seasonal non-fish-bearing streams that are potential debris flow track or high-energy reaches that have the potential to deliver to fish-bearing streams will have RCAs that extend 50 feet (horizontal distance) from the aquatic zone for the first 500 feet upstream of the end of fish use to recruit wood into streams from standing trees. Upstream of the 500-foot temperature-protection zone, the buffer will be 35 feet (horizontal distance) from the aquatic zone, to the

potential initiation site in potential debris flow track or high-energy reaches (Table 4-4; Figure 4-9). This length and width is sufficient to contain 98% and 93% of all debris flow impact widths, respectively, based on unpublished debris flow track data collected from two 1996 storms (Robison et al. 1999.). As a result, existing standing trees and downed wood within reaches identified as likely debris flow tracks will be available as large wood inputs to the aquatic system, mimicking the natural mass wasting regime.

- Seasonal non-fish reaches that are not potential debris flow tracks or high energy as described above will not have an RCA, but they will have a 35-foot equipment restriction zone (ERZ). No ground-based equipment will be permitted within the 35-foot ERZ. If harvest does occur, it would be through hand felling, ground yarding using equipment with sufficient reach to remove trees, or cable yarding systems. Disconnected sections of seasonal streams (e.g., no stream channel or evidence of surface flow) will not have RCAs except ground-based equipment restrictions. The ERZ is further described in Conservation Action 2: Riparian Equipment Restriction Zones. The differing buffer strategies for the three seasonal stream types is depicted in Figure 4-10.

Table 4-3. Minimum Buffer Widths (Horizontal Distance) for All Type F and Large and Medium Type N

	Minimum Management Area Width (feet)	
Stream Type	**Type F**	**Type N**
Large	120	120
Medium	120	120
Small	120	See Table 4-4
Seasonal[a]	120	See Table 4-4

[a] Seasonal: A stream that does not have surface flow after July 15.

Table 4-4. Minimum Riparian Conservation Area Widths (Horizontal Distance) for Small Perennial and Seasonal Type N Streams

	Minimum Management Area Width (feet)	
Stream Type	**Within 500-foot Temperature Zone**	**Upstream of 500-foot Temperature Zone**
Perennial small Type N	120	35
Potential debris flow track (Seasonal Type N)[a]	50	35
High energy (Seasonal Type N)[b]	50	35
Seasonal other (Type N)[c]	0[d]	0[d]

[a] Potential debris flow tracks: Reaches on seasonal Type N streams that have a high potential of delivering wood to a Type F stream.
[b] High Energy: Reaches on seasonal Type N streams that have a high potential of delivering wood and sediment to a Type F stream during a high-flow event.
[c] Seasonal: A stream that does not have surface flow after July 15.
[d] A 35-foot equipment restriction zone will apply to these streams.

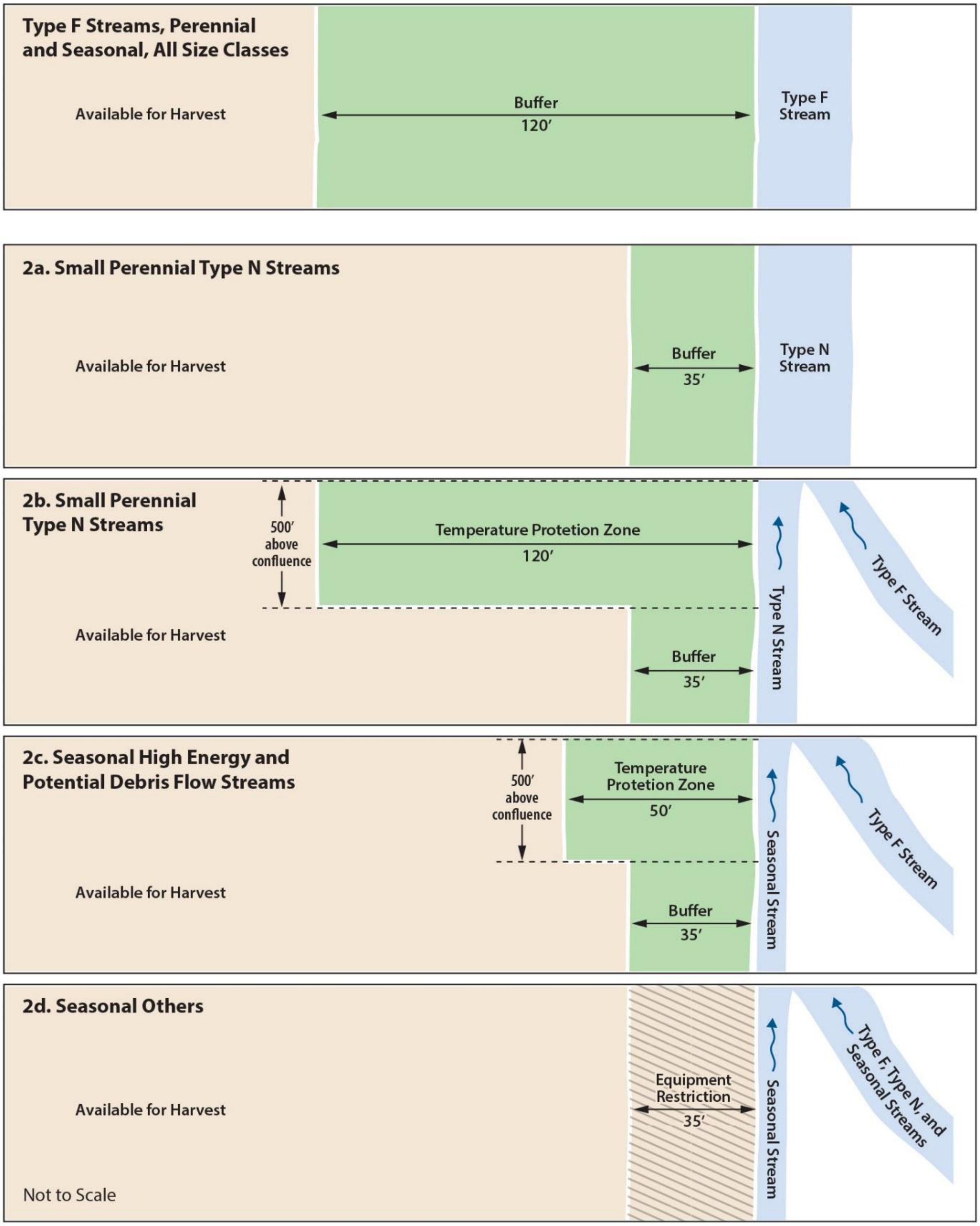


Figure 4-8. Riparian Conservation Areas on Type F Streams, Perennial and Seasonal, All Size Classes

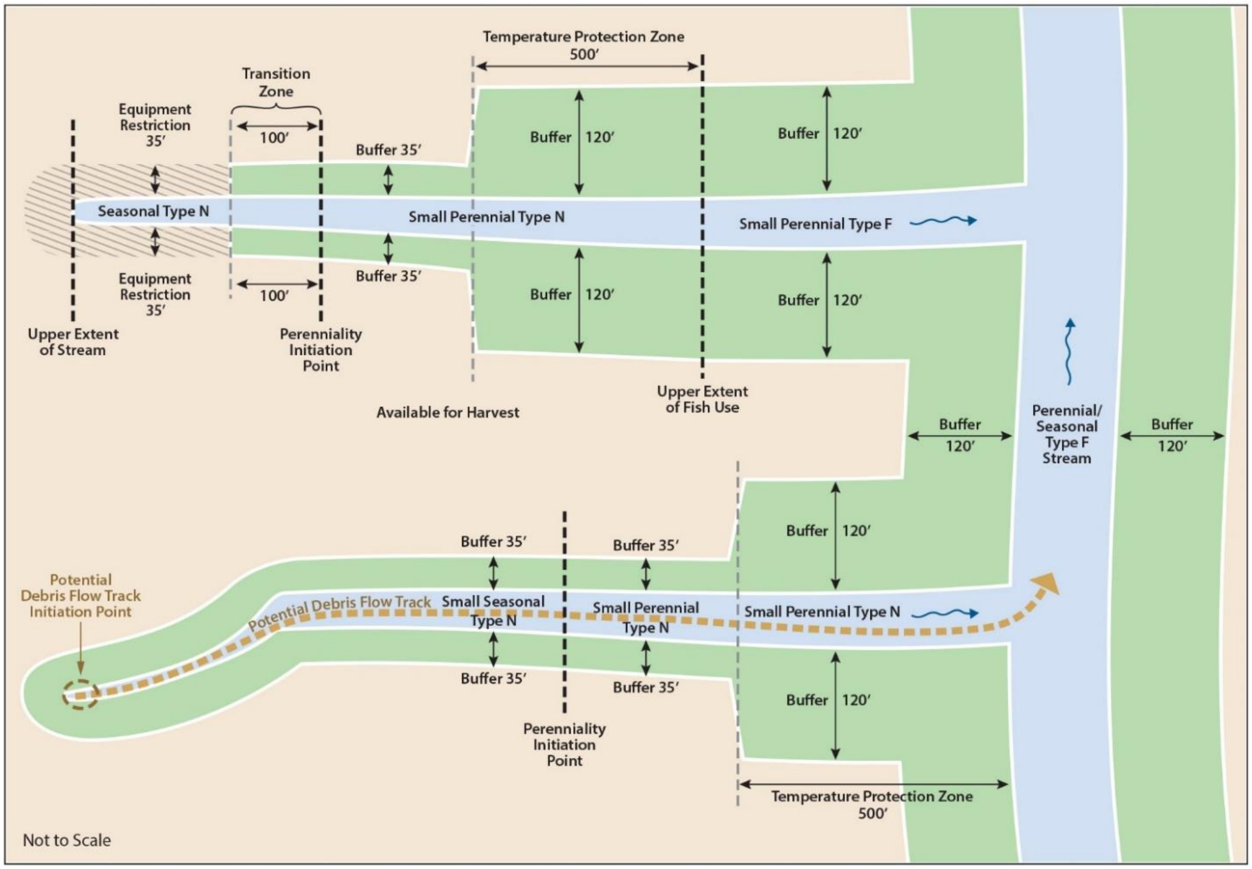


Figure 4-9.Riparian Conservation Areas in Temperature Protection Zones

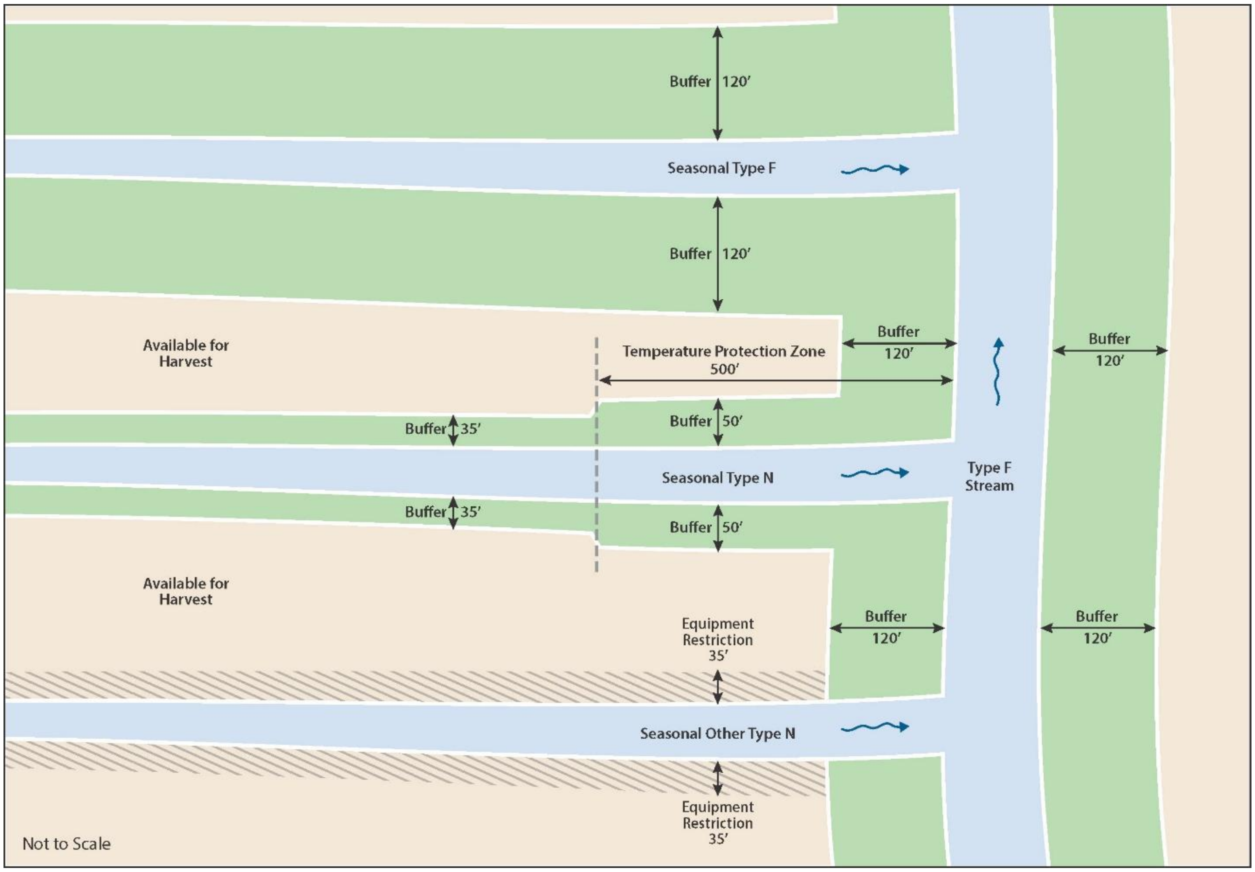


Figure 4-10. Riparian Conservation Areas Along Seasonal Streams

If stream-associated seeps and springs occur in a harvest unit, their extent will be evaluated when determining the RCA. Where a seep or spring is connected to a perennial stream, as determined by either surface flow or the presence of wetland plants and hydric soils, it will be included in the RCA buffer for that stream. Where the seep or spring is not fully encompassed by the RCA for the associated stream, the RCA will be extended to encompass it with a 35-foot buffer (Figure 4-11).

The width of the RCA will also be expanded, if necessary, to more fully encompass nearby unstable slopes known as inner gorges and aquatic adjacent unstable areas. Inner gorges represent over-steepened soil slopes or exposed bedrock next to a stream, where the stream-adjacent slope is significantly steeper[10] than the gradient of the surrounding upland hillsides. Inner gorges represent hydrology that is actively notching itself into the surrounding terrain, which often has a slope break paralleling the stream. Unstable slopes adjacent to streams are locations of active and former landslides and often have a more arcuate expression. Where either of these slope features are identified, the RCA will be extended. The extension will go to the inner gorge slope break or the top of the adjacent unstable slope, up to a maximum of 170 feet (horizontal distance) from the edge of the aquatic zone, whichever occurs first (Figure 4-11). The additional RCA width in these areas will ensure that landslides and other soil movement (i.e., sloughing) will function to the benefit of the aquatic system through wood delivery and nutrient cycling, and provide additional shade to streams where slope aspect is favorable.

[10] Significantly steeper means having a slope gradient adjacent to the stream of 70% (35 degrees) or greater, and where the height of the slope break is at least 15 feet (measured vertically) above the elevation of the channel.

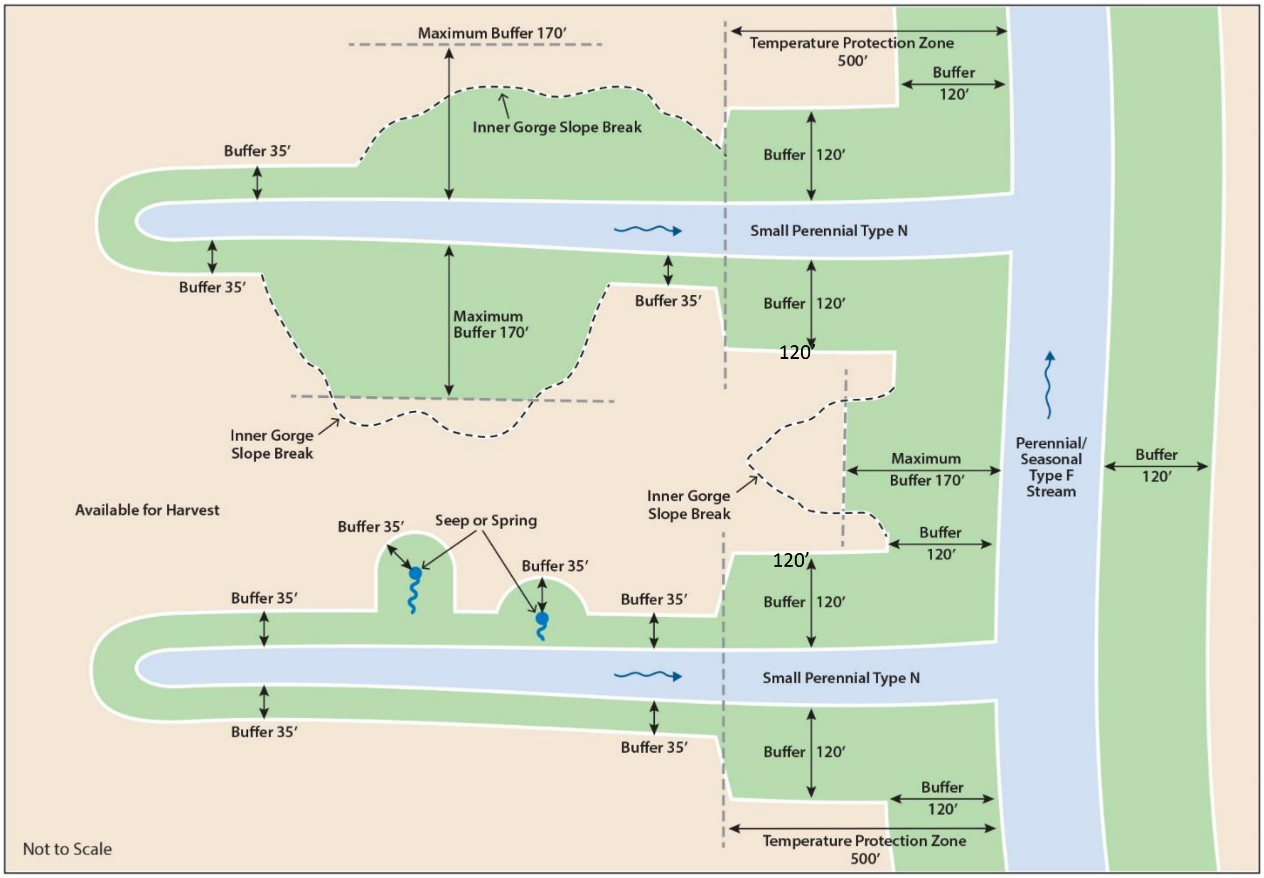


Figure 4-11. Effects of Seeps, Springs, and Inner Gorges on Riparian Conservation Areas

RCAs are intended to provide the ecological functions and processes required to create and maintain habitat for the covered fish species in the permit area (Reeves et al. 2016). The prescribed buffers in large and medium fish and non-fish streams, as well as small fish streams, are sufficient to capture large woody material projected to be available over the permit term, and provide shading to protect stream temperatures (TerrainWorks 2020). The amount of shade provided by streamside vegetation is perhaps the most important variable affecting stream temperatures in a forested environment (Groom et al. 2011).

Headwaters that do not support fish typically drain at least 60% to 70% of a catchment area, constitute up to 90% of the stream network's length, and provide a prey base, source of downed wood, and sediment input for downstream fish reaches (Olsen et al. 2007, Reeves et al. 2003). Along small non-fish-bearing streams, the overall goal of RCAs is to retain and grow vegetation sufficient to support important functions and processes in the various types of streams and to contribute to achieving properly functioning conditions in downstream fish-bearing waters, as well as benefit the Cascade and Columbia torrent salamander. The functions of these streams will be maintained by retaining vegetation in riparian areas during harvest activities. This HCP recognizes that a variety of small non-fish-bearing streams exists across the forest landscape and that these streams may differ in their physical characteristics, dominant functional processes, and contribution to watershed-level processes.

As stated previously, headwaters, which include seasonal streams, provide numerous ecological services. Furthermore, coho use the upper portion of coastal stream networks, including seasonal streams, for spawning and high-flow refuge. Wigington et al. (2006) found that overwinter smolt survival rates for juvenile coho is higher in seasonal streams than mainstems and equivalent to survival in perennial streams. The function of these seasonal streams will be maintained by retaining vegetation, minimizing soil disturbance, and protecting channel morphology in riparian areas during harvest activities.

Special Considerations for Unstable Slopes

Landslides are the dominant erosional process in the mountainous terrain of the northwest Oregon State forests, with shallow, rapidly moving landslides being a common feature. These landslides have a depth comparable to the rooting depth of vegetation in steep terrain, which is usually defined by a relatively hard, impermeable bedrock surface. Shallow slides usually only involve the upper weathered bedrock and overlying soil, are almost always less than 5 feet deep, and have been found to average only 2.5 feet deep at the initiation site (Robison et al. 1999). Because of these characteristics, they can be affected by timber harvest and related ground-disturbing activities.

Shallow, rapidly moving slides can originate in headwalls or elsewhere on mountain slopes. Some slides occur in the absence of forest-management activities, while some are related to past logging practices or current management activities. As landslides are initiated, debris moves downslope. In cases where the slide reaches the stream network, it may continue, incorporating water and becoming a more fluid mass known as a debris flow. Debris flows can gather volume by adding soil, stream sediment, and woody material as they traverse the stream network to lower topographic positions. These flows are events that can shape stream habitat in the permit area; however, not all landslides reach the stream network, and not all debris flows travel into fish-bearing streams. When debris flows enter fish-bearing streams, increased sedimentation can deteriorate instream habitat and water quality (Ubechu and Okeke 2017). Debris flows in headwater streams generally overwhelm the stream, cause scour, and do not add complexity. While debris flows can travel to fish-bearing streams and scour or bury habitat (Thompson and Service 2008), they can also deliver large woody material along with gravels, sands, and silt-sized material to streams. These organic and inorganic materials are requirements for long-term aquatic health affecting processes such as food sources, nutrient cycling, sediment routing, channel morphology, and refugia (Bilby and Bisson 2001). ODF uses geotechnical expertise in planning and carrying out management activities to minimize the increased risk of slope movements that can result from forest-management operations.

The channel network in the permit area will be evaluated on a harvest unit basis to determine which hill slopes and headwater streams are potential sources of debris flows to fish-bearing streams. Other features, such as inner gorges and aquatic adjacent unstable slopes, are also identified during harvest planning and the field assessment.

The field assessment will identify if the following:

- Potential for shallow landslides (harvest and road considerations, unstable legacy road side cast, etc.)
- Deep-seated landslides (road and waste area considerations)
- Signs of movement (cracking, piston butting, etc.)
- Recent landslides

- Forest Practices Act (FPA) Landslide and Public Safety Rules

Each of these potential unstable slopes are then added to the buffering scheme of the standard stream buffers identified above. Standing trees may also be left on adjacent areas that are not directly related to these riparian considerations, due to operational considerations. Designating these areas can help reduce the near-term likelihood of landslides due to harvest activities and support the delivery of large woody material to the aquatic environment when they do occur.

4.7.2 Conservation Action 2: Riparian Equipment Restriction Zones

As shown in Table 4-2, Conservation Action 2 is intended to support the following biological objectives.

- 1.1 Wood Recruitment
- 1.2 Implement Stream Enhancement Projects
- 1.3 Water Quality and Quantity
- 1.4 Fish Passage

RCAs (Conservation Action 1: Establish Riparian Conservation Areas) will be in place to conserve and maintain the riparian process as described in the biological goals and objectives. However, in some cases covered activities will need to occur inside of RCAs. Activities that could occur inside of RCAs will include establishing yarding corridors, constructing or maintaining roads (including temporary roads and stream crossings), vacating or decommissioning roads, developing recreation trails, and conducting stream-enhancement activities (including tipping/falling trees into the stream). If heavy machinery is used for stream enhancement, line-pulling is preferred for large tree installation. However, some machinery access is permitted for rock/log/tree placement or other restoration work.

Where these activities take place within an RCA, a 35-foot ERZ will be maintained, where vegetative, ground-disturbance, and tree-canopy removal will be minimized and best management practices followed. The ERZ will occur on both sides of the stream. This ERZ represents the land closest to the stream, including streambanks. Most riparian functions are supported to some extent by vegetation in this zone, including providing aquatic shade, delivering down wood and organic inputs (leaves and tree liter) to the stream and riparian area, stabilizing the streambank, contributing to floodplain functions, and influencing sediment-routing processes. To protect these processes ODF will minimize stream entry with machinery and choose locations to minimize the loss of riparian trees or cause increase erosion to the banks.

Management directions for how to operate inside of ERZs (0 to 35 feet) are listed below for each stream type.

- All Type F streams, all sizes (large, medium, and small)
    - Road, culvert, and restoration activities:
        - Limit work location and activities to access, excavation, and other earth work needed for construction/removal of stream crossings, culvert installation/replacement, and instream restoration projects.

    - Minimize construction and project footprint, and limit tree and vegetation removal to not extend beyond what is necessary to accomplish the activity.
    - Follow best management practices identified in Conservation Action 11: Road Construction and Management Measures.
  - Yarding activities:
    - No tree felling beyond what is necessary for safe, operational accommodation of the activity.
    - Less than 10% vegetative disturbance of overall work area.
    - Full suspension required during cable yarding.
    - No ground-based equipment operation.
    - Leave any trees damaged or felled in RCAs from yarding activities, unless designated for in-water placement in other areas.
    - Where possible, fall any trees toward the stream.
    - Average yarding corridors to be 15 to 20 feet wide, with a maximum of 35 feet, and be spaced no closer than 100 to 150 feet apart.[11]
- Large and medium Type N streams
  - Road, culvert, and restoration activities:
    - Limit work to only those actions required for construction/removal of stream crossings, culvert installation/replacement, and instream restoration projects.
    - Minimize construction and project footprint, and limit tree and vegetation removal to not extend beyond what is necessary to accomplish the activity.
- Follow best management practices identified in Conservation Action 11: Road Construction and Management Measures.
  - Yarding activities:
    - No tree felling beyond what is necessary for safe, operational accommodation of the activity.
    - Less than 10% vegetative disturbance of overall work area.
    - Full suspension required during cable yarding.
    - Average yarding corridors to be 15 to 20 feet wide, with a maximum of 35 feet, and be spaced no closer than 100 to 150 feet apart.
    - No ground-based equipment operation.
    - Leave any trees damaged or felled from yarding activities.
    - Where possible, fall any trees toward the stream.

[11] Actual yarding corridor width will be determined by the size of the tree crowns, to allow for yarding lines to be lifted through the canopy without damaging the crowns of remaining standing trees, and to allow for felled trees to be yarded into and through the corridor without damaging or becoming hung up on remaining standing trees.

- Small perennial Type N, small seasonal Type N: high-energy and potential debris flow tract streams
    - Road, culvert, and restoration activities:
        - Limit work to only those actions required for construction/removal of stream crossings, culvert installation/replacement, and instream restoration projects.
        - Minimize construction and project footprint, and limit tree and vegetation removal to not extend beyond what is necessary to accomplish the activity.
        - Follow best management activities identified in Conservation Action 11: Road Construction and Management Measures.
    - Yarding activities:
        - No tree felling beyond what is necessary for safe, operational accommodation of the activity.
        - No ground-based equipment operation.
        - Less than 10% vegetative disturbance of overall work area.
        - Leave any trees damaged or felled from yarding activities.
        - Average yarding corridors to be 15 to 20 feet wide, with a maximum of 35 feet, and be spaced no closer than 100 to 150 feet apart.
        - Where possible, fall any trees toward the stream.
- Other small seasonal Type N streams
    - Road, culvert, and restoration activities:
        - Limit work to only those actions required for construction/removal of stream crossings, culvert installation/replacement, and instream restoration projects.
        - Minimize construction and project footprint, and limit tree and vegetation removal to not extend beyond what is necessary to accomplish the activity.
        - Follow best management practices identified in Conservation Action 11: Road Construction and Management Measures.
        - Maintain integrity of stream channel.
        - No ground-based equipment operation.
        - Maintain non-tree vegetation.
        - Less than 10% vegetative disturbance of overall work area.
        - Leave existing down trees.

4.7.3 Conservation Action 3: Stream Enhancement

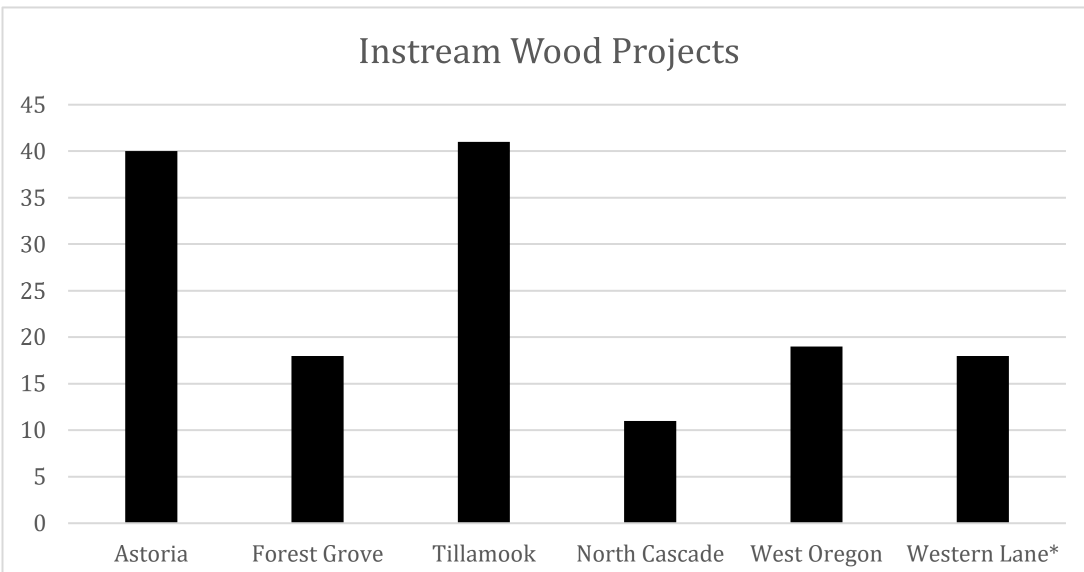
As shown in Table 4-2, Conservation Action 3 is intended to support the following biological objectives.

- 1.1 Wood Recruitment

- 1.2 Stream Enhancement Projects
- 1.4 Fish Passage

Stream enhancement projects will focus on restoring natural processes to create habitats that improve overall conditions for the covered species and other aquatic organisms in the permit area, allowing for immediate improvements to instream complexity, while the adjacent riparian forests are developing to provide long-term benefits. Appendix D provides an overview of fish populations in the permit area that could benefit from stream enhancement projects.

Over the course of 23 years (1995–2018) ODF has implemented 147 instream wood placement habitat projects in the permit area (Figure 4-12). These projects were designed and often implemented in collaboration with local ODFW biologists. Some projects were implemented during active harvest activities. Projects usually involved placing large woody material (typically at least five logs or trees per structure site with several sites per project) and/or boulders in streams to improve habitat conditions primarily for coho, but also for steelhead, or Chinook. During this same time period, ODF donated 7,009 logs to local watershed councils for use in similar stream enhancement projects that occurred throughout the species' range.



Source: OWEB 2020

*Western Lane totals represent data reported to Oregon Watershed Enhancement Board as Western Lane District, Coos District, and Grants Pass Unit, as all these lands are now managed out of the Western Lane District. Projects on Common School Forest Land in the Elliott State Forest are not reported in this graph.

Figure 4-12. Number of Stream Enhancement Projects Implemented by the Oregon Department of Forestry from 1995 to 2018 in the Permit Area, by Forest District

As described in Conservation Action 12: Establish and Maintain Conservation Fund, ODF will support restoration projects through the development of a conservation fund that can be used by ODF to execute restoration projects. For aquatics, the fund will focus on improvements that address limiting factors of the fish species covered by the HCP. Stream enhancement projects can range from simple projects like installation of large woody material to more complex floodplain reconnections or channel restoration projects.

Project planning and design will consider basin, watershed, species action plans and assessments, local knowledge and expertise of current habitat conditions, intrinsic potential, stream processes, and the disturbance regime at the watershed and basin scale to identify areas best suited for enhancement (Appendix D). Projects will be designed and implemented consistent with the natural dynamics and geomorphology of the site and with the recognition that introduction of materials will cause changes to the stream channel. Projects will be selected that contribute to the timely improvement of desired aquatic conditions for the covered species within the permit area, described in the biological objectives. Depending on available resources, projects will be designed to create conditions and introduce materials sufficient to enhance or reestablish natural physical and biological processes.

Identification of high-intrinsic-potential[12] stream reaches in the permit area will allow restoration projects to target key areas that will produce the most beneficial response for the covered aquatic species (Burnett et al. 2007). Targeting specific limiting factors, such as large woody material and overwinter habitat, will achieve immediate benefits to salmon. Long-term benefits will be achieved through a focus on restoring habitat-forming processes, riparian vegetation, and connectivity in line with the reach's natural potential.

Selecting Stream Enhancement Projects

Stream enhancement projects will supplement benefits that will be realized from implementation of the Riparian Conservation Areas. The actions work together to avoid, minimize, and mitigate effects on covered species.

The implementation of RCAs will minimize increases in stream temperatures, minimize sediment transfer to streams from covered activities, and facilitate the recruitment of wood through natural tree fall and debris flow events. Therefore, the primary focus of stream enhancement projects will be to address areas that are slow to recover from disturbance or past land use, or have deficient stream processes and/or habitat components that are required by the covered species. Stream enhancement projects, along with the remainder of the aquatic-related conservation actions, will collectively offset the impact of the taking of covered species over the course of the permit term.

ODF will consider the following factors when identifying, planning, and implementing stream enhancement projects:

- Ensure that stream enhancement projects are distributed in a fashion that addresses covered species at a level commensurate with the estimated level of effect from covered activities.
- Promote the recovery of the covered species by addressing a population(s) limiting factors.
- Promote the implementation of projects identified in local, state, or federal planning documents (e.g., recovery plans and watershed plans) that would provide the greatest benefit to the covered species through partnerships with watershed councils, industry, Non-Governmental Organizations, and state and federal agencies (e.g., NOAA Fisheries, USFWS, ODFW).
- Prioritize projects that advance, or provide added benefit, to previous stream enhancement projects.

[12] High-intrinsic potential is a measure of a stream's capacity to provide high-quality habitat based on a fish species' habitat requirement.

- Prioritize projects that can address multiple limiting factors over projects that address a single limiting factor, where applicable.
- Implement process-based restoration actions that create and maintain habitat. For instance, beaver reintroduction may be used in certain reaches to promote the creation of deep pool and off-channel habitat for juvenile salmon.
- Prioritize projects that occur in the permit area. However, ODF will consider projects that occur outside the permit area, but within a watershed under ODF ownership, that are key for recovery of the covered species. For projects that are located on ownerships outside the permit area, those land owners and managers must adhere to management standards in and around the project that will ensure the project meets its objectives.
- Consider project feasibility: site accessibility, construction cost, area of habitat gained/cost, level of risk.
- Select projects based on the best available scientific information, including watershed-level modeling, in conjunction with habitat and fish distribution data from ODFW and other sources to assess potential project benefits. Areas designated as critical habitat with high-intrinsic potential scores will be prioritized.

ODF will continue to support the implementation of the Strategic Action Plans for the Oregon Coast coho independent population. ODF involvement will include providing sites for restoration work, access, and materials (e.g., wood). ODF's continued involvement in the Strategic Action Plans will benefit Oregon Coast coho, as projects will be designed to address their limiting factors. These actions may occur outside the permit area but will be counted toward ODF's mitigation goal. As needed, ODF will obtain input from ODFW for Implementation Plans and Annual Operations Plans and identify potential stream enhancement opportunities that could be incorporated into timber harvest and other management activities to benefit the covered species.

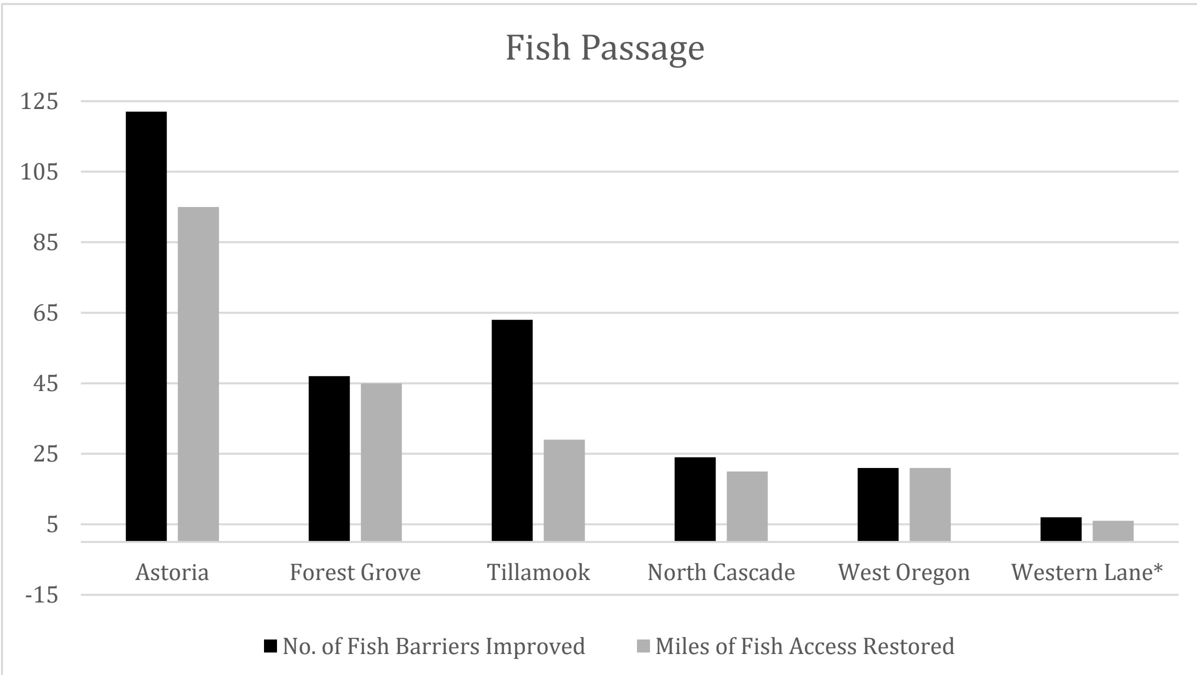
4.7.4 Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers

As shown in Table 4-2, Conservation Action 4 is intended to support the following biological objective.

- 1.4 Fish Passage

One of the biggest sources of salmon decline in the Pacific Northwest is the presence of a large number of artificial barriers, such as small dams, culverts, dikes, or levees that reduce or block access of salmon to large portions of their historical habitat (O'Hanley and Tomberlin 2005). Maintaining or improving fish passage through structures, such as culverts and other artificial barriers in streams, is critical to maintaining habitat connectivity (Roni et al. 2002). Reconnecting stream habitat that has been closed to salmonids is an important component when addressing impaired salmon stocks (O'Hanley and Tomberlin 2005). While fish passage is not identified as a primary limiting factor for the evolutionary significant unit/independent populations of covered salmonids, removing or improving fish-passage barriers in the permit area will benefit the covered species by increasing access to previously unavailable or underutilized habitat.

ODF has actively worked to replace blocked or undersized culverts to improve fish passage. Over the course of 23 years (1995 to 2018) ODF has implemented 284 fish-passage improvement projects to improve or open up access to 216 miles of stream. Most of this work has occurred in the Astoria District (Figure 4-13). Projects typically involved eliminating culvert jumps and placing new culverts so they will hold gravel and simulate a natural streambed.



Source: OWEB 2020

*Western Lane totals represent data reported to Oregon Watershed Enhancement Board as Western Lane District, Coos District, and Grants Pass Unit, since all these lands are now managed out of the Western Lane District. Projects on Common School land in the Elliott State Forest are not reported in this graph.

Figure 4-13. Number of Fish-Passage Projects Implemented from 1995 to 2018 in the Permit Area, by Forest District, and Miles of Fish Access Restored

In the permit area, there are currently 169 impassable fish barriers and 93 partial barriers, with the majority occurring in the northwest portion of the permit area (ODFW 2019; Table 4-5). During the Implementation Planning (IP) process, which occurs every 10-years as part of ODF's regular forest management planning process, fish barriers will be reviewed. ODF will prioritize improvements that will meet NOAA Fisheries' basin-wide objectives and have the greatest benefit for the covered species (fish and torrent salamanders). Following the prioritization process described by Roni et al. (2002), the review will identify culverts and other artificial blockages, along with specific information on habitat quality and quantity and fish presence and absence above and below each blockage. This will allow for a prioritized list of culvert upgrades and end-of-life culvert replacements based on a cost-benefit analysis within each implementation planning cycle. All new and replacement stream crossings will be designed to meet current NOAA Fisheries and ODFW passage criteria to maintain upstream and downstream passage for the covered fish species.

Table 4-5. Fish-Passage Barriers in the Permit Area by Independent Population

Population	Blocked	Partially Blocked	Unknown Anadromous	Total
Columbia River Chum – Coastal	14	9	18	41
Big Creek[a]	5	3	10	18
Claskanie River	7	5	8	20
Youngs Bay	2	1	0	3
Oregon Coast Coho	**124**	**83**	**51**	**258**
North Coast	**109**	**64**	**66**	**206**
Necanium	0	1	0	1
Nehalem	63	30	16	109
Nestucca	2	10	2	14
Tillamook Bay[b]	44	23	15	82
Mid-Coast	**9**	**8**	**10**	**27**
Siletz	0	2	1	3
Siuslaw	2	4	6	12
Yaquina[c]	7	2	3	12
Mid-South Coast	**3**	**1**	**5**	**9**
Coos	3	1	5	9
Lakes	0	0	1	1
Tenmile	0	0	1	1
Umpqua	**3**	**10**	**2**	**15**
Lower Umpqua	1	4	0	5
Middle Umpqua	1	1	0	2
South Umpqua	1	5	2	8
Upper Willamette River Chinook	**14**	**0**	**0**	**14**
Molalla River	3	0	0	3
North Santiam River	11	0	0	11
Upper Willamette River Steelhead	**16**	**1**	**3**	**20**
West Side Tributaries	16	1	3	20
SONCC Coho - Rogue	**1**	**0**	**0**	**1**
Illinois	1	0	0	1
Total	**169**	**93**	**72**	**334**

Source: ODFW 2019
Priority Barriers
[a] Gnat Creek Concrete Intake – Unknown Anadromous
[b] Tuffy Weir - blocked
[c] Unnamed Culvert – partial blocked

The following conditions identified in the inventory will be considered a priority for repair.

- Culvert outlet drops in fish-bearing streams.
- Nonembedded culvert with gradients above 0.5% slope.

- Structures such as old log fills.
- High washout potential due to an undersized structure and/or long steady grades below a stream crossing.
- Scour, oversteepening, or other erosion around culvert inlets and outlets.
- Structural deterioration of culverts.

From 1995 to 2018 ODF replaced an average of 12 culverts a year, with the number replaced being much lower in recent years because the most significant barriers (i.e., blocking the most habitat) had been completed. Recently, fewer more complex and costly replacements have been completed. ODF commits to repairing or replacing at least 50% of the culverts that do not currently meet fish-passage requirements to provide passage over the course of the 70-year permit term. This equates to improving 167 culverts that have been identified to date by ODFW (Table 4-5) as either complete barriers, a partial blockage, or unknown.

As shown in Table 4-5, three ODFW high-priority culverts in the permit area, one each in the Forest Grove, Astoria, and West Oregon Districts, were identified during the 2019 prioritization and will be reviewed by ODF for improvement as soon as feasible. These three barriers in the permit area are part of a larger group of barriers identified that represent the highest-priority fish barriers for fish passage in Oregon (ODFW 2019). These areas represent locations where culvert improvements would result in the greatest habitat gains for the covered species. These barriers will be corrected when they occur in a harvest unit. However, there is the likelihood that priority barriers will not overlap with proposed harvest units in the IP (10-year plan). If there is no overlap in harvest units and priority barriers, ODF will consider correcting these barriers, as mitigation, to maximize benefit to the covered species in the permit area. ODFW updates the fish-passage priority list every 5 years. At each update, ODF will determine if additional priority barriers have been identified in the permit area that require additional review by ODF during the IP and Annual Operation Planning (AOP) processes.

4.7.5 Conservation Action 5: Standards for Road Improvement and Vacating

As shown in Table 4-2, Conservation Action 5 is intended to support the following biological objectives.

- 1.3 Water Quality and Quantity
- 1.4 Fish Passage

As described in Chapter 2, many historic logging roads remain in the permit area that were not built to current design standards and can be improved. In other cases, historic roads were located in unsuitable areas and, therefore, cannot or should not be maintained because they are unstable, unsafe, or subject to chronic erosion. These unsuitable roads will be vacated, closed, and stabilized where possible. Both road improvement and road vacating are described in this conservation action as landscape enhancements. Conservation Action 10: Minimize Effects from Road Construction and Management on Covered Species, describes ODF's maintenance of existing and usable roads to ensure their continued stability in order to minimize erosion into aquatic systems.

4.7.5.1 Road Improvement Projects

Road improvement projects will occur at sites that have been determined to be high risk for the covered species due to accelerated erosion and sediment loading, changes in channel morphology, or runoff characteristics of watersheds, all of which cause secondary changes in channel morphology and affect fish habitat (Furniss et al. 1991). The purpose of road improvements and best management practices is to disconnect the road system hydrologically from the stream channels. Identification and prioritization of large road improvement projects will be done as part of each IP, and more opportunistic or immediate needs (e.g., unanticipated culvert failure) will be addressed through the AOP process. To determine what road segments pose a risk to the covered species, ODF will use the Forest Road Hazard Inventory (ODF 2000), or suitable surrogate, to review the current conditions of the road system in the permit area to identify potential erosion and landslide hazards in proposed harvest areas. Methods for identifying potential landslide areas include initial inspection of high-resolution topographic data (i.e., light detection and ranging [LiDAR]), aerial photographs and, where necessary, field survey by a geotechnical specialist to identify sites with a high likelihood of failure and delivery to a stream (Roni et al. 2002). This process will identify existing roads that should be reconstructed or considered for removal, based on factors identified below, to reduce the potential for failure or contributing sediment to the stream channel.

Sidecast Failures/Slope Stability

- Steep slopes.
- Nearby slope failures.
- High cut slopes, i.e., over 15 feet high.
- Sidecast over 2 feet deep on steep slopes.
- Fills supported by trees and/or organic debris.
- Arc-shaped cracks in the fill or other evidence of fill movement.

Water Quality/Sediment Delivery[13]

- Direct delivery of sediment in runoff water from roads to streams.
- Ditch downcutting.
- Inadequate depth and/or poor-quality road surfacing.
- Damaged, collapsing, and/or inadequate drainage relief structures. Relief culvert shall be placed at a minimum of 200 feet away from any stream crossing, where possible, to allow filtering of sediment from the road ditches or upslope vegetation.

Eroding Soil on Cut-and-Fill Slopes

- Buried culverts.
- Fill erosion at culvert outlet.

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[13] Hydrologically disconnecting the road system from the stream.

Current/Planned Uses of Road

- Unsafe conditions are present, i.e., width, alignment, visibility, etc.
- Volume of traffic exceeds road design.
- Road surfacing will not accommodate current/planned uses.

Several factors will affect the final ranking of road improvement projects. Included are factors, such as the need and timing of the planned uses of the road; costs and biological benefits of the project; amount and type of environmental damage that is occurring or could occur; likelihood that damage will occur; and the risk of impacts on human life/safety or private property. Factors such as the availability of funds, equipment, staff capacity, the time of the year, and potential impacts on covered species will affect the scheduling of road improvement projects.

Improvements may include the following items.

- Re-aligning the horizontal and/or vertical alignment of the road.
- Upgrading stream crossings and culverts to meet fish-passage standards (Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers).
- Installing additional cross-drainage structures.
- Reshaping the roadbed and/or ditch line for improved surface drainage.
- Upgrading the road surface by adding new rock.
- Removing and/or stabilizing fill slopes that exhibit instability.
- Relocating sections of roads away from sensitive areas, such as streams.
- Repairing washouts, fill or cut slope failures, and severe damage to road surfacing.

The design of road improvement projects will follow the general guidelines for road design and construction described previously. However, because of the nature of some road improvement projects, additional engineering and design work may be needed before construction begins.

4.7.5.2 Road Vacating

Some roads, including legacy roads, may need to be vacated due to their proximity to a fish-bearing stream, high erosion potential, or landslide hazards that could affect the covered species, and because these issues cannot be addressed with road improvement projects. The purpose of vacating roads is to disconnect the road system hydrologically from the stream channels. Vacated forest roads will be left in a condition where road-related damage to the waters of the State is unlikely. When a road is to be vacated and taken off the active road network, erosion prevention work will be performed so that continued maintenance is not necessary. Vacated roads will have sidecast material, stream crossings, culverts, cross drains and fills removed; unstable road and landing fills excavated; ditch and road surfaces treated to disperse runoff and prevent surface erosion; and exposed soils revegetated. Segments of a road that have near-natural levels of risk for sediment delivery can be left intact and receive minimal road drainage improvements.

Over the course of 23 years (1995 to 2018) ODF closed or vacated 138 miles of road in the permit area, primarily to reduce sediment transport to the aquatic system. Where feasible, alternate routes were established in ridgetop locations, and some legacy roads were no longer needed for forest-management activities. The majority of this activity occurred in the Astoria District (Table 4-6).

Table 4-6. Miles of Roads Closed and Vacated (1995–2018)

District	Miles of Roads Vacated
Astoria	68
Forest Grove	8
Tillamook	31
North Cascade	14
West Oregon	4
Western Lane[a]	13
Total	**138**

[a] Western Lane totals represent data reported to the Oregon Watershed Enhancement Board as Western Lane District, Coos District, and Grants Pass Unit, because all these lands are now managed out of the Western Lane District.

During the permit term, ODF will review roads during the IP and AOP processes to identify sections that will be improved, vacated, closed, and/or gated in across the permit area to benefit the covered species.

4.7.6 Conservation Action 6: Establish Habitat Conservation Areas

As shown in Table 4-2, Conservation Action 6 is intended to support the following biological objectives.

- 4.1 Oregon Slender Salamander Habitat
- 5.1 Existing Northern Spotted Owl Nesting, Roosting, and Foraging Habitat
- 6.1 Existing Marbled Murrelet Nesting Habitat
- 6.2 Marbled Murrelet Nesting Habitat Enhancement
- 7.1 Red Tree Vole Habitat
- 7.2 Red Tree Vole Habitat Enhancement
- 8.1 Coastal Marten Habitat

The designation, preservation, and long-term enhancement of HCAs throughout the permit area is the primary conservation action intended to conserve, maintain, and enhance habitat for the terrestrial covered species. As described below, ODF will immediately designate upon permit issuance 275,000 acres of HCAs in 200 units to support the persistence of northern spotted owl, marbled murrelet, red tree vole, Oregon slender salamander, and coastal marten. These HCAs (and the portion of RCAs within them) represent 43% of the permit area that will be conserved, maintained, and enhanced to provide habitat for covered species throughout the permit term (Attachment A).

Ownership patterns also played a major factor in determining the location and extent of HCAs, including designating large HCAs where other public lands are lacking and ODF is the majority public land owner. Such areas occur primarily in the northern portion of the Coast Range Ecoregion. Of nine HCAs greater than 5,000 acres, eight are in the Clatsop and Tillamook State Forests (Coast Range Ecoregion), and one is in the Santiam State Forest (West Cascades Ecoregion). HCAs between 1,000 and 5,000 acres occur throughout the permit area, but are located predominantly on the north coast (13 of 23). Smaller HCAs are found throughout the permit area, but predominate on lands outside the north coast, where ODF managed lands are smaller and more scattered. These smaller HCAs are designated to protect known species occurrence, or provide connectivity between federal lands within smaller patchwork ownership patterns.

The overall purpose of HCAs includes the following.

- Conserve, maintain, and enhance existing habitat for terrestrial covered species in the permit area over the permit term.
- Improve lower quality habitat in HCAs, where necessary and where such treatments can be implemented effectively and efficiently, including expanding and connecting existing habitat to improve landscape-level habitat value.
- Limit management activities in HCAs to those necessary and prudent to improve habitat quality over the permit term.

Forests within HCAs will be managed to maintain and develop late-seral structure stands as they relate to specific habitat needs for individual covered species. As described under Conservation Action 7: Manage Habitat Conservation Areas, HCA standards will direct land-management activities in HCAs to improve long-term habitat values for covered species in HCAs.

HCA Design Criteria

ODF designed HCAs to avoid, minimize, and mitigate for the impacts of take of terrestrial covered species to the maximum extent practicable while maintaining an economically viable harvest program (Attachment A).

The primary design criteria for HCAs is to conserve, maintain, and enhance habitat in and adjacent to existing occupied habitat, as well as to increase overall habitat values for covered species at the landscape level. Over the course of the permit term, the HCAs will result in interconnected blocks of covered species habitat to help meet the goals and objectives stated in this HCP, including supporting the persistence of covered species under changing circumstances related to climate change.

The permit area contains patches of habitat suitable for covered species interspersed within a matrix of less suitable habitat or areas that are unsuitable. HCAs were designed to provide both local and landscape contiguity, and as a result contain both suitable habitat and non-habitat areas. Suitable habitat within HCAs will be managed only as needed to maintain or accelerate development of mature habitat conditions. Unsuitable habitat will be allowed to develop naturally into habitat or managed to accelerate development of suitable habitat to expand and connect existing habitats (Conservation Action 7: Manage Habitat Conservation Areas).

HCA design criteria includes maintaining known habitat areas for protection of northern spotted owl and marbled murrelet nest sites. HCA boundaries provide buffering to known occupied species habitat, to avoid creating hard edges (e.g., within 100 meters of marbled murrelet nesting habitat). ODF will use both passive management and targeted silvicultural activities to increase the quality and quantity of covered species habitat over time in the HCAs. Improvement of covered species habitat in HCAs will balance habitat removed from covered activities outside of HCAs over the course of the permit term.

HCAs were established by considering the following criteria and available data.

- **Occupied habitat:** Areas where covered species are known to currently exist, including nesting locations and occurrence data for northern spotted owl, marbled murrelet and, where available, red tree vole.
- **Historically occupied habitat:** Areas where covered species have been documented in the past 30 years and where habitat remains, but where status is currently unoccupied or unknown. Historic sites with documented occupancy or occurrence over multiple years were identified as a priority for conservation.
- **Suitable habitat:** Areas that contain habitat suitable for covered species as defined by the habitat distribution models in Chapter 2 but that are currently unsurveyed or unoccupied.
- **Future habitat adjacent to suitable habitat:** Areas that do not currently contain suitable habitat but are adjacent to or close to areas with suitable habitat, and that can become suitable habitat efficiently and effectively, either passively or through active management. Over time, this will increase late-seral habitat amount, patch size, and connectivity, creating larger and better-connected blocks of suitable habitat than exist today.
- **Patch size:** Areas that already contain larger blocks of suitable habitat, as well as occupied habitat that is fragmented but that could be consolidated through long-term habitat development in areas between habitat patches.
- **Edge:** HCAs were designed to minimize the edge-to-area ratio to reduce "edge effects" on covered species, particularly marbled murrelet. This includes both patch HCA shape configuration and the inclusion of unsuitable habitat adjacent to designated occupied habitat.
- Proximity to other HCAs and suitable **Proximity**: Areas that are in proximity of other HCAs and suitable habitat managed by federal entities.
- **Adjacency**: Areas where the permit area is adjacent to covered species occurrences and habitat located on federal lands.
- **Geographic representativeness:** Areas that could serve to create an HCA network that is distributed across the permit area—rather than concentrated in a few areas—to maintain habitat availability across the full range of each covered species in the permit area (thus protecting the genetic diversity within subpopulations of covered species).

HCA Designations

The HCP designates 200 HCAs, totaling 273,000 acres, or 43% of the permit area (including portions of RCAs occurring in HCAs). Designated HCAs include blocks of habitat in the northern portion of the Oregon Coast Ecoregion, an area where state lands are believed to be essential in maintaining and expanding the current distribution of both northern spotted owls and marbled murrelets (USFWS 2011, 1997). Appendix E includes additional details and a map set of designated HCAs.

Table 4-7 summarizes the acres of suitable and highly suitable habitat in the permit area and the percentage of acres included in HCAs for the covered species. Additional habitat to be created over the term of the HCP is described under Conservation Action 7: Manage Habitat Conservation Areas.

Table 4-7. Acres of Modeled Suitable or Highly Suitable Covered Species Habitat in Habitat Conservation Areas

Species	Habitat in Permit Area at Beginning of Permit Term	Habitat in HCAs at the Beginning of Permit Term	% of Total in Permit Area	Habitat in Permit Area at End of Permit Term	Habitat in HCAs at end of Permit Term	% of Total in Permit Area	HCP Commitment to Conserve, Maintain, and Enhance Habitat[b]
Northern spotted owl[a]	42,000	31,000	72%	197,000	180,000	91%	130,000
Marbled murrelet	16,000	15,000	93%	160,000	148,000	92%	95,000
Red tree vole	37,000	31,000	85%	159,000	147,000	93%	90,000
Oregon slender salamander	23,000	17,000	74%	27,000	19,000	73%	16,000

[a] 28 out of 31 active northern spotted owl nest sites are inside of HCAs

[b] Commitments to conserve, maintain, and enhance acres of covered species habitat were estimated based the assumption that within the permit term 50% of highly suitable habitat and 80% of suitable habitat could be achieved in the permit area (primarily inside of HCAs)

4.7.7 Conservation Action 7: Manage Habitat Conservation Areas

As shown in Table 4-2, Conservation Action 7 is intended to support the following biological objectives for increasing long-term habitat for terrestrial species.

- 5.1 Existing Northern Spotted Owl Habitat
- 5.3 Northern Spotted Owl Habitat Enhancement
- 6.2 Marbled Murrelet Nesting Habitat Enhancement
- 7.2 Red Tree Vole Habitat Enhancement
- 8.2 Coastal Marten Habitat

As described in Conservation Action 12: Establish and Maintain Conservation Fund, ODF will support the management of habitat conservation areas through the development of a conservation fund, which can be used by ODF to implement specific management standards in HCAs over the life of the HCP. The overarching management objective for HCAs is to increase the quality and quantity of habitat for terrestrial covered species. Therefore, the only management actions that will occur in HCAs are those that will contribute toward achieving that objective, or at least do not preclude that the objective will be achieved (e.g., recreation activities conducted consistent with the HCP and ITP). The purpose of HCA management standards is to provide clear guidance for implementing on-the-ground actions in HCAs consistent with the goals and objectives of the HCP. HCA management standards for covered activities in HCAs are presented in Table 4-8. These standards will be applied in all HCAs; however, they are most applicable to early- and mid-seral stands in HCAs, where the majority of active management to enhance habitat conditions is expected to occur.

All management within this conservation action will be performed consistent with Conservation Action 10: Seasonal Operational Restrictions.

Management of Existing Late-Seral Habitat in Habitat Conservation Areas

Stands in HCAs that already contain late-seral habitat suitable for covered species are expected to require minimal management to maintain suitable or highly-suitable habitat conditions for covered species. Therefore, management of existing late-seral habitat in HCAs will be limited to treatments that will clearly enhance habitat in the near-term by creating specific habitat components such as snags or small (0.5 to 2 acres) stand gaps to increase stand heterogeneity. Insects and disease and fire are natural components of forest ecosystems, and treatments to address these risks may entail short-term degradation of late seral stands that are already functioning as habitat for covered species. For instance, the removal of ladder fuels can reduce canopy layering, or the removal of insect infested trees can result in less future snag and large wood recruitment. As a result, late seral habitat within HCAs will generally not be managed. Instead, treatments to reduce fire, insect and disease risk will occur in stands adjacent to late seral habitat, rather than within late seral habitat. Fire risks may increase over time due to climate change (Oregon Climate Change Research Institute 2017), so actions to reduce fire risks to late seral habitat may also increase over time, but this should be partially ameliorated by treatments in other stands and the ingrowth of additional late seral habitat within HCAs over the permit term.

Application of conservation actions will be based on site-specific conditions, as informed by forest inventory data and baseline surveys. Specific treatments will also follow measures to minimize displacement or disturbance to covered species, as outlined in Conservation Action 10: Seasonal Operational Restrictions.

Management to Accelerate Development of Late-Seral Habitat in Habitat Conservation Areas

Managing stands in HCAs that are lacking late-seral forest habitat characteristics will help promote those habitat components needed by the covered species. These important characteristics include large trees and snags, multistoried and multi-species canopies, and large woody material. The primary purpose of these management actions is to selectively and strategically improve and accelerate development of such habitat characteristics for terrestrial covered species that rely on late-seral forests.

There is broad professional consensus that thinning and other silvicultural treatments can accelerate the development of late-seral forest, including habitat suitable for northern spotted owls (Kuehne et al. 2015, Dodson et al. 2012, Andrews 2005). The Revised Recovery Plan for Northern Spotted Owl (USFWS 2011) notes that thinning can be effective in accelerating development of northern spotted owl habitat, particularly in stands 50 years or older that contain uniform, densely stocked stands that are not likely to achieve habitat complexity for many decades without intervention. Newton et al. (2015) found that variable density thinning within such stands (50 to 55 years old) allowed development of some larger trees by the age of 65, as well as increasing overall structural and tree species diversity. While thinning may have short-term adverse effects on habitat quality (USFWS 2011), Newton et al. (2015) reported that crown cover increased rapidly during the 15 years following thinning. In addition, these younger stands typically have lower habitat suitability, so short-term effects of thinning are less impactful to covered species. ODF will manage varying types of partial cutting (i.e., thinning, variable density retention harvest, patch cuts) to increase vertical and horizontal spatial heterogeneity, overall tree size, and understory development. As a given stand becomes older, the intensity of silviculture applied becomes generally less intensive, to balance potential short-term adverse effects with long-term habitat development (Chapter 3; Table 4-9).

In addition to increased suitable habitat over time for northern spotted owl (Objective 5.3), these types of management activities will also serve to achieve biological objectives for marbled murrelet (Objective 6.2) and red tree vole (Objective 7.2; Table 4-8). Application of management activities to accelerate development of late-seral habitat will be based on site-specific conditions, as informed by forest inventory data and baseline surveys, and occur primarily early in the HCP permit term, in order to realize the benefits to these species prior to the end of the permit term. For instance, management of younger stands with a significant amount of western hemlock infected with dwarf mistletoe may develop large limb structures that are suitable for marbled murrelet nesting platforms. Specific treatments will also follow measures to minimize disturbance to covered species, as outlined under Conservation Action 10: Seasonal Operational Restrictions.

Types of Management Actions

[**Note to Reader:** *Silvicultural prescriptions that will be used in HCAs, including the pace and scale of those activities, are still under discussion and refinement by the Scoping Team. Ultimately this section will detail the decision making process for management decisions in HCAs, the criteria or occasions* *when different management prescriptions will be utilized, and the expected biological outcomes and benefits for covered species. Those refinements are currently under discussion with the Scoping Team*.]

Table 4-8 describes specific management standards to apply for management actions to be taken to improve habitat conditions, as well as management standards for other ODF covered activities.

Table 4-8. Management Standards for Habitat Conservation Areas

[**Note to Reader:** *A table will be included which outlines silvicultural practices that will occur in HCAs and the expected biological outcomes, once those practices have been defined and reviewed by the Scoping Team.]*

4.7.8 Conservation Action 8: Conservation Actions Outside Habitat Conservation Areas and Riparian Conservation Areas

As shown in Table 4-2, Conservation Action 8 is intended to support the following objective.

- 4.1 Existing Oregon Slender Salamander Habitat
- 5.1 Existing Northern Spotted Owl Habitat
- 5.2 Northern Spotted Owl Dispersal Habitat

Objective 5.2 will be maintained outside of HCAs. It is also intended to increase forest structure outside of HCAs to support other covered terrestrial species movements across the landscape, including support of Objective 4.2, Downed Wood, for Oregon slender salamander.

Under the conservation strategy, approximately 325,000 acres (51%) of the permit area will be outside of HCAs or RCAs. This conservation action describes the approach ODF will take to manage this important component of the landscape to avoid and minimize adverse effects on covered species from the activities covered under this HCP.

The area outside of HCAs and RCAs is essential to sustainable and predictable timber harvest and revenues for ODF. To this end, ODF will manage those areas to achieve multiple values, including social, environmental, and economic values. In the most productive forest lands, most stands will be managed for timber production, with a focus on growing stands that generates a product mix of predominantly large and medium sawtimber. This will be accomplished by growing most stands to the culmination of mean annual increment (CMAI). CMAI represents the point at which the growth rate of a stand begins to slow, or culminate, due to competition for resources among the trees in the stand as the relative density of the trees increase. CMAI occurs at varying stand ages, depending on initial planting density, species mix, site productivity, and density management. In the majority of cases, a stand will be planted and receive a precommercial thinning and at least one commercial thinning entry prior to regeneration harvest. Depending on individual site conditions, a stand may receive two commercial thinning entries, or none at all.

In implementing this conservation action, ODF will commit to standards that improve landscape-level forest structure through multiple measures, including using a green tree retention strategy that prioritizes leaving the oldest, largest trees, especially those with large branches or other characteristics desirable for the covered species, during regeneration harvest. Where these trees persist until the next harvest, they would again be prioritized for retention, as the oldest, largest trees. The standards are intended to create landscape-level habitat values for covered species, including foraging habitat and connectivity between designated HCAs (Conservation Action 6: Establish Habitat Conservation Areas). This strategy, in conjunction with habitat-centric silvicultural activities and passive management in HCAs, will allow overall forest conditions that function to the benefit of the covered species.

An important aspect of the strategy is that habitat values provided for covered species outside of HCAs and RCAs will be dynamic, with habitat values that are gained in one area over time being eventually lost through harvest. However, some of these same values will be replaced elsewhere in the permit area as legacy structure increases over time. Using this approach, when combined with management of HCAs, habitat values at the landscape level will be improved over the permit term.

Landscape-Level Management Standards

Maintain a Minimum Amount of Northern Spotted Owl Dispersal Habitat on the Landscape

One of the primary management standards will be the commitment to maintain northern spotted owl dispersal habitat across the permit area. This HCP defines dispersal habitat the same as the criteria for dispersal habitat in the 2011 recovery plan (USFWS 2011): Stands of trees averaging 11 inches in diameter at breast height (DBH) or greater and at least 40% canopy closure (Appendix C). This translates into habitat that is modeled as marginal habitat as described in Chapter 2 and Appendix C. To meet Objective 5.2, ODF will maintain a minimum 40% of the permit area outside HCAs and RCAs in conditions that meet the definition of dispersal habitat for northern spotted owl (i.e., modeled *marginal* habitat quality).

This target for northern spotted owl dispersal habitat outside of HCAs is supported by recent studies. For example, Davis et al. (2016) found that a threshold of at least 40% dispersal habitat across the landscape accounted for 90% of documented northern spotted owl movements reported by Forsman et al. (2002). ODF will maintain a minimum of 40% dispersal habitat over the permit area, including habitat both inside and outside of HCAs and RCAs. The overall percentage and spatial arrangement of dispersal habitat will vary, based largely on habitat conditions and known habitat-management strategies on lands adjacent to the permit area (e.g., federal species and habitat occurrence managed under the *Northwest Forest Plan* [USDA and USDI 1994], versus industrial forestlands without a specific habitat management plan).

Stand-Level Management Standards

Retain Forest Legacy Features

Other management standards are intended to retain and improve the existing structure in managed stands over time. These structures consist primarily of existing old-growth, large trees and snags (both scattered and grouped), and downed wood. Management standards have been designed to provide land managers with flexibility in developing site-specific plans.

Within other stands, higher levels of retention will be made during harvests to achieve a greater structure, including within-stand and landscape-level habitat structure and diversity. Table 4-9 summarizes the management standards that will be applied throughout the term of the HCP.

Table 4-9. Timber Stand Management Standards Outside of HCAs and RCAs

Category	Management Standards
Maximum size of regeneration harvest allowed	• *Per FPA*: 120 acres
Minimum distance between adjacent regeneration harvest units	• *Per FPA*: No harvest within 300 feet of the perimeter of a prior harvest unit if the combined acreage of the harvest would exceed 120 acres in size, unless the prior harvest unit has been reforested as required by all applicable regulations and: ○ At least the minimum tree stocking required by rule is established per acre; and either ○ The resultant stand of trees has attained an average height of at least 4 feet; or ○ At least 48 months have elapsed since the stand was created and it is “free to grow” as defined by the FPA.
Spotted owl dispersal habitat maintenance	• At least 40% of stands will be in a condition that meets the definition of northern spotted owl dispersal habitat across the permit area. at all times.
Leave tree retention	• Two trees per acre would be retained within any timber stand harvested using regeneration harvest techniques. Trees selected for retention will be prioritized using the following criteria, during each final harvest, with the intention that selected trees will persist through multiple harvests for the duration of the permit term: ○ Known nest trees and groups of trees around nest trees. ○ Trees older than 120 years old. ○ Trees with key habitat features (e.g., large branches, broken or forked tops, cavities). ○ Trees from the dominant cohort of the stand.
Snag retention	• Two snags per acre, in addition to the two green trees per acre above. Snags selected for retention will be prioritized using the following criteria: ○ Minimum 30 feet tall. ○ Largest diameter available (minimum 11 inches DBH). ○ Snag decay class 2 through 5, preferring least decayed (Thomas et al. 1979). ○ Located within, or adjacent to, patches of retained green trees. • In stands where existing snags are fewer than two per acre, retain all snags over 20 inches DBH unless such snags are determined to be a safety hazard. In stands with less than one existing large (greater than 24 inches DBH and 20 feet tall) snag per acre, leave two additional live trees per acre, using the leave tree retention criteria above.

Category	Management Standards
Downed wood retention	• During harvest activities, retain existing down logs. During regeneration harvest, retain an average of 600 to 900 cubic feet of hard conifer logs (decay class 1 and 2) per acre, including an average of two logs per acre greater than 24 inches in diameter (at the largest end), where available. ○ Where this is not available, leave as many 24-inch-diameter (at the largest end) logs as possible and consider additional green tree or snag retention for future natural downed wood recruitment. • Retain nonmerchantable coarse woody debris on site. • Minimize use of broadcast or pile burning to that needed to meet site productivity, reforestation and fuels reductions goals and retain wood piles for habitat values. • In Oregon slender salamander habitat, ensure supply of decayed downed wood, snags, and trees larger than 20 inches DBH.

[a] Harvest Type 1 is heavy thinning. Harvest Type 2 consists of clearcuts with some residual seedlings, saplings, and poles retained. Harvest Type 3 consists of clearcuts with few residual trees left.

4.7.9 Conservation Action 9: Strategic Terrestrial Species Conservation Actions

The conservation strategy will result in an increase in habitat for all of the terrestrial covered species, but other factors may remain that limit the ability of covered species to take advantage of the new habitat and for populations to increase. The Conservation Fund, described in Conservation Action 12 and in Chapter 9, *Cost and Funding*, will provide funding on an annual basis to address these limiting factors. The priorities for how the Conservation Fund is used will change during the permit term but ODF will work with USFWS and ODFW along with species experts and other state and federal partners to identify where and how Conservation Fund monies are spent. Expenditures will be tracked and reported annually. Use of the funds will generally fall into four categories:

1. Address known stressors on species survival (e.g., barred owl on Northern Spotted Owl).
2. Research on covered species are responding to management actions in HCAs.
3. Implement activities to boost species populations (e.g., NSO reintroduction).
4. Gain a better understanding of species ecology or habitat use that could influence how management actions are used in HCAs.

Some of specific uses of the Conservation Fund for terrestrial species are known, while others will emerge during the permit term.

Barred owl removal

Regardless of the amount and type of habitat that is in the permit area barred owls continue to stress northern spotted owl populations. One potential use of the fund would be to establish and/or support regional barred owl management removal projects/programs that are led by USFWS. ODF will work in concert with USFWS and other regional partners—including ODFW, Bureau of Land Management (BLM), and U.S. Forest Service (USFS)—and non-federal landowners to conduct barred owl management programs across private, state, and federal lands.

Competition with established populations of barred owls is a prominent and complex threat to the long-term persistence of the northern spotted owl (USFWS 2011; Lesmeister et al. 2018; ODF 2019). Barred owls appear to co-occupy and outnumber spotted owls throughout much of the entire range of the threatened subspecies (Yackulic et al. 2012; Dugger et al. [2016], as cited by Lesmeister et al. [2018]).]), and the majority of the permit area.

Studies indicate that barred owls have a strong negative impact on northern spotted owls and have resulted in lower northern spotted owl occupancy, reduced survival, lower reproductive rate, lower detection, and even limited hybridization between the two species (Lesmeister et al. 2018; Long and Wolfe 2019). USFWS currently authorizes the conducted experimental removal of barred owls from four study areas in California, Oregon, and Washington to assess where they are assessing the effectiveness of barred owl removal methods and resulting effects on northern spotted owl populations (USFWS 2013b). In the *Revised Recovery Plan for the Northern Spotted Owl* (USFWS 2011), USFWS acknowledges the need for aggressive strategies to address the threat from barred owls on spotted owls.

One of the experimental removal areas for barred owl incorporated approximately 20,000 acres of ODF lands (and the permit area) in Lane County. This barred owl removal area was part of the

USFWS Oregon Coast Ranges Study Area. In 2016, USFWS issued ODF a 12-year enhancement of survival permit and Safe Harbor Agreement under Section 10(a)(1)(A) of the ESA for the barred owl removal experiment on these ODF lands. The associated Incidental Take Permit covered spotted owls that might reoccupy historic sites that had been surveyed and were unoccupied by resident spotted owls for the three years prior to the initiation of removal on the study area. Final analysis of the experimental results is underway and should provide clarity on whether this experimental program has identified effective removal techniques of barred owl and whether that removal measurably improves populations of northern spotted owl. This conservation action is designed to apply barred owl removal methods in portions of the permit area, if the USFWS experimental results indicates that removal is a viable tool.

For the duration of the permit term, ODF will establish a Conservation Fund, as described under Conservation Action 12: Establish and Maintain Conservation Fund to assist in implementing barred owl research and management activities in the permit area. Specific actions funded may include further investigations of the most effective barred owl removal techniques. It is anticipated that the majority of barred owl management activities would occur in the first 20 years of implementation and that ODF funding would be most beneficial during that time period.

If the results of the experimentation suggest that removing barred owls measurably benefits northern spotted owls, ODF will continue to contribute funding to support barred owl management programs. Funding from the Conservation Fund will be spent on control efforts in the permit area. Due to the geographic distribution of the permit area it is likely that the bulk of barred owl control funding would be allocated to regional barred owl control programs on the north coast, but contribution to barred owl control programs in other parts of the permit area are not precluded.

If the results of such efforts suggest that removing barred owls measurably benefits northern spotted owls, ODF will continue to contribute funding to support barred owl control programs, especially to help USFWS expand the scale and duration of the barred owl removal efforts in the permit area. Funding from the Conservation Fund will be spent on control efforts in the permit area. Due to the geographic distribution of the permit area it is likely that the bulk of barred owl control funding would be allocated to regional barred owl control programs on the north coast, but contribution to barred owl control programs in other parts of the permit area are not precluded.

If barred owl control is found by USFWS to be impractical or ineffective in increasing northern spotted owl populations, then ODF will discontinue monetary contributions, consistent with the adaptive management program described in Chapter 6, *Monitoring and Adaptive Management*.

This conservation action will contribute to meeting Objective 5.3, Increase Northern Spotted Owl Habitat, by removing barred owls from historical spotted owl territories and by reducing interspecies competition for habitat and prey.

Northern Spotted owl Reintroduction

At some point in the future, provided that barred owl removal proves to be successful, there may be interest in reintroducing northern spotted owls onto Oregon forests or creating a captive breeding program to boost owl numbers in western Oregon. The HCAs would be possible locations for those releases, and ODF could partner with other organizations and agencies to create such a program.

Conservation Action Effectiveness Research

Conservation funds could also be used to strategically address research questions needed to more effectively execute the conservation strategy over time for covered species such as red tree vole, Oregon slender salamander, and coastal marten and for which targeted research could improve conservation delivery.

4.7.10 Conservation Action 10: Seasonal Operational Restrictions

As shown in Table 4-2, Conservation Action 10 is intended to support the following biological objectives.

- 5.1 Existing Northern Spotted Owl Habitat
- 6.1 Existing Marbled Murrelet Nesting Habitat

The following seasonal restrictions will be followed to prevent noise and other disturbance from covered activities that may significantly interfere with essential behaviors of either northern spotted owl or marbled murrelet, particularly breeding. Seasonal operational restrictions described in this conservation action apply to both inside and outside of HCAs and RCAs, unless otherwise noted. Seasonal restrictions are organized in this conservation action by covered species.

Northern Spotted Owl

Since 1993, ODF has implemented seasonal restrictions on harvest activities to avoid and minimize disruption of northern spotted owl nest sites. Current restrictions are defined in the *Aquatic Restoration Biological Opinion II (ARBO II)* issued by USFWS to USFS, BLM, and the Bureau of Indian Affairs (BIA) (USFWS 2013). This conservation action commits ODF to continuing these seasonal restrictions for the duration of the HCP.

Table 4-10 lists the types of activities and buffer distances assumed to have no effect. Covered activities that may result in take will be avoided under the HCP. The following restrictions would be applied to all covered activities (Table 4-10 shows disruption distances applicable to the equipment types).

To reduce adverse effects on northern spotted owl, covered activities will not occur within distances expected to result in take (Table 4-10) during the critical breeding period (between March 1 and July 15) for any active known owl activity center within or outside of HCAs. Covered activities will be prohibited within distances prescribed in Table 4-10 until after the critical breeding season, or until ODF determines that there is no nesting activity or young are not present. One exception is for any action that involves Type I helicopters, which would not be allowed in the critical nesting window until September 30.

An ODF wildlife biologist may extend or reduce the restricted season based on site-specific information of known breeding activity or local conditions that ameliorate disturbance effects. Examples include such considerations as late or recycled nesting attempts, establishment of nonbreeding status, local topography, and acoustic shadow.

Table 4-10. Operational Distance Restrictions for Active Northern Spotted Owl Nest Sites during the Nesting Season[a,b]

Covered Activity	Where Not Allowed during Early Nesting Season (March 1–July 15)[d]
Light maintenance (e.g., road brushing and grading, clearing of downed trees) at campgrounds, trails, administrative facilities, and roads	No restrictions, as activities would occur only at sites with existing high levels of human activity
Chainsaws/tree felling	≤ 65 yards
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	≤ 65 yards
Pile-driving, rock-crushing and screening equipment	≤ 120 yards
Blasting (road construction)[c]	≤ 0.25 mile
Blasting (quarry development)[c]	≤ 0.25 mile
Helicopter: Type I (Chinook 47)	≤ 265 yards
Helicopter: Type II (Boeing Vertol 107, Sikorsky S-64)	≤ 150 yards
Helicopter: Type III (K-MAX, Bell 206 L4, Hughes 500)	≤ 110 yards
Small fixed-wing aircraft (Cessna 185, etc.)	≤ 110 yards
Tree climbing	≤ 25 yards
Burning (prescribed fires, pile burning)	≤ 0.25 mile

Source: USFWS 2013

[a] Active sites are based on nest tree locations or designated activity center if nest site is not known. Suitable northern spotted owl nesting habitat assumed to contain active nest unless verified absent through surveys conducted following approved USFWS or demographic research survey protocols.

[b] These restrictions apply unless ODF is under a fire, search and rescue, or other public emergency in the vicinity of the designated occupied habitat or likely nesting habitat. Distances are measures from the nest tree location if known or edge of nesting stand if exact location is not known.

[c] As measured from the edge of the active nest site to the limit of the activity performed, unless ODF determines that young are not present, based on USFWS-approved survey methods, at which point distance restrictions may be lifted on a case-by-case basis.

[d] Disruption distances associated with blasting may be reduced if a site-specific evaluation by the area biologist finds that topographic or other features provide adequate acoustic shadowing.

Marbled Murrelet

To avoid disturbance to nesting marbled murrelet adults and chicks, ODF will apply management standards during the murrelet nesting season (April 1 to September 15) in stands designated as occupied habitat upon completion of the HCP. Site-specific topographic features will be considered when seasonal restrictions are applied. ODF will, at a minimum, avoid disturbance in the "disruption" thresholds identified by USFWS (2013) for marbled murrelet nest sites (Table 4-11).

Table 4-11. Operational Restriction Distances for Marbled Murrelet Designated Occupied Habitat[a]

Covered Activity	Where not Allowed during the Critical Nesting Period (April 1–August 5)	Where not Allowed for the Remainder of the Nesting Period (August 6–September 15) with Daily Timing Restrictions[b]
Rock crushing	≤ 180 yards	≤ 180 yards
Blasting (road construction)[c]	≤ 0.25 mile	≤ 0.25 mile
Blasting (quarry development)[c]	≤ 1 mile	≤ 1 mile
Helicopter: Type I (Chinook47d)	≤ 0.25 mile or ≤ 800 feet above ground level (AGL)	≤ 0.25 mile or ≤ 800 feet AGL
Helicopter: Type II & III (Boeing Vertol 107, Sikorsky S-64; K-MAX, Bell 206 L4, Hughes 500)	≤ 120 yards or ≤ 800 feet AGL	≤ 120 yards or ≤ 800 feet AGL
Light road maintenance (e.g., road brushing, grading, ditch cleaning, clearing of downed trees) on commonly used roads and trails	No restrictions[d]	No restrictions
Log hauling	No restrictions	No restrictions
Chainsaws (excludes felling hazard/danger trees)	≤ 100 yards	No restrictions
Heavy equipment for construction, repairs, bridge construction, culvert replacements, etc.	≤ 100 yards	No restrictions

Source: USFWS

[a] These restrictions apply unless ODF is under a fire, search and rescue, or other public emergency in the vicinity of the designated occupied habitat. Distances are measures from the nest tree location if known or edge of nesting stand if exact location is not known.

[b] The first work restriction stops 2 hours after sunrise, and the work restriction starts again 2 hours before sunset.

[c] Disruption distances associated with blasting may be reduced if a site-specific evaluation by the area biologist finds that topographic or other features provide adequate acoustic shadowing.

[d] Disturbances with no likely adverse effects and associated no restrictions needed are based conclusions presented in USFWS 2013.

ODF may deviate from these restrictions only in situations where either (1) applying these restrictions would compromise the safety of ODF staff, contractors, or members of the public; or (2) applying a more limited restriction is clearly justified based on site conditions. Deviations from these restrictions are expected to be rare and will be applied by ODF only after a site-specific review by the wildlife biologist, documentation of recommendations, and approval by ODF's HCP administrator. The wildlife biologist will consider site-specific, topographic features and the location of the likely nesting habitat when considering any deviations from these restrictions. Any deviations will be documented as part of monitoring reporting requirements, as described in Chapter 6.

4.7.11 Conservation Action 11: Road Construction and Management Measures

As shown in Table 4-2, Conservation Action 11 is intended to support the following biological objectives.

- 1.1 Wood Recruitment
- 1.3 Water Quality and Quantity
- 1.4 Fish Passage

Forest roads can reduce wildlife habitat through habitat removal, fragmentation, and disturbance associated with road use. Forest roads that are not designed, built, and maintained according to best management practices can have particularly high potential to adversely affect fish habitat. Roads can degrade salmon habitats through increased delivery in fine sediment, landslide frequency, and changes in stream hydrology (Furniss et al. 1991, Boston 2016). In addition, stream-crossing structures such as culverts can impede the transport and delivery of sediment and woody material to downstream reaches (Roni et al. 2002). Roads in the permit area will be managed to keep as much forest land in a natural, productive condition as possible while also limiting impacts on the covered species by minimizing the removal of key habitat components, preventing water quality problems, minimizing disruption of natural streams, providing fish passage where roads cross fish-bearing streams, and minimizing exacerbation of natural mass-wasting processes.

Surface erosion and delivery of sediment to streams can be substantially reduced through best management practices for road design and maintenance (Roni et al. 2002). Stream processes that can be restored through road design and improvement techniques are shown in Table 4-12 and will be considered when designing new roads and improving existing road systems in the permit area to benefit the covered salmonids.

Table 4-12. Processes Restored by Various Road Improvement Techniques

		Sediment Delivery		
Road Improvement Technique	**Hydrology**	**Fine (sand and smaller particles)**	**Coarse (gravel and larger particles)**	**Conservation Action**
Removal of active roads or legacy roads	X	X	X	Conservation Action 5
Culvert or stream crossing upgrades (repair unstable crossings)		X	X	Conservation Action 4
Sidecast removal or reduction		X	X	Conservation Action 11
Reduce road drainage to stream[a]	X	X		Conservation Action 11
Increase surface material thickness or hardness with crushed rock or paving		X		Conservation Action 11
Traffic reduction (unpaved roads)		X		Conservation Action 11

Source: Roni et al. 2002

[a] Drainage reduced through increased crossings and by diverting water onto forest floor.

An existing geographic information system (GIS) overlay of the road network in the permit area will be maintained and updated, as needed, and will be used for planning purposes to limit impacts on the covered species. Development of new roads, and improvements to existing roads, will be in accordance with the standards laid out in the *Forest Roads Manual* (ODF 2000) and NOAA Fisheries (2011).

Road Design to Minimize Impacts on Covered Species

Construction of road networks can lead to accelerated erosion rates in a watershed (Furniss et al. 1991). ODF planning and district staff will solicit input from geotechnical specialists in designing roads and harvest units. This input is based on interpretive geology and the use of soil and rock mechanics in slope stability analysis. It provides a rationale for risk assessment and mitigation in forest land management decisions. The use of geotechnical analysis in management decisions makes it possible to minimize the number or magnitude of management activity-induced soil movements and protect the aquatic covered species.

The most common causes of road-related mass movements are related to inappropriate placement and construction of road fills, inadequate road maintenance, insufficient culvert sizes, very steep hill gradients, placement or sidecast of excess materials, poor road location, removal of slope support by undercutting, and alteration of slope draining by interception and concentration of surface and subsurface water (Wolf 1982 as cited in Furniss et al. 1991). Many of these problems with forest road construction can be traced back to poor road design. With careful siting of roads and appropriate planning to minimize the length of roadbed needed to support timber operations and recreational access, the impacts of road construction and maintenance can be minimized.

ODF has identified the following road design measures from the *Forest Roads Manual* (ODF 2000) and Roni et al. (2002) that will be implemented to minimize potential impacts on the covered aquatic species. The intent of these road design measures is to hydrologically disconnect the road system from streams.

- Temporary and permanent roads and landings will be located on stable locations, e.g., ridge tops, stable benches, or flats, and gentle to moderate side slopes.
- Roads no longer needed for resource management and that are at risk of failure or are contributing sediment to streams will be vacated, consistent with valid existing rights.
- Roads will be located away from streams, wetlands, unstable areas, and sensitive resource sites, including sensitive wildlife habitats. Buffers of undisturbed land will be maintained between roads and streams. Removal of old growth trees, or trees with structures known to be important to the covered species (e.g., potential murrelet nesting platforms) will be avoided, where feasible.
- Road development within the RCA will only occur when other alternatives are not operationally feasible and economically viable.
- Where crossings of fish-bearing streams occur, bridges and culverts will be designed to meet NOAA Fisheries (2014) and ODFW fish-passage laws (Oregon Revised Statute 509.580 through 910 and in OAR 635, Division 412).

- New roads will use the minimum design standards practical with respect to road width, radius, and gradient. This will minimize road width and the resultant cut-and-fill slopes, minimizing effects on the covered aquatic species from new road construction.
- Road designs will provide for proper drainage of surface water so as not to introduce runoff into streams. These measures could include the use of grade breaks, out-sloping, in-sloping, ditching, road dips, water bars, and relief culverts.
- Ditches and cross-drain discharges will be directed onto the forest floor away from streams to limit runoff and fine sediment delivery into the stream.
- Cross drains will not discharge onto unstable slopes, and full-bench construction (no sidecast fill) will be used on steep slopes to avoid sidecast failure.
- Aligned rock fill will be installed over culverts to reduce the risk of erosion and failure, in case culverts become plugged or overtopped.
- The road runoff to the stream channel will be disconnected by outsloping the road approach. If outsloping is not possible, runoff control, erosion control, and sediment-containment measures will be used. These may include using additional cross drain culverts, ditch lining, and catchment basins. Ditch flow conveyance to the stream will be prevented or reduced through cross-drain placement above the stream crossing (minimum of 200 feet from a stream).
- Underdrain structures will be installed when roads cross or expose springs, seeps, or wet areas rather than allowing intercepted water to flow downgradient in ditchlines.
- Surface drainage structures (e.g., broad based dips, leadoff ditches) will be armored to maintain functionality in areas of erosive and low strength soils.

In addition, as with all covered activities, specific nesting sites for marbled murrelet or northern spotted owl will be protected as described in Conservation Actions 6: Establish Habitat Conservation Areas, 7: Manage Habitat Conservation Areas, and 10: Seasonal Operational Restrictions.

Road Construction and Maintenance to Minimize Impacts on Covered Species

Once forest roads are designed to minimize impacts on the covered species, ODF will build and maintain the roads using techniques that will also minimize impacts on covered species. Soil erosion and stream sedimentation may occur during and following road construction or maintenance. Proper construction practices will reduce erosion and stream sedimentation impacts on the covered species.

The following guidelines will be followed during road construction and maintenance, additional details are provided in Appendix H: *Summary of ODF Roads Manual*:

- Roads within or adjacent to RCAs that cannot be hydrologically disconnected (or connection mitigated), or are otherwise unsuitable for wintertime haul, will be closed to logging trucks during wintertime wet weather as specified at the ODF district level. This includes all native surfaced roads (dirt).
- Commercial road use will be suspended where the road surface is deteriorating due to vehicular rutting or standing water and turbid runoff is likely to reach waters of the State.

- Road construction will occur in HCAs to allow for habitat enhancement projects, provide efficient access to other areas of the forest outside of HCAs, allow for access required for adjacent landowners, and improve the overall efficiency of the transportation network to reduce impacts from roads more broadly. Transportation planning for HCAs will be done in conjunction with the wildlife biologist to minimize impacts on known species occurrence and suitable habitat. Road construction within HCAs will be conducted with additional considerations (e.g., avoiding habitat occupied by covered species, seasonal restrictions) to protect covered terrestrial species habitat. Project scope and scale will be considered by the wildlife biologist to determine the best application of seasonal restrictions (e.g., allowing for more acute disturbance in 1 year, versus lower level chronic disturbance extended projects over multiple years).
- In-water construction (e.g., stream crossings) will follow the established Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife (ODFW 2008) to minimize impacts on the covered species and their habitat. If work needs to occur outside of the established work window ODF will obtain appropriate approvals from ODFW.
- Storage and staging areas for road construction, harvest activities, HCP management and restoration projects will be sited at least 150 feet away from a waterbody or wetland to avoid erosion or contamination of waters of the United States (80 FR 37053).
- Construction activities will be conducted during the dry season (April 1 through November 1) or during prolonged periods of dry weather. If rainy weather[14] occurs, construction will be suspended. Soils that are saturated with water, that would become muddy when disturbed, and that have the potential to reach waters of the State, will be allowed to drain before construction resumes.
- To reduce surface erosion, vegetation removal, soil disturbance, and clearing and grubbing will be limited to the minimum needed to construct the road.
- Excess road excavation materials will be disposed of at a stable site that will not contribute to sedimentation or otherwise degrade covered species habitat.
- Roads with high erosion potential will be rocked. The hardest crushed rock available will be used when rocking a road with the potential to deliver sediment to streams to reduce road surface erosion and generation of sediment into adjacent waterbodies. Increased thickness of surfacing material has been found to reduce surface erosion by approximately 80%. The quality of available rock may be limited by protections for other covered species, e.g., where quarry development conflicts with covered species nesting habitat.
- All road drainage structures (ditches, out-sloping, culverts, water bars, dips, etc.) will be in place as soon as possible during construction of the road, and before the rainy season.
- Areas of bare soil, which could deliver sediment to waters of the state, will have effective drainage established or will be mulched and/or seeded before the start of the rainy season to reduce surface erosion. These areas include, but are not limited to, unsurfaced road grades, cut slopes, fill slopes, waste areas, borrow areas, and rock pits.
- Construction of roads near waterbodies will use best management practices to prevent or minimize potential of sediment delivery to water.

[14] When 2 inches of rain is expected in a 24-hour period.

- When a road construction project is partially completed at the start of the rainy period (mid-October), the project will be left in a condition that will minimize erosion and the sedimentation of streams during the rainy period. Drainage measures will be performed on uncompleted subgrades, such as surface smoothing, out-sloping, water-barring, and dip installation. Mulching and/or grass seeding will be done on all cut slopes, unarmored fill slopes, and on any other areas of bare soil where erosion and sedimentation could affect water quality. Silt fences and/or hay dams will be used near streams to prevent sedimentation. The road will be barricaded to prevent unauthorized use.
- The road surface will be drained effectively by using crowning, insloping or outsloping, grade reversals (rolling dips), and waterbars or a combination of these methods. Concentrated discharge onto fill slopes will be avoided unless the fill slopes are stable and erosion proofed.
- Native seed and certified weed-free mulch will be applied to cut-and-fill slopes, ditchlines, and waste disposal sites with the potential for sediment delivery to wetlands, Riparian Reserves, floodplains and Waters of the State upon completion of construction and as early as possible to increase germination and growth. If necessary, sites will be reseeded to accomplish erosion control. Seed species will be selected that are fast growing, have adequate ability to provide ample groundcover and soil-binding properties. Mulch will be applied to will stay in place and at site-specific rates to prevent erosion.
- Prior to the wet season, effective road surface drainage maintenance will be performed on logging roads that were used for harvest during the season and observed to need maintenance. Ditch lines will be cleared in sections where there is lowered capacity or where the lines are obstructed by dry ravel, sediment wedges, small failures, or fluvial sediment deposition. Accumulated sediment and blockages will be removed at cross-drain inlets and outlets. Natural-surface and aggregate roads will be graded where the surface is uneven from surface erosion or vehicle rutting. Crowning, outsloping or insloping will be restored for the road type for effective runoff. Outlets will be removed or provided for through berms on the road shoulder.
- Cleaned ditch lines and bare soils that drain directly to wetlands, floodplains, and waters of the State will be seeded with native species and mulched with weed-free mulch.
- Undercutting of cut-slopes will be avoided when cleaning ditch lines.

In addition, as with all covered activities, specific nesting sites for marbled murrelet or northern spotted owl will be protected as described in Conservation Actions 5, 6, and 9.

Rock Quarries

[**Note to Reader:** *Additional information will be included regarding current and future rock quarries and any necessary measures needed to allow for new quarries to be established consistent with the HCP and ITP*.]

4.7.12 Conservation Action 12: Establish and Maintain Conservation Fund

ODF will establish a conservation fund that can be used to fund stream enhancement projects (Conservation Action 3: Stream Enhancement), barrier removal projects (Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers), upland restoration projects (Conservation

Action 7: Manage Habitat Conservation Areas), and barred owl management activities (Conservation Action 9: Strategic Terrestrial Species Conservation Actions). Execution of restoration projects and barred owl management activities will vary over time. Every timber contract will contribute to the conservation fund through a direct monetary contribution from timber sales. Funding for the program is described in Chapter 9. Funds will be expended consistent with the details of Conservation Strategies 3, 7, or 9.

*[***Note to Reader:*** There are ongoing discussions about whether other activities beyond those described here could be funded using the Conservation Fund.]*

Chapter 5
Effects Analysis and Level of Take

5.1 Introduction

This chapter presents the analysis of effects of the covered activities on each covered species and their habitat in the permit area. Section 5.2 describes the approach and methods used for the effects analysis. Sections 5.3 through 5.10 describe the effects of the covered activities on each of the covered species. Discussions of effects are grouped according to covered species with similar types of effects. For example, the first section (5.3) discusses all effects on covered salmon, while Section 5.4 discusses effects on two covered salamanders with similar resource needs. Discussions of effects for terrestrial species are presented individually for each species.

The effects analysis for each covered species includes an assessment of sources and types of take, the amount of projected take, the impacts of the taking of individuals on population levels, the beneficial and net effects of the conservation strategy, and effects on designated critical habitat (for those that have designated critical habitat).

This chapter also summarizes the expected cumulative effects, as defined under Section 7 of the federal Endangered Species Act (ESA), of non-federal projects other than Western Oregon State Forest Habitat Conservation Plan (HCP) in or near the plan area, on each covered species and their critical habitat.

5.1.1 Regulatory Context

This effects analysis includes mandatory elements of an HCP and information necessary for the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries (collectively, the Services) to make their findings for issuance of their permits. Sections of the ESA relevant to this effects analysis are as follows.

- Section 10(a)(2)(A)(i) requires, among other requirements, that an HCP specify the impacts on covered species that will likely result from the taking.
- Section 10(a)(2)(B)(ii) and (iv) state that the USFWS and NOAA Fisheries may only issue an incidental take permit if, among other requirements, the applicant will minimize and mitigate impacts to the maximum extent practicable, and the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

As described in Chapter 1, *Introduction,* the Services will need to consult internally to comply with Section 7 of the ESA prior to issuance of permits. As a component of this internal consultation, the Services must prepare a written biological opinion describing how the agency's action will affect all listed species and their designated critical habitat. The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (HCP Handbook) (USFWS and NOAA Fisheries 2016) recommends that an HCP include the information necessary for the Services to complete the internal consultation process under Section 7 of ESA, including a defined action area and associated effects at the local, recovery unit, and range-wide scales. Section 7 also requires a determination as to whether the federal action (issuance of an incidental take permit) is likely to destroy or adversely modify designated critical habitat.

5.2 Approach and Methods

5.2.1 Determining and Defining Effects

The definition of *effects* used in this HCP follows the 2019 ESA rule revisions (USFWS and NOAA Fisheries 2019), which simplified the formal definition of "effects of the action" by combining the categories of direct effects, indirect effects, and effects of interrelated and interdependent actions. The HCP considers effects without further classifying as whether the effects are considered direct or indirect or resulting from interrelated or interdependent actions. Per 50 Code of Federal Regulations (CFR) 402, as revised, effects are considered if they would meet the following two-pronged test.

- If they would not occur but for the proposed action (i.e., implementation of activities described in Chapter 3, *Covered Activities*).
- If they are reasonably certain to occur.

The effects analysis assumes that all proposed conservation actions defined in Chapter 4, *Conservation Strategy*, will be implemented as described (i.e., effects considered and identified are those that would still occur even with conservation actions, including avoidance and minimization measures, in place).

5.2.2 Sources and Types of Effects

The term effect refers to a change that is the result of a covered activity. This analysis focuses on effects that change the condition of a covered species or its habitat. Effects can be either adverse or beneficial. The verb *affect* is used to mean "to have an effect on."

Effects were determined following an "effects pathway" model described in the HCP Handbook, by which project activities are subdivided into their individual components that, in total, make up all the activities that may be needed to complete the covered activity. The model follows the chain of causation to effects, starting with the covered activities and associated components and stressors to resource needs of the species that is affected. The model then considers the behavioral and physical responses of individuals to those stressors and associated biological effects (e.g., reduced reproduction or survival). Next, the model considers how the biological effects on individuals would translate into population-level effects on numbers and distribution.

Effects considered here are those effects that are reasonably likely to occur after proposed avoidance and minimization measures are in place, including the level of take projected to occur over the duration of the permit. The effects analysis considers the HCP mitigation measure as part of the beneficial and net effects evaluation conducted for each covered species.

The effects analysis relies on the following.

- Application of the best available information regarding known effects of covered activities (Chapter 3) on covered species.

- The distribution and extent of covered species and their habitats (Chapter 2, *Environmental Setting;* Appendix C, *Covered Species Accounts*).
- The natural history, essential behaviors, and resource requirements of covered species (Appendix C).

The approach to analyzing effects was programmatic. As described in Chapter 3, the covered activities will occur over a wide geographic area and over a 70-year permit duration. As a result, this effects analysis provides estimates of acres of habitat where terrestrial covered species habitat function will be reduced by covered activities and describes how covered activities may result in loss of ecological processes that influence the quality of covered fish and aquatic salamander habitat. Beneficial and net effects for each species were evaluated to describe the extent to which loss of habitat function will be offset by the conservation actions described in Chapter 4.

Adverse effects include any effects of the covered activities that adversely affect covered species or their habitat. For covered species, adverse effects may reduce the number, range, reproductive success, or survival of the covered species. Adverse effects may also affect species behavior in ways that adversely affect reproduction or survival. Adverse effects on covered species' habitat are effects that reduce the ability of the habitat to sustain the species, as a result of either reducing the quantity or quality of the habitat; this is also referred to as loss of habitat function.

Effects may also be considered beneficial, insignificant, or discountable. Beneficial effects have positive effects without any adverse effects on the species or habitat. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur (USFWS and NOAA Fisheries 1998).

5.2.3 Methods and Metrics for Calculating Take

The Oregon Department of Forestry (ODF) has determined that proposed covered activities are reasonably certain to result in take of one or more of the covered species and, therefore, is applying for incidental take permits. ESA defines *take* as: to harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct. 16 United States Code (U.S.C.) 1542(b).

ODF is seeking an incidental take permit for covered activities that may harm covered species. *Harm* in the definition of take in the ESA means an act that kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3).

According to the HCP Handbook, the HCP must identify the impacts likely to result from the proposed incidental take. It must include defined units to quantify impacts in terms of taking a number of affected individual animals or acceptable habitat surrogate units within the permit area. These same units are used on the incidental take permit to specify the authorized levels of incidental take.

The covered salmon take is estimated based on the proportion of each evolutionarily significant unit's (ESU) distribution within the permit area and the acres of projected harvest levels within the watersheds that overlap with each ESU.

For the covered terrestrial species, take is estimated based on the expected loss, modification, and future growth of habitat, as determined by applying habitat models to the outcomes of forest management activity modeling. The unit of take is the acres of modeled habitat values classified as highly suitable or suitable that would be modified by covered activities over the duration of the permit. A habitat-based approach is a common practice of the USFWS in biological opinions and in the development of HCPs (USFWS 2019). As described in Appendix C, ODF is using habitat models to account for habitat quality and the relative probability of occupancy for, and associated take of, covered terrestrial species. A habitat-based approach to evaluating the effects of the proposed action on terrestrial covered species is appropriate due to the difficulty and costs of locating occupied sites, the variation in the number of individuals present at any given time, and, perhaps most importantly, the difficulty of monitoring the actual number of individuals taken during implementation. In addition, the terrestrial species covered under this HCP are at risk primarily due to loss of habitat. Habitat is closely associated with reproduction, population numbers, and distribution of the terrestrial species covered under this HCP, and habitat can be effectively and efficiently monitored. For these reasons, quantifying effects on modeled habitat offers the most reasonable and meaningful measure of assessing, permitting, and monitoring anticipated take of terrestrial covered species for this HCP and for the associated incidental take permit.

It is important to note that projected habitat levels presented in this chapter are not HCP commitments, but rather are projections ODF is using to estimate the level of take and to determine appropriate avoidance, minimization, and mitigation measures needed to offset that projected level of take. Habitat projections will also be used as part of monitoring to determine if habitat is developing as expected and, if not, to determine appropriate adaptive management actions (see Chapter 6, *Monitoring and Adaptive Management*). The commitments in this HCP are management based, and include designating and managing Habitat Conservation Areas (HCAs), as described under Conservation Actions 6: Establish Habitat Conservation Areas and 7: Manage Habitat Conservation Areas.

For northern spotted owl and marbled murrelet, effects are further documented in terms of the number of known occupied northern spotted owl territories or marbled murrelet "significant observation" locations that may be adversely affected under the terms and conditions of the HCP.

5.2.4 Determining Impacts of Take

The *Impacts of the Taking…* section for each covered species is based on guidance provided in the HCP Handbook. While authorized take relates to individuals of a covered species, the impact of taking considers the population-level impact that is commiserate with the species distribution and permit area. Per the HCP Handbook, determining impacts of take consists of defining the context and intensity of take identified.

Context is the setting in which the impact of the take analysis occurs. It usually includes geographic and temporal scales. For this HCP, context is evaluated at the following scales for terrestrial covered species: ecoregion, recovery unit (as defined in recovery plans), and entire range. Covered fish species will be analyzed at the population level and at the ESU level. Context also includes a description of the conservation role of the permit area to the covered species. *Intensity* is the severity of the impact and is defined in this HCP as the percent of the ESU impacted and the quantity and degree to which habitat would be affected.

5.2.5 Determining Beneficial and Net Effects

The conservation actions defined in Chapter 4 outline the measures ODF will undertake to minimize and mitigate the impacts of taking. Minimization measures are already considered as part of the effects determination and in predicting and calculating take. Mitigation measures have not been considered in the effects analysis because take occurs whether or not it is compensated for by mitigation. Mitigation proposed as part of conservation actions includes creating additional habitat to compensate for habitat lost or habitat with reduced function during the permit term. Therefore, for each species for which an increase in habitat quality or quantity is proposed, the "net" effect on habitat has been quantified. The timing of when such benefits would occur is described in relation to the timing of effects intended to be mitigated.

In some cases, the process of improving habitat quality may result in short-term adverse effects (e.g., thinning). Such short-term adverse effects are considered under the *Impacts of the Taking…* sections.

5.2.6 Determining Effects on Critical Habitat

The *Effects on Critical Habitat* section for each species provides an analysis of the effects on critical habitat, if it has been formally designated by USFWS or NOAA Fisheries for the covered species (critical habitat may be designated only for listed species). This analysis is not a requirement for an HCP, but is intended to assist the Services in their mandatory evaluation of whether the federal action of issuing a Section 10(a)(1)(B) permit may destroy or adversely modify designated critical habitat. The Services document this analysis in their Section 7 Biological Opinions to conclude their intra-service consultation. The critical habitat analysis in this HCP is provided to support the analysis in the Services' Biological Opinions.

Effects on salmon and steelhead critical habitat are evaluated by assessing effects of HCP implementation on physical and biological features of freshwater spawning and rearing sites in stream reaches within designated critical habitat.

Critical habitat has been designated in the permit area for Oregon Coast coho, Lower Columbia River coho, and Upper Willamette River steelhead (Chapter 2). Critical habitat has not been designated in the permit area for any of the other covered fish species or for the Columbia torrent salamander or Cascade torrent salamander, so effects on critical habitat for these species are not discussed further.

Effects on critical habitat of terrestrial species are evaluated by determining and quantifying the area (in acres) of effects on lands within designated critical habitat units, including the current condition of the lands as highly suitable, suitable, marginal, or non-habitat. Terrestrial covered species with designated critical habitat in the permit area are northern spotted owl and marbled murrelet (Appendix C). Critical habitat has not been designated for Oregon slender salamander, red tree vole, or coastal marten.

5.2.7 Determining Cumulative Effects

Per the HCP Handbook cumulative effects are "those effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the action area." Following this definition, cumulative impacts are limited to reasonably foreseeable future state or private actions not subject to federal jurisdiction or permit or funding of any kind. Future federal actions are not considered because they require separate consultation pursuant to Section 7 of the ESA. Past and present actions are not considered as part of cumulative effects because the cumulative analysis in HCPs is focused only on future effects.

Cumulative effects are addressed under the *Impacts of the Taking…* section for each covered species. An analysis of cumulative effects is provided in this HCP to support the requirement that the Services' Biological Opinion consider the cumulative effects on all listed species when the effects of the proposed action are considered.

5.3 Effects Analysis for Covered Salmon Evolutionary Significant Units

This section describes the effects of the covered activity on the eight ESUs of listed salmon and steelhead covered by this HCP. Many of the effects of the covered activities are the same or similar across all or most of the listed salmonid ESUs covered by this HCP. In cases where effects are similar or the same, the listed salmon and steelhead ESUs covered by this HCP are referred to as the covered salmon species. The known range of Oregon Coast coho and Spring Chinook, Lower Columbia River coho, and Columbia River chum have the greatest overlap with the permit area (Appendix C). Upper Willamette River steelhead, Upper Willamette River Chinook, and Southern Oregon/Northern California Coast coho have limited distribution in the permit area (Appendix C). Lower Columbia River Chinook fish distribution does not overlap the permit area, but waters from the permit area empty into streams within their distribution (Appendix C).

This section presents the analysis of effects of the covered activities on covered salmonid species and their habitat in the permit area. Effects of the action refer to the permanent or temporary direct and indirect effects of an action on a species or its habitat. The conservation actions (Chapter 4) in the HCP are expected to protect salmon, steelhead, and their habitat within the permit area. The likelihood of direct injury to, or death of, any salmonid from forestry activities, road management, or other operational activities is expected to be low under the HCP. Effects on the covered species, by independent population, are described below.

This section also presents the cumulative effects of projects other than HCP covered activities in or near the permit area and effects on covered species' critical habitat.

5.3.1 Sources and Types of Effects

The covered activities described in Chapter 3 could result in the following categories of stressors on the covered salmonid species, each of which is described in more detail below.

- **Reduce large wood recruitment**. Reduction in availability of large wood for instream complexity.
- **Reduce water quality and quantity**. Reduction in function or quality of habitat as a result of covered activities.
- **Impede fish passage**. Reduction in access to suitable habitat due to barriers (e.g., undersized culverts, large jump heights)
- **Cause direct mortality**. Injury or mortality of individuals as a result of handling or crushing by equipment, humans, or felled trees.

The stressors listed above are categorized in this manner to facilitate a meaningful assessment of the effect's pathways for the covered salmonid species. The sections below describe the effects pathways associated from each of the stressors that result from the covered activities.

Vulnerability of the covered salmon to take by the described activities is dependent on the life-stage of the salmon, their residency time in the system, their location in the system, and the timing of activities. These factors are considered below in the summary of stressors.

5.3.1.1 Large Wood Recruitment

A common issue in fish-bearing streams in western Oregon is a lack of instream wood due to historic land management decisions such as removal of trees in the riparian area and clearing of wood and logjams from the streams. Reduced instream wood is the result of removal of trees from within the riparian zone around streams and rivers over time for timber, as well as the long-standing practice of clearing debris and logjams from river channels (Bryant 1983). Large living and dead wood in the riparian zone provides important habitat for the covered salmon and steelhead. Large riparian trees that die and fall into and near streams, such as within floodplains and wetlands, regulate sediment and flow routing, influence stream channel complexity and stability, increase pool volume and area, and provide refugia and cover for fish (Bisson et al. 1987, Gregory et al. 1987, Hicks et al. 1991, Ralph et al. 1994, Bilby and Bisson 1998). The loss of wood is a primary limiting factor for salmonid production in almost all watersheds west of the Cascade Mountains (Appendix D).

Harvest in riparian areas adjacent to streams eliminates or reduces the amount of wood available for delivery to streams. Reductions in riparian forests that provide large wood for recruitment would reduce instream habitat (e.g., habitat and channel complexity, cover) used by the covered salmon and steelhead in the permit area for rearing and migration. The effects of the HCP on large wood recruitment are expected to be minor due to the implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 2: Riparian Equipment Restriction Zones.

Implementation of this conservation action will retain nearly all of the available wood volume in the permit area during the 70-year permit term (TerrainWorks 2020), which will be available for recruitment into streams that support covered salmon and steelhead. Most of the wood recruited (88%) comes from streamside sources (i.e., riparian conservation areas adjacent to fish bearing streams), while the remainder (12%) comes from debris flows in the upper watersheds (TerrainWorks 2020).

Wood delivery to Type F waters from unstable slopes can result from shallow landslides debris flows and debris torrents as well as from deep-seated landslide processes. Because implementation of the HCP will retain a 500-foot by 50-foot wood-protection buffer at the intersection between high energy and potential debris-flow streams and fish-bearing streams, wood recruitment from these areas is expected to remain at or near background levels. This is particularly true for areas in the northern part of the permit area where high landslide frequencies make mass wasting an important debris-delivery mechanism.

Within the Riparian Conservation Areas (RCAs) thinning and other silviculture practices will not be employed. Minor reductions in the amount of wood available for recruitment within the RCAs will be associated with the rare occurrence where a new road is constructed in the RCA because no upland alternative is viable. The construction of a new road will require vegetation removal that will persist until the road is vacated and trees can regrow. Acres of riparian habitat that will be protected under Conservation Action 1: Establish Riparian Conservation Areas are shown in Table 5-1; this represents the area under the HCP that will be maintained as a source of wood for the covered species. These acres are further split out by ESU in Section 5.3.2, *Impacts of the Taking on Salmon and Steelhead*.

Table 5-1. Acres of Riparian Conservation Areas Created Under the Habitat Conservation Plan

	North Coast	South Coast	Willamette Valley	Total
Acres of Habitat in RCAs	65,300	4,400	7,600	77,300
Percent of Total Acres	84%	6%	10%	100%

Potential for Take to Occur

The implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 2: Riparian Equipment Restriction Zones will retain enough riparian forest to allow large wood to be recruited into fish-bearing streams within the permit area, including streams with high debris flow potential that are not fish bearing. The construction of new roads, cable corridors, and quarries will result in minor reductions in the amount of wood available for recruitment at some locations in the permit area. This action will be governed by Conservation Action 10: Road Construction and Management Measures, which limits new road construction in RCAs to occur when no other viable alternative is available. This minor reduction in available large wood and the habitat alterations associated with removal of wood for roads, cable corridors, and quarries would be unlikely to result in take. In addition, the implementation of conservation actions in the RCAs will result in the development of larger trees over time, leading to higher quality wood recruitment into the aquatic system throughout the permit term.

5.3.1.2 Water Quality and Quantity

Riparian areas maintain ecological processes, such as regulating stream temperature and streamflow, cycling nutrients, providing organic matter, filtering chemicals and other pollutants, trapping and redistributing sediments, stabilizing stream channels and banks, absorbing and detaining floodwaters, maintaining fish habitats, and supporting the food web for a variety of biota (Buffler 2005). The reduction of functional riparian forests can degrade water quality and quantity, while protection, and expansion, of existing riparian forests can improve conditions.

The effects of timber harvest and its associated activities can impact the covered species at both a local and watershed scale. Implementation of the HCP will include protection of existing functional riparian systems and restoration of degraded systems to address potential water quality issues. An assessment of the function and quality of habitat, related to water quality and quantity parameters, as a result of covered activities is presented below. Further analysis of impacts, by ESU, is provided in Appendix F.

Water Temperature

Fish are cold blooded animals, and the environmental conditions of the stream control their body temperature. Because water temperature affects the body temperature of fish, it can regulate activity and physiological processes (Thompson and Larsen 2004). Stream temperature directly influences aquatic organisms' physiology, metabolic rates, and life history behaviors and influence aspects of important processes of habitat for fish and aquatic species such as nutrient cycling and productivity (Allen 1995). Interactions between external drivers of stream temperature such as air temperature, solar radiation, and wind speed and the internal structure of the stream system such as the channel, riparian zone, and alluvial aquifer, drive temperature (Poole and Berman 2001).

Harvest activities adjacent to fish-bearing streams can increase summer stream temperatures through reduction of shade that results in increased solar radiation reaching the water's surface. This can also occur on small, non-fish-bearing streams that flow into fish-bearing streams, particularly in stream reaches immediately above fish-bearing streams. These temperature increases, if not managed, can extend downstream into fish-bearing waters and affect the covered salmon and steelhead.

During the summer months, many of the streams salmon juveniles inhabit are already close to lethal temperatures, and with the expectation of rising stream temperatures due to global climate change, increases in infection rates of juvenile salmon by parasites and competition by warm water species may become an increasingly important stressor both for freshwater and marine survival (NOAA Fisheries 2016). Effects of rising temperature on the covered species could include physiological stress and reduced growth, disruption of life cycle timing, and increased predation and disease that would potentially reduce survival and reproductive success (NOAA Fisheries 2016).

Potential effects on water temperature from harvest activities in the permit area are addressed by maintaining RCAs adjacent to the aquatic zone (see Chapter 4 for full RCA description). Stream shading and instream temperature protection will be maintained by retaining vegetation in riparian areas during adjacent harvest activities.

RCA widths vary by stream type. All fish-bearing streams, and large and medium non-fish-bearing perennial streams have a 120-foot minimum buffer. The U.S. Environmental Protection Agency (EPA) (2013) indicates that a 120-foot no-cut buffer is adequate to prevent riparian shade loss that would cause stream temperatures to increase.

RCAs adjacent to small non-fish-bearing perennial and seasonal streams will be narrower than RCAs adjacent to fish-bearing and medium and large non-fish-bearing streams. Small perennial non-fish-bearing streams will have Temperature Protection Zones (TPZ) that extend 120 feet (horizontal distance) from the aquatic zone for the first 500 feet upstream of the end of fish use to protect stream temperatures in water within that 500 feet. It also allows for some temperature recovery from upstream, as it flows from a small non-fish perennial stream into a fish-bearing stream. Upstream of the 500-foot process protection zone, the buffer will be 35 feet (horizontal distance) from the aquatic zone.

The 120-foot RCA (horizontal distance) within the 500-foot TPZ at the intersection of fish and small perennial non-fish streams will help ameliorate stream temperature increases. The TPZ was identified based on a literature review process with the HCP Scoping Team.[1] A list of sources reviewed by the Scoping Team to assess how forestry activities and riparian management strategies affect downstream temperatures and identify the proposed TPZ is provided in Appendix E and summarized below.

[1] The Scoping Team is composed of representatives from ODF, Oregon Department of State Lands, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, USFWS, and NOAA Fisheries.

A literature review and assessment of heating related to buffer width and buffer length is provided in Appendix E. The results of these analysis indicate that while a 120-foot-wide by 500-foot-long TPZ buffer will not entirely dissipate accumulated heat from the harvested area, it will allow stream temperatures to return to near the preharvest temperature regime prior to reaching a fish-bearing stream.

While the 120-foot-wide by 500-foot-long TPZ is not expected to completely offset the effects of harvest on stream temperature, it would result in substantial reduction of water temperature changes prior to entering fish-bearing streams. Bladon et al. (2018) found that while maximum daily stream temperatures were elevated in small, non-fish-bearing headwaters after harvest there was no measurable downstream warming related to upstream harvest activities.

Numerous upstream-downstream longitudinal studies examined temperature recovery downstream of single harvest units. Davis et al. (2015), in an analysis of sites from ODF's RipStream study, found that the temperature change 300 meters (984 feet) downstream of harvest units on small and medium fish-bearing streams was approximately 56% of the change at the harvest unit, on average (range of 1% to 82% of harvest unit change). However, this behavior was highly site-dependent (streams with lower gradients and/or greater surface area showed lower temperature change magnitudes at 300 meters). Arismendi and Groom (2019), in another RipStream analysis, also showed a tendency for downstream sites to converge towards the preharvest equilibrium, that the tendency generally strengthened with time, and post-harvest temperature regimes with wide buffers returned to behavior that was statistically similar to their preharvest characteristics while sites with narrow buffers often did not. Several other studies examining the extent of stream temperature recovery towards preharvest conditions downstream of harvest units show incomplete downstream mitigation of single harvest unit temperature increases that were due to narrow streams buffers (Keith et al. 1998: 0.5° of 5.0 degrees Celsius [°C] of the temperature increase remaining after 73 meters [240 feet] and 0.5° of 6.0°C temperature increase remaining after 46 meters [151 feet]; MacDonald et al. 1998: 2° of 3.0°C increase remaining after 500 meters [1,640 feet]; Rutherford et al. 2004: 0.77 to 7.18°C increase reduced by 0.35 to 2.51°C, over distances of 153 to 892 meters [502 to 2,926 feet]; Wilkerson et al. 2006 [unbuffered streams]: 1.8° of 2.8°C of increase remaining and 1.3° of 2.5°C increase remaining after 100 meters [328 feet]; and Zwieniecki and Newton 1999: study mean across sites was 0.4° of 1.09°C increase remaining after 150 meters [492 feet]).

Unlike the small non-fish-bearing streams observed by Bladon et al. (2018), some of the above studies were primarily on fish-bearing streams. Non-fish-bearing headwater streams often have very high groundwater inputs, low flow volumes relative to fish-bearing streams, and substantial post-harvest flow increases so heat loss and dilution may be a greater factor in return to equilibrium than in fish-bearing streams (e.g., Moore et al. 2003, Story et al. 2003, Kibler et al. 2013). Heated water from harvested sites around non-fish-bearing headwaters can rapidly decrease in temperature and move towards pre-harvest equilibrium upon flowing through fully forested stream reaches in the absence of subsequent harvest units, depending on site conditions such as gradient and cold water inputs. With other harvest units present, measurable cumulative heating is probable unless harvest site best management practices (BMPs) prevent substantial riparian shade loss. Cole and Newton (2013) showed cumulative temperature increases through multiple harvest units with private forest-type buffers (0 to 50 feet), even when separated by uncut reaches, on three of four study streams. The 120-foot-wide buffers in the TPZ will likely prevent additional harvest-related heating.

While temperature recovery may not be total through the 500-foot TPZ, the relative total flow contribution of non-fish streams in a harvest unit to the receiving fish-bearing stream is critical. For example, a temperature increase of 0.5°C in a non-fish stream will be undetectable (≤0.2°C) if it provides 40% or less of the total fish-bearing stream's flow, while an increase of 1.5°C must comprise no more than 13% of the total combined flow. This includes an average increase of 1°C for a 35-foot buffer, which falls within the range of responses in the longitudinal studies described above. With attenuation to 0.75°C at 500 feet (see Appendix E), temperature increases may be undetectable if the non-fish streams' contributions in a particular harvest area are no more than 27% of the combined total flow of the receiving fish-bearing stream. Based on Bladon et al. (2018), that non-fish stream contribution could be as high as 67%. Considering the range of temperature recovery responses in the literature, the semi-conservative nature of heat pollution, and the dependence on site-specific characteristics, the 500-foot TPZ provides a reasonable degree of certainty that measurable temperature impacts on fish-bearing reaches in the permit area will be avoided.

Conservation Action 11: Road Construction and Management Measures will limit new road construction and stream crossings within RCAs and provides BMPs for roads that need to be constructed in the RCA due to no other viable alternative, and existing road improvement and vacating projects. Right-of-way clearing for road building can permanently remove an average of 45 feet of vegetation within the new road's right-of-way that would reduce stream shading due to a reduction in tree density. Management direction will limit new road construction such that roads will rarely[1] occur in RCAs, which limits temperature effects on adjacent streams. However, some circumstances will require new road construction in the RCAs for harvest in areas outside the RCAs to occur. Due to the limited amount of roads that are expected to be constructed in the RCAs and the implementation of Conservation Action 11: Road Construction and Management Measures, impacts on stream shading and temperature are expected to be localized and minor.

Culvert replacement, installation, and removal will frequently[2] occur in RCAs; however, in locations where stream crossings are required, small amounts of overstory vegetation may need to be removed in addition to the right of way. This additional removal is typically in situations where a culvert is being replaced with a larger one that is more capable of fish passage, which can require slightly more area to sink into the stream channel. Because culvert work will be distributed in space and time throughout the permit area, effects associated with small decreases in shading will be localized and minor. Further, some of this vegetation will regrow over time and provide stream shading.

Road maintenance and vacating activities could require brushing, removal of hazard trees, culvert cleaning, road resurfacing (e.g., rocking), and drainage improvements. These actions could require that trees and brush be removed; however, vegetation removed would be primarily from the understory, which does not affect shading. The removal of hazard trees could impact overstory vegetation that provides stream shade; however, this would occur infrequently[3] and would not affect enough overstory vegetation in one location to cause more than a minor localized impact.

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[1] Less than once annually for any given State Forest District.

[2] Will occur multiple times annually. Amount of activity varies by district, dependent on habitat and forest health goals.

[3] Activity intersects RCAs a few times annually, but is generally not be present in every State Forest District, every year.

Quarries constructed in the RCAs can remove trees, reducing the shade potential. The loss of shade can increase stream temperatures, which would affect the covered salmon and steelhead species.

The implementation of Conservation Action 1: Establish Riparian Conservation Areas, Conservation Action 2: Riparian Equipment Restriction Zones, and Conservation Action 11: Road Construction and Management Measures will keep stream shade reduction to a minimum and protect water temperature. Covered salmon and steelhead are likely to experience minor, localized increases in water temperature associated with harvest in smaller order streams that have smaller stream buffers and new road construction. Streams, and associated covered species, that are most at risk from minor increases in stream temperatures are those that are 303(d) listed for temperature. These effects are discussed by ESU below in Section 5.3.2.

Suspended Sediment

Forestry activities, if not managed properly, can increase the input of fine sediment into the aquatic system, which degrades spawning areas, reduces pool refuge habitat, decreases winter refuge areas for juveniles, and impedes feeding visibility. Lakel et al. (2010) found that streamside management zones (buffers) between 25 and 100 feet are effective in trapping sediment before it can enter streams. Conservation Action 1: Establish Riparian Conservation Areas reduces sedimentation by maintaining a buffer of 120 feet in all perennial fish-bearing streams and a buffer of 35 to 120 feet on all perennial streams, and 35 to 50 feet on seasonal streams that are potential debris flow tracks (PDFT) or high energy (HE). Other seasonal non-fish-bearing streams (i.e., not PDFT or HE) will maintain a 35-foot equipment restriction zone. There are 88.6 miles of existing roads in the RCAs. Of that, 7 miles of road are within 35 feet of a waterbody, the remaining 81.6 miles occur between 35 and 120 feet of a waterbody. Based on Lakel et al. (2010) these RCAs will be enough to minimize sediment inputs to the aquatic system from road and harvest activities.

Any work that needs to occur within the RCA, such as road system management activities, will follow Conservation Action 2: Riparian Equipment Restriction Zone and maintain a 35-foot equipment restriction zone from the other edge of the aquatic zone for all streams. This zone applies to both sides of the stream. Construction of new roads in the RCAs will be minimized by following Conservation Action 11: Road Construction and Management Measures, which provides measures to minimize potential impacts on the covered species. Measures such as following the *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife* (ODFW 2008) will ensure the covered salmon and steelhead are not directly affected by construction activities. Management direction such as siting requirements, proper drainage, and erosion control measures will limit inputs of sediment to the aquatic system over the course of the permit term.

Ongoing use and maintenance of logging roads in the permit area will be a continual potential source of sedimentation. Similarly, an increase in the volume of truck traffic during timber harvest activities could increase the delivery of fine sediment to adjacent streams. However, as stated above, Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 11: Road Construction and Management Measures will limit inputs of sediment to the aquatic system. These actions will ensure that an adequate buffer exists between the road and stream to minimize sedimentation. They will also require that maintenance activities would occur in a manner that will not likely result in harm of the covered salmon and steelhead, that roads that cannot be hydrologically disconnected will be closed during wet weather, and that commercial road use in areas where turbid runoff is likely to reach waters of the State will be suspended.

Culvert replacement, installation, and removal has the potential to temporarily increase downstream sedimentation. To limit the effect this will have on the covered species all in-water work, including culvert replacement, installation, and removal would occur during the Oregon Department of Fish and Wildlife (ODFW) in-water work window. This will limit the potential for the covered salmon and steelhead to be affected by any sediment plumes that may be associated with this work.

New logging roads allow easy public access to areas that were previously less accessible. Increased human activity in and around streams could affect stream bank stability (Kaufmann et al. 2009). Recreational activities involving horseback riding, off-highway vehicles, mountain bikes, and foot traffic can compact soil and cause the loss of vegetative structure in riparian areas, which could increase erosion and sedimentation in adjacent waterbodies (USFS n.d.). The indirect effects of increased access could result in increased deposition of fine sediment on the stream bed.

Rock quarries provide rock and gravel for road construction and management activities across the permit area. Rock quarry activities can generate sediment when pits are excavated, and the material is crushed, piled, and hauled. Sediment is most likely to enter streams from quarries within a distance of 150 feet. Quarries outside of riparian areas may transport sediment via road ditches if the ditches are connected to streams.

Implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 11: Road Construction and Management Measures will limit work on steep slopes in the permit area. Regulating timber harvesting and road and landing construction on steep, unstable slopes will limit sediment input by preventing potential mass-wasting events associated with ODF management activities.

Habitat restoration activities implemented under Conservation Action 3: Stream Enhancement could result in harm of covered species. Stream restoration projects within the permit area may include placement of logs or whole trees in streams to create pools and to retain spawning gravels, replacement or removal of stream crossing structures (i.e., culverts) that block fish passage, relocation or redesign of improperly located roads, stabilization of sediment sources (i.e., cut bank improvement of road drainage systems), road closure, and/or road decommissioning. These activities may temporarily affect covered fish species through scouring and erosion but will ultimately be beneficial, and will follow BMPs to reduce short-term impacts.

Within aquatic ecosystems, important functions of large wood include the storage, sorting, and modulation of the downstream movement of sediment. The presence of large wood in upstream reaches promotes sediment storage, which reduces fine sediment that degrades and entombs salmon redds; while in spawning areas it helps reduce bed mobility, which also helps to keep redds intact and minimize their loss through the movement of the spawning substrate during high flows (NOAA Fisheries 2016). As described in Section 5.3.1.1, *Large Wood Recruitment*, implementation of Conservation Action 1: Establish Riparian Conservation Areas will ensure that nearly all available wood volume in the permit area will remain in RCAs (TerrainWorks 2020), which will be available for recruitment into streams that support to covered salmon and steelhead. This wood will be available throughout the permit area and provide upstream sediment storage opportunities that will sort fine sediment and limit redd entombment.

The implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 11: Road Construction and Management Measures would limit effects on the covered salmon and steelhead in the permit area to minor, localized increases in sedimentation associated with new road construction, existing road and culvert maintenance, road use, and habitat restoration activities. While implementation of these conservation actions will minimize management-related erosion and sedimentation, complete elimination of management and public recreation related inputs is not possible.

Chemical Contaminants

If not sited properly forest roads can direct and increase the runoff of soils into waterbodies, increasing sedimentation and exposure to potential chemical spills (Gucinski et al. 2001). Stormwater runoff from impervious surfaces delivers a wide variety of pollutants to aquatic ecosystems, such as metals (e.g., copper and zinc), petroleum-related compounds (polynuclear aromatic hydrocarbons), along with the sediment washed off the road surface (Driscoll et al. 1990, Buckler and Granato 1999, Colman et al. 2001, Kayhanian et al. 2003). Pesticides and metals can be toxic to fish at high concentrations and have been shown in the laboratory to affect fish behavior even at very low concentrations. Accidental introduction of contaminants associated with timber harvest activities (e.g., fuel spills from timber harvest equipment) could result in mortality or inhibit normal behaviors of covered species that encounter these contaminants. The introduction of contaminants associated with maintenance-related activities would have similar effects.

The implementation of Conservation Action 11: Road Construction and Management Measures reduces the potential that activities associated with road construction and use in the RCAs would result in the runoff of contaminants into the adjacent stream. All new roads in or adjacent to RCAs will be hydrologically disconnected if possible. Roads that cannot be disconnected, or are unsuitable for wintertime haul, will be closed to logging trucks during wet weather. Staging and storage areas associated with construction activities in the RCAs would be at least 150 feet away from any waterbody or wetland to minimize leaks and spills that could enter waters of the State.

Road maintenance may require the spraying of herbicide to control vegetation. Measures described in Chapter 3 under the *Chemical* headings, and implementation of Conservation Action 11: Road Construction and Management Measures would limit application within the RCA to hand spraying or spraying from a truck, and/or mechanical removal. BMPs will be followed to ensure that chemicals do not reach a waterway. Aerial spraying will not be used within the RCAs. Harvest units adjacent to RCAs may be subject to aerial herbicide application. In areas adjacent to RCAs, herbicides will be applied in accordance with federal standards following the labeled instructions. BMPs identified in Chapter 3, including extending the RCA buffers by 15 feet during upland chemical application, will be followed to ensure drift, associated with aerial application, does not reach the aquatic environment. Results from the placement of drift cards in select RCAs will be reviewed annually for buffer adequacy. If it is found that drift into the RCA has occurred, the conditions under which the affected area was sprayed will be reviewed, and the BMPs will be updated to ensure future aerial herbicide applications will not enter the aquatic environment.

Fertilizers will not be used in RCAs. It is possible that stands adjacent to RCAs would be fertilized prior to harvest; however, fertilization is not a normal practice for ODF.

Conservation Action 11: Road Construction and Management Measures would result in the construction of hydrologically disconnected roads, and 150-foot setbacks for refueling, which would make the risk of aquatic contamination very low. In addition, fertilizer and aerial herbicides will not be used inside RCAs. For chemical application outside the RCAs, the RCAs would provide an adequate vegetated buffer that would prevent any herbicides from reaching the stream. If, through the use of drift cards, the prescribed buffers are found to be inadequate they will be expanded to ensure protection of the aquatic zone. While implementation of these conservation actions will minimize the potential for chemical contamination, complete elimination of inputs cannot be assured as small spills may occur.

Water Quantity

Forests influence water yield through the interception of precipitation and transpiration by trees. Increased coarse sediment following logging can increase the effect of low flows by shallowing and widening stream channels (Hickes et al. 1991). Conservation Action 1: Establish Riparian Conservation Areas addresses potential effects on water quantity from harvest activities in the permit area by maintaining RCAs adjacent to the aquatic zone, which includes the stream channel(s) and associated aquatic habitat features (beaver ponds, stream-associated wetlands, side channels, and the channel migration zone). This riparian vegetation will provide bank stability and prevent the shallowing and widening of a stream that can occur in its absence.

Upland timber harvest can affect streamflow. When a forest is harvested, water that is normally transpired by trees becomes available for streamflow. Post-harvest, peak streamflows after fall and spring storms generally increase; however, flows associated with large mid-winter events are generally unaffected as soils are already saturated regardless of cover type (Brown n.d.). The creation of RCAs under Conservation Action 1: Establish Riparian Conservation Areas will reduce runoff associated with storm events, which will limit delivery of sediments to the stream as well as mass soil movement (Bathurst and Iroumé 2014, Grant and Wolff 1991). Potential debris flow tracts and high energy streams will have RCAs that extend 50 feet (horizontal distance) from the aquatic zone for the first 500 feet upstream of the end of fish use to capture material into a fish-bearing stream. These areas are the most likely to deliver wood and sediment to fish-bearing streams that would affect the covered salmon and steelhead. Debris flows that occur in the permit area would be a short-term scouring event. In the short term these events could directly destroy redds or kill fish; however, they also introduce and redistribute spawning gravels and wood that provide habitat for the covered species.

Peak stream flows can be exacerbated by road-related runoff. Construction of new roads in the RCAs will be minimized to the extent possible. Any work that needs to occur within the RCA, such as road system management activities, will follow Conservation Action 2: Riparian Equipment Restriction Zone and maintain a 35-foot equipment restriction zone from the other edge of the aquatic zone for all streams. This zone applies to both sides of the stream. Construction of new roads in the RCAs will be minimized by following Conservation Action 11: Road Construction and Management Measures, which provides measures to minimize potential impacts on the covered species. Measures such as following *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife* (ODFW 2008) will ensure the covered salmon and steelhead are not directly affected by construction activities. In addition, roads located near a fish-bearing stream that have a high erosion potential, or landslide hazards that could affect the covered species will be evaluated for vacating. Roads that are vacated will follow the measures described in Conservation Action 5: Standards for Road Improvement and Vacating, which will fully disconnect the road from the stream, resulting in a decrease in peak flows. The implementation of these conservation actions will partially ameliorate the effects of road runoff and associated changes in peak streamflow.

ODF maintains water developments such as small water catchments, basins, and impoundments, which provide a water source for firefighting or for filling water trucks that may be on standby during prescribed burning or wildland fires. These water developments are located at creeks and rivers, and springs. Up to 35 new water drafting sites could be built and operational during the 70-year permit term. The primary method used to extract water would be portable pumps. The use of multiple pumps in a small area has the potential to deplete streamflow, which could affect the covered salmon and steelhead depending on timing. Most fire response occurs in the summer months, during low flow, but is complete by the fall when the salmon and steelhead are returning to spawn. Therefore, reduction in streamflow is not likely to affect migration and spawning, but it could impact salmon rearing in the freshwater system.

Most water quantity effects would be minimized under Conservation Action 1: Establish Riparian Conservation Area, Conservation Action 11: Road Construction and Management Measures, and Conservation Action 5: Standards for Road Improvement and Vacating. Salmon and steelhead are likely to experience minor, localized decrease in water quantity associated with fire-related water drafting. Similarly, salmon and steelhead would also experience localized increases in water quantity associated with storm events. These storm events can cause debris flows that enter fish-bearing streams.

5.3.1.3 Fish Passage

Stream crossings such as bridges or culverts can be migration barriers that affect the covered salmon and steelhead. Migration barriers limit or prohibit access to upstream habitat, limiting spawning and rearing locations within the species range. Stream crossings that are replaced, installed, or removed under this HCP will be compliant with Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers that requires new and replacement culverts meet NOAA Fisheries (2014) and ODFW(2015) passage criteria to ensure culverts are designed to maintain hydraulic conditions, including hydrology, velocities, and slopes that pass juvenile and adult fish. Culvert replacements and upgrades will occur at those areas identified to be a passage barrier or that are at the end of their life and due for an upgrade.

Culvert replacement would create a temporary fish barrier during construction as well as decrease shading and increase sedimentation. Measures are taken to offset potential impacts, articulated in the *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife* (ODFW 2008) or will obtain appropriate approvals from ODFW if it needs to occur outside appropriate windows. Effects of instream work are described in Section 5.3.1.2, *Water Quality and Quantity* as are the effects associated with vegetation removal and increased sedimentation.

The removal or modification of artificial barriers in the permit area will increase fish passage to upstream areas that could be used by salmon and steelhead for spawning and rearing. The access to additional previously inaccessible habitat will increase the carrying capacity of the system, potentially increasing populations of covered fish.

5.3.1.4 Direct Mortality

Direct mortality of the covered salmon and steelhead could occur if they make contact with equipment, personnel, or chemicals, or are present during dewatering associated with the covered activities. In-water activities such as culvert maintenance and installation, stream crossing construction, and stream enhancement projects have the potential to affect the covered fish species. As described in Conservation Action 11: Road Construction and Management Measures, in-water work will follow the established *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife* (ODFW 2008) or will obtain appropriate approvals from ODFW if it needs to occur outside appropriate windows. The ODFW work windows will minimize impacts on the covered species and their habitat by having work occur during times that avoid the vulnerable life stages of fish, including migration, spawning, and rearing.

5.3.2 Impacts of the Taking on Salmon and Steelhead

The sections below provide ESU-specific assessments of implementation of the HCP. Take resulting from habitat loss and other adverse effects, described above, is not expected to result in an adverse impact on the species' long-term persistence in the permit area for the following reasons:

- Covered activities will occur outside the RCAs and equipment restriction zones (ERZs). Implementation of the HCP will protect and enhance approximately 77,300 acres of forest along 5,405 river miles.
- Road decommissioning and culvert replacement activities that will occur under the HCP will reduce road-related sedimentation across the permit area and remove existing barriers to improve instream habitat conditions and make additional upstream habitat accessible for the covered salmon.
- Stream enhancement projects that will occur under the HCP will focus on restoring natural processes to create habitats that improve overall conditions for the covered species and other aquatic organisms in the permit area, allowing for immediate improvements to instream complexity, while the adjacent riparian forests are developing to provide long-term benefits.

While individual actions can affect the covered species, BMPs and conservation actions identified in Chapters 3 and 4, respectively, will minimize those effects on minor, localized changes that will be spread out across the permit area. To assess the overall impact of timber harvest on the covered salmon and steelhead, timber harvest modeling was used to predict the pace, scale, and amount of harvest over the course of the permit term. The results of this modeling exercise were used to determine if clearcut conditions would occur in any watersheds/ESUs over the course of the permit term that could result in watershed effects.

As described in Section 5.3.1 the RCAs will mitigate most of the effects associated with harvest activities to the covered salmon and steelhead. However, harvest outside of the RCAs can contribute to changes in watershed processes.[1] If more than 19–25% of a watershed is clear-cut at any given time, elevated peak flows become measurable; however, these effects diminish as the watershed becomes larger (Grant et al. 2008, Stednick 1996). Increases in peak flow associated with storm events can cause geomorphic effects with effects being amplified in rain-on-snow watersheds (Grant et al. 2008). Flows that are large enough to alter channel morphology, bank erosion, or habitat structure have the highest likelihood of affecting fish (Grant et al. 2008).

Detailed results of the watershed analysis, by Hydrologic Unit Code (HUC) 10, are presented in Appendix F. The below section focuses on identifying HUC 10 watersheds, by ESU, or group of ESUs, that could experience elevated peak flows associated with timber harvest (stands <10 years old) in the permit area. The analysis focuses on the proportion of land within ODF ownership that would exhibit clearcut conditions; however, in some instances the analysis is expanded to the larger HUC 10 for context. If an average of 20% of timber in the permit area of the HUC would be <10 years old over the course of the permit term effects on fish could occur. Outside the permit area it is assumed

[1] Annual water and sediment yield, low flows, peak flows, and water quality metrics (e.g., temperature, chemical composition).

that watersheds that are primarily privately owned will have younger stands, while federally owned watersheds are likely to have older aged forests.

5.3.2.1 Oregon Coast Coho and Spring Chinook

Oregon Coast Coho consist of 27 independent and dependent populations, 13 of which have no stream miles in the permit area, and 14 populations that could be affected by harvest in their watershed (Appendix F). The majority of these independent populations have less than 5% of their stream miles in the permit area while the Nehalem and Tillamook Bay have 49 and 28%, respectively, of their stream miles in the permit area. The remaining 13 populations do not overlap the permit area, will not be affected by covered activities, and are therefore not further discussed. Effects on the 14 populations where harvest would occur in the permit area are discussed below. Given the high proportion of the Nehalem and Tillamook Bay in the permit area, impacts those populations are also further discussed in their own sections. Effects on Oregon Coast Spring Chinook are expected to be the same as those described for Oregon Coast coho and are not described separately.

The Oregon Coast ESU is composed of 4,227,104 acres; the permit area encompasses 639,489 acres within this ESU and overlaps 43 HUC 10s (Appendix F). Rivers in the ESU flow from the mountains of the Coast Range, except for the Umpqua River, which extends east through the Coast Range to drain the Cascade Mountains (NOAA Fisheries 2016). Rivers and streams in this ESU are fed by both rainfall and snowmelt, though most systems are rain-dominated.

An assessment of clear-cut conditions at 5-year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (0–10 years) in the permit area ranges from 0% in the Clark Branch South Umpqua River, Olalla Creek – Lookinglass Creek, and Umpqua River – Sawyers Rapids to 15% in Beaver Creek, Nestucca River, and Trask River. The distribution of clear-cuts in the permit area, across the permit term will not exceed 20% of the total forest cover; therefore, upland harvest in the permit area is not likely to affect overall watershed process for any of the HUC 10s in the Oregon Coast Coho ESU.

Nehalem Independent Population

The Nehalem Independent Population of Oregon Coast Coho (HUC 17100202) is composed of 464,777 acres; the permit area encompasses 209,569 acres within this subbasin that overlap six HUC 10s (Appendix F). Rivers and streams in the Nehalem subbasin are primarily fed by rainfall.

An assessment of clear-cut conditions at 5 year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (010 years) in the permit area ranges from 6% in the Salmonberry River to 16% in the Upper Nehalem River. The distribution of clear-cuts in the permit area, across the permit term, will not exceed 20% of the total forest cover for any HUC 10 in range of the Nehalem Independent Population at any point during the permit term. This, in conjunction with the large overall size of the subbasin, indicates that upland harvest is not likely to affect overall watershed process in the Nehalem subbasin. Furthermore, watersheds located in the rain-dominated zone, such as the Nehalem, are less sensitive to changes in peak flows (Grant et al. 2008).

Tillamook Bay Independent Population

The Tillamook Bay Independent Population of Oregon Coast Coho is composed of 342,363 acres; the permit area encompasses 214,980 acres within this subbasin that overlaps six HUC 10s (Appendix F). Rivers and streams in the Tillamook Bay watershed are primarily fed by rainfall.

An assessment of clear-cut conditions at 5 year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (0–10 years) in the permit area ranges from 5% in the Kilchis River and Tillamook River HUCs to 15% in the Trask River HUC. The distribution of clear-cuts in the permit area, across the permit term, will not exceed 20% of the total forest cover for any HUC 10 in range of the Tillamook Bay Independent Population. This, in conjunction with the large overall size of the subbasin, indicates that upland harvest is not likely to affect overall watershed process in the Nehalem subbasin. Furthermore, watersheds located in the rain-dominated zone, such as Tillamook Bay, are less sensitive to changes in peak flows (Grant et al. 2008).

5.3.2.2 Lower Columbia River Coho, Chinook, and Columbia River Chum

Lower Columbia River Coho, Chinook, and Columbia River Chum ESUs have minor overlap with the permit area (Chapter 2 and Appendix D). Their ESUs are composed of 325,599 acres, with 43,639 acres that overlap five HUC 10s in the permit area. The permit area is in the Coast Range ecological zone where rivers and streams are primarily fed by rainfall.

An assessment of clear-cut conditions at 5-year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (0–10 years) in the permit area ranges from 0% in the Salmon River HUC to 19% in the Big Creek HUC. The distribution of clear-cuts in the permit area, across the permit term, will not exceed 20% of the total forest cover; therefore, upland harvest in the permit area is not likely to affect overall watershed process for any of the HUC 10s within the range of Lower Columbia River coho, Lower Columbia River Chinook, and Columbia River chum.

5.3.2.3 Upper Willamette River Spring Chinook and Winter Steelhead

Upper Willamette River Spring Chinook and Winter Steelhead ESUs have minor overlap with the permit area (Chapter 2 and Appendix D). Their ESU boundaries are not identical, so total ESU and permit area acreages are not included here. Rivers and streams in the Willamette River basin are fed by rainfall and snowmelt.

An assessment of clear-cut conditions at 5-year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (0–10 years) in the permit area ranges from 0% in the Quartzville Creek – Green Peter Lake HUC to 21% in the Rickreall Creek – Willamette River HUC. While Rickreall Creek exceeds the 20% threshold, watershed effects are not expected as the permit area accounts for less than 1% of the overall acreage within this HUC. Therefore, upland harvest in the permit area is not likely to affect overall watershed process for any of the HUC 10s within the range of Upper Willamette River Spring Chinook and Winter steelhead.

5.3.2.4 Southern Oregon/Northern California Coast Coho

The Southern Oregon/Northern California Coast Coho ESU has minor overlap with the permit area (Chapter 2 and Appendix D). Their ESU is composed of 606,716 acres, with 9,295 acres that overlap 20 HUC 10s in the permit area. Rivers and streams in these watersheds are primarily fed by rainfall.

An assessment of clear-cut conditions at 5-year intervals, by HUC 10, is provided in Appendix F. Average percent of HUC 10 watersheds in clear-cut and young forest conditions (0–10 years) in the permit area is expected to exceed 20% of the permit area in the following HUCs: Josephine Creek – Illinois River, West Fork Illinois, Hellgate Canyon – Rogue River, and Shady Cove – Rogue River HUCs; however, the permit area represents a small portion of the overall watershed for each of these. Therefore, while clearcuts in the permit area for these HUCs will exceed a 20% average of the total forest cover over the course of the permit term, the clearcut acreage in the permit area represents a small portion of the overall HUC 10 (Appendix F). Consequently, upland harvest in the permit area is not likely to affect overall watershed process for any of the HUC 10s within the range of the Southern Oregon/Northern California Coast coho.

5.3.2.5 Climate Change

Climate change is described in Section 2.3.1.3, *Climate and Climate Change,* and is expected to result in warmer, drier summers, reduced snowpack, lower summer flows, higher summer stream temperatures, and increased winter floods. These changes would affect the covered salmon and steelhead by reducing available summer rearing habitat, increasing potential scour and egg loss in spawning habitat, increasing thermal stress, and increasing predation risk. Climate change will cause the covered salmon and steelhead to be exposed to more intense winter flooding and more severe summer low flow periods.

Higher winter stream flows increase the risk that winter floods could damage spawning redds and wash away incubating eggs. Earlier peak stream flows could also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation. Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, nonnative species (ISAB 2007).

As described in Chapter 4, the RCAs are adequate to prevent instream warming, and harvest within each HUC 10 is not expected to exceed the 20% threshold that would result in watershed effects.

[**Note to reader:** *Further analysis on how the aquatic conservation strategy will address changing threats under climate change is underway and will be presented in a future draft.*]

5.3.3 Beneficial and Net Effects on Salmon and Steelhead

This section describes how implementation of the conservation actions will achieve the biological goals and objectives to benefit the covered salmon and steelhead. As required by the regulations for incidental take permits (50 CFR 222.307), the HCP will "avoid, minimize, and mitigate the impacts of take to the maximum extent practicable." The conservation actions described in Chapter 4 are expected to maintain and improve the natural processes necessary for salmon spawning and rearing habitat in the permit area. The HCP is expected to have both short- and long-term benefits to the covered salmon and steelhead by implementing the following.

- Implementing a more protective riparian strategy than mandated by the Oregon Forest Practices Act. RCAs will be implemented adjacent to fish- and non-fish-bearing streams to protect riparian forests during and following harvest activities and contribute to the long-term development of large wood to benefit instream habitat over time.
- Promoting the development of older forests within RCAs and upland areas within HCAs to improve instream habitat quality.
- Limiting the construction of new roads in RCAs and having BMPs in place for road management activities will limit runoff and sediment inputs.
- Implementing stream enhancement and restoration projects to benefit habitat for the covered salmon at key locations.

The HCP covers approximately 5,405 river miles in the permit area that are within the range of the covered salmon species distribution. Limiting factors for each ESU are presented in Chapter 2 and Appendix C. While limiting factors vary across ESU and independent population, the main factors limiting the listed salmon and steelhead in the permit area that ODF has the ability to affect are physical habitat quality and quantity and water quality associated with land management. Recovery plans have been developed for the covered salmon species with a goal of improving the viability of the species to the point that they meet the delisting criteria and no longer require ESA protection.

The implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action and Conservation Action 2: Riparian equipment Restriction Zones will protect 77,300 acres of riparian forests from harvest in the permit area. These RCAs ameliorate impacts on stream habitat by maintaining necessary connections between terrestrial and aquatic forest conditions and providing a corridor around streams. Streams with riparian corridors have intact vegetative cover (shading) and will not likely have increased stream temperatures, larger diurnal temperature fluctuations (Macdonald et al. 2003, Johnson and Jones 2000), or warm adjacent downstream reaches. Riparian corridors provide a physical barrier that keeps logging debris (slash) from adjacent activity from reaching the stream and maintains shading over the stream maintaining ambient stream temperatures (Jackson et al. 2001, Richardson et al. 2010). They also function as a filter to absorb increased nutrients following harvest and sediments from exposed/disturbed soils (Richardson et al. 2010).

Riparian buffers and other tree reserves are highly susceptible to wind throw due to increased edge-effect (Hassen et al. 2005). In years following harvest, tree fall into or adjacent to the stream is highly common and will impact salmonid habitat by altering stream-channel dynamics. Windthrow following harvest and the presence of a riparian buffer provide a source of large wood recruitment to streams (Hairston-Strang and Adams 1998). Large wood within streams provides collection points for spawning gravel, facilitates pool formation, and creates habitat cover (quality rearing habitat). Tree fall from the buffer creates a low risk of direct take and indirect harm of fish, through the potential crushing or disturbance of redds, creation of severe logjams that are potential barriers to upstream movement, and potential temporary increase of fines.

Although there is a potential for streams to warm because of silvicultural activities, the likelihood is very small when harvest takes place outside of riparian areas. This is especially applicable to small streams because temperature increases in headwater streams are unlikely to produce substantial changes in the temperatures of larger streams into which they flow unless the total inflow of heated tributaries constitutes a significant proportion of the total flow in the receiving stream (Kibler et al. 2013, Moore et al. 2005 as cited in Reeves et al. 2016). Silvicultural actions are not permitted within the RCAs and will, therefore, not contribute to stream warming.

Over the course of the permit term the distribution of the forest stand age over time in the RCAs will continue to develop into older forests as they will not be harvested. In addition, 36,561 acres of RCAs overlap with HCAs. Thinning will not occur in these RCAs, but will be used in the adjacent HCAs to promote development of old growth trees, which will benefit the covered salmon and steelhead. As trees get older and bigger, they will continue to stabilize streamside soils, provide shade, and be available for recruitment all of which will benefit the covered fish species.

A review of Oregon forest roads after the 1996 storm (Skaugset and Wemple 1998) indicates that most of the road-related erosion in the permit area is associated with roads that were constructed during or before the 1960s. And of those roads, most erosion incidents were associated with mid-slope locations, not roads that were located on the ridge or valley bottom. Existing roads that are contributing to sedimentation will be inventoried and addressed under Conservation Action 5: Standards for Road Improvement and Vacating.

Road decommissioning can ameliorate the effect of increases in peak flows to the streams caused by new road construction by disconnecting runoff from previous roads to streams. Road decommissioning will include blocking the road, out-sloping and adding waterbars for drainage control, ripping and subsoiling the roadbed, culvert removal, and replanting the roadbed. Roads that receive full decommissioning (ripping and subsoiling) will have the most beneficial effect of reducing runoff to streams. The fully decommissioned roads will provide a long-term benefit of decreasing peak flows to streams by disconnecting these roads from the stream.

Construction of new roads in the RCAs will be minimized to the extent possible. When roads need to be constructed in an RCA, they will follow Conservation Action 11: Road Construction and Management Measures, which will ensure all new roads are hydrologically disconnected and not constructed in sensitive environments (e.g., streamside, midslope, steep slopes). Conservation action will also ensure management direction is in place to limit the use of roads with the potential to deliver sediment to the streams during the wet season. Overall, the combination of all road-related conservation measures will result in a reduction in road-related sediment input to the aquatic system over the course of the permit term.

Implementation of Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers and Conservation Action 11: Road Construction and Management Measures will result in an increase in stream miles accessible to the covered salmon and steelhead by improving and removing existing barriers and ensuring all new stream crossings meet NOAA Fisheries and ODFW regulations. ODF will replace at least 167 (50%) culverts identified by ODFW that do not currently meet fish passage criteria expanding the upstream extent of the covered salmon and steelhead over the course of the permit term.

Riparian areas experiencing moderate annual climate conditions can have higher humidity and can act as a buffer against fire and as a refuge for fire-sensitive species (Halofsky and Hibbs 2008). Some studies have found fire typically occurs less frequently in riparian areas (Russell and McBride 2001, Dwire et al. 2016). The creation of RCAs in the permit area will provide resilience against climate change by continuing to provide a source of shade and buffer against increased wildlife fires.

Full implementation of the ODF HCP will result in a net increase in quality of available habitat for the covered salmon species. With full implementation of the HCP, 5,405 river miles and 77,300 acres of riparian habitat will be managed and protected. Long-term benefits in the permit area associated with implementation of the conservation actions include: improved habitat, increased channel complexity, increased fish passage to spawning and rearing habitat, improved water quality conditions, and improved functioning of riparian forest, which would address limiting factors for the covered species, and improve conditions for the covered species in the permit area over the course of the 70-year permit term.

5.3.3.1 Benefits of Monitoring and Adaptive Management Program

The monitoring program described in Chapter 6 includes ODF's commitment to document trends in habitat conditions across the permit area to verify that the biological goals and objectives are met. The results of the monitoring program will provide documentation that the intended benefits to the covered salmon and steelhead habitat are being realized. Should monitoring results indicate that biological objectives are not being realized, ODF will implement the adaptive management process described to rectify deficiencies.

5.3.3.2 Net Effects

The conservation strategy includes maintaining riparian conservation areas, which will not be harvested and will develop into older forests over the permit duration. The RCAs will provide long-term protection and enhancement of the covered salmon and steelhead habitat in exchange for allowable harvest in other habitat areas outside of the RCAs to maintain important economic values from ODF lands within the permit area.

Minor, localized take associated with the covered activities will be offset through the implementation of stream enhancement projects. These projects will restore natural processes and create habitat that will improve the overall conditions for the covered species in the permit area.

5.3.4 Effects on Critical Habitat

Within the permit area designated critical habitat occurs for Oregon Coast Coho, Lower Columbia River Coho, Lower Columbia River Chinook, Upper Willamette River Spring Chinook, and Upper Willamette River Winter Steelhead (Table 5-2). There is no designated critical habitat for Columbia River chum and Southern Oregon/Northern California Coast coho in the permit area, therefore, there will be no effect on these species' critical habitat.

Under the HCP all stream miles designated as critical habitat within the permit area will be protected by RCAs. The RCAs will promote the development of function riparian forests with large trees that will provide shade, contribute to instream habitat, and improve water quality and quantity. Existing roads in the RCAs will be assessed to identify locations that contributing sediment to the aquatic system and need to by hydrologically disconnected or moved. In addition, development of new roads in the RCAs will be limited to areas where no other option is economically or operationally feasible. If new roads are constructed in the RCA they will maintain a 35-foot minimum buffer from the edge of the stream to minimize sedimentation. The commitment to reduce sedimentation from existing roads and limit future road development will limit potential sediment inputs to critical habitat. The commitment to improve fish passage will increase available spawning and rearing habitat within the permit area. As riparian conditions are developing in the

RCAs, stream enhancement projects will focus on restoring natural processes to create habitats that improve overall conditions for the covered species and other aquatic organisms in the permit area, allowing for immediate improvements to instream complexity.

Designated critical habitat in the plan area is a small portion of the overall designated critical habitat. While the covered activities could have minor, localized effects on critical habitat , implementation of the conservation actions identified in Chapter 4, and described above, are expected to protect the physical and biological features that support the life history requirements of for Oregon Coast Coho, Lower Columbia River Chinook, Lower Columbia River Chinook, Upper Willamette River Spring Chinook, and Upper Willamette River Winter Steelhead in the permit area and would be unlikely to destroy of adversely modify critical habitat.

Table 5-2. Miles of Critical Habitat by ESU in the Permit Area

ESU	Total Miles of Designated Critical Habitat	Miles of Critical Habitat in Permit Area	Percent
Oregon Coast Coho	6,568	435	6.6
Nehalem Independent Population	514	192	37
Tillamook Bay Independent Population	375	189	50
Lower Columbia River Coho	3,281	25	>1
Lower Columbia River Chinook	1,314	5	>1
Columbia River Chum	712	0	0
Upper Willamette River Spring Chinook	1,472	3	>1
Upper Willamette River Winter Steelhead	1,285	14	1
Southern Oregon/Northern California Coast Coho	N/A	N/A	N/A

5.3.5 Cumulative Effects on Salmon and Steelhead

Cumulative effects, as defined in this HCP, are the combined effects of future state, local, or private (i.e., non-federal) actions that are reasonably certain to occur in the action area, considered collectively with the effects of this HCP.

At the time of the writing of this HCP, ODF is not aware of any future state or local actions that may contribute to cumulative effects that are reasonably certain to occur. The Department of State Lands (DSL) is currently preparing an HCP for the Elliott State Forest. As an HCP, it is required to fully offset the impacts of take and is unlikely to adversely affect the Oregon Coast coho population or distribution or otherwise contribute to cumulative effects. In addition, because the Elliott State Forest HCP is in development and not yet final, it is not considered a cumulative effect in this HCP (per the regulatory definition of cumulative effects, 50 CFR 02.02).

ODF is not aware of any other non-federal landowner that is seeking an incidental take permit through Section 10 of the ESA. Therefore, actions on other non-federal lands are not anticipated to contribute to cumulative effects, because those landowners are required to avoid take under Section 9 of the ESA. Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational development plans (e.g., mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines). But ODF is not aware of any specific projects reasonably certain to occur within the covered fish ESUs.

5.4 Effects Analysis for Eulachon

This section describes the effects of the covered activity on eulachon. Eulachon may only occur in a limited portion of the permit area. The permit area does contain a small number of tidally influenced streams along the Columbia River, where eulachon may exist now or at some point during the permit term (Appendix C).

5.4.1 Sources and Types of Take

Sources and types of take would be the same as those described for salmon and steelhead in Section 5.3. Eulachon occur primarily in the mainstem Columbia River and alcoves in the mouths of its tributaries. These mainstem rivers are outside the permit area and eulachon are unlikely to migrate upstream into the streams that occur in the permit area.

5.4.2 Impacts of the Taking on Eulachon

Direct effects on this species would be unlikely. However, they could be affected by changes in water quality and quantity of tributaries of the Columbia River. As described in Section 5.3, these changes would be minor due to implementation of the conservation actions (Chapter 4) and BMPs (Chapter 3).

5.4.3 Beneficial and Net Effects

The implementation of conservation actions to benefit the covered salmon and steelhead would benefit eulachon by providing adequate shade in the permit area to maintain/cool water temperatures that are likely to ameliorate the impact of climate change in tributaries to the Columbia River.

5.4.4 Effects on Critical Habitat

Critical habitat has not been designated for eulachon within the permit area; therefore, none will be affected.

5.4.5 Cumulative Effects on Eulachon

Eulachon are unlikely to occur in the permit area. With implementation of the HCP, streams that feed into eulachon habitat will be protected to offset effects associated with timber harvest and protect against climate change. The HCP will minimize and mitigate the impacts on eulachon to the maximum extent practicable, and provide for the conservation of the species in the permit area.

5.5 Effects Analysis for Columbia and Cascade Torrent Salamanders

This section describes the effects of the covered activity on Columbia torrent salamander and Cascade torrent salamander.

Within the permit area there are approximately 677 stream miles of potential habitat (perennial non-fish bearing streams) for Columbia torrent salamander within their range. Known occurrences of Columbia torrent salamander in the permit area are clustered in Clatsop County, south of the Clatsop State Forest and in Tillamook, Washington, and Yamhill Counties (Appendix C).

The permit area includes approximately 76 stream miles of suitable habitat (perennial non-fish-bearing streams) for Cascade torrent salamander. Known occurrences of Cascade torrent salamander in the permit area, based on ODF and Global Biodiversity Information Facility (GBIF) data are clustered in Linn County, in the Santiam State Forest. Additional occurrences in the vicinity of the permit area have been recorded in Marion, Clackamas, and Lane Counties (Appendix C).

5.5.1 Sources and Types of Take

The covered activities described in Chapter 3 could result in the following categories of stressors on the covered torrent salamander species, each of which is described in more detail below.

- **Reduced water quality and quantity:** Reduction in function or quality of habitat as a result of covered activities.
- **Habitat loss and fragmentation:** Reduction in habitat resulting in habitat fragmentation from covered activities.
- **Direct mortality:** Injury or mortality of individuals resulting from handling or crushing by equipment, humans, or felled trees.

The stressors listed above are categorized in this manner to facilitate a meaningful assessment of the effect's pathways for the covered torrent salamander species. The following sections describe the effects pathways associated from each of the stressors that result from the covered activities.

5.5.1.1 Water Quality and Quantity

Water Temperature

Because torrent salamanders are closely associated with streams and have specific requirements for clear, cold, well-shaded streams (Stebbins 1951), activities that alter these stream conditions degrade the species' habitat. Activities in riparian areas that remove canopy cover, such as timber harvest, timber management, and fire management, may result in increased water temperatures and decreased dissolved oxygen (Thomas et al. 1993, Blaustein et al. 1995). Torrent salamanders are highly sensitive to temperature changes (Dunham et al. 2007).

Expected temperature effects on torrent salamanders from implementation of the HCP would be the same as described under *Water Temperature* in Section 5.3.1.2. The implementation of Conservation Action 1: Establish Riparian Conservation Areas, Conservation Action 2: Riparian Equipment Restriction Zones, and Conservation Action 11: Road Construction and Management Measures will keep stream shade reduction to a minimum and protect water temperature. Torrent salamanders are likely to experience minor, localized increases in water temperature associated with harvest in smaller order streams that have smaller stream buffers and new road construction. Streams, and associated covered species, that are most at risk from minor increases in stream temperatures are those that are 303(d) listed for temperature.

Suspended Sediment

Sedimentation associated with forest management activities degrade habitats used by torrent salamanders. Expected effects associated with sedimentation from implementation of the HCP would be similar to those described under *Suspended Sediment* in Section 5.3.1.2.

The implementation of Conservation Action 1: Establish Riparian Conservation Areas and Conservation Action 11: Road Construction and Management Measures would limit effects on torrent salamanders in the permit area to minor, localized increases in sedimentation associated with new road construction, existing road and culvert maintenance, road use, and habitat restoration activities. While implementation of these conservation actions will minimize management-related erosion and sedimentation, complete elimination of management-related inputs is not possible.

Chemical Contaminants

Chemicals such as herbicides and fertilizers not only can have direct impact on torrent salamanders (from absorption through their skin) but could enter torrent salamander habitat from adjacent covered activities. Broad-scale herbicide treatments applied to forest land shrub layer could drift into nearby streams and waterways and potentially negatively affect torrent salamanders (Howell and Maggiulli 2011). Episodic release of chemicals trapped in snowmelt may have some direct and indirect effects on Cascade torrent salamanders, particularly where they may accumulate in the foothills of the Cascade Range (Olson pers. comm. 2009, as cited in Howell and Maggiulli 2011). Accidental spills of chemicals (e.g., fuels, petroleum, herbicides) that are used during covered activities, can be toxic to aquatic organisms. For example, the surfactant in Roundup® is known to be lethal to frog larvae (Relyea 2005). Covered activities conducted in or near torrent salamander habitat has the potential to expose individuals and eggs to toxic chemicals.

Conservation Action 11: Road Construction and Management Measures would result in the construction of hydrologically disconnected roads, and 150-foot setbacks for refueling, which would make the risk of aquatic contamination very low. In addition, fertilizer and aerial herbicide use will not occur in the RCAs, and the RCA will provide an adequate vegetated buffer that would prevent any chemicals applied outside the RCA from reaching the stream. While implementation of these conservation actions will minimize the potential for chemical contamination, complete elimination of inputs cannot be assured as small spills may occur.

5.5.1.2 Habitat Loss and Fragmentation

One of the main threats to torrent salamanders it the loss of habitat. Loss of habitat may also contribute to habitat fragmentation. Fragmentation of habitats may lead to the further isolation of populations and restriction of gene flow, which makes populations more vulnerable to local extirpations. These factors are compounded by the relatively long time it takes these salamanders to reach sexual maturity (approximately 4.5 years), and the low number of eggs produced per female and the tendency for females to produce only one clutch per year (Blaustein et al. 1995, Howell and Maggiulli 2011).

Temporary habitat loss may result from the development and use of temporary access roads that cross streams. These areas, however, would be restored to pre-disturbance conditions when covered activities are complete. Where possible, temporary disturbance areas would be located within the permanent disturbance footprint, such as within a recreational facility or quarry area.

Roads and culverts crossing streams may also pose barriers to amphibian movements (Howell and Maggiulli 2011). Perched culverts are problematic for torrent salamander movement due to the loss of substrate continuity, increased water velocity at the downstream outflow pipe, significant drops at the outflow pipe, and lack of instream structures (e.g., quiet pool) (Howell and Maggiulli 2011). Because torrent salamanders are highly associated with the stream channel and adjacent moist ground, the salamanders will not likely move upland to navigate around the barriers that roads and culverts may present. Although it is not known to what degree, roads that cross streams may also fragment habitat for Columbia and Cascade torrent salamanders (Howell and Maggiulli 2011). An inability to disperse puts populations at risk because it limits gene flow and the ability to recolonize after disturbance (Jackson 2003).

The implementation of Conservation Action 1: Establish Riparian Conservation Areas, Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers, and Conservation Action 11: Road Construction and Management Measures would limit effects on torrent salamanders in the permit area to minor, localized areas of habitat loss associated with new culvert installation, and road-related stream crossings.

5.5.1.3 Direct Mortality

Timber harvest or forest management activities that take place in or immediately adjacent to suitable streams and disturb stream surfaces could result in direct injury or mortality of individual salamanders and their eggs. Equipment and vehicles used to conduct covered activities could also crush salamanders resulting in direct injury or mortality. The implementation of Conservation Action 1: Establish Riparian Conservation Areas, and Conservation Action 2: Riparian Equipment Restriction Zones limits work in RCAs. Conservation Action 11: Road Construction and Management Measures will reduce the risk of mortality by developing roads away from streams and implementing buffers of undisturbed land between roads and streams. While implementation of these conservation actions will minimize the potential for direct mortality, complete elimination of direct mortality cannot be assured as it may occur when temporary stream crossings or culverts are constructed. These effects would be localized and temporary.

5.5.1.4 Other Stressors

Diseases in torrent salamanders are currently unknown (Howell and Maggiulli 2011); however, Jancovich et al. (1997) suggest that iridoviri virus, *Ambystoma tigrinum*, has been implicated in a series of mass salamander mortalities in the United States and that the disease is being spread via anthropogenic means. Although more common in frogs, salamanders have been documented with chytridiomycosis and mortalities have occurred (Scheele et al. 2019). Increased human presence in suitable Columbia and Cascade torrent salamander habitat could increase the potential for introduction of disease.

The construction of additional roads in the permit area over the course of the permit term will provide additional public access. Implementation of Conservation Action 11: Road Construction and Management Measures will limit construction of new roads inside the RCAs ,and Conservation Action 5: Standards for Road Improvement and Vacating will result in identification and vacating of existing roads inside RCAs. Overall, road miles inside RCAs, and associated public access, are not expected to increase significantly over the course of the permit term.

5.5.2 Impacts of the Taking on Columbia and Cascade Torrent Salamanders

The permit area supports an estimated 677 miles of Columbia torrent salamander habitat and 76 miles of Cascade torrent salamander habitat. Under the HCP, take through direct harm and habitat modification will be minimized through the establishment of RCAs and ERZs (Conservation Actions 1: Establish Riparian Conservation Areas and 2: Riparian Equipment Restriction Zones). With implementation of the HCP, suitable habitat for Columbia and Cascade torrent salamanders in the permit area will be conserved in RCAs as shown in Table 5-3. However, some disturbance in riparian areas will still occur. Direct mortality of torrents could occur if they make contact with equipment, personnel, or chemicals, or are present during dewatering associated with the covered activities. In-water activities such as culvert maintenance and installation, stream crossing construction, and stream enhancement projects have the potential to affect torrent salamanders. The occurrence of these activities in the RCA and ERZ would be infrequent; when they do occur the implementation of the conservation actions (Chapter 4) will limit the potential for injury or mortality of the torrent salamanders resulting directly from the covered activities. Therefore implementation of the HCP is not expected to affect the persistence of local populations.

Table 5-3. Miles of Perennial Non-Fish-Bearing Streams and Associated RCA Widths in the Range of Torrent Salamanders in the Permit Area

	Perennial Non-Fish-Bearing			Total
Species	Large	Medium	Small	
Columbia Torrent Salamander	4.3 (120-foot RCA)	105.9 (120-foot RCA)	566.5 (35- to 120-foot RCA)	676.56
Cascade Torrent Salamander	2.3 (120-foot RCA)	15.1 (120-foot RCA)	58.3 (35- to 120-foot RCA)	75.58

5.5.3 Beneficial and Net Effects on Columbia and Cascade Torrent Salamanders

The HCP will have positive effects on torrent salamanders by: (1) increasing the overall amount and quality of late-successional coniferous forest habitat near streams; (2) maintaining canopy cover directly adjacent to streams; (3) protecting and improving water quality and instream habitat; and (4) providing protection of talus fields (including all permanently wet talus), all of which are important habitat components for this species. Minimal negative effects are expected because the riparian buffers to be implemented under the HCP will maintain stream temperatures and minimize impacts of timber harvesting on Columbia and Cascade torrent species.

When combined with upland forest management measures such as no-harvest in the RCAs and development of mature and late-seral forest in the HCAs, the riparian protection measures will minimize the effects of timber harvesting on the microclimate of small streams. Mature forest cover is beneficial to torrent salamanders because it contributes to the cool, moist microclimate required by adults. Riparian management measures will protect shade, bank stability, instream habitat, and water quality in the watershed(s). These stream functions are critical to the fully aquatic larval of torrent salamanders, which require cold, clear, oxygen-rich water. Road construction and maintenance measures, including road closures to the public, road abandonment, roadside vegetation, erosion control, culvert improvements, stream-crossing improvements, and road construction improvements on steep and unstable soils, will protect existing water quality and stream habitat and improve connectivity of riparian corridors with closed-canopy riparian forests. Species-specific measures designed to protect salmon and steelhead will benefit Columbia and Cascade torrent salamanders by providing permanent protection of riparian forests used by the species.

5.5.4 Effects on Critical Habitat

Critical habitat has not been designated for Columbia torrent salamander and Cascade torrent salamander.

5.5.5 Cumulative Effects on Columbia and Cascade Torrent Salamanders

With implementation of the HCP, all of the suitable habitat for Columbia and Cascade torrent salamanders in the permit area will be conserved in RCAs. All lands in the conservation area that support torrent salamanders will be monitored and adaptively managed to maintain the habitat value and function for the species. Full implementation of the HCP will protect the riparian areas used by the torrent salamanders. The HCP will minimize and mitigate the impacts on Columbia and Cascade torrent salamanders to the maximum extent practicable, and provide for the conservation of the species in the permit area.

5.6 Effects Analysis for Oregon Slender Salamander

5.6.1 Sources and Types of Take

Covered activities that include disturbing or removing large woody debris used by Oregon slender salamander—including timber harvest, thinning, road work, quarry work, and recreation development and maintenance—are projected to result in the following two types of incidental take of Oregon slender salamander.

- Harm due to direct injury or mortality, such as inadvertently crushing individuals during harvest operations or exposing individuals to sunny, dry conditions leading to desiccation.
- Harm due to habitat modification to the extent that Oregon slender salamander have reduced survival or reproductive success.

The following sections describe the criteria and thresholds for determining when such take will occur, the effects pathways leading to take, and the specific covered activities expected to result in take, as well as those covered activities not expected to result in take.

5.6.1.1 Criteria and Thresholds for Determining Take

Habitat must be occupied by Oregon slender salamanders to expose individuals to the effects of habitat modification. Habitat modification within stands with documented occupancy or that are modeled as suitable or highly suitable are most likely to result in take, as these are places that

Oregon slender salamander are most likely to be present. Therefore, to quantify the level of incidental take of Oregon slender salamanders, the HCP uses the acres of suitable and highly suitable habitat that would be harvested or otherwise disturbed under the HCP.

Table 5-4 summarizes the general sources of habitat modification and the associated thresholds used in this HCP to determine the level of take presented in Section 5.7.2, *Quantity and Timing of Take*. The effects pathways leading to such take are described in the next subsection. For this assessment, *modification* is considered altered habitat structure or composition so that habitat values move from highly suitable or suitable to marginal or non-habitat.

Table 5-4. Criteria and Threshold for Determining Take on Oregon Slender Salamander

Covered Activities Assumed to Take Oregon Slender Salamander	Covered Activities with Beneficial, Insignificant, or Discountable Effects
• Covered activities that modify a stand (e.g., regeneration harvest or thinning) with known presence • Covered activities or other disturbance (including use of heavy equipment) within *suitable* or *highly suitable* habitat.	• Covered activities that modify stands modeled as *marginal* habitat or as *non-habitat*.

5.6.1.2 Effects Pathways

As stated, modification of occupied habitat will be the primary stressor acting on Oregon slender salamanders over the permit duration. The effects pathways leading to harm due to direct injury or mortality include all covered activities that would involve tree felling and yarding and associated heavy equipment operation and other physical disturbance that could remove or break apart large wood and associated bark plates and moss mats or directly crush individual Oregon slender salamanders.

The effects pathway includes reduced forest structure, particularly the reduction of large downed logs required by the species (Clayton and Olson 2009). Loss of these forest structures and overstory may result in the following stressors to resources.

- Reduce availability of large downed wood and associated habitat, including habitat refuges and microclimates.
- Reduce future recruitment of large downed wood and associated habitat.
- Remove bark plates and moss mats on downed logs required by Oregon slender salamander.
- Reduce available foraging habitat and associated prey.
- Expose downed wood habitat to sunlight and associated heating and drying (desiccation)(Garcia et al. 2020).
- Fragment habitat and consequently isolate individuals and small groups due to limited dispersal capabilities (Clayton and Olson 2009).

Individual Oregon slender salamanders that survive the initial disturbance would likely move and attempt to find new habitat. During movement, individuals will be exposed to increased risks of predation and environmental stress, including heat and desiccation. Individuals may also not find suitable habitat and may die from exposure.

The physical response to such stressors and associated behavioral responses will be reduced physical fitness due to increased energy expenditure (e.g., stress, thermoregulation, metabolism, movement) and reduced energy capture (prey). These energy costs can result in an energy deficit that translates into biological effects, including reduced physical fitness, reproduction, and survival of individual Oregon slender salamander. Harm would occur when energy deficits result in reduced reproductive success or direct mortality of adults through starvation, exposure/desiccation (heat/cold/rain), disease, or predation. Harm may also occur if habitat is fragmented, preventing movement and associated foraging and reproductive success.

The effects pathway ends with the consideration of the biological effects on individuals within the context of regional and range-wide distribution and populations, which is discussed in Section 5.6.3, *Impacts of the Taking on Oregon Slender Salamander*. Figure 5-1 summarizes the general effects pathways identified for potential harm to Oregon slender salamander due to habitat modification.

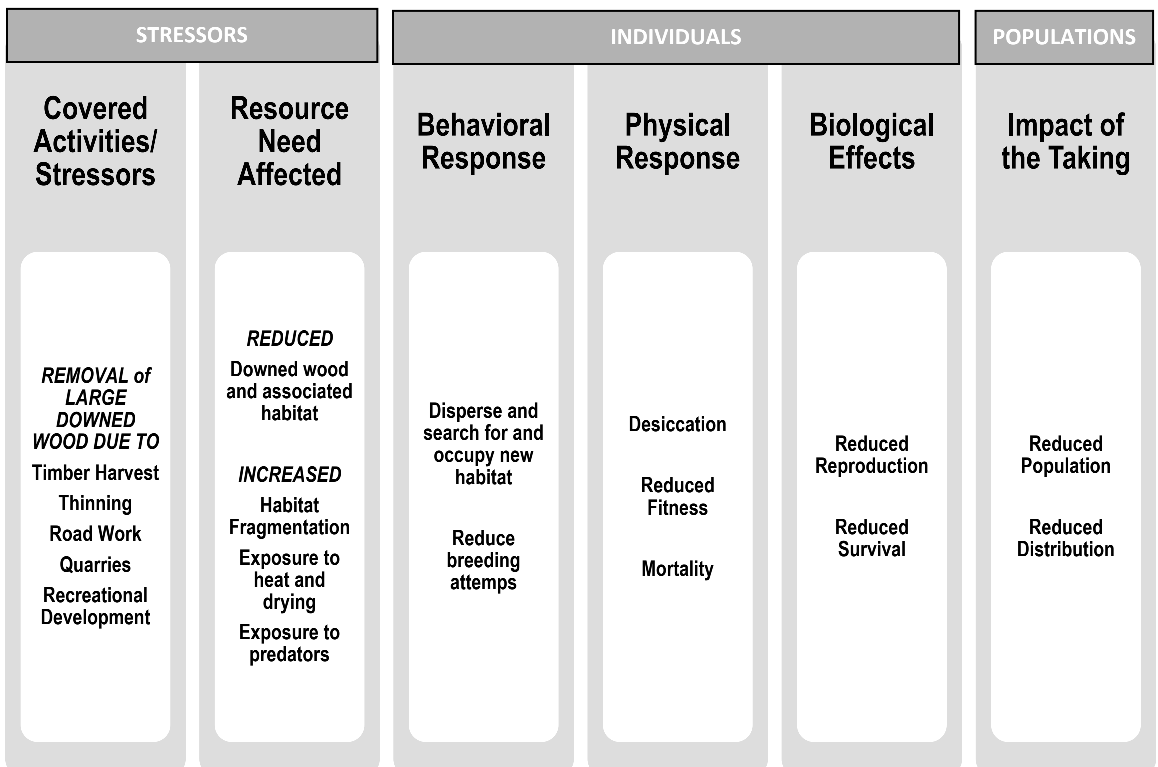


Figure 5-1. Effects Pathways for Impacts of Take of Oregon Slender Salamander via Habitat Modification

5.6.1.3 Covered Activities that May Result in Take

Any covered activity that will physically disturb moss and litter layers and downed wood where Oregon slender salamanders are present may rise to the level of take either through direct injury and mortality or through habitat modification and associated loss of resources needed by Oregon slender salamanders for breeding, feeding, and shelter. These activities include timber harvest (regeneration and thinning), road construction, quarry work, and recreation development and maintenance (e.g., at campgrounds, trails, trailheads).

Timber harvest, including regeneration harvest and thinning, is the primary activity that is expected to rise to the level of take. Table 5-5 lists covered activities and associated types of take expected to occur over the duration of the permit. Details regarding the effects pathways are provided in the previous subsection.

Table 5-5. Sources and Types of Take of Oregon Slender Salamander Expected Under the Terms of the HCP

Covered Activity	Type of Take
Regeneration Harvest	Regeneration harvests and associated temporary roads, landings, yarding operations, and use of heavy equipment within suitable and highly suitable habitat is the primary source of take expected for Oregon slender salamander. Take will primarily be due to risk of direct mortality or exposure of individuals that are not directly killed. Habitat may be reduced in suitability through disturbance of downed wood.
Slash piling	Mechanical piling of smaller slash after regeneration harvest could result in the disturbance of some larger pieces of downed wood. Subsequent burning of piles may result in the loss of some large downed wood.
Thinning	As with regeneration harvest, thinning within occupied habitat could result in direct mortality, exposure, or reduced habitat suitability.
Road Management	Removal of hazard trees along roads has the potential to reduce habitat values for Oregon slender salamander by reducing source of future wood recruitment.
Other Covered Activities That Disturb Large Downed Wood	Development of new roads, quarries, and recreation infrastructure and maintenance (e.g., campgrounds, trails, trailheads) within suitable and highly suitable Oregon slender salamander habitat has the potential to result in take due to direct mortality or habitat loss.
Controlled Burning	Cole et al. (1997) found that other salamander species were able to persist following controlled burns and hypothesized that refugia in large downed wood may protect individuals from harm during burns. However, individual Oregon slender salamanders may be injured or killed during controlled burns conducted within occupied habitat.

5.6.1.4 Covered Activities Not Expected to Result in Take

Covered activities that do not disturb large woody debris within known occupied or modeled suitable habitat are unlikely to cause adverse effects that rise to the level of take. Table 5-6 lists the covered activities not expected to result in take of Oregon slender salamander.

Table 5-6. Covered Activities Not Expected to Result in Take of Oregon Slender Salamander

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
All Covered Activities Conducted Outside of Suitable and Highly Suitable Habitat	Covered activities that do not modify suitable or highly suitable habitat would not result in take.
Site Preparation, Tree Planting, and Release Treatments	Use of herbicides has not been shown to directly harm other salamander species (Cole et al. 1997), although some species may be indirectly affected through loss of vegetative cover. Because Oregon slender salamanders are terrestrial and live out most of their lives under moss

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
	and bark plates, they would not likely be directly exposed to herbicides and would not be affected by changes in vegetative cover.
Animal Damage Control	Control of mountain beaver (*Aplodontia rufa*) will not adversely affect Oregon slender salamanders because large woody debris would not be disturbed.
Fertilizer Application	ODF does not currently use fertilization in young or mature stand management. While exposure to fertilizer is possible, the level of exposure is not expected to adversely affect Oregon slender salamanders as the species is completely terrestrial, including for breeding (Clayton and Olson 2009), and does not use ponds or water in which fertilizer may accumulate.
Precommercial Thinning and Pruning	Thinning and pruning of young stands does not involve extensive disturbance of large, downed wood and is not likely to adversely affect Oregon slender salamanders or their habitat.
Unmanned Aircraft Systems	No effect pathways identified.
Livestock Grazing	The permit area has limited grazing potential and grazing is not expected within suitable habitat.
Road System Management Activities	
Existing Road System	Existing roads add to habitat fragmentation effects, which may block movements. However, the presence of existing roads is not expected to rise to the level of take because they are considered part of the environmental baseline.
Road Use	Road use, including administrative, haul traffic, and recreational/public vehicle use, could conceivably result in direct injury or death of Oregon slender salamander, but due to the limited movements of this species (Clayton and Olson 2009), the risk is expected to be discountable.
Road Maintenance	Work within the road prism would not be likely to affect Oregon slender salamander habitat.
Road Decommissioning	Road decommissioning would not disturb large downed wood or otherwise adversely affect Oregon slender salamander.
Drainage Structure Construction and Maintenance	Drainage work would not adversely affect Oregon slender salamander habitat.
Minor Forest-Product Harvest	Harvest of forest greens would not affect habitat. Firewood collection could remove woody debris from forest stands.
Water Drafting and Storage (fire management)	This activity is not likely to adversely affect Oregon slender salamander habitat.
Conservation Strategy Implementation Activities:	
Aquatic Habitat Restoration	Aquatic habitat restoration may result in minor habitat modification, such as select tree tipping or removal, but such effects are not likely to rise to the level of take because of the avoidance and minimization measures described in Chapter 4.
Barred Owl Management	This activity is not likely to adversely affect Oregon slender salamander habitat.
Research and Monitoring Activities	This activity is not likely to adversely affect Oregon slender salamander habitat.

5.6.2 Quantity and Timing of Take

Based on timber harvest and forest growth modeling, approximately 20,047 acres of suitable Oregon slender salamander habitat would be harvested over the duration of the permit. Not all of this habitat will be suitable at the outset of the permit. Some stands will grow into habitat as time progresses and the forest develops characteristics indicative of suitable or highly suitable habitat. Habitat modification will occur inside and outside of HCAs. No highly suitable habitat is projected to be modified within the permit area over the permit duration.

Inside of HCAs, habitat modification will only be done in situations where those short-term silvicultural actions will result in long-term increases in habitat quality. Within HCAs, ODF projects 2,928 acres of suitable habitat will be thinned to improve habitat values.

Outside of HCAs, suitable habitat will be harvested or thinned for commercial forestry production. ODF projects that 20,047 acres of suitable habitat will be harvested and 12,577 acres will be thinned over the permit duration. Table 5-7 summarizes the suitable and highly suitable habitat that would be modified through thinning or lost through regeneration harvest over the 70-year permit duration.

Table 5-7. Oregon Slender Salamander Habitat Projected to be Harvested or Thinned Under the HCP Over the Permit Duration

	Habitat Thinned		Habitat Harvested		
Location	Highly Suitable	Suitable	Highly Suitable	Suitable	Total
Within HCAs	--	2,928	--	--	2,928
Outside of HCAs	--	12,577	--	20,047	32,624
Total	**--**	**15,505**	**--**	**20,047**	**35,552**

5.6.3 Impacts of the Taking on Oregon Slender Salamander

Take resulting from this habitat loss and other adverse effects, described above, would take place within the following contexts and levels of intensity.

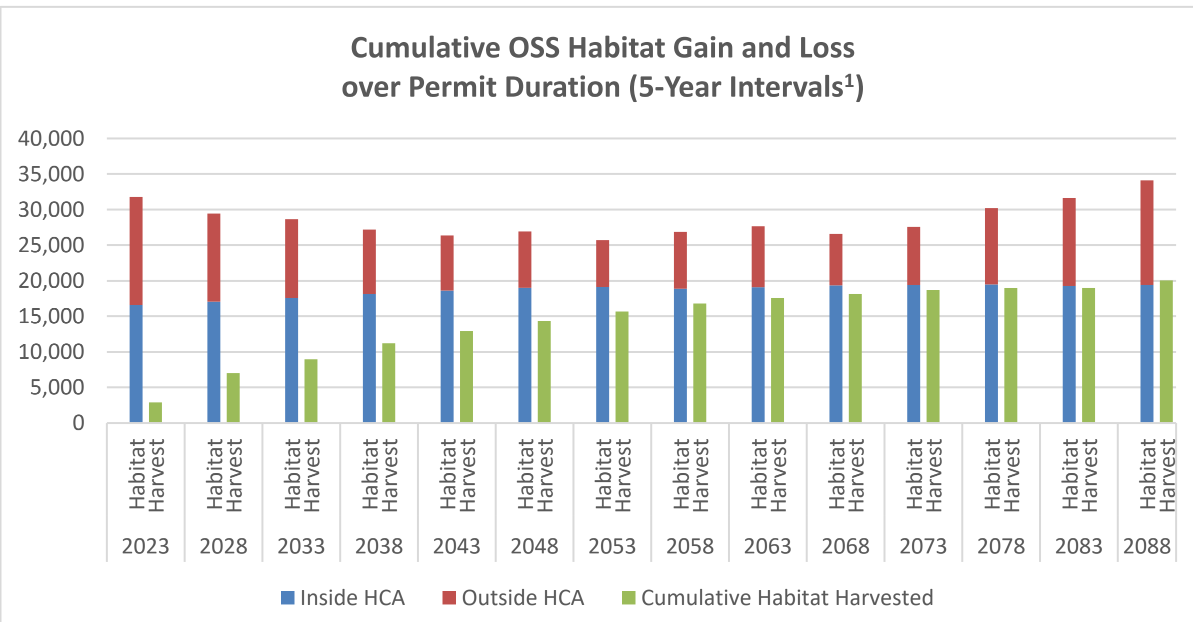
- The 63 acres of highly suitable habitat currently present within the permit area would be conserved within HCAs.
- Approximately 48% (16,634 acres) of existing suitable habitat would also be conserved within HCAs.
- Suitable habitat outside of HCAs that would be harvested is located in smaller and more fragmented habitat patches than habitat to be conserved in HCAs.
- Oregon slender salamanders are known to persist in harvested areas if sufficient legacy downed wood and associated habitat is retained (Garcia et al. 2020), as will occur under the HCP, so while habitat that has been harvested would no longer meet the HCP model definition of suitable habitat (which includes tall trees and advanced seral stage), the impact of the taking from habitat modification is not likely to eliminate all Oregon slender salamanders from affected areas considered take under this HCP.

Effects of habitat modification are considered to occur throughout the duration of the permit. However, large wood is expected to increase over time throughout the permit area, so some modification due to thinning would be temporary. All modifications within HCAs would be temporary, although development of desired suitable habitat characteristics may not be achieved in all stands within HCAs by the end of the permit term.

5.6.4 Beneficial and Net Effects on Oregon Slender Salamander

Under the HCP, Oregon slender salamander populations will benefit from (1) protection of occupied habitat (Conservation Action 6*:* Establish Habitat Conservation Areas) and (2) an increased amount and quality of habitat over the permit duration (Conservation Actions 6 and 7: Manage Habitat Conservation Areas).

Within HCAs, the conservation strategy is projected to result in 12,776 acres of suitable Oregon slender salamander habitat and 6,653 acres of highly suitable habitat at the end of the permit term. This represents a gain of 2,805 acres of habitat within HCAs; an additional 540 acres of highly suitable habitat is projected to be present outside of HCAs at the end of the permit term. These increases in habitat compare to the projected cumulative modification of 20,047 acres of habitat due to harvest and 15,505 acres due to thinning. Figure 5-2 shows the cumulative habitat harvested and total habitat present over the duration of the permit, in 5-year increments.



Note: Each year noted in the chart represents the 5-year period starting on the year noted (e.g., 2023 represents years 2023–2027). Projected habitat levels presented in this chapter are not HCP commitments, but rather are projections ODF is using to estimate the level of take and to determine appropriate avoidance, minimization, and mitigation measures needed to offset that projected level of take.

Figure 5-2. Oregon Slender Salamander Habitat Harvested and Total Habitat, in 5-Year Increments

5.6.5 Effects on Critical Habitat

Critical habitat has not been designated for Oregon slender salamander.

5.6.6 Cumulative Effects on Oregon Slender Salamander

Cumulative effects, as defined in this HCP, are the combined effects of future state, local, or private actions that are reasonably certain to occur in the action area, considered collectively with the effects of this HCP.

At the time of this HCP, there are no future state or local actions that may contribute to cumulative effects that are reasonably certain to occur. DSL is currently preparing an HCP for the Elliott State Forest, but Oregon slender salamander is not proposed to be covered under that plan. Because the Elliott State Forest HCP is a contemporaneous effort, it is not considered a cumulative effect in this HCP (per the regulatory definition of cumulative effects, 50 CFR 402.02).

Effects on Oregon slender salamander populations and distribution from impacts on other non-federal lands have likely already occurred due to relatively long histories of intensive commercial forest management coupled with lower retention standards for large downed woody debris. Therefore, actions on private lands are not anticipated to contribute to cumulative effects.

Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational infrastructure development and maintenance (e.g., mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines). ODF is not aware of any specific projects reasonably certain to occur within the range of the Oregon slender salamander.

5.7 Effects Analysis for Northern Spotted Owl

5.7.1 Sources and Types of Take

All covered activities that involve tree removal within modeled, suitable or highly suitable habitat—including timber harvest, thinning, road work, quarry work, and recreational infrastructure development and maintenance—have the potential to result in four types of incidental take of northern spotted owls.

- Harm in the form of direct injury or mortality from activities such as inadvertently destroying a nest with young or eggs.
- Harm due to behavioral or physical responses to noise and disturbance, such as unintentionally flushing an owl from a nest and exposing the young or eggs to predation or rain.
- Harm due to habitat modification to the extent that owls become more susceptible to predation, abandon established territories, or have reduced reproductive success due to reduced foraging efficiency (i.e., lack of forage or expansion of home range).
- Harm due to habitat modification that reduces the resilience of spotted owls to barred owl competition.

The conservation strategy described in Chapter 4 is designed to minimize or avoid these potential sources and types of take. Harm due to direct injury or mortality and disturbance of active nest sites will be avoided through Conservation Action 10: Seasonal Operational Restrictions during the nesting season.

Harm due to modification of suitable or highly suitable habitat from timber harvest is the primary source and type of take of northern spotted owls that ODF anticipates to occur over the permit duration. The HCP minimizes such habitat modification through designated HCAs (Conservation Action 5: Standards for Road Improvement and Vacating) and associated conservation measures (Conservation Action 6: Establish Habitat Conservation Areas). Inside of HCAs, harvest activities will occur where there are opportunities to increase the quality and quantity of habitat for covered species over the duration of the permit (Conservation Action 6). This includes regeneration harvest in non-habitat or heavy thinnings in stands of non-habitat or marginally suitable habitat that are unlikely to grow into suitable habitat without intervention. Stands requiring this management would be treated during the first 25 years of the permit term so they are put on a trajectory to eventually develop into higher quality habitat than would have developed without intervention. In those instances, short-term effects on northern spotted owl habitat are expected to be minimal, given that operations are in non-habitat or habitat of marginal suitability. Less intensive thinning or variable density thinning may be used in habitat of low suitability to accelerate the development of understory and mid-story canopy, or promote horizontal diversity. These treatments may have short-term negative effects, primarily through the removal of some forest canopy cover; however, these effects would be offset by the acceleration of better habitat in a shorter time frame.

[**Note to reader:** *Details are still being developed regarding the criteria and decision process for implementing silvicultural treatments within HCAs to accelerate habitat growth.]*

Outside of HCAs and RCAs, habitat will be subject to harvest, although dispersal habitat will be maintained (Conservation Action 7: Manage Habitat Conservation Areas). The potential for habitat loss to result in take of northern spotted owl will be higher in locations where nesting activity is occurring; lower in locations where nesting activity once occurred, but has not been documented recently; and lowest in locations where no nesting activity has ever been documented.

The following sections describe the criteria and thresholds for determining when take will occur, the effects pathways leading to take, and the specific covered activities expected to result in take, as well as those not expected to result in take.

5.7.1.1 Criteria and Thresholds for Determining Take

To quantify the level of incidental take of northern spotted owls, the HCP uses the acres of suitable and highly suitable habitat that would be harvested or otherwise disturbed under the HCP. Not all modification of suitable and highly suitable habitat will result in take. The likelihood that effects of habitat modification from timber harvest on northern spotted owls would rise to the level of take depends on (1) existing conditions of the stand to be modified and (2) proposed harvest specifications. Habitat must be occupied by northern spotted owls in order for individuals (or pairs or young) to be exposed to the effects of habitat modification. In addition, the habitat modification must be sufficiently severe as to interfere with essential behaviors to the extent that individuals are actually harmed.

Habitat modification within active sites and stands that are modeled as suitable or highly suitable are most likely to result in take, as these are places that are mostly likely to support nesting, roosting, and foraging habitat for northern spotted owls. Therefore, the HCP uses modification of suitable and highly suitable habitat as a primary metric of take for northern spotted owls.

Table 5-8 summarizes the general sources of habitat modification and the associated thresholds used in this HCP to determine the level of take presented in Section 5.7.2, *Quantity and Timing of Take*. The effects pathways leading to such take are described in the next subsection.

Table 5-8. Criteria and Threshold for Determining Take of Northern Spotted Owl

Covered Activities Assumed to Take Northern Spotted Owl	Harvest Activities with Beneficial, Insignificant, or Discountable Effects
• Covered activities that modify[a] a stand (e.g., regeneration harvest or thinning) with a known nest tree in it regardless of modeled habitat status of that stand. • Covered activities that modify modeled *suitable* or *highly suitable* habitat as defined by the species habitat model for this HCP.[b]	• Covered activities (e.g., regeneration harvest or thinning) in stands modeled as *marginal* habitat or as *non-habitat*.

[a] *Modification* is considered altered habitat structure or composition so that habitat values move from highly suitable or suitable to marginal or non-habitat.

[b] The potential for habitat loss to result in take of northern spotted owl will be higher in locations where nesting activity is occurring; lower in locations where nesting activity once occurred, but has not been documented recently; and lowest in locations where no nesting activity has ever been documented.

5.7.1.2 Effects Pathways

As described in Section 5.7.1, *Sources and Types of Take*, modification of occupied habitat through tree removal will be the primary stressor acting on northern spotted owls over the permit duration. Habitat modification may result in take only if the habitat is occupied and if remaining suitable and highly suitable habitat is not sufficient to support the individual owls or owls that were once occupying the habitat that was modified by covered activities.

The effects pathway leading to take begins with reduced forest structure, including reduced tree density, canopy cover, canopy layers, and large trees, snags, and downed logs. Loss of these forest structures may result in the following stressors to resources.

- Eliminate large trees and associated canopy cover required for nesting.
- Eliminate perches, canopy cover, and multiple canopy layers required for roosting and foraging.
- Reduce available prey that is associated with high levels of forest structure.
- Increase the presence of competitors and predators that are able to use habitats modified by timber harvest, including great horned owls, barred owls, and corvids.
- Fragment habitat so that habitat patches become inaccessible or require additional effort and predation risk to access.
- Create habitat that that reduces the resilience of spotted owls to barred owl competition.

The behavioral response of individual owls (or pairs) to such stressors may include the following.

- **Avoidance**. Individual northern spotted owls will not nest in clear cuts and heavily thinned stands that result in low or reduced canopy cover and fewer large trees and associated buffer habitat. Owls may also avoid roosting or foraging in modified habitat due to reduced perches, canopy protection, and availability of prey. Owls may also avoid habitat patches that become isolated due to habitat modification.

- **Shift nesting area or do not nest**. If suitable alternative habitat is available, established pairs may shift nest sites to new areas if a nesting site is lost or if barred owls occupy nesting areas due to habitat modification. If habitat is not available, owls may not nest for 1 or more years until a suitable nesting area is found.
- **Abandoned nesting attempts**. Established spotted owl pairs may have lower nest success due to reduced prey capture or due to exposure to predators near nesting areas or due to disturbance. Owls may also not attempt to nest if adequate prey is not available.
- **Shift foraging areas or use smaller areas**. Northern spotted owls may expand foraging areas to make up for loss habitat (Meiman et al. 2003), potentially using areas with lower suitability and prey base. Owls may also simply confine use to remaining habitat, resulting in a reduced home range and associated reduced prey base.
- **Shift in prey**. Individuals may select different prey species due to reduced availability of preferred prey species.
- **Territory abandonment**. At some point, loss of habitat may be sufficient to cause northern spotted owls to abandon established territories due to lack of habitat or to displacement by barred owls. Abandonment of a territory and search for replacement territory may or may not result in pairs splitting up. In either case, abandoning a territory to search for a new one would place tremendous stress on individuals, including increased energy expenditures (movement) and decreased energy acquisition (feeding).

All of these stressors and associated behavioral responses may result in an ultimate physical response of reduced physical fitness due to increased energy expenditure (e.g., stress, increased time spent moving or hunting) and reduced energy capture (prey). These energy costs can result in an energy deficit that translates into biological effects, including reduced physical fitness, reproduction, and survival of individual northern spotted owls. Harm would occur when energy deficits result in reduced nesting successes or mortality of adults through starvation, exposure (heat/cold/rain), disease, or predation.

The effects pathway ends with the consideration of the biological effects on individuals within the context of regional and range-wide distribution and populations, which is discussed in Section 5.7.3, *Impacts of the Taking on Northern Spotted Owl*.

Figure 5-3 summarizes the general effects pathways identified for potential harm to northern spotted owls due to habitat modification.

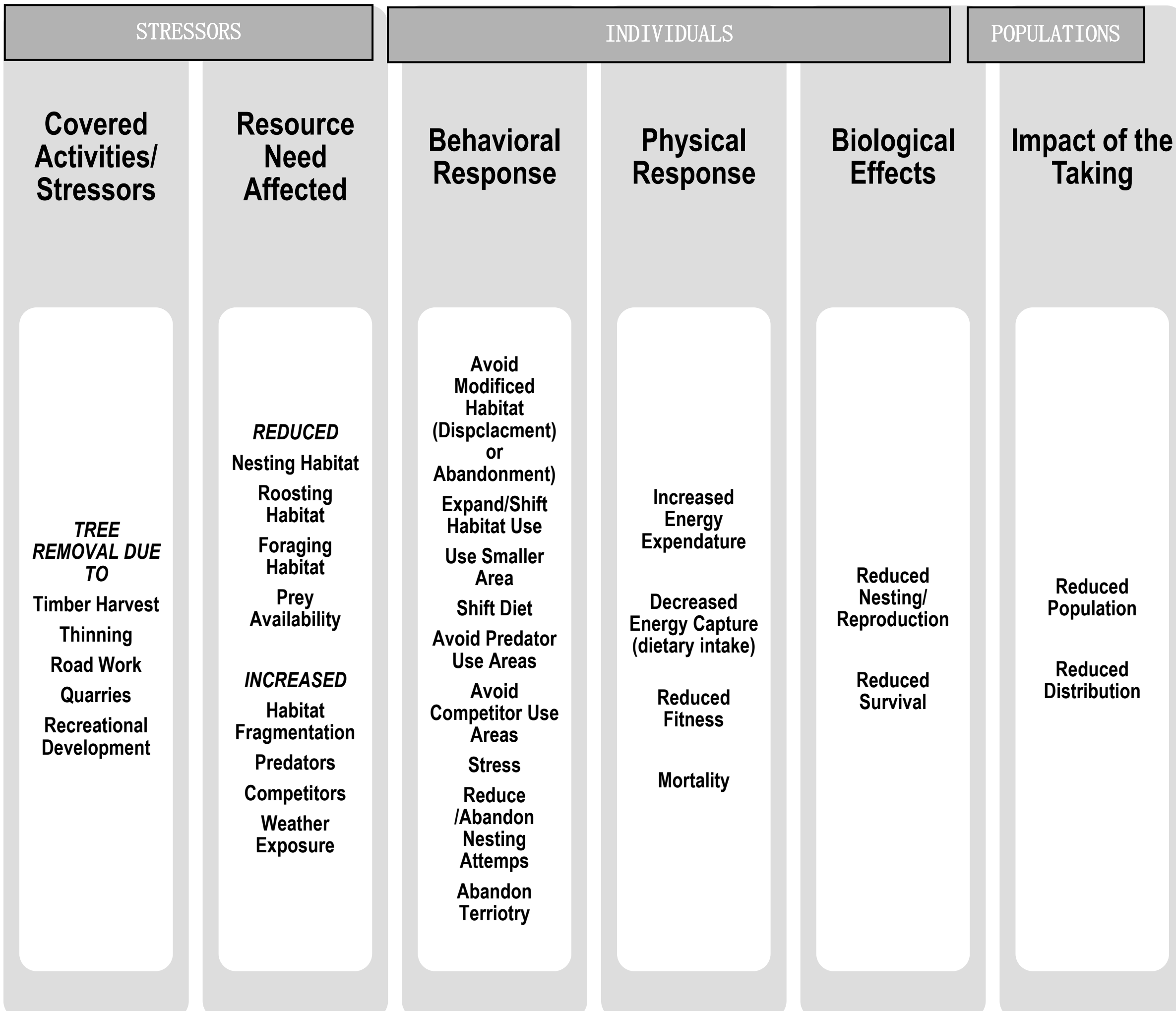


Figure 5-3. Effects Pathways for Impacts of Take of Northern Spotted Owl via Habitat Modification

5.7.1.3 Covered Activities that May Cause Take

Based on the thresholds and effects pathways described previously, several covered activities will result in take via habitat modification when conducted within suitable and highly suitable habitat, including regeneration harvest, thinning, landings, road construction, quarry work, and recreation infrastructure development and maintenance (e.g., campgrounds, trails, trailheads). Table 5-9 lists covered activities and associated types of take expected to occur over the duration of the permit.

Table 5-9. Sources and Types of Take of Northern Spotted Owl Expected from Covered Activities

Covered Activity	Type of Take
Regeneration Harvest	Removal of suitable or highly suitable habitat currently occupied by northern spotted owls can kill or injure northern individuals by significantly impairing essential behavioral patterns, including nesting, roosting, and foraging. Behavioral response may include shifting habitat use or abandonment of the territory, leading to reduced prey capture, reproductive success, and survival. Habitat modification can also increase exposure to predation and competition from barred and great horned owls and other species.
Thinning	As with regeneration harvest, thinning could remove a sufficient number and type of trees to reduce habitat values for northern spotted owls, resulting in potential reduced reproductive success or site abandonment.
Other Covered Activities that Involve Tree Removal	Development of new roads, quarries, or recreation infrastructure as well as maintenance (e.g., campgrounds, trails, trailheads) within active northern spotted owl nest sites has the potential to result in take due to habitat modification, including potential reduced prey capture and associated reproductive success and increased exposure to predators.

Most habitat modification is expected to occur outside of HCAs and RCAs. Some timber harvest activities inside of HCAs may also result in short-term modification of a few areas of non-habitat or marginally suitable habitat, including regeneration harvest and thinning where needed to improve long-term habitat conditions. However, silvicultural prescriptions inside of HCAs will only be carried out if such harvest would result in higher habitat quality later in the permit term than was present prior to the prescription. All timber harvest practices are allowed inside of HCAs, but they will only be conducted if they meet that criteria. As previously mentioned, take from direct destruction of active nest sites will be avoided through seasonal timing restrictions.

Take via habitat modification may occur throughout the duration of the incidental take permit. Take in the early years of the permit will occur within existing habitat, while take in later years may include habitat that is currently not suitable but that has developed into suitable habitat over time. The amount and timing of take anticipated to occur through habitat modification over the permit duration is described in Section 5.7.2, *Quantity and Timing of Take*.

5.7.1.4 Covered Activities Not Expected to Result in Take

Covered activities conducted outside of suitable and highly suitable habitat are not expected to cause take because northern spotted owls are not expected to occupy non-habitat areas, and habitat must be occupied for take to occur.

The potential for covered activities to result in take of northern spotted owls differs among the three major conservation designations defined in Chapter 4 (i.e., inside HCAs and RCAs, and outside of HCAs and RCAs). As previously described, most take will occur outside of HCAs and RCAs.

Within HCAs, thinning, regeneration treatments of hardwood dominated stands, and regeneration treatment of Swiss needle cast stands will be conducted to improve forest conditions for covered species (Conservation Action 6: Establish Habitat Conservation Areas). Such treatments could temporarily reduce habitat values for roosting and foraging because of reduced canopy cover and perch structure. However, such effects are not expected to result in harm due to the non-habitat or marginal suitability of these stands and the avoidance and minimization measures described in Chapter 4 (Conservation Actions 5: Standards for Road Improvement and Vacating, 6: Establish Habitat Conservation Areas, and 9: Strategic Terrestrial Species Conservation Actions). Management activities will not be conducted within specified distances known activity centers during the nesting season (Chapter 4, Table 4-12).

Similarly, within RCAs, aquatic habitat restoration projects could involve tree removal, but such effects are not likely to rise to the level of take because of the small amount of habitat affected and the avoidance and minimization measures described in Chapter 4 (e.g., avoiding disturbance of nest trees). Other covered activities would either not be conducted within RCAs or would be conducted only when such activities would not result in take as determined by an ODF biologist.

Barred owl management will be implemented consistent with Conservation Action 9: Strategic Terrestrial Species Conservation Actions. Other covered activities similarly will not result in sufficient habitat modification to result in take. Table 5-10 lists the covered activities that are not expected to rise to the level of take of northern spotted owls.

Table 5-10. Covered Activities Not Expected to Result in Take of Northern Spotted Owl

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
All Covered Activities Conducted Outside of Suitable and Highly Suitable Habitat	Covered activities that do not modify suitable and highly suitable habitat would not result in take.
Helicopter use	Helicopters used for aerial application of herbicides and fertilizer would follow avoidance measures defined under Conservation Action 10: Seasonal Operational Restrictions.
Site Preparation, Tree Planting, and Release Treatments	Reforestation and young stand management activities will take place outside of suitable and highly suitable habitat and are not likely to adversely affect northern spotted owls.
Animal Damage Control	Mountain beavers represent only a small and very seasonal proportion of northern spotted owl diets (Forsman 2004), and control activities will occur only in reforestation areas that are non-habitat for northern spotted owl foraging with the exception of edge habitat.
Fertilizer Application	Fertilizer will not be applied within suitable and highly suitable habitat. The USFWS recovery plan (USFWS 2011) and scientific literature do not identify fertilizer as a potential stressor for northern spotted owls.
Precommercial and Commercial Thinning	Precommercial thinning will be conducted in young forest stands and will not occur within northern spotted owl nesting, roosting, or foraging habitat. Light to heavy commercial thinning could occur within dispersal habitat. However, a minimum of 40% of the landscape will be maintained as suitable dispersal habitat (Conservation Action 8: Conservation Actions Outside Habitat Conservation Areas and Riparian Conservation Areas), an amount that has been determined to be sufficient to maintain connectivity for northern spotted owl dispersal (Davis et al. 2016).
Unmanned Aircraft Systems and Helicopter Use	Nest site disturbance from drones and helicopters would be avoided through seasonal operational restrictions (Conservation Action 10: Seasonal Operational Restrictions).

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
Livestock Grazing	The permit area is generally not suitable for grazing or other agricultural uses, and such uses are not likely to occur within suitable and highly suitable northern spotted owl habitat.
Existing Road System	Existing roads add to habitat fragmentation effects, encourage use by predators such as great horned owls, and provide access that may encourage people to enter suitable habitat areas. However, the presence of existing roads is not expected to rise to the level of take because they are considered part of the environmental baseline and current nest sites have been established in the presence of the road system.
Road Management	Removal of hazard trees along roads has the potential to reduce habitat values for northern spotted owl. However, the effects are likely to be discountable in relation to the intensity and location of habitat modification (small amount next to roads) to the large home range size of northern spotted owls.
Road Use	Road use has not been reported in the literature as a source of take of northern spotted owls (Lesmeister et al. 2018). Most road use in the permit area is an existing use and considered part of the environmental baseline, and road density will be reduced in some areas under the HCP as part of the aquatic conservation strategy.
Road Maintenance	Work within the road prism is not likely to adversely affect northern spotted owl habitat.
Road Decommissioning	Road decommissioning would not adversely affect northern spotted owl habitat and may provide long-term benefits.
Drainage Structure Construction and Maintenance	Drainage work would take place within the existing road prism (footprint) and will not adversely affect northern spotted owl habitat.
Minor Forest-Product Harvest	Harvest of forest greens would not adversely affect owl habitat. Permitted firewood collection could remove woody debris from recent harvest units. Firewood permits issued will be limited to slash piles that have been left on or adjacent to landings in recent harvest units.
Controlled Burning	The likelihood of smoke harming spotted owls is low. No direct mortality or displacement of spotted owls due to smoke has been reported in the literature, even in cases where thick smoke covered several spotted owl site-centers for a week (USFWS 2011). Existing fire management protocols are expected to adequately reduce the chance of fire spreading into suitable and highly suitable habitat to be negligible.
Water Drafting and Storage (fire management)	This activity will not require large tree removal or otherwise adversely affect northern spotted owl habitat.
Aquatic Habitat Restoration	Aquatic habitat restoration may result in minor habitat modification, such as select tree tipping or removal, but such effects are not likely to rise to the level of take because of the avoidance and minimization measures described in Chapter 4.
Barred Owl Management	The HCP includes ODF's commitments to support barred owl removal and those activities will be conducted in a manner that avoids take of northern spotted owl.
Research and Monitoring Activities	Research and monitoring is generally not expected to result in take. If any research or monitoring activity is determined to likely result in take (e.g., climbing active nest trees during the breeding season), then ODF will obtain

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
	necessary clearance with the USFWS (or the research organization will, if a different entity).

5.7.2 Quantity and Timing of Take

5.7.2.1 Suitable and Highly Suitable Habitat Modification/Loss

Based on timber harvest and forest growth modeling, approximately 39,000 acres of suitable/highly suitable northern spotted owl habitat would be harvested over the duration of the permit. Not all of this habitat will be suitable at the outset of the permit. Some stands will grow into habitat as time progresses and the forest develops characteristics indicative of suitable or highly suitable habitat. Habitat modification will occur inside and outside of HCAs.

Inside of HCAs, habitat modification will only be done in situations where those short-term silvicultural actions will result in long-term increases in habitat quality. These areas include stands dominated by alder, infected with Swiss needle cast, or otherwise determined to require regeneration to provide long-term habitat value. Under those circumstances it is unlikely, but still possible, for there to be a short-term loss in habitat function. Within HCAs, ODF projects that 514 acres of suitable habitat will be regeneration harvested during the first 15 years of the permit and 1,923 acres of suitable habitat will be thinned to improve habitat values. No highly suitable habitat is anticipated to be thinned within HCAs.

Outside of HCAs, suitable and highly suitable habitat will be harvested or thinned for commercial forestry production. ODF projects that 34,382 acres of suitable habitat and 785 acres of highly suitable habitat will be removed due to harvest activities over the permit duration. Suitable and highly suitable habitat that would be harvested outside of HCAs would be greater in the first four decades of the permit term.

Table 5-11 summarizes the suitable and highly suitable habitat that would be modified through thinning or lost through regeneration harvest over the 70-year permit duration.

Table 5-11. Northern Spotted Owl Habitat Projected to Be Harvested or Thinned Under the HCP Over the Permit Duration (acres)

	Habitat Thinned		Habitat Harvested		
Location	Highly Suitable	Suitable	Highly Suitable	Suitable	Total
Within HCAs	0	1,923	0	514	2,437
Outside of HCAs	0	1,183	785	34,382	36,350
Total	**0**	**3,106**	**785**	**34,896**	**38,787**

5.7.2.2 Northern Spotted Owl Territories

Loss of northern spotted owl activity centers and in some cases associated nest sites due to covered activities is expected to be rare over the duration of the permit. Of the 31 known active northern spotted owl activity centers in the permit area, all but three[1] are included in HCAs. By definition, management activities in HCAs will only be implemented to increase habitat quality for northern spotted owls over the permit term, so loss of activity centers due to habitat loss inside HCAs is not expected.

It is expected that the three activity centers outside of HCAs would be lost over time, likely due to a reduction in habitat quality within them; although none of them have a history of nesting, the activity centers themselves will not be disturbed by covered activities during the nesting season (Conservation Action 10: Seasonal Operational Restrictions).

Table 5-12 summarizes existing northern spotted owl activity centers, including those that will be authorized to be harvested under the HCP.

Table 5-12. Existing Northern Spotted Owl Activity Centers Within the Permit Area

	Pair-Resident	Pair-Unknown[a]	Resident Single	Total
Inside HCA	18	4	6	28
Outside HCA	2	0	1	3
Total	20	4	7	31
Maximum Amount and % Taken by Covered Activities	2 (10.0%)	0 (0%)	1 (14.3%)	3 (9.7%)

[a] Activity centers for which surveys indicate a suspected pair that was not confirmed based on the survey protocol criteria.

There are 126 northern spotted owl activity centers located on adjacent lands within the provincial radius[2] of the activity center.

*[***Note to reader***: Details regarding adjacent NSO sites, associated conservation actions, and anticipated effects are still in development and under discussion with the Scoping Team].*

Table 5-13 summarizes existing active northern spotted owl nest sites located on adjacent lands where the provincial radius overlaps with the permit area.

[1] Two active pair territories and one resident single territory are located within lands outside of HCAs and RCAs, and, therefore, these owls are expected to be displaced through timber harvest and associated habitat modification under the terms of the HCP.

[2] The provincial radius of a circle centered on the activity center that represents an approximate home range for an owl in a given geographic location. Based on guidance from the USFWS, ODF uses the following provincial radii: Klamath Province (Southwest Unit), 1.3 miles; Oregon Cascades (North Cascade District), 1.2 miles; Oregon Coast Ranges (all other Districts), 1.5 miles.

Table 5-13. Adjacent Active Northern Spotted Owl Activity Centers Within the Provincial Radius of the Permit Area

Ecoregion	Number of Activity Centers on Adjacent Lands
Coast Range – Northwest (Tillamook and Clatsop area)	6
Coast Range – Central	36
Coast Range – South	24 (adjacent lands include Elliott State Forest)
West Cascades	11
Klamath	49
Total	**126**

5.7.3 Impacts of the Taking on Northern Spotted Owls

5.7.3.1 Context, Intensity, and Duration of Impacts

Take resulting from habitat loss and other adverse effects, described Section 5.7.2, *Quantity and Timing of Take*, would take place within the following contexts and levels of intensity:

- Approximately 90% of existing activity centers[1] within the permit area would be retained within HCAs.
- Approximately 31% of existing suitable habitat would be located outside of HCAs and subject to harvest. Approximately 69% of existing suitable habitat will be retained within HCAs. No highly suitable habitat will be thinned or harvested under the HCP inside HCAs.
- The sites that will be taken have not had documented nesting or young in the past 6 years.

Harvest of suitable and highly suitable habitat within the two active pair territories outside the HCAs would occur during the permit term. If owls are occupying this habitat at the time it is modified by covered activities, then during or following harvest (that would be conducted outside the nesting season, per Conservation Action 10: Seasonal Operational Restrictions), the owls may relocate to other areas or may die due to inadequate food, exposure, or predation. Seasonal operating restrictions will apply to management activities affecting these two activity centers, as defined in Table 4-12.

Removal of suitable and highly suitable northern spotted owl habitat outside of HCAs and RCAs will also likely result in localized reductions in habitat available for non-territorial individuals seeking to establish new territories. However, the HCAs established under Conservation Action 6: Establish Habitat Conservation Areas as well as RCAs established under Conservation Action 1: Establish Riparian Conservation Areas will provide habitat where non-territorial individuals can persist and provide sources of replacement for northern spotted owls that die or vacate their territories (or for habitat that that becomes available due to barred owl removals). Retention standards for legacy structures, especially the prioritization of large green trees intended to persist through multiple harvests, will enhance dispersal conditions outside HCAs by providing roosting structure within

[1] Existing activity centers are defined as those activity centers that have been confirmed at one point and have had ≤ 6 consecutive years of surveys with no observations. Activity centers that have not been surveyed consistently during the last 6 years were assumed to have their same status as of their most recent survey history.

younger stands. Where this leave occurs in patches (versus scattered individual leave trees), they may also provide enhanced sheltering and foraging opportunities.

The HCP includes conserving the most valuable and occupied habitat in other portions of the permit area, supporting northern spotted owl recovery efforts on adjacent federal lands managed under the Northwest Forest Plan amendment (U.S. Forest Service) and the Resource Management Plan (Bureau of Land Management).

Effects of habitat modification are considered to occur throughout the duration of the permit. However, some modification due to thinning would be temporary. All modifications within HCAs would be temporary, although development of desired suitable habitat characteristics will not be achieved in all stands within HCAs by the end of the permit term.

5.7.3.2 Effects on Critical Habitat

USFWS has designated critical habitat for the northern spotted owl on approximately 9.5 million acres in 11 units and 60 subunits in Washington, Oregon, and California (USFWS 2011). Of these, portions of five units totaling 169,195 acres are located within the permit area.

Of the total northern spotted owl critical habitat designated within the permit area, 73% (126,085 acres) is located within Unit 1, North Oregon Coast and 18% (30,526 acres)is located within Unit 2, Oregon Coast. The remaining acres are located within Unit 9, Klamath West (6%/10,129 acres) and Unit 10, Klamath East (2%/2,454 acres).

While ODF considered critical habitat when delineating HCAs as part of the terrestrial conservation strategy, the two do not completely overlap. Actual species occurrence, existing highly suitable habitat, and connectivity were the primary drivers for HCA delineation. In addition, much of the areas designated as critical habitat is currently not suitable for northern spotted owl. Of the 169,195 acres of designated critical habitat for northern spotted owl within the permit area, only 9% (15,441 acres) is currently suitable (Table 5-14). Of this, all but 4 acres of designated critical habitat that is currently highly suitable is located within HCAs (1,171 acres) and 71% (14,271 acres) that is currently suitable is within HCAs. As described under Section 5.7.4, *Beneficial and Net Effects*, total suitable and highly suitable habitat within HCAs is projected to be 168,655 acres at the end of the permit duration

Table 5-14 provides the breakdown of designated critical habitat acres, by suitability class, within and outside of HCAs.

Table 5-14. Northern Spotted Owl Critical Habitat and Modeled Existing Habitat Suitability (acres)

Unit	Highly Suitable	Suitable	Marginally Suitable	Non-Habitat	Total
1. North Oregon Coast Ranges	**459**	**7,549**	**50,614**	**67,463**	**126,085**
Critical Habitat within HCAs	458	4,929	28,211	31,530	65,128
Critical Habitat outside of HCAs	1	2,620	22,404	35,933	60,957
2. Oregon Coast Ranges	**643**	**4,970**	**12,546**	**12,368**	**30,526**
Critical Habitat within HCAs	639	4,142	6,078	3,975	14,834
Critical Habitat outside of HCAs	3	828	6,468	8,393	15,692
9. Klamath West	**70**	**1,632**	**3,333**	**5,094**	**10,129**
Critical Habitat within HCAs	70	1,055	1,265	2,209	4,599
Critical Habitat outside of HCAs	0	577	2,068	2,885	5,530
10. Klamath West		**119**	**469**	**1,866**	**2,454**
Critical Habitat within HCAs	0	47	169	469	684
Critical Habitat outside of HCAs	0	72	299	1,398	1,769
Total	**1,171**	**14,271**	**66,962**	**86,791**	**169,195**
% Critical Habitat within HCA	100%	71%	53%	43%	50%
%Critical Habitat outside of HCA	0%	29%	47%	56%	50%

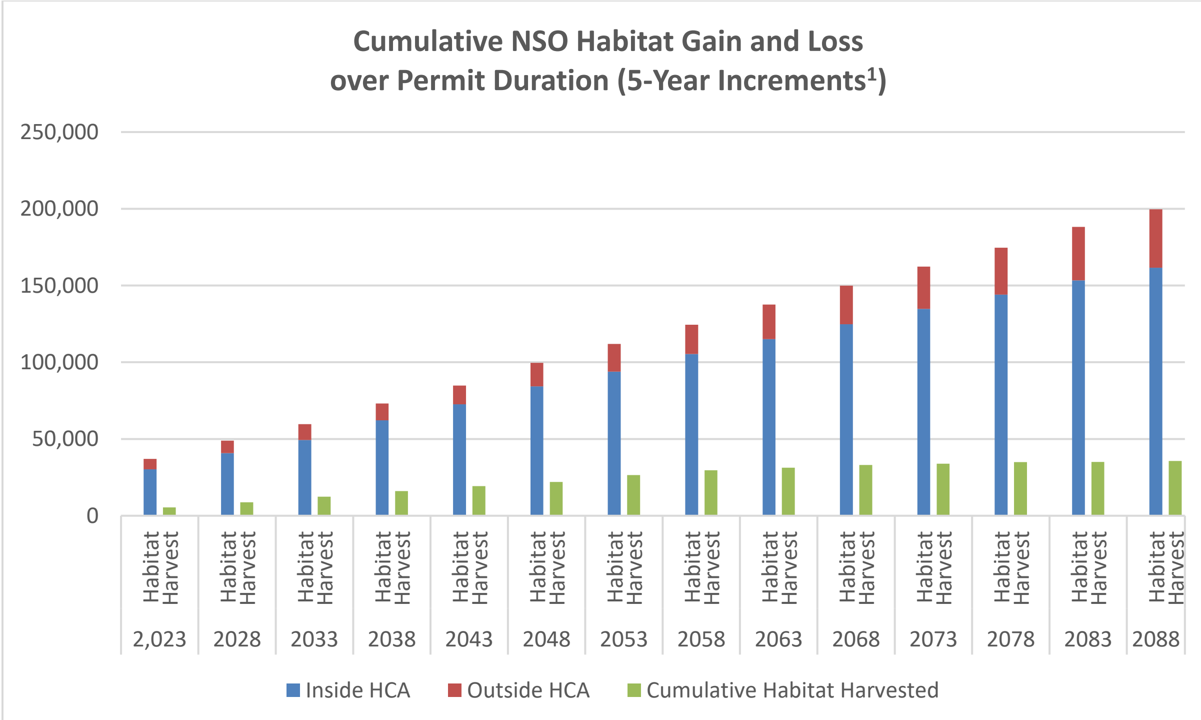
5.7.4 Beneficial and Net Effects on Northern Spotted Owl

This section describes how mitigation measures included in the HCP will fully offset the impacts of take on northern spotted owl described above, as required by the regulations for incidental take permits (50 CFR 222.307).

5.7.4.1 Benefits of Habitat Conservation Areas

The conservation strategy (Conservation Actions 6: Establish Habitat Conservation Areas and 7: Manage Habitat Conservation Areas) is projected to result in 161,596 acres of suitable or highly suitable habitat for northern spotted owl within HCAs at the end of the permit term. This represents a net gain of 131,375 acres of habitat within HCAs, compared to the loss outside of HCAs of 35,680 acres due to regeneration harvest and 3,136 acres due to thinning. Models also project the potential development of an additional 17,976 acres of suitable habitat and 9,872 acres of highly suitable habitat developing outside of HCAs by the end of the permit term.

Figure 5-4 shows the modeled projections of cumulative habitat harvested and total habitat present over the duration of the permit, in 5-year increments.



Note: Each year noted in the chart represents the 5-year period starting on the year noted (e.g., 2023 represents years 2023-2027). Projected habitat levels presented in this chapter are not HCP commitments, but rather are projections ODF is using to estimate the level of take and to determine appropriate avoidance, minimization, and mitigation measures needed to offset that projected level of take.

Figure 5-4. Northern Spotted Owl Habitat Harvested and Potential Total Habitat, in 5-Year Increments

*[**Note to reader:** Dispersal habitat projections (in 5-year increments) are pending further classification and analysis.]*

Habitat development will be accelerated—where needed and financially and technically practicable—using variable density thinning and, in some cases (such as stands infected with Swiss needle cast or dominated by alder), regeneration harvest. Where regeneration harvest is used in HCAs, it will be coupled with increased green tree retention standards and young stand management practices focused on the development of large trees, complex tree canopies, and diverse understories. This conservation action is consistent with Recovery Action 6 of the *Revised Northern Spotted Owl Recovery Plan* (USFWS 2011), which states "in moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."

As noted in Chapter 4, the conservation approach was developed in the context of a forested landscape that has been modified from historical conditions, particularly in the northwest portion of the permit area (i.e., the Tillamook and Clatsop State Forests). As a result, many forest stands are now dominated by densely spaced, young conifer and mixed deciduous forest (for a detailed description of current conditions and their history, see Chapter 2). Less than 20,000 acres of the permit area contains highly suitable habitat for northern spotted owl. However, due in part to investments made by ODF since the mid-1990s to improve forest conditions, much of this habitat is capable of becoming habitat suitable for northern spotted owl at some point during the permit term.

The conservation strategy has been developed to anticipate this increase of habitat over time and to proactively develop an HCP that includes a significant portion of these areas to be allowed or encouraged through active management to become suitable habitat for northern spotted owls, and to maintain this habitat. This is consistent with Recovery Action 32 in the *Revised Northern Spotted Owl Recovery Plan* (USFWS 2011). The benefits of developing additional habitat within HCAs is that, rather than operating on a "no-take" basis, which conserves only the minimum habitat that is necessary to avoid take of currently "active" (occupied), the HCP will proactively designate and manage habitat that is currently not suitable in order to create more suitable habitat on the landscape over time.

The extent and location of HCAs is anticipated to ensure the persistence of northern spotted owls throughout the permit area, including within the north coast areas, which USFWS has identified as a priority for maintaining the viability of the Oregon Coast Recovery Unit (USFWS 2011).

In addition, under Conservation Action 9: Strategic Terrestrial Species Conservation Actions, ODF will establish a conservation fund to assist USFWS in implementing barred owl research and management activities within the permit area. The benefits of barred owl removal are still being evaluated, but, based on initial research (Wiens 2019), control of barred owls, if implemented, could enhance survival and site tenacity within the permit area over the duration of the permit, and thus further offset the projected impacts of take under this HCP.

5.7.4.2 Benefits of Monitoring and Adaptive Management Program

The monitoring program described in Chapter 6 includes ODF's commitment to document progress toward maintenance and enhancement of existing nesting, roosting, and foraging habitat over the permit term. The monitoring program also includes efforts to confirm occupation status of habitat over time, using a combination of field surveys and bioacoustic monitoring in activity centers and suitable/highly suitable habitat with unknown occupancy within HCAs. Both efforts will provide documentation to the USFWS and interested stakeholders that the intended benefits to northern spotted owls are being realized. Should monitoring results indicate that biological objectives are not being realized, then ODF will use the adaptive management process described in Chapter 6 to implement changes to improve progress toward the biological objectives.

5.7.4.3 Net Effects

USFWS and others have consistently stated the need to conserve and restore large areas of contiguous, high-quality habitat across the range of the northern spotted owl to prevent further population declines and to allow for the recovery of the species (Lesmeister et al. 2018, Dugger et al. 2016, Forsman et al. 2011, USFWS 2011). The conservation strategy includes focusing management for species habitat improvement in contiguous areas of suitable habitat and associated active northern spotted owl nesting territories within HCAs. Designated HCAs will provide long-term protection and enhancement of northern spotted owl habitat in exchange for allowable harvest in other habitat areas outside of HCAs to maintain important economic values from ODF lands within the permit area.

As previously described, the HCP is projected to result in a net increase in suitable habitat for northern spotted owls over the permit duration, thereby fully offsetting habitat modification that is projected to occur outside of HCAs and RCAs (Figure 5-4).

The amount of habitat conserved and additional habitat to be developed over time is expected to fully offset the amount of authorized take and maintain and enhance northern spotted owl reproduction, numbers, and distribution within the permit area over the duration of the permit.

5.7.5 Cumulative Effects on Northern Spotted Owl

At the time of the writing of this HCP, ODF is not aware of any future state or local actions that may contribute to cumulative effects that are reasonably certain to occur. On state lands, DSL is currently preparing an HCP for the Elliott State Forest. As an HCP, it is required to fully offset the impacts of take and is unlikely to adversely affect northern spotted owl populations or distribution or otherwise contribute to cumulative effects. In addition, because the Elliott State Forest HCP is a contemporaneous effort, it is not considered a cumulative effect in this HCP (per the regulatory definition of cumulative effects, 50 CFR 402.02).

On industrial private lands, most effects on spotted owl populations and distribution have likely already occurred throughout Western Oregon, and actions in the future will be subject to take avoidance measures required by the Forest Practices Act. If private timber companies are likely to take northern spotted owl they must seek an incidental take permit through Section 10 of the ESA. Therefore, actions on private lands are not anticipated to contribute to cumulative effects.

Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational infrastructure and maintenance (e.g., trailhead parking lots, mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines). But ODF is not aware of any specific projects reasonably certain to occur within the Oregon Coast Recovery Unit for northern spotted owl that may significantly contribute to cumulative effects.

5.8 Effects Analysis for Marbled Murrelet

5.8.1 Sources and Types of Take

All covered activities that involve tree removal—including timber harvest, thinning, road work, quarries, and recreational infrastructure development and maintenance—have the potential to result in three types of incidental take of marbled murrelet.

- Harm due to direct injury or mortality, such as inadvertently destroying a nest with eggs or young.
- Harm due to disturbance from noise and activities, such as missed feedings of young due to adult murrelets avoiding the nesting areas.
- Harm due to habitat modification to the extent that murrelets have reduced reproductive success due to predation or abandonment of the nesting site, including from edge effects due to harvests adjacent to nesting habitat that degrade microclimate, increase nest depredation, or result in increased windthrow.
- Harm due to habitat modification to the extent that murrelets stop nesting within a previously used tree or stand.

Harm due to disturbance near known active nest stands during the nesting season and harm due to direct injury or mortality will be avoided through seasonal operational restrictions during the nesting season (Conservation Action 10: Seasonal Operational Restrictions). The following sections describe the criteria and thresholds for determining when take will occur, the effects pathways leading to take, and the specific covered activities expected to result in take, as well as those not expected to result in take.

5.8.1.1 Criteria and Thresholds for Determining Take

To quantify the level of incidental take of marbled murrelets, the HCP uses the acres of suitable and highly suitable habitat that would be harvested or otherwise disturbed under the HCP due to covered activities. Harm due to habitat modification from timber harvest is the primary source and type of take of marbled murrelets ODF anticipates to occur over the permit duration. While take through habitat modification has been minimized through designated HCAs (Conservation Action 6: Establish Habitat Conservation Areas), habitat outside of HCAs and RCAs will be subject to harvest under the HCP. As described under Section 5.8.2, *Quantity and Timing of Take*, no suitable marbled murrelet habitat will be harvested within HCAs. In those instances, there could be short-term effects on marbled murrelet habitat that result in long-term benefits.

Outside of HCAs, the potential for habitat loss to result in take of marbled murrelet will be higher in locations where occupied behavior has been confirmed via surveys and lower in locations where surveys have been conducted but no behavior indicative of occupancy has ever been documented.

Table 5-15 summarizes the general sources and thresholds used in this HCP to determine when covered activities have the potential to rise to the level of take of marbled murrelets. Note that all of these types of take may not occur. Projected level and type of take is described in Section 5.8.2 below. The effects pathways leading to such take are described in the next subsection.

Table 5-15. Criteria and Threshold for Determining Take of Marbled Murrelets

Covered Activities Assumed to Take Marbled Murrelet	Covered Activities with Beneficial, Insignificant, or Discountable Effects
• Covered activities that modify[a] a stand (e.g., regeneration harvest or thinning) with observations indicative of occupancy,[b] regardless of habitat modeling designation. • Covered activities that modify a stand modeled as *suitable* or *highly suitable* within the range of species.[c] • Covered activities that modify habitat immediately adjacent[c] to a stand with observations indicative of occupancy or modeled as *suitable* or *highly suitable* within the range of the species.	• Covered activities within stands modeled as *marginal* or *non-habitat* in all districts within the range of marbled murrelets[c] unless there are observations indicative of occupancy. • Activities in stands modeled as marginal or non-habitat that are immediately adjacent to suitable, highly suitable, or stands that have observation indicative of occupancy, where those activities do not result in an increase of edge to, or otherwise degrade the habitat quality of the adjacent habitat. *[Note to reader: thresholds for edge effects pending further discussion and analysis]*

[a] *Modification* is considered altered habitat structure or composition so that habitat values move from highly suitable or suitable to marginal or non-habitat.

[b] Indicative of occupancy is defined as observations of murrelets flying subcanopy, circling, certain audio detections (wing beats, jet dives, stationary calling), and survey areas with ≥ 3 survey visits with presence detections.

[c] Effects on marbled murrelet are most likely to occur in modeled habitat in Astoria, Tillamook, Western Oregon, Western Lane, and Coos Districts and less likely to occur in Forest Grove based on species range and past survey history. No effects are expected in North Cascade or Southwest.

[c] Immediately adjacent means within 100 meters (328 feet) of the stand edge.

5.8.1.2 Effects Pathways

The effects pathway leading to take begins with reduced forest structure, including large trees and associated nesting platforms and reduced tree density, canopy cover, and canopy layers. Loss of these forest structures may result in the following stressors to resources.

- Eliminate trees with platforms that are required for nesting (Nelson and Wilson 2002), either through direct harvest or subsequent windthrow events along harvest edges.
- Create "hard edges" (recent clearcuts) near nest trees or stands, increasing exposure to nest predators (Malt and Lank 2007) and reducing microclimate conditions needed to support nesting platforms (van Rooyen et al. 2011). Microclimate effects on moss can occur within 150 feet of hard edges, possibly further in areas with greater wind exposure (Raphael et al. 2018).

Cutting down active nest trees or stands during the nesting season will be avoided through the conservation measures described in Chapter 4 (Conservation Action 10: Seasonal Operational Restrictions). Therefore, effects of modified nesting habitat will not be realized until murrelets return to nest. The behavioral response of individual marbled murrelets (or pairs) to such stressors may include the following.

- **Continued use.** In situations where nest trees are retained but edge habitat is created near the nest location, then birds returning to nest may still use the tree, but the eggs and young could be lost due to increased predation risks created by the modified habitat.
- **Abandonment of nest site**. Adults returning to stands that have been significantly modified by timber harvest or other covered activities may seek a new nest location or may forego nesting for the year. If seeking a new nest location, the pair would likely expend considerable energy and may acquire less energy due to less time spent foraging. The pair or individuals may or may not find a suitable replacement nest location. In addition, loss of a nest site could affect pair bonds. In any case, the likely biological effect is assumed to be lost reproductive success for at least 1 year.

The effects pathway ends with the consideration of the biological effects on individuals within the context of regional and range-wide distribution and populations, Because available nesting habitat and associated reproduction levels is considered a limiting factor in current population numbers (Raphael et al. 2018), loss of nest locations or increased predation risk could reduce local population levels through reduced nesting and production of young. Such population-level effects are discussed under Section 3.8.3, *Impacts of the Taking on Marbled Murrelet*.

Figure 5-5 summarizes the potential effects pathways from covered activities, on individual murrelets, through to population-level effects.

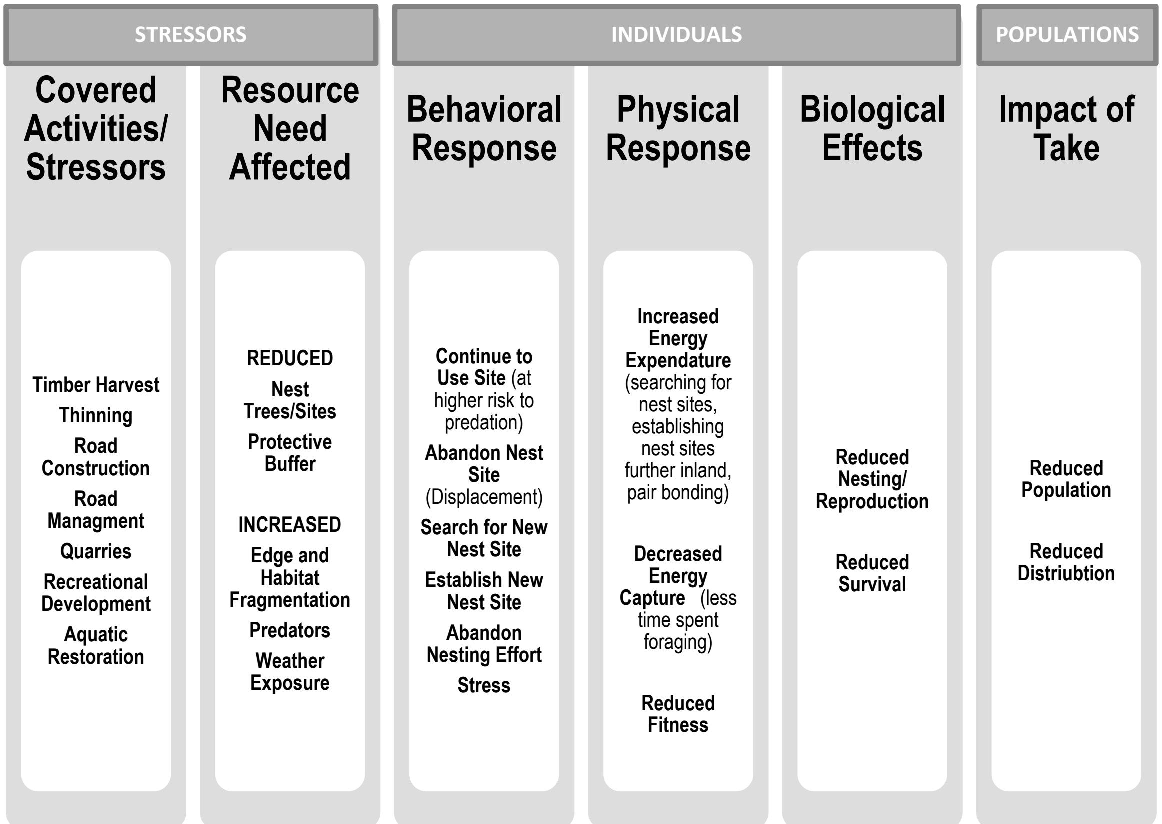


Figure 5-5. Effects Pathways for Impacts of Take of Marbled Murrelets via Habitat Modification from Covered Activities

5.8.1.3 Covered Activities that May Result in Take

Harm via timber harvest and associated modification of occupied habitat will be the primary source and type of take of marbled murrelets. Other covered activities may also include tree removal that could modify marbled murrelet habitat if conducted in such habitat, including new road construction, landings, and development of new quarries and recreation infrastructure and maintenance (e.g., campgrounds, trails, trailheads). Establishment of recreation infrastructure has the added potential for take of increasing corvid populations (ravens, jays, and crows), which may in turn increase predation risks to marbled murrelets nesting near such areas (Malt and Lank 2007, Walker and Marzluff 2015, Raphael et al. 2018).

Timber harvest activities inside of HCAs may also result in habitat modification or removal. Silvicultural prescriptions inside of HCAs will only be carried out if the harvest action would result in higher habitat quality over the duration of the permit. These areas include stands dominated by alder with little or no conifer component, or those infected with Swiss needle cast that have limited potential to provide habitat value during the permit term. In these situations, replacement stands may not achieve all suitable habitat characteristics during the permit term; however, they will achieve a higher level of suitability than the non-habitat or marginally suitable habitat stand they replace.

Take via habitat modification may occur throughout the duration of the incidental take permit. As with northern spotted owl, take in the early years of the permit will occur within existing suitable habitat outside of HCAs, while take in later years may include habitat that is currently not suitable but that has developed over time. The amount and timing of take anticipated to occur through habitat modification over the permit duration is described in Section 5.8.2.

Not all habitat modification will result in take. As with other covered terrestrial species, the likelihood that effects of habitat modification from timber harvest on marbled murrelets will rise to the level of take depends on (1) existing conditions of the stand to be modified and (2) proposed harvest specifications. Habitat must be used at some point in time by nesting marbled murrelets in order for nesting murrelets to be exposed to the effects of habitat modification, although it may not occur every year (i.e., annual variation of actual nesting in occupied habitat). In addition, the habitat modification must be sufficiently severe as to interfere with nesting to the extent that individuals or their eggs or young are actually harmed. Habitat modification will be most likely to result in take within stands that are modeled as suitable or highly suitable, as these are places that are most likely to support marbled murrelet nesting. Table 5-16 summarizes covered activities and associated type of take expected to occur under the permit terms and conditions.

Table 5-16. Sources and Types of Take of Marbled Murrelet Expected Under the Habitat Conservation Plan

Covered Activity	Type of Take
Regeneration Harvest	Removal of habitat within or adjacent to occupied stands has the potential to increase predation and reduce nest site productivity. Removal of habitat that is near, or that includes, the nest tree would likely cause marbled murrelets to abandon the nesting area and seek replacement habitat elsewhere. Finding replacement habitat may place a high energy demand on displaced individuals and reduce the likelihood of successful nesting for at least 1 year or longer, depending on available replacement habitat.
Thinning	As with regeneration harvest, thinning could remove a sufficient number and type of trees to reduce habitat values for nesting marbled murrelets, with the potential for reduced reproductive success or nest abandonment.
Road Construction and Maintenance	New road construction within suitable habitat of unknown occupancy status has the potential to increase predation risks on eggs or young and reduce overall reproductive success or cause nest abandonment. Road construction would not take place in habitat that is known to be occupied, but maintenance of existing roads would still take place outside the critical nesting period.
Other Covered Activities Outside of HCAs and RCAs	Development of new quarries and recreation infrastructure as well as maintenance (e.g., campgrounds, trails, trailheads) within occupied habitat has the potential to result in take due to habitat modification, including potential reduced reproductive success or nest abandonment. In addition, recreational infrastructure development and maintenance has the potential to increase predator populations and may increase predation of marbled murrelet nests or young.

5.8.1.4 Covered Activities Not Expected Cause Take

Covered activities conducted more than 100 meters from suitable marbled murrelet nesting habitat are not expected to cause take because most significant physical and biological effects on murrelet nesting stands (e.g., windthrow, loss of moss for nesting substrate, reduced canopy cover, increased predation) are believed to occur within this distance (USFWS 2019).

Within HCAs, thinning and hardwood release treatments to improve forest conditions (Conservation Action 7: Manage Habitat Conservation Areas) will not be conducted within a specified distance of occupied nesting areas during the nesting season (Chapter 4, Table 4-12).

Other covered activities will either not be conducted within HCAs or will be conducted only when such activities will not result in take (Conservation Action 7: Manage Habitat Conservation Areas).

Similarly, within RCAs, aquatic habitat restoration projects could result in disturbance or minor habitat modifications, including tree removal, but such effects are not likely to rise to the level of take because of the small amount of habitat affected and the avoidance and minimization measures described in Chapter 4 (e.g., avoiding disturbance or destruction of nest trees). Other covered activities will either not be conducted within RCAs or will be conducted only when such activities will not result in take as determined by an ODF biologist.

Table 5-17 lists covered activities that are not expected to rise to the level of take of marbled murrelets.

Table 5-17. Covered Activities Not Expected to Result in Take of Marbled Murrelet

Covered Activity	Rationale for Determining that Habitat Modification Will Not Result in Take
All Covered Activities Conducted Outside of Suitable and Highly Suitable Habitat	Activities that do not modify suitable or highly suitable habitat would not result in take.
Helicopter Use	Helicopters used for aerial application of herbicides and fertilizer and for aerial yarding would follow avoidance measures defined under Conservation Action 10: Seasonal Operational Restrictions.
Site Preparation, Tree Planting, and Release Treatments	Reforestation and young stand management activities will take place outside of suitable habitat and are not likely to adversely affect marbled murrelets.
Animal Damage Control	Animal damage control treatments will occur primarily in reforestation areas that are non-habitat for marbled murrelet. Treatments that include an area surrounding the reforestation area may intersect habitat for marbled murrelet, but are not expected to result in take.
Fertilizer Application	In addition to taking place outside of suitable habitat, there is no indication that fertilizer application will harm marbled murrelets. The USFWS recovery plan (USFWS 1997) and scientific literature do not identify fertilizer application as a potential stressor for marbled murrelets.
Precommercial Thinning and Pruning	Precommercial thinning will be conducted in young forest stands and will not occur within suitable marbled murrelet habitat.
Unmanned Aircraft Systems (UAS)	Nest disturbance from drones will be avoided through seasonal operational restrictions (Conservation Action 10: Seasonal Operational Restrictions). For situations where UAS are used for research or monitoring during the nesting season on nests, a separate incidental take permit for the project will be obtained by the party conducting research and monitoring.
Livestock Grazing	State forests in western Oregon have limited grazing potential, and no use is expected within suitable marbled murrelet habitat.

Covered Activity	Rationale for Determining that Habitat Modification Will Not Result in Take
Existing Road System	The presence of existing roads is not expected to rise to the level of take because they are considered part of the environmental baseline and current nest locations have been established in the presence of the road system.
Road Management	Removal of hazard trees along roads has the potential to reduce habitat values for marbled murrelets. However, minimization and avoidance measures will protect nest locations.
Road Use	Marbled murrelets rarely fly at ground level and are not expected to be at risk of collisions with vehicles.
Road Maintenance	Work within the road prism rarely intersects marbled murrelet nesting habitat.
Road Decommissioning	Road decommissioning will not adversely affect murrelet habitat and may improve habitat conditions over time by reducing hard edge effects and reducing human use.
Drainage Structure Construction and Maintenance	Drainage work will not adversely affect marbled murrelet nesting habitat
Minor Forest-Product Harvest	Harvest of forest greens will not alter habitat conditions or expose murrelets to significant exposure from harvesters.
Controlled Burning	The likelihood of smoke harming marbled murrelets is low, as burns are rarely conducted within the breeding season when murrelets are present. They are only conducted when wind speeds are low and consistent, and smoke plumes generally drift in one direction, which reduces the likelihood that it would drift toward a nest. Existing fire management protocols are expected to adequately mitigate the chance of fire spreading into suitable habitat.
Water Drafting and Storage (fire management)	This activity is not likely to adversely affect nesting marbled murrelets or their eggs or young.
Aquatic Habitat Restoration	Aquatic habitat restoration may result in minor habitat modification, such as select tree tipping or removal, but such effects are not likely to rise to the level of take because of the avoidance and minimization measures described in Chapter 4.
Barred Owl Management	The HCP includes ODF's commitments to support barred owl removal and those activities will be conducted in a manner that avoids take of marbled murrelets.
Research and Monitoring Activities	Research and monitoring within HCAs and RCAs would be conducted to avoid take. Outside of HCAs and RCAs, research and monitoring may be conducted in conjunction with activities that may involve take. If any research or monitoring activity is determined to likely result in take, then ODF will obtain necessary clearance with the USFWS (or the research organization will, if a different entity)

5.8.2 Quantity and Timing of Take

5.8.2.1 Suitable and Highly Suitable Habitat Modification/Loss

Based on timber harvest and forest growth modeling, 15,415 acres of suitable/highly suitable marbled murrelet habitat will be harvested or thinned over the duration of the permit. Not all of this habitat will be suitable at the outset of the permit. Some stands will grow into habitat as time progresses and the forest develops characteristics indicative of suitable or highly suitable habitat. Habitat modification will occur inside and outside of HCAs.

Modification of marbled murrelet habitat within HCAs will only be done in situations where those short-term silvicultural actions will result in long-term increases in habitat quality. The opportunity to realize habitat benefits while maintaining the integrity of habitat that is currently suitable or highly suitable is expected to be rare. While management prescriptions in such situations would be tailored to maintain existing suitable characteristics, it is still possible, for there to be a loss or reduction in the quality of suitable or highly suitable habitat. Within HCAs, ODF anticipates no regeneration harvest and 739 acres of thinning in suitable habitat to improve habitat values. No highly suitable habitat would be harvested or thinned within HCAs.

Outside of HCAs, suitable and highly suitable habitat will be harvested or thinned for timber production. ODF projects that 14,671 acres of suitable habitat and 388 acres of highly suitable habitat will be removed due to harvest activities over the permit duration. Table 5-18 summarizes the suitable and highly suitable habitat that would be modified through thinning or lost through regeneration harvest over the 70-year permit duration.

Table 5-18. Marbled Murrelet Habitat Projected to Be Harvested or Thinned Under the HCP Over the Permit Duration

	Habitat Thinned		Habitat Harvested		
Location	**Highly Suitable**	**Suitable**	**Highly Suitable**	**Suitable**	**Total**
Within HCAs	--	739	--	--	739
Outside of HCAs	--	5	388	14,671	15,064
Total	--	**744**	**388**	**14,671**	**15,803**

5.8.2.2 Marbled Murrelet Nesting Sites

Loss of nesting habitat is expected to be rare over the duration of the permit, because the majority of confirmed occupied sites are located within HCAs. Of the 363 survey detections indicating marbled murrelet occupancy in the permit area, all but 4 are included in HCAs. By definition management activities in HCA will only be implemented to increase habitat quantity for marbled murrelet over the permit term, so loss of nest trees inside HCAs is not expected. It is expected that occupied stands outside of HCAs could be lost over time, likely due to a reduction in habitat quality in the stand; however, harvest of potential nesting habitat will continue to be avoided during the nesting season as long as nesting persists (Conservation Action 10: Seasonal Operational Restrictions). Additionally, ODF has surveyed the vast majority of highly suitable marbled habitat on the permit area over the last 30 years and estimates very little potential loss of highly suitable habitat of unknown occupancy. Harvest of low quality or marginal habitat of unknown occupancy status that occurs across the permit area is the primary source of potential take outside of HCAs.

Table 5-19 summarizes the results of marbled murrelet surveys that have been conducted over the permit area over many years (see Appendix C).

Table 5-19. Marbled Murrelet Survey Results Within the Permit Area, Including Those Inside and Outside HCAs

HCP Allocation	Significant[a]	% in HCA	Presence – Visual[b]	% in HCA	Presence – Audio[c]	% in HCA	Total
Inside HCA	359	99	248	84	620	87	1,227
Outside HCA	4		47		96		147
Total	**363**		**295**		**716**		**1,374**

[a] "Significant" observations are assumed active nesting sites.
[b] "Presence – Visual" indicates the possibility of nesting, but birds observed may be traveling to other stands.
[c] "Presence – Audio" increases the possibility that the surveyed stand is occupied, but calls are frequently heard far away from nesting areas, so not a strong indicator of nesting. See Evans Mack (2003) for details on survey protocol and result classification.

5.8.3 Impacts of the Taking on Marbled Murrelet

5.8.3.1 Context, Intensity, and Duration of Impacts

Take resulting from habitat loss and other adverse effects, described in Section 5.8.2 above, would take place within the following contexts and levels of intensity.

- Approximately 83% of existing habitat is located within HCAs, including approximately 81% of existing suitable and 97% of highly suitable habitat.
- 99% of known occupied habitat within the permit area will receive long-term protections within HCAs, regardless of the modeled suitability of their habitat.

Take of the most valuable habitat and occupied nest locations will be largely avoided through the conservation strategy presented in Chapter 4. Effects of habitat modification are considered to occur throughout the duration of the permit. However, some modification due to thinning would be temporary. All modifications within HCAs would be temporary, although development of desired suitable habitat characteristics may not be achieved in all stands within HCAs by the end of the permit term.

5.8.3.2 Effects on Critical Habitat

USFWS has designated critical habitat for marbled murrelet on approximately 1.5 million acres in Oregon (USFWS 2016), of which 163,160 acres are within the permit area within five units.

Of the total marbled murrelet critical habitat designated within the permit area, 82% (133,907 acres) is within Unit OR-01, located in the northwest portion of the planning area and 16% (25,607 acres) is within Unit OR-03, located in the north Oregon Coast area.

While ODF considered critical habitat when delineating HCAs as part of the terrestrial conservation strategy, the two do not completely overlap. Actual species occurrence, existing highly suitable habitat, and connectivity were the primary drivers for HCA delineation. In addition, much of the areas designated as critical habitat are currently not suitable for marbled murrelet. Of the 163,160 acres of designated critical habitat for northern spotted owl within the permit area, less than 1% (869 acres) is currently highly suitable and 7% (11,598 acres) is currently suitable (Table 5-20).

Of this, all but 1 acre of designated critical habitat that is currently highly suitable is located within HCAs (868 acres) and 74% (8,559 acres) of designated critical habitat that currently suitable is within HCAs. As described under Section 5.8.3, *Beneficial and Net Effects on Marbled Murrelet*, total suitable and highly suitable habitat within HCAs is projected to be 168,655 acres at the end of the permit duration.

Approximately 63,358 acres (39%) of designated critical habitat for marbled murrelet are located outside of HCAs and, therefore, would be subject to modification due to timber harvest or other covered activities. Of the critical habitat that would be subject to modification under the HCP, only 1 acre is currently modeled as highly suitable, and 3,039 are currently suitable. The remaining acres of designated critical habitat for marbled murrelet located outside of HCAs include approximately 5,000 acres of marginally suitable habitat and 55,326 acres of non-habitat.

Table 5-20 provides details on the amount of harvest that would occur within designated marbled murrelet critical habitat, together with the current habitat suitability of these areas.

Table 5-20. Marbled Murrelet Critical Habitat Subject to Harvest Under the Habitat Conservation Plan (acres)

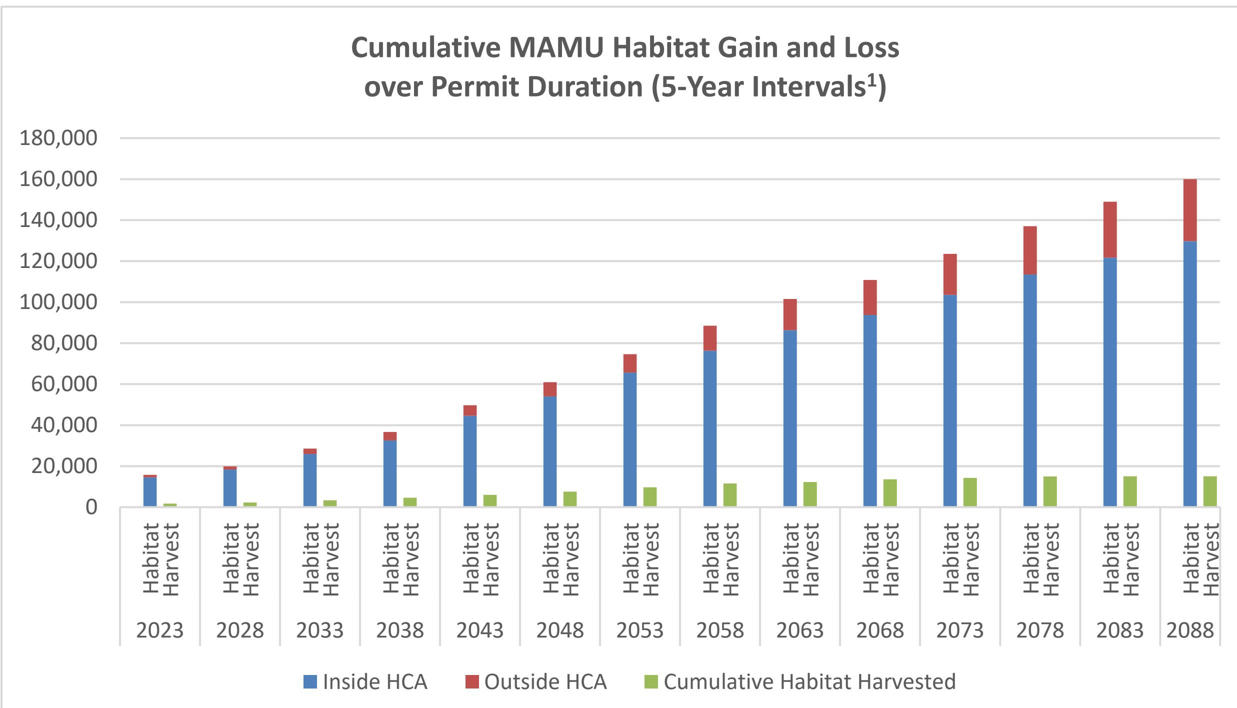
	Highly Suitable	Suitable	Marginally Suitable	Non-Habitat	Total
OR-01					
Total Within Permit Area	576	7,992	16,669	108,670	133,907
Critical Habitat Within HCAs	575	5,971	13,021	66,274	85,842
Critical Habitat Outside of HCAs	0	2,021	3,648	42,396	48,065
OR-02					
Total Within Permit Area	11	98	20	3,271	3,400
Critical Habitat Within HCAs	11	98	20	3,231	3,360
Critical Habitat Outside of HCAs	0	0	0	41	41
OR-03					
Total Within Permit Area	254	3,478	3,299	18,576	25,607
Critical Habitat Within HCAs	253	2,461	1,957	5,783	10,455
Critical Habitat Outside of HCAs	1	1,017	1,342	12,792	15,152
OR-04					
Total Within Permit Area	25	15	11	161	213
Critical Habitat Within HCAs	25	14	10	63	112
Critical Habitat Outside of HCAs	0	1	1	98	101
OR-07					
Total Within Permit Area	3	15	0	15	33
Critical Habitat Within HCAs	3	15	0	15	33
Critical Habitat Outside of HCAs	0	0	0	0	0
Total All Critical Habitat					
Total Within Permit Area	869	11,598	20,001	130,693	163,160
Critical Habitat Within HCAs	868	8,559	15,008	75,367	99,802
Critical Habitat Outside of HCAs	1	3,039	4,992	55,326	63,358
% Critical Habitat Within HCAs	100%	74%	75%	58%	61%
% Critical Habitat Outside of HCAs	0%	26%	25%	42%	39%

5.8.4 Beneficial and Net Effects on Marbled Murrelet

5.8.4.1 Benefits of Habitat Conservation Areas

The conservation strategy (Conservation Actions 6: Establish Habitat Conservation Areas and 7: Manage Habitat Conservation Areas) is projected to result in 129,755 acres of suitable or highly suitable for marbled murrelet within HCAs at the end of the permit term. This represents a gain of 115,214 acres of habitat within HCAs, compared to the loss 15,059 acres of habitat due to harvest and 744 acres due to thinning. Models also project an additional 17,359 acres of suitable habitat and 9,872 acres of suitable habitat developing outside of HCAs at the end of the permit term.

Figure 5-6 shows the cumulative habitat harvested and total habitat present over the duration of the permit, in 5-year increments.



Note: Each year noted in the chart represents the 5-year period starting on the year noted (e.g., 2023 represents years 2023–2027). Projected habitat levels presented in this chapter are not HCP commitments, but rather are projections ODF is using to estimate the level of take and to determine appropriate avoidance, minimization, and mitigation measures needed to offset that projected level of take.

Figure 5-6. Marbled Murrelet Habitat Harvested and Total Habitat, in 5-Year Increments

5.8.4.2 Benefits of Monitoring and Adaptive Management Program

The monitoring program described in Chapter 6 includes ODF's commitment to document progress toward maintenance and enhancement of existing marbled murrelet nesting habitat over the permit term. This will include reporting of acres of habitat as well as known occupied habitat over the permit area at permit issuance.

The monitoring program also includes efforts to confirm occupation status of habitat over time, using a combination of field surveys and potentially bioacoustics monitoring in stands containing suitable marbled murrelet nesting habitat.

Should monitoring results indicate that biological objectives are not being realized, then ODF will implement the adaptive management process described in Chapter 6 to rectify deficiencies.

5.8.4.3 Net Effects

As stated in Chapter 4 the conservation approach was developed in the context of a forested landscape that has been modified from historical conditions, particularly in the northwest portion of the permit area (i.e., the Tillamook and Clatsop State Forests). As a result, many forest stands are now dominated by densely spaced, young conifer and mixed deciduous forest (for a detailed description of current conditions and their history, see Chapter 2), and the permit area contains relatively little highly suitable habitat for marbled murrelet. However, many existing forest stands are within a sufficiently mature level of development that it is capable of becoming habitat suitable for marbled murrelet nesting over the duration of the permit.

The conservation strategy has been developed to anticipate this increase of habitat over time and to include a significant portion of these areas to be allowed to become suitable habitat for marbled murrelets through establishment of HCAs and a moderate level of active management to maintain and enhance habitat over the permit duration.

As shown in Figure 5-6, the HCP is projected to result in a net increase in suitable habitat for marbled murrelets over the permit duration, thereby fully offsetting habitat modification that is projected to occur under the terms and conditions of the HCP.

These areas within designated HCAs will provide long-term protection and enhancement of marbled murrelet habitat in exchange for allowable harvest in other habitat areas outside of HCAs to maintain important economic values from ODF lands within the permit area. The amount of habitat conserved and additional habitat to be developed over time is expected to maintain and enhance marbled murrelet reproduction, numbers, and distribution within the permit area over the duration of the permit.

5.8.5 Cumulative Effects on Marbled Murrelet

Cumulative effects, as defined in this HCP, are the combined effects of future state, local, or private actions that are reasonably certain to occur in the action area, considered collectively with the effects of this HCP.

At the time of this HCP, there are no future state or local actions that may contribute to cumulative effects that are reasonably certain to occur. On state lands, DSL is currently preparing an HCP for the Elliott State Forest that includes incidental take of marbled murrelets and northern spotted owls. As an HCP, it is required to fully offset the impacts of take and is unlikely to adversely affect marbled murrelet populations or distribution or otherwise contribute to cumulative effects. In addition, because the Elliott State Forest HCP is a contemporaneous effort, it is not considered a cumulative effect in this HCP (per the regulatory definition of cumulative effects, 50 CFR 402.02).

Effects on marbled murrelet populations and distribution from impacts on private lands have likely already occurred throughout the Oregon Coast Recovery Unit, and actions on private lands in the future will be subject to take avoidance under the federal ESA. Therefore, actions on private lands are not anticipated to contribute to cumulative effects.

Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational infrastructure development and maintenance (e.g., mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines). ODF is not aware of any specific projects reasonably certain to occur within the Oregon Coast Recovery Unit for marbled murrelet.

5.9 Effects Analysis for Coastal Marten

*[***Note to reader***: Coastal marten conservation actions and associated effects analysis are still in progress. The following is preliminary].*

5.9.1 Sources and Types of Take

All covered activities that involve tree removal—including timber harvest, thinning, road work, quarry work, and recreational infrastructure development and maintenance—have the potential to result in two types of incidental take of coastal marten.

- Harm due to direct injury or mortality via roadkill or destroying a den with young during harvest operations.
- Harm due to habitat modification to the extent that individual coastal martens have reduced survival or reproductive success.

Because coastal marten are believed to be absent from approximately 90% of the permit area (see Species Account, Appendix C), covered activities will have limited effects on behaviors, habitat use, or survival of individuals over the permit duration. Coastal marten distribution includes all ODF managed lands from the northern boundary of Lane County south to the California border and west of Interstate 5 (49,987 acres). This HCP assumes that any timber harvest in this area would have adverse effects on potentially suitable habitat. This is due to limited information about how coastal martens respond to harvest and the relative density of coastal martens in suitable habitat. So this is a conservative estimate of the amount of take that would actually occur.

5.9.1.1 Criteria and Thresholds for Determining Take

Habitat must be occupied by coastal marten to expose individuals to the effects of habitat modification. Therefore, habitat modification within stands that are most likely to support coastal marten at some time over the duration of the permit has the highest potential to effect the species. The HCP uses modification of suitable habitat as a primary metric of take for coastal marten.

Table 5-21 summarizes the general sources of habitat modification and the associated thresholds used in this HCP to determine the level of take presented in Section 5.7.2, *Quantity and Timing of Take*.

Table 5-21. Criteria and Threshold for Determining Take to Coastal Marten

Covered Activities Assumed to Take Coastal Marten	Covered Activities with Beneficial, Insignificant, or Discountable Effects
• Covered activities that modify[a] a stand (e.g., regeneration harvest or thinning) with known presence, particularly a known den location. • Covered activities that modify a stand within *suitable* habitat outside of HCAs.	• Habitat management activities inside of HCAs will have a beneficial effect on coastal marten. • Covered activities on parcels outside the range of coastal marten will have insignificant or discountable effects.

[a] Modification is considered altered habitat structure or composition so that habitat values move from highly suitable or suitable to marginal or non-habitat.

5.9.1.2 Effects Pathways

The effects pathways leading to harm due to direct injury or mortality include all covered activities that would physically disturb denning habitat, including harvesting, yarding, clearing, and grading associated with timber harvest.

The effects pathway of harm due to habitat modification begins with covered activities that reduce forest structure, particularly large trees, snags, downed logs, and a dense understory of shrubs (Slauson et al. 2019a, 2019b). Timber harvest will be the primary source of such habitat modification over the duration of the permit. Based on the USFWS Coastal Marten Species Status Assessment (USFWS 2018) and on the most recent habitat modeling study for coastal marten (Slauson et al. 2019b), loss of these forest structures and overstory may result in the following stressors to resources required by coastal marten.

- Reduce volume of large downed wood and associated resting, denning, and foraging habitat.
- Reduce future recruitment of large downed wood and associated habitat.
- Reduce shrub layers and associated foraging habitat and cover from predators.
- Reduce prey densities due to loss of cover and food required by prey species (e.g., truffles and seeds).
- Increase exposure to predators that use more general habitat requirements, particularly bobcat.
- Increase exposure to competitors, including bobcat, gray fox, raccoon, and western spotted skunk.
- Fragment habitat and consequently remove landscape-level habitat requirements and isolate individuals or local populations.

The behavioral response of individual coastal marten to such stressors may include avoiding disturbed areas and using a smaller area, expanding foraging into new adjacent areas, or abandoning an existing territory altogether. Using a smaller area would reduce prey intake. Expanding use or moving to a new area would expose individuals to increased predation risks and lack of food. The ultimate physical response to all these behavioral responses would likely include reduced physical fitness due to increased energy expenditure (e.g., stress, increased time spent hunting and moving) and reduced energy capture (prey). These energy costs can result in an energy deficit that translates into biological effects, including reduced reproduction and survival. Harm would occur when energy deficits result in reduced reproductive success or direct mortality of adults through starvation, exposure (heat/cold/rain), disease, or predation. Harm may also occur if habitat is fragmented, preventing movement and associated foraging and reproductive success.

The effects pathway ends with the consideration of the biological effects on individuals within the context of regional and range-wide distribution and populations, which is discussed in Section 5.9.3, *Impacts of the Taking on Coastal Marten*.

Figure 5-7 summarizes the general effects pathways identified for potential harm to coastal marten due to habitat modification.

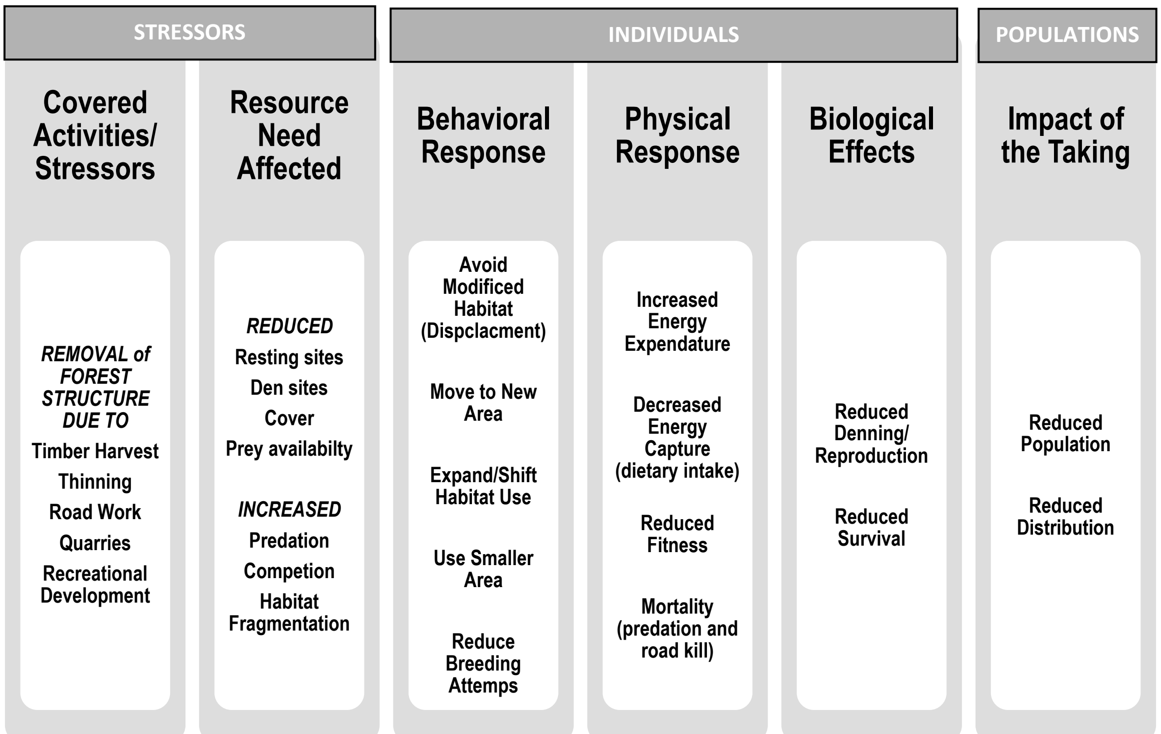


Figure 5-7. Effects Pathways for Impacts of Take of Coastal Marten via Habitat Modification

5.9.1.3 Covered Activities that May Result in Take

Any covered activity that will physically disturb habitats where coastal marten are present may rise to the level of take either through direct injury and mortality or through habitat modification and associated loss of resources needed by coastal marten for breeding, feeding, and shelter. Timber harvest, including regeneration harvest, and thinning, is the primary activity that is expected to rise to the level of take. Table 5-22 lists covered activities and associated types of take expected to occur over the duration of the permit. Details regarding the effects pathways are provided in the previous subsection.

Table 5-22. Sources and Types of Take of Coastal Marten Expected Under the Terms of the HCP

Covered Activity	Type of Take
Regeneration Harvest	Regeneration harvests and associated temporary roads, landings, yarding operations, and use of heavy equipment within suitable habitat is the primary source of take expected for coastal marten.
Thinning	As with regeneration harvest, thinning within occupied habitat could result in take via habitat modification.
Herbicide Application	While herbicides will be applied in recent regeneration harvest units and outside of suitable habitat, coastal marten may forage or travel within younger forests with dense shrub layers (Slauson et al. 2019). Therefore, herbicide application could reduce foraging and movement habitat and expose individuals to increase predation risks and competition pressures.
Road Construction and Maintenance	New road construction within occupied or suitable habitat will reduce available habitat and could be a source of mortality.
Other Covered Activities Outside of HCAs and RCAs	Development of new quarries and recreation infrastructure as well as maintenance (e.g., campgrounds, trails, trailheads) within occupied or suitable coastal marten habitat is expected to result in take due to direct mortality or habitat modification.

5.9.1.4 Covered Activities Not Expected to Result in Take

Cover activities that do not disturb suitable habitat are unlikely to cause adverse effects that rise to the level of take. Table 5-23 lists covered activities not expected to modify suitable habitat and result in take of coastal marten over the duration of the permit.

Table 5-23. Covered Activities Not Expected to Result in Take of Coastal Marten

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
All Covered Activities Conducted Outside of Suitable and Highly Suitable Habitat	Covered activities that do not modify suitable habitat would not result in take.
Site Preparation, Tree Planting, and Release Treatments	Reforestation and young stand management activities will take place outside of suitable habitat and are not likely to adversely affect coastal marten.
Animal Damage Control	Control of mountain beaver could reduce prey availability, but treatments would occur primarily in non-habitat, so overall effect is not expected to rise to the level of take. Mountain beaver control will not modify coastal marten habitat.
Fertilizer Application	In addition to taking place outside of suitable habitat, there is no indication that fertilizer application will harm coastal marten.
Precommercial Thinning and Pruning	Precommercial thinning will take place in young stands, so such effects would not be expected to rise to the level of take.
Unmanned Aircraft Systems	No effect pathways identified.
Livestock Grazing	The permit area has limited grazing potential and grazing is not expected within suitable habitat.
Existing Road System	Existing roads add to habitat fragmentation effects that may block movements. However, the presence of existing roads is not expected

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
	to rise to the level of take because they are considered part of the environmental baseline.
Road Maintenance	Work within the road prism would not be likely to affect coastal marten habitat.
Road Decommissioning	Road decommissioning would not adversely affect coastal marten habitat.
Drainage Structure Construction and Maintenance	Drainage work would not adversely affect coastal marten habitat.
Minor Forest-Product Harvest	Harvest of forest greens or firewood gathering would not occur at sufficient levels within suitable habitat to modify habitat suitability for coastal marten.
Water Drafting and Storage (fire management)	This activity is not likely to adversely affect coastal marten habitat.
Aquatic Habitat Restoration	Aquatic habitat restoration may result in minor habitat modification, such as select tree tipping or removal, but such effects are not likely to rise to the level of take because of the avoidance and minimization measures described in Chapter 4.
Barred Owl Management	Barred owl management would have no effect on coastal marten habitat. Prey base may increase in some areas.
Research and Monitoring Activities	Research and monitoring is not likely to adversely affect coastal marten habitat or otherwise harm individuals.

5.9.2 Quantity and Timing of Take

[**Note to Reader:** *Quantification of take for coastal marten is still in process and will be included in a future draft of the HCP*.]

Based on timber harvest and forest growth modeling, approximately [TBD] acres of suitable coastal marten habitat would be harvested over the duration of the permit. Not all of this habitat will be suitable at the outset of the permit. Some stands will grow into habitat as time progresses and the forest develops characteristics indicative of suitable or highly suitable habitat. Habitat modification will occur inside and outside of HCAs. No highly suitable habitat is projected to be modified within the permit area over the permit duration.

Inside of HCAs, habitat modification will only be done in situations where those short-term silvicultural actions will result in long-term increases in habitat quality. Within HCAs, ODF projects that [TBD] acres of suitable habitat will be thinned to improve habitat values.

Outside of HCAs, suitable habitat will be harvested or thinned for commercial forestry production. ODF projects that [TBD] acres of suitable habitat will be harvested and [TBD] acres will be thinned over the permit duration. Table 5-24 summarizes the suitable and highly suitable habitat that would be modified through thinning or lost through regeneration harvest over the 70-year permit duration.

Table 5-24. Coastal Marten Habitat Projected to Be Harvested or Thinned in Suitable Habitat Under the HCP Over the Permit Duration (acres)

	Habitat Thinned	Habitat Harvested	
Location	**Suitable**	**Suitable**	**Total**
Within HCAs	TBD	TBD	TBD
Outside of HCAs	TBD	TBD	TBD
Total	**TBD**	**TBD**	

5.9.3 Impacts of the Taking on Coastal Marten

Take resulting from this habitat loss and other adverse effects, described above, would take place within the following contexts and levels of intensity:

- All areas within the range of coastal marten are considered potentially suitable habitat, with approximately 50,000 acres (8%) of the permit area containing potentially suitable habitat.
- Approximately 51% (25,289 acres) of potentially suitable habitat within the permit area would be conserved within HCAs.

Effects of habitat modification are considered to occur throughout the duration of the permit. However, large wood is expected to increase over time throughout the permit area, so some modification due to thinning would be temporary. All modifications within HCAs would be temporary, although development of desired suitable habitat characteristics may not be achieved in all stands within HCAs by the end of the permit term.

5.9.4 Beneficial and Net Effects on Coastal Marten

5.9.4.1 Benefits of Habitat Conservation Areas

The conservation strategy (Conservation Actions 6: Establish Habitat Conservation Areas and 7: Manage Habitat Conservation Areas) is projected to result in the improvement of 25,289 acres of suitable habitat for coastal marten within HCAs at the end of the permit term. In addition, RCAs are expected to provide foraging, denning, and dispersal habitat, with suitability improving over time. Figure 5-8 shows the cumulative habitat harvested and total habitat present over the duration of the permit, in 5-year increments.

[Figure to Come]

Figure 5-8. Coastal Marten Habitat Harvested and Total Habitat, in 5-Year Increments 9 (in prep)

5.9.4.2 Benefits of Monitoring and Adaptive Management

The monitoring program described in Chapter 6 includes ODF's commitment to provide technical support and financial assistance to coastal marten research and monitoring efforts in Oregon. The program will benefit coastal marten populations in Oregon in the following ways.

- Expand current understanding of the distribution and interactions of existing marten populations.
- Protect known breeding marten and their offspring (including protecting occupied den sites, minimizing activities that may disturb the marten using those den sites, and prohibiting trapping within 2.5 miles of known den site).
- Improve current understanding of marten response to vegetation management activities.
- Aid in acquiring more accurate estimates of marten densities.
- Examine predator populations in and between occupied areas.
- Facilitate future translocation and monitoring of marten in portions of the permit area where they no longer exist.
- Facilitate the cooperation and collaboration among land managers and federal and state wildlife agencies in furthering marten conservation in western Oregon.

ODF will also participate in the Oregon Forest Carnivore Working Group and related USFWS-led Marten Stakeholder Meetings and seek opportunities to collaborate in research and monitoring efforts related to marten to provide information needed by forest managers and conservation biologists to determine effective strategies and techniques for coastal marten conservation.

Also, as described in Chapter 6, adaptive management will allow for mutually agreed-upon changes to conservation commitments in response to changing conditions or new information, where those changes will avoid or minimize effects to the maximum extent practicable and provide a conservation benefit for marten. Adaptive management changes will occur in response to biological information indicating that the conservation commitments are ineffective at meeting the stated goals of the HCP. Examples include if best available scientific data reveal that: (1) protection measures for denning female marten may be inadequate to minimize or avoid take; or (2) retention strategies for trees, snags, and downed wood are inadequate or could be improved with modifications or additions (e.g. slash piles). Should the USFWS or other ODF cooperators desire to implement adaptive management research to determine the characteristics (location, aspect, size, structure, grouping) of slash piles used for denning by martens, ODF will cooperate in managing its planned timber harvests to leave unburned slash piles for monitoring and controlled research on active management of slash to create habitat elements useful to marten.

5.9.4.3 Net Effects

As shown in Figure 5-8, the HCP is projected to result in a net increase in suitable habitat for coastal marten over the permit duration, thereby fully offsetting habitat modification that is projected to occur under the terms and conditions of the HCP.

These areas within designated HCAs will provide long-term protection and enhancement of coastal marten habitat in exchange for allowable harvest in other habitat areas outside of HCAs to maintain important economic values from ODF lands within the permit area. The amount of habitat conserved and additional habitat to be developed over time is expected to maintain and enhance coastal marten reproduction, numbers, and distribution within the permit area.

5.9.5 Cumulative Effects on Coastal Marten

Cumulative effects, as defined in this HCP, are the combined effects of future state, local, or private actions that are reasonably certain to occur in the action area, considered collectively with the effects of this HCP.

At the time of this HCP, there are no future state or local actions that may contribute to cumulative effects that are reasonably certain to occur. On state lands, DSL is currently preparing an HCP for the Elliott State Forest, but coastal marten are currently not proposed to be covered under that plan. Because the Elliott State Forest HCP is a contemporaneous effort, it is not considered a cumulative effect in this HCP (per the regulatory definition of cumulative effects, 50 CFR 402.02).

Effects on coastal marten populations and distribution from impacts on private lands have likely already occurred throughout the historic range of coastal marten. Therefore, actions on private lands are not anticipated to contribute to cumulative effects.

Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational infrastructure development and maintenance (e.g., mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines).ODF is not aware of any specific projects reasonably certain to occur within the range of the coastal marten.

5.10 Effects Analysis for Red Tree Vole, North Oregon Coast Distinct Population Segment

5.10.1 Sources and Types of Take on Red Tree Vole

All covered activities that involve tree removal—including timber harvest, thinning, road work, quarry work, and recreational infrastructure development and maintenance—have the potential to result in the following types of incidental take of red tree vole.

- Harm due to direct injury or mortality, such as inadvertently killing individuals during harvest operations.
- Harm due to habitat modification to the extent that red tree voles have reduced survival or reproductive success.

The following sections describe the thresholds for determining when such take will occur, the effects pathways leading to take, and the specific covered activities expected to result in take, as well as those covered activities not expected to result in take.

5.10.1.1 Criteria and Thresholds for Determining Take

Habitat must be occupied by red tree voles to expose individuals to the effects of habitat modification. Therefore, habitat modification within known occupied stands or stands that are modeled as suitable or highly suitable are most likely to result in take, as these are places that are mostly likely to support red tree voles. Therefore, the HCP uses modification of suitable and highly suitable habitat as a primary metric of take for red tree voles.

Table 5-25 summarizes the general sources of habitat modification and the associated thresholds used in this HCP to determine the level of take presented in Section 5.7.2, *Quantity and Timing of Take*.

Table 5-25. Criteria and Thresholds for Determining Potentially Adverse Effects on Red Tree Voles

Covered Activities with Potential to Effect	Covered Activities with Beneficial, Insignificant, or Discountable Effects
• Covered activities that modify[a] a stand (e.g., regeneration harvest or thinning) with known presence • Covered activities that modify *suitable* or *highly suitable* habitat.	• Covered activities in stands modeled as *marginal* habitat or as *non-habitat*.

[a] Modification is considered altered habitat structure or composition so that habitat values move from highly suitable or suitable to marginal or non-habitat.

5.10.1.2 Effects Pathways

The effects pathways leading to harm due to direct injury or mortality include all covered activities that would involve felling trees occupied by red tree voles, including timber harvest, thinning, road work, quarry work, and recreational infrastructure development and maintenance.

Because red tree voles spend nearly their entire lives within tree canopies, individuals would not likely be able to flee tree felling operations and would fall with the tree, either being directly injured or killed or forced to flee and find new habitat. If surviving, individuals would be subject to stress, increased energy expenditure, decreased food intake, and risk of mortality due to predation and starvation. The cost of relocation may be reduced reproduction effort and success due to increased energy costs or potentially lower suitable habitat.

The effects pathway ends with the consideration of the biological effects on individuals within the context of regional and range-wide distribution and populations, which is discussed in Section 5.10.3, *Impacts of the Taking on Red Tree Vole*.

Figure 5-9 summarizes the general effects pathways identified for potential harm to red tree voles due to habitat modification.

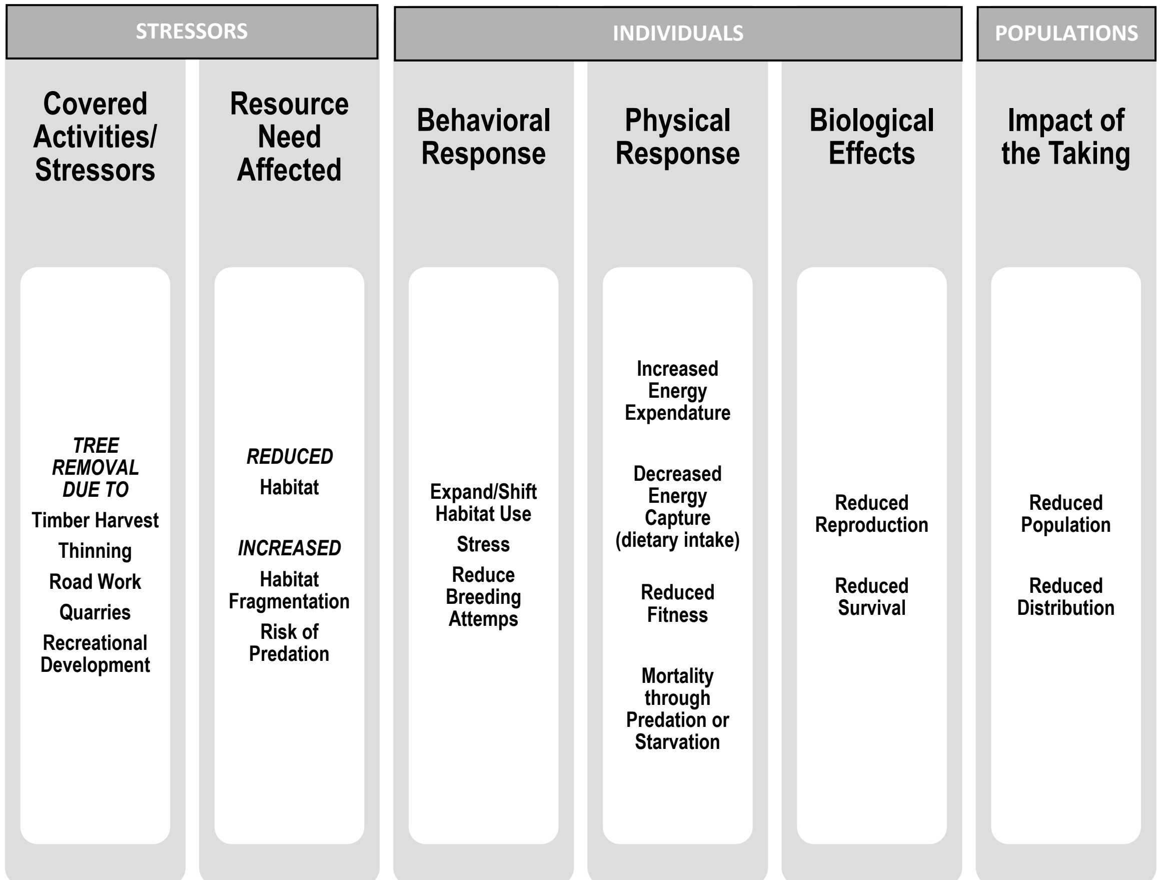


Figure 5-9. Effects Pathways for Impacts of Take of Red Tree Vole via Habitat Modification

5.10.1.3 Covered Activities that May Result in Take

Any covered activity that will remove trees where red tree voles are present may rise to the level of take either through direct injury and mortality or through habitat modification and associated loss of resources needed by red tree voles for breeding, feeding, and shelter. These activities include timber harvest (regeneration and thinning), road construction, quarry work, and recreation infrastructure development and maintenance (e.g., campgrounds, trails, trailheads).

Timber harvest, including regeneration harvest and thinning, is the primary activity that is expected to rise to the level of take. Table 5-26 lists covered activities and associated types of take expected to occur over the duration of the permit. Details regarding the effects pathways are provided in the previous subsection.

Table 5-26. Sources and Types of Take of Red Tree Vole Expected Under the Terms of the HCP

Covered Activity	Type of Take
Regeneration Harvest	Regeneration harvests and associated temporary roads, landings, yarding operations, and use of heavy equipment within suitable habitat is the primary source of take expected for red tree vole.
Thinning	As with regeneration harvest, thinning within occupied habitat could result in direct mortality or reduced habitat suitability.
Road Construction and Maintenance	New road construction within occupied suitable habitat will reduce habitat as well as fragment habitat and isolate individuals.
Road Management	Hazard tree removal and any other tree removal required for road maintenance can remove trees used by red tree vole.
Other Covered Activities Outside of HCAs and RCAs	Development of new quarries and recreation infrastructure as well as maintenance (e.g., campgrounds, trails, trailheads) within occupied red tree vole habitat is expected to result in take due to direct mortality or habitat modification.

Other covered activities outside of HCAs and RCAs including development of new quarries and recreation infrastructure as well as maintenance (e.g., campgrounds, trails, trailheads) within occupied red tree vole habitat has the potential to result in take due to direct mortality or habitat modification.

5.10.1.4 Covered Activities Not Expected to Result in Take

Cover activities that do not disturb large woody debris within modeled suitable habitat are unlikely to cause adverse effects that rise to the level of take. Table 5-27 lists the covered activities not expected to result in take of red tree voles.

Table 5-27. Covered Activities Not Expected to Result in Take of Red Tree Voles

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
All Covered Activities Conducted Outside of Suitable and Highly Suitable Habitat	Covered activities that do not modify suitable or highly suitable habitat would not result in take.
Site Preparation, Tree Planting, and Release Treatments	Reforestation and young stand management activities will take place outside of suitable habitat and are not likely to adversely affect red tree voles.
Animal Damage Control	Control of mountain beaver will not have any effect on red tree voles because habitat would not be disturbed.
Fertilizer Application	While exposure to fertilizer is possible, the level of exposure is not expected to adversely affect red tree voles.
Precommercial Thinning and Pruning	Precommercial thinning occurs in young stands (generally less than 30 years old) and therefore is not likely to occur within suitable habitat.
Unmanned Aircraft Systems	Not effect pathways identified.
Livestock Grazing	The permit area has limited grazing potential and grazing is not expected within suitable habitat.

Covered Activity	Rationale for Determining that Habitat Modification Would Not Result in Take
Existing Road System	Existing roads add to habitat fragmentation effects that may block movements. However, the presence of existing roads is not expected to rise to the level of take because they are considered part of the environmental baseline.
Road Use	Road use, including administrative, haul traffic, and recreational/public vehicle use, is not likely to affect red tree voles because they spend their entire lives within trees.
Road Maintenance	Work within the road prism would not be likely to affect red tree vole habitat.
Road Decommissioning	Road decommissioning would not adversely affect red tree vole habitat and may provide benefits at some point in the future.
Drainage Structure Construction and Maintenance	Drainage work would not adversely affect red tree vole habitat
Controlled Burning	Controlled burning will not take place within suitable red tree vole habitat.
Minor Forest-Product Harvest	Harvest of forest greens or firewood collection would have no effect on red tree vole habitat.
Water Drafting and Storage (fire management)	This activity is not likely to adversely affect red tree vole habitat.
Aquatic Habitat Restoration	Aquatic habitat restoration may result in minor habitat modification, such as select tree tipping or removal, but such effects are not likely to rise to the level of take because of the avoidance and minimization measures described in Chapter 4.
Barred Owl Management	Barred owl management would have no effect on red tree vole habitat. Predation levels may be reduced.
Research and Monitoring Activities	Research and monitoring is not likely to adversely affect red tree vole habitat or otherwise harm individuals.

5.10.2 Quantity and Timing of Take

Based on timber harvest and forest growth modeling, approximately 33,000 acres of suitable/highly suitable red tree vole habitat would be harvested over the duration of the permit. As with the other terrestrial species, not all of this habitat will be suitable at the outset of the permit. Some stands will grow into habitat as time progresses and the forest develops characteristics indicative of suitable or highly suitable habitat. Habitat modification will occur inside and outside of HCAs.

Inside of HCAs, habitat modification will only be done in situations where those short-term silvicultural actions will result in long-term increases in habitat quality. Under those circumstances it is unlikely, but still possible, for there to be a loss or reduction in suitability of suitable or highly suitable habitat.

ODF anticipates approximately 600 acres of suitable habitat that will be regeneration harvested during the first 15 years of the permit and less than 20 acres of suitable habitat that will be thinned to improve habitat values. No highly suitable habitat is anticipated to be regeneration harvested or thinned within HCAs.

Outside of HCAs, suitable and highly suitable habitat will be harvested or thinned for commercial forestry production. ODF projects that 27,088 acres of suitable habitat and 4,361 acres of highly suitable habitat located outside of HCAs will be removed due to harvest activities over the permit duration. Table 5-28 summarizes the suitable and highly suitable habitat that would be modified through thinning or lost through regeneration harvest over the 70-year permit duration.

Table 5-28. Red Tree Vole Habit Projected to Be Harvested or Thinned Under the HCP Over the Permit Duration

	Habitat Thinned		Habitat Harvested		
Location	**Highly Suitable**	**Suitable**	**Highly Suitable**	**Suitable**	**Total**
Within HCAs	--	855	--	597	1,452
Outside of HCAs	--	15	4,361	27,088	31,463
Total	**--**	**869**	**4,361**	**27,685**	**32,915**

5.10.3 Effects on Critical Habitat

No critical habitat has been designated for red tree vole.

5.10.4 Impacts of the Taking on Red Tree Vole

Take resulting from this habitat loss and other adverse effects, described above, would take place within the following contexts and levels of intensity.

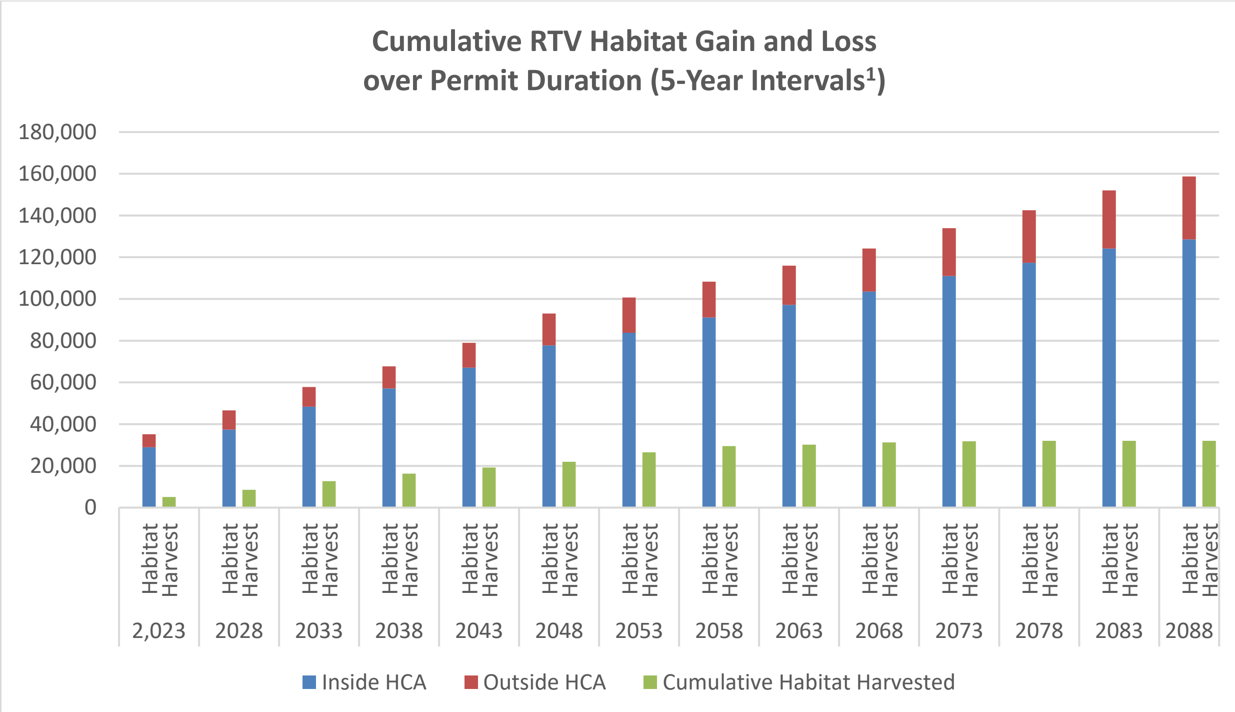
- Approximately 73% of existing habitat is located within HCAs, including approximately 67% of existing suitable habitat and 88% of highly suitable habitat.
- Habitats outside of HCAs that would be harvested are suitable habitat (rather than highly suitable) and are located in smaller and more fragmented habitat patches than habitat to be conserved in HCAs.

Effects of habitat modification are considered to occur throughout the duration of the permit. However, some modification due to thinning would be temporary. All modifications within HCAs would be temporary, although development of desired suitable habitat characteristics may not be achieved in all stands within HCAs by the end of the permit term.

5.10.5 Beneficial and Net Effects on Red Tree Vole

The conservation strategy (Conservation Actions 6: Establish Habitat Conservation Areas and 7: Manage Habitat Conservation Areas) is projected to result in 55,047 acres of suitable red tree vole habitat and 73,517 acres of highly suitable habitat within HCAs at the end of the permit term. This represents a gain of 99,627 acres of habitat within HCAs, Models also project an additional 9,142 acres of suitable habitat and 10,226 acres of highly suitable habitat developing outside of HCAs by the end of the permit term.

These increases in habitat compare to the projected cumulative modification of 32,046 acres of habitat due to harvest and 969 acres due to thinning. Figure 5-10 shows the cumulative habitat harvested and habitat present over the duration of the permit, in 5-year increments.



Note: Each year noted in the chart represents the 5-year period starting on the year noted (e.g., 2023 represents years 2023–2027). Projected habitat levels presented in this chapter are not HCP commitments, but rather are projections ODF is using to estimate the level of take and to determine appropriate avoidance, minimization, and mitigation measures needed to offset that projected level of take.

Figure 5-10. Red Tree Vole Habitat Harvested and Total Habitat, in 5-Year Increments

5.10.6 Cumulative Effects on Red Tree Vole

Effects on late-seral red tree vole habitat on private lands have likely already occurred throughout the range of the species, and actions in the future will similarly continue to suppress growth into late-seral habitat. Therefore, actions on private lands are not anticipated to contribute to cumulative effects in late-seral habitat for red tree vole. Red tree voles also use young stands and the extent to which this occurs and the role that young stands play in the life history of the species is not yet fully understood. Forest management on private lands that occur in younger stands do have the potential to result in effects on red tree vole throughout the range of the species.

Other state, local, or private future actions that are reasonably certain to occur may include road construction, recreational infrastructure development and maintenance (e.g., mountain bike trail networks), and linear rights-of-way construction (e.g., transmission lines, pipelines). But ODF is not aware of any specific projects reasonably certain to occur within the range of red tree vole in Oregon.

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Chapter 6
Monitoring and Adaptive Management

6.1 Monitoring and Adaptive Management Program

This chapter describes the monitoring and adaptive management framework for the Western Oregon State Forest Habitat Conservation Plan (HCP). The framework includes guidelines and recommendations that will help the Oregon Department of Forestry (ODF) develop a detailed program during the initial years of implementation. The purposes of this framework and the final monitoring program are to ensure compliance with the HCP, to assess the status of covered species and their habitats, and to evaluate the effects of management actions such that the conservation strategy described in Chapter 4, *Conservation Strategy*, including the biological goals and objectives, is achieved. Adaptive management and monitoring are integrated processes, and monitoring will inform and change management actions to continually improve outcomes for covered species. An overview of the program, monitoring and management actions, and data and reporting requirements are found below.

It is beyond the scope of this HCP to develop a comprehensive program at this time. Rather, the goal of this chapter is to provide sufficient guidance to ensure that the program designed during implementation will meet Endangered Species Act (ESA) regulatory standards discussed in Section 6.1.1, *Regulatory Context*.

6.1.1 Regulatory Context

An HCP must provide for the establishment of a monitoring program that generates information necessary to assess compliance and verify progress toward achieving the biological goals and objectives of the HCP (50 Code of Federal Regulations [CFR] 17.22(b)(2)(A-F), 50 CFR 17.32(b)(2)(i-iii), and 50 CFR 222.307(b)(5)). Adaptive management programs are generally recommended for large, programmatic plans and those with data gaps and scientific uncertainty that could affect how species are managed and monitored in the future. The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (HCP Handbook) (USFWS and NOAA Fisheries 2016) describes adaptive management as a method for addressing uncertainty in natural resource management and states that management must be linked to measurable biological goals and monitoring.

6.2 Monitoring

6.2.1 Types of Monitoring

Recent guidance for conservation planning defines monitoring as the “systematic and usually repetitive collection of information typically used to track the status of a variable or system” (Atkinson et al. 2004). The monitoring program will provide the information necessary to assess HCP compliance and project effects, verify progress toward achieving the biological goals and objectives, and provide the scientific data necessary to evaluate the success of the HCP’s conservation program. ODF will monitor and report trends in quantity and quality of habitat for covered species over time and at different spatial scales (permit area, ecoregion, and local landscape), using habitat suitability models that are tied to forest inventory metrics. Separate monitoring will be completed to assess species use of habitat and species response to habitat management. ODF will also conduct compliance monitoring to ensure adherence to HCP implementation and management standards, and effectiveness monitoring to determine if conservation actions are having the intended effect of improving conditions for covered species. A description of these monitoring types is provided below.

6.2.1.1 Compliance Monitoring

Compliance monitoring (also known as implementation monitoring) tracks the status of HCP implementation and documents that the requirements of the HCP are being met. Compliance monitoring verifies that ODF is carrying out the terms of the HCP. ODF will track compliance monitoring internally to ensure the HCP is working as planned and will provide the monitoring results to the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries who will verify the HCP remains in compliance. As defined by the HCP, compliance monitoring will track the following components:

- Location, extent, and timing of loss of covered species habitats to ensure the proposed maximum extent of take is not exceeded and to ensure that increases in the quantity and quality of habitat quality are appropriately balanced with loss of habitat from covered activities (see Chapter4).
- Habitat management, including the types of silvicultural activities used in Habitat Conservation Areas.
- Restoration activities in upland and aquatic locations.
- Implementation of conservation actions, including those that involve avoidance and minimization requirements (see Chapter 4).
- Reporting of management actions and monitoring activities (e.g., what monitoring activities were implemented and resulting reports produced).
- Location, extent, and timing of implementation of other conservation actions (e.g., aquatic restoration projects).
- Tracking expenditures from the Conservation Fund.

6.2.1.2 Effectiveness Monitoring

Effectiveness monitoring assesses the biological success of the HCP. Effectiveness monitoring evaluates whether the effects of implementing the conservation strategy described in Chapter 4 is consistent with the assumptions and predictions made during development of the conservation strategy (USFWS and NOAA Fisheries 2016). Effectiveness monitoring assesses whether implementation of the conservation strategy is achieving the HCP's biological goals and objectives. Effectiveness monitoring typically measures the effects of management actions on covered species, status and trends in resources (e.g., percent cover of land-cover types), and status and trends of stressors to the biological resources (e.g., distribution of invasive species) (Atkinson et al. 2004).

To conduct effectiveness monitoring, it is necessary to first develop thresholds of success for management actions. These may include quantitative measures such as area of habitat suitable for covered species. Quantifying these conditions before and after management is the basis for judging success. In most cases, success will not be immediately apparent, and monitoring must be conducted over a sufficient period for results to manifest. Effectiveness monitoring is focused on the status of covered species and the results of conservation measures.

Understanding the effects of management actions is a critical component of the monitoring and adaptive management program. The purpose of this monitoring is to ascertain the success of management in achieving desired outcomes, to provide information and mechanisms for altering management if necessary, and to evaluate whether the conservation strategy described in Chapter 4 was successful.

The preliminary or initial component of this monitoring will include the development and assessment of success criteria for management actions, as well as a baseline for habitat conditions across the permit area. The baseline for individual criteria may come from existing known conditions and trends (i.e., from existing monitoring programs) or from modeled conditions. The biological goals and objectives will inform success criteria so that it is clear whether progress is being made towards biological goals and objectives during the permit term. A more detailed monitoring program, including monitoring design and success criteria, will be developed during the first 2 years following permit issuance.

6.2.2 Monitoring of Covered Activities

[**Note to Scoping Reader:** *The Scoping Team continues to work on the finer details of the monitoring program. This section will be filled in once there is further agreement on Tables 6-1 and 6-2. The sections in this portion of the chapter will simply provide more detail on how the monitoring will work and why it is at the proper level of detail to address key questions under this HCP. While that information is not available now the tables can suffice to provide enough detail to describe the monitoring program and to establish the cost of the monitoring program discussed in Chapter 9, Cost and Funding*.]

6.2.2.1 Compliance Monitoring

[**Note to Reader:** *The sale close out process would be the primary tool used to demonstrate compliance with the HCP and permits. Information captured during that process would then be summarized in annual reports. The details of how that process would work during implementation are currently under discussion.*]

6.2.3 Monitoring of Aquatic Conservation Actions

[**Note to Reader:** *This section is under development. Refer to Table 6-1 for details for this section. Once the specifics of the monitoring program are finalized with the Scoping Team, this section will provide more detail about how the monitoring will be implemented, how it allows ODF to address biological goals and objectives, and the methods that will be used.]*

6.2.4 Monitoring of Terrestrial Conservation Actions

[**Note to Reader:** *This section is under development. Refer to Table 6-2 for details for this section*. *Once the specifics of the monitoring program are finalized with the Scoping Team, this section will provide more detail about how the monitoring will be implemented, how it allows ODF to address biological goals and objectives, and the methods that will be used.*]

Table 6-1. Compliance and Effectiveness Monitoring for Biological Goals and Objective and Associated Conservation Actions for Aquatic Covered Species

				Compliance Monitoring		Effectiveness Monitoring		
Biological Goal	**Biological Objectives**	**Conservation Actions**	**Summary of Actions**	**Monitoring Action**	**Metrics**	**Monitoring Action**	**Metrics**	**Data Source (for metrics)**
Goal 1: Support the Persistence and Climate Change Resilience of Covered Fish	1.1 Wood Recruitment (riparian structure, wood volume on unstable slopes, long-term trends of instream Large Wood Debris [LWD])	1: Establish Riparian Conservation Areas (RCAs)	Retain 120-foot riparian buffer on Type N perennial streams for 500 feet along the stream, immediately upstream of Type F streams (temperature protection zone), and 35-foot riparian buffer upstream of the temperature protection zone, for remainder of Type N perennial reach. Retain 50-foot RCA on PDFT and HE streams for 500 feet along the stream, immediately upstream of Type F streams, and 35-foot riparian buffer upstream for remainder of Potential Debris Flow Tract (PDFT) or High Energy (HE) reach. Include an RCA along a 100-foot long segment of stream immediately upstream of end of perenniality to protect transition from seasonal Type N to perennial Type N	ODF receives compliance information during sale close out process Annual report on timber sales that needed to observe exceptions to RCAs	Summary of sales with exceptions provided in annual report	Trends in stream conditions (LWD) – 10-year monitoring interval	Large wood frequency & volume 1. volume 2. # key pieces 3. # pieces	Oregon Department of Fish and Wildlife (ODFW) Aquatic Inventories Project (AIP) 2019
		2: Establish Equipment Restriction Zone (ERZ)	Restrict ground based equipment inside of a 35-foot ERZ except for Exceptions identified in HCP	ODF receives compliance information during sale close out process Annual report on timber sales that needed to observe exceptions to RCAs	Summary of sales with exceptions provided in annual report	Field survey of ERZ effectiveness for preventing soil erosion in waters of the state	% soil surface disturbed	--
		3: Stream Enhancement	Implement instream wood placement projects in select stream reaches	Document annual enhancement projects completed by project type and stream length and/or pieces donated (concurrent w/Obj. 1.2) Track annual expenditures from Conservation Fund	Narrative in annual report Conservation Fund summary in annual report	Monitoring of projects over time, specific to the immediate post-implementation condition	Large wood change from original placement (decrease or increase from project implementation) 1. volume 2. # key pieces 3. # pieces	ODFW AIP 2019 Other project-specific protocols for metrics.

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Action	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Action	Effectiveness Monitoring: Metrics	Data Source (for metrics)
		11: Minimize Effects from Road Construction and Management	Minimize effects from road construction and management in RCAs	Document miles of roads within RCAs that were constructed or underwent management activities annually Document miles roads vacated from RCAs annually	Miles of roads built Miles of roads maintained Miles of road vacated Number of stream crossings constructed or improved by type (e.g. culverts, bridges)	Wet weather and/or haul monitoring of road surfacing, drainage paths, and stream turbidity	Road surfacing condition Visual evidence of hydrologic connection Upstream/Downstream turbidity monitoring at random road crossings	ODF roads data, including stream crossing features Contract administration reporting
	1.2 Stream Enhancement Projects (conserve, maintain & enhance stream channel complexity)	3: Stream Enhancement	Identify, prioritize, and fund stream enhancement projects	Summarize in annual report list of stream enhancement projects, justification for project selection, and list of potential projects in upcoming year Document on project basis any benefit on covered species habitat	Number and type of projects Narrative in annual report Conservation Fund summary in annual report	Trends in stream conditions (channel complexity) – 10-year monitoring interval	1. Active channel width 2. Channel morphology 3. Pool frequency	ODFW AIP
		12. Establish Conservation Fund	Establish Conservation Fund for stream restoration projects	Track annual expenditures from Conservation Fund	Fund collection and expenditure (annual), including in-kind work or materials	--	--	--
	1.3 Water Quality and Quantity (long-term trends in temp, fine sediment in riffles, summer low flow)	1: Establish RCAs	Maintain and/or increase stream shading to improve stream temperature Implement temperature protection zone	ODF receives compliance information during sale close out process Annual report on timber sales that needed to observe exceptions to RCAs	Summary of sales with exceptions provided in annual report	Trends in stream conditions – 10-year monitoring interval	1. Channel shade 2. Riparian conifer density by size class 3. Riparian hardwood density by size class 4. Stream temperature monitoring	ODFW AIP ODFW stream temperature study with in higher density temperature monitoring in key watersheds Department of Environmental Quality (DEQ) monitoring programs Near-infrared remote sensing data
		5. Road Improvement and Vacating	Identify roads in the permit area that are high risk of sedimentation for improvement or vacating	Baseline and every 10th year – use Forest Road Hazard Inventory (ODF 2009) or suitable surrogate, to review current conditions of road system in permit area; document roads most susceptible to degrading aquatic conditions in proposed harvest areas	Miles of road or road segments	--	--	--

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Action	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Action	Effectiveness Monitoring: Metrics	Data Source (for metrics)
			Disconnect the road system hydrologically from stream channels	Document annually any road improvements completed by road length and roads vacated by road length	Miles of roads improved Miles of roads vacated	Before-After-Control-Impact (BACI) design for a subset of improved versus control sites	1. Sediment delivery at connection points for different flow events 2. Persistence of fine sediment in riffles downstream of connection points	Specific monitoring protocol for hydrologic connectivity
		11: Minimize Effects from Road Construction and Management	Minimize effects from road construction and management in RCAs	Document miles of roads within RCAs that were constructed or underwent management activities annually Document miles of roads vacated from RCAs annually	Miles of roads built Miles of roads maintained Miles of road vacated	--	--	--
	1.4 Fish Passage (remove or modify artificial barriers during routine construction, emergency road repair, or maintenance work)	4. Remove or Modify Artificial Fish Passage Barriers	Conduct fish passage inventory every 5 years and prioritize and identify projects to repair/replace during permit term	Keep updated priority list of barriers for removal or modification Report barriers modified each year, separating barrier modification during timber sale from barrier modification through use of Conservation Fund or other monies Design repair and replacement stream crossings to meet NOAA Fisheries (2014) and ODFW (ORS 509.580 through 910 and in OAR 635, Division 412) passage criteria to maintain passage for covered fish species	Barriers modified Miles of stream opened above barriers Narrative plus photos in annual report			--
		5. Road Improvement and Vacating	Identify roads in the permit area that are high risk of sedimentation for improvement or vacating	Baseline and every 10th year – use Forest Road Hazard Inventory (ODF 2009) or suitable surrogate, to review current conditions of road system in permit area; document roads most susceptible to degrading aquatic conditions in proposed harvest areas	Miles of road or road segments Barriers removed or modified	--	--	--

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Action	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Action	Effectiveness Monitoring: Metrics	Data Source (for metrics)
		11: Minimize Effects from Road Construction and Management	Minimize effects from road construction and management in RCAs	Document miles of roads within RCAs that were constructed or underwent management activities annually Document miles of roads vacated from RCAs annually Document barriers removed or modified	Miles of roads built Miles of roads maintained Miles of road vacated Barriers removed or modified	--	--	--
Goal 2: Support the Persistence of Columbia Torrent Salamander in the Clatsop and Tillamook State Forests	2.1 Riparian Habitat within Species Range (conserve and maintain riparian habitat along 677 stream miles)	1: Establish RCAs	Retain 120-foot riparian buffer on Type N perennial streams for 500 feet along the stream, immediately upstream of Type F streams (temperature protection zone), and 35-foot riparian buffer upstream of the temperature protection zone, for remainder of Type N perennial reach. Retain 50-foot RCA on PDFT and HE streams for 500 feet along the stream, immediately upstream of Type F streams, and 35-foot riparian buffer upstream for remainder of PDFT or HE reach Include an RCA along a 100-foot-long segment of stream immediately upstream of end of perenniality to protect transition from seasonal Type N to perennial Type N	ODF receives compliance information during sale close out process Annual report on timber sales that needed to observe exceptions to RCAs	Summary of sales with exceptions provided in annual report	Opportunistic partnerships and access to permit area for partner studies	--	--
Goal 3: Support the Persistence of Cascade Torrent Salamander in the Santiam State Forest	3.1 Riparian Habitat within Species Range (conserve and maintain riparian habitat along 76 stream miles)	1: Establish RCAs	Retain 120-foot riparian buffer on Type N perennial streams for 500 feet along the stream, immediately upstream of Type F streams (temperature protection zone)), and 35-foot riparian buffer upstream of the temperature protection zone, for remainder of Type N perennial reach Retain 50-foot RCA on PDFT and HE streams for 500 feet	ODF receives compliance information during sale close out process Annual report on timber sales that needed to observe exceptions to RCAs	Summary of sales with exceptions provided in annual report	Opportunistic partnerships and access to permit area for partner studies	--	--

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Action	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Action	Effectiveness Monitoring: Metrics	Data Source (for metrics)
			along the stream, immediately upstream of Type F streams, and 35-foot riparian buffer upstream for remainder of PDFT or HE reach Include an RCA along a 100-foot long segment of stream immediately upstream of end of perenniality to protect transition from seasonal Type N to perennial Type N					

Definitions

- **Compliance Monitoring** (also known as *implementation monitoring*) – Compliance monitoring verifies that ODF is carrying out the terms of the HCP: i.e., did they do what they said they would?
  - Tracking establishment of programs (e.g., conservation fund)
  - Adherence to standard practices
  - Completion of conservation actions (road vacating, passage improvements, etc.)
- **Effectiveness Monitoring** – Are the results as expected?
  - Changes in habitat quality and quantity – Trends over time
  - Active management for habitat improvement – Habitat in managed forest stands compared to unmanaged control stands
  - Measurable outcomes in aquatic environment (e.g., temperature, wood recruitment) – Trends over time
  - Increases in aquatic habitat complexity and related metrics as a result of enhancement projects (e.g., pools, off-channel habitat)

Table 6-2. Compliance and Effectiveness Monitoring for Biological Goals and Objective and Associated Conservation Actions for Terrestrial Covered Species

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
Goal 4: Support the Persistence of Oregon Slender Salamander in the Santiam State Forest	4.1 Existing Oregon Slender Salamander Habitat (conserve, maintain, and enhance 16,000 acres of occupied or modeled suitable habitat)	6: Establish Habitat Conservation Areas (HCAs)	Conserve 16,000 acres of occupied, suitable, or highly suitable habitat within and adjacent to existing occupied habitat in Santiam State Forest	Document establishment and maintenance of HCAs	Annual reporting on acres and type of harvest in HCAs through sale close out reports	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term	1. Acres of habitat by suitability category 2. Difference from baseline acreage and change since last reporting period 3. Over time linkage between previous harvest actions and relative changes in habitat quality to inform future management actions
	4.2 Downed Wood (maintain and/or enhance abundance of LWD in occupied or suitable habitat)	7: Manage HCAs	Variable density thinning combined with small gap creation in stands identified as potentially benefitting from this treatment	Document annually management actions that occur in HCAs in order to improve species habitat, using the timber sale contract administration close out process	Annual reporting on acres and type of harvest in HCAs Annual reporting on downed wood retention from the timber sale contract administration close out process	Determine trends of downed wood in HCAs over time Survey selected management actions pre- and post-activity to determine differences in quantity of downed wood by decay class	1. Trend monitoring through densified Forest Inventory and Analysis (FIA) plot network 2. Pre- and post-activity sampling of selected activities to determine: • Cubic feet of downed wood pre- and post-harvest, by decay class • Measured decay classes, snags, and number of green trees
		8: Management outside HCAs and RCAs	Retain legacy structures (i.e., downed wood) to the maximum extent practicable	Document compliance with Management Standards outside HCAs and RCAs, using the timber sale contract administration close out process	Report exceptions when standards were not able to be implemented and justification Annual reporting on downed wood retention from the timber sale contract administration close out process	--	3. Trend monitoring through densified FIA plot network
			During regeneration harvest, retain an average of 600 to 900 cubic feet of hard conifer logs (decay class 1 and 2) per acre, including an average of 2 logs per acre greater than 24 inches in diameter (at the largest end), where available Ensure supply of decayed downed wood, snags, and green trees larger than 20 inches in diameter at breast height	Document compliance with Management Standards outside of HCAs and RCAs, using the timber sale contract administration close out process	Report exceptions when standards were not about to be implemented and justification Annual reporting on downed wood retention from the timber sale contract administration close out process		4. Trend monitoring through densified FIA plot network

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
Goal 5: Support the Persistence of Northern Spotted Owl in the permit area	5.1 Existing Northern Spotted Owl Habitat (conserve, maintain, and enhance at least 30,000 acres of existing nesting, roosting, and foraging habitat)	6: Establish HCAs	Establish HCAs that include 30,000 acres of suitable and highly suitable northern spotted owl (NSO) habitat that will support nesting, roosting, and foraging habitat and marginally suitable habitat that will support dispersal habitat	Document establishment and maintenance of HCAs	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term Confirm occupation status of habitat over time through Activity Center Monitoring and Habitat Validation Monitoring	1. Acres of habitat by suitability category, as modeled from inventory metrics, using densified FIA plot network, LiDAR, and stand exams 2. Difference from baseline acreage and change since last reporting period 3. Monitoring of a subset of management activities and relative changes in habitat quality compared to anticipated modeled outcomes 4. **Activity Center Monitoring –** Combination of field surveys and bioacoustic monitoring around activity centers to estimate occupancy by active pairs and resident singles 5. **Habitat Validation Monitoring –** Beginning in Year 20 survey of existing habitat and ingrowth of suitable and highly suitable NSO habitat inside of HCAs for presence using a combination of field surveys and bioacoustics monitoring
		7: Manage HCAs	Use silvicultural treatments in HCAs to develop 100,000 acres of suitable or highly suitable habitat by the end of the permit term	Better understand the influence of silvicultural treatments on changes in species habitat quality	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Same metrics as Objective 5.1.
		9: Barred Owl Management	Fund barred owl management activities out of the Conservation Fund	Document annually contributions to and expenditures from the Conservation Fund for barred owl management	Narrative in annual report Conservation Fund summary in annual report	--	--
		10: Seasonal Operational Restrictions	Prohibit covered activities within distances expected to affect NSO during critical breeding period (Mar 1–Jul 15) (see Table 4-12)	Document annually compliance with restrictions and any deviations from restrictions through sale close out process	Deviations require: 1. Site-specific review by area biologist 2. Documentation of recommendations 3. Approval by ODF's HCP manager	--	--

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
		12. Establish Conservation Fund	utilizing conservation fund on reforestation activities in HCAs and strategic terrestrial species conservation actions	Track annual expenditures from Conservation Fund	Fund collection and expenditure (annual), including in-kind work or materials	--	--
	5.2 Northern Spotted Owl Dispersal Habitat (maintain sufficient quality, quantity, and configuration of dispersal habitat)	8: Management Strategy Outside of HCAs and RCAs	Maintain a minimum of 40% dispersal habitat at the subgeographic level	Document percentage of dispersal habitat at landscape level outside of RCAs and HCAs over permit area at 5-year intervals	Acres and percentage of habitat modeled and what develops into highly suitable, suitable, or marginal outside of HCAs and RCAs every 5 years	Determine whether base requirement (at least 40%) is being met and any relative changes over time	Acres of habitat type by suitability category and percentage of watersheds within species range
	5.3 Northern Spotted Owl Habitat Enhancement (increase quantity of nesting, roosting, and foraging habitat by at least 100,000 acres)	Same actions stated for Objective 5.1					
Goal 6: Support the Persistence of Marbled Murrelet in the permit area	6.1 Existing Marbled Murrelet Nesting Habitat (conserve, maintain, and enhance at least 15,000 acres of known occupied or suitable nesting habitat)	6: Establish HCAs	Establish HCAs that include 15,000 acres of suitable and highly suitable marbled murrelet habitat, including areas known to be occupied from previous surveys	Document establishment and maintenance of HCAs	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Acres of habitat by suitability category, as modeled from inventory metrics, using densified FIA plot network, LiDAR, and stand exams 2. Difference from baseline acreage and change since last reporting period 3. Monitoring of a subset of management activities and relative changes in habitat quality compared to anticipated modeled outcomes 4. Average and range of habitat patch size and interior to perimeter ratio 5. **Habitat Validation Monitoring–** Beginning in Year 20 a monitoring effort designed to assess nesting activity in the permit area; the effort would be focused on locations with habitat inside of HCAs that have not been surveyed in the past but where occupancy is expected due to adjacency to other occupied areas, or locations where habitat quality has improved to suitable under the HCP, focusing especially on stands that are known to have platform trees

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
		7: Manage HCAs	Use silvicultural treatments in HCAs to develop 80,000 acres of suitable or highly suitable habitat	Better understand the influence of silvicultural treatments on changes in species habitat quality	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Same metrics as Objective 6.1
		10: Seasonal Operational Restrictions	Prohibit covered activities within distances expected to affect nesting marbled murrelet (see Table 4-13)	Document annually compliance with restrictions and any deviations from restrictions through sale close out process	Deviations require: 1. Site-specific review by area biologist 2. Documentation of recommendations Approval by ODF's HCP manager	--	--
Goal 7: Support the Persistence of Red Tree Vole in the permit area	7.1 Conserve, maintain, and enhance at least 20,000 acres of currently occupied habitat or habitat that is suitable or highly suitable with unknown occupancy	6: Establish HCAs	Establish HCAs that include 20,000 acres of suitable and highly suitable red tree vole habitat, including areas known to be occupied from previous surveys	Document establishment and maintenance of HCAs	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5 year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Acres of habitat by suitability category, as modeled from inventory metrics, using densified FIA plot network, LiDAR, and stand exams 2. Difference from baseline acreage and change since last reporting period 3. Monitoring of a subset of management activities and relative changes in habitat quality compared to anticipated modeled outcomes 4. **Habitat Validation Monitoring** – A monitoring effort designed to assess nesting activity in the permit area; the effort would be focused on locations with habitat inside of HCAs that have not been surveyed in the past but where occupancy is expected or locations where habitat quality has improved to suitable under the HCP; monitoring effort for suitable and highly suitable habitat could begin immediately and monitoring of habitat that grows in would begin at year 20; ODF will seek partnerships with researchers and other agencies in order to structure monitoring in way that meaningfully contributes to the

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
							understanding of the species in western Oregon forests
		7: Manage HCAs	Use silvicultural treatments in HCAs to improve species habitat quality over time	Better understand the influence of silvicultural treatments on changes in species habitat quality	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Same metrics as Objective 7.1
	7.2 Red Tree Vole Habitat Enhancement (increase the amount of suitable or highly suitable habitat by at least 70,000 acres)	Same conservation actions, monitoring actions, and metrics as Objective 7.1					
Goal 8: Support the Persistence of Coastal Marten in the permit area	8.1 Existing Coastal Marten Habitat (conserve, maintain, and enhance at least 25,000 acres of denning, foraging, and dispersal habitat)	1: Establish RCAs 6: Establish HCAs	Establish HCAs that include 25,000 acres of suitable coastal marten habitat, including areas known to be occupied from previous surveys	Document establishment and maintenance of HCAs	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Acres of habitat by suitability category, as modeled from inventory metrics, using densified FIA plot network, LiDAR, and stand exams 2. Difference from baseline acreage and change since last reporting period 3. Monitoring of a subset of management activities and relative changes in habitat quality compared to anticipated modeled outcomes 4. **Habitat Validation Monitoring –** Field-based habitat surveys in a subset of stands thought to be suitable, in order to confirm microhabitat features necessary for likely species occupancy; surveys in suitable habitat can begin immediately; over time an association of habitat characteristics and LiDAR-based inventory information can be used to better predict habitat quality within the range of the species

Biological Goal	Biological Objectives	Conservation Actions	Summary of Actions	Compliance Monitoring: Monitoring Objectives	Compliance Monitoring: Metrics	Effectiveness Monitoring: Monitoring Objectives	Effectiveness Monitoring: Metrics
		7: Manage HCAs	Use silvicultural treatments in HCAs to improve species habitat quality over time	Better understand the influence of silvicultural treatments on changes in species habitat quality	Annual reporting on acres and type of silvicultural activity in HCAs, by habitat suitability categories for the covered species, using the timber sale contract administration process	Document acres of suitable or highly suitable habitat in the permit area at 5-year intervals over the permit term and over time link relative changes in habitat quality to silvicultural treatments	1. Same metrics as Objective 8.1
	8.2 Coastal Marten Habitat Enhancement (increase the quantity of denning, resting, foraging, and dispersal habitat over the permit term)	Same conservation actions, monitoring actions, and metrics as Objective 8.1					

Definitions

- **Compliance Monitoring** (also known as *implementation monitoring*) – Compliance monitoring verifies that ODF is carrying out the terms of the HCP: i.e., did they do what they said they would?
  - Tracking establishment of programs (e.g., conservation fund)
  - Adherence to standard practices
  - Completion of conservation actions (road vacating, passage improvements, etc.)
- **Effectiveness Monitoring** – Are the results as expected
  - Changes in habitat quality and quantity – Trends over time
  - Active management for habitat improvement – Habitat in managed forest stands compared to unmanaged control stands
  - Measurable outcomes in aquatic environment (e.g., temperature, wood recruitment) – Trends over time
  - Increases in aquatic habitat complexity and related metrics as a result of enhancement projects (e.g., pools, off-channel habitat)

6.3 Adaptive Management

6.3.1 Overview of Adaptive Management Strategy for the HCP

This section describes how ODF will use adaptive management to respond to monitoring results and new information. Chapter 7, *Assurances*, describes how ODF will respond to changed and unforeseen circumstances, including new species listings, climate change, fire, wind events, invasive species, and disease. An overarching goal of the adaptive management program is to optimize implementation of the HCP and all other ODF programs that are related to or support the implementation of the HCP. ODF is striving for efficiency and effectiveness on all fronts and all programs, including how HCP implementation will adhere to that objective.

For the purposes of this HCP, adaptive management is a decision-making process used to examine alternative strategies (e.g., conservation actions) to meet the biological goals and objectives, and, if necessary, adjust future management actions based on new information (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016). Adaptive management is based on a flexible approach whereby actions can be adjusted as uncertainties become better understood or as assumptions change. Monitoring and learning from the outcomes of past actions is the foundation of adaptive management (Williams et al. 2007).

The conservation strategy of this HCP is based on the best scientific information currently available, and it is expected that the conservation actions will effectively achieve the biological goals and objectives as stated in Chapter 4. However, there are varying degrees of uncertainty associated with the management techniques and conditions within the plan area. Future improvements in forest inventory methods and increased accuracy or precision of important metrics, or improvements in species habitat models, may result in different estimations of current and projected habitat trends. Results of effectiveness monitoring may indicate that some management techniques are more or less effective than anticipated, resulting in an increase or decrease in their use, or modifications in how they are implemented. Evolving science on the habitat requirements, life histories, and distributions of covered species may inform changes to the pattern of implementation of strategies on the landscape. Monitoring strategies themselves may change, as they are improved to better quantify or describe specific habitat metrics.

To address these uncertainties, the monitoring and adaptive management program allows ODF to learn from experience and reevaluate and revise the type, extent, and location of conservation actions when necessary to meet the biological goals and objectives of the HCP.

6.3.2 Adaptive Management Process

The adaptive management process will follow the conceptual model provided in the HCP Handbook (USFWS and NOAA Fisheries 2016). The model includes a series of steps for identifying problems and their sources, designing and implementing responses to problems, and evaluating the effectiveness of the responses, resulting in a cycle of continuous learning and improvement (Figure 6-1).

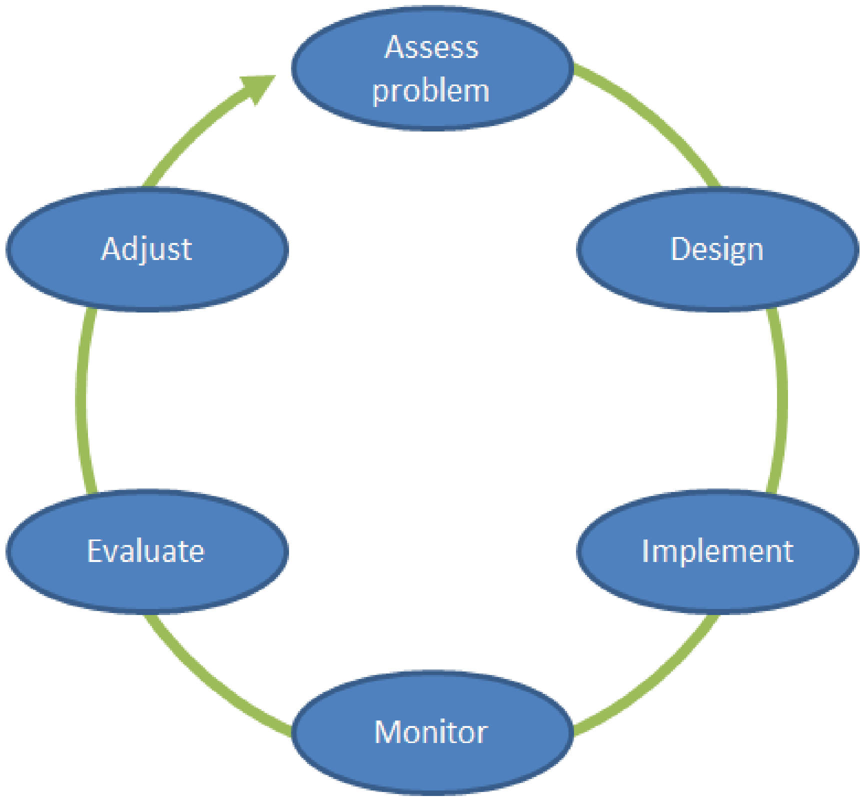

Figure 6-1. Adaptive Management Concept Model

Based on this model, the general adaptive management process of the HCP will be as follows:

1. **Monitor**

    a. The monitoring and reporting program will be implemented at the district and plan-wide levels as described in Sections 6.1, *Monitoring and Adaptive Management Program,* and 6.2, *Monitoring*.

    b. Monitoring teams, district staff, and forest management contractors will assess and identify deficiencies, lessons learned, new information, new techniques, or other opportunities for improvement; and compile and report such information and associated recommendations to the appropriate district staff to forward to the HCP administrator.

    c. Monitoring results and associated lessons learned will be compiled and documented in annual reports.

    d. There will be annual reports, 5-year midpoint check ins, and 10-year comprehensive reviews.

2. **Evaluate**

    a. The HCP administrator will evaluate this information to identify current and projected levels of accomplishment in achieving biological goals and objectives and where an adaptive management response may be appropriate. This includes the identification of areas of both under- and over-accomplishment.

   b. The administrator will facilitate discussions with district and other ODF staff and potentially other state and federal agencies to fully understand the trends identified, evaluate options for adjustments and corrective actions, and select an adaptive management response.

3. **Adjust**

   a. The corrective or adaptive management response will be defined and adjustments made at the appropriate planning level, including adjustments to budgets, operations plans, implementation plans, and policies (see Section 6.3.3, *Range of Adaptive Management Adjustments*).

   b. As stated above, monitoring results will be tracked, as will any modifications to management practices or alternative strategies selected for implementation in response to monitoring results.

ODF will also coordinate and share the results of monitoring and the effectiveness of adaptive management responses with USFWS, NOAA Fisheries, Oregon Department of Fish and Wildlife, Department of State Lands, Department of Environmental Quality, county partners, stakeholder groups, and the public.

6.3.3 Range of Adaptive Management Adjustments

Before the USFWS and NOAA Fisheries can issue a permit under the HCP, there must be a clear understanding and agreement between them and ODF as to the range of adjustments to the management actions that might be required as a result of any adaptive management provisions (USFWS and NOAA Fisheries 2016). The HCP Handbook further states that changes to the conservation program should be planned to minimize the need for amending the permit.

Toward these ends, adaptive management under the HCP is not expected to require changes to biological goals and objectives of the HCP. Rather, the range of adaptive management adjustments is expected to fall within operational level planning, including adjustments to annual budgets, project-specific operation plans, 10-year implementation plans, and operation policies, as described below.

- **Budgets** are prepared both biennially and annually, and have a major effect on the type and extent of management activities conducted in any given year. The HCP administrator will consider results of monitoring, recommended adaptive management adjustments and needs, as well as new information and available funding opportunities and constraints when developing annual budgets and work plans and adjust budgets accordingly.

- **Implementation Plans** are developed to detail how management strategies that are outlined in the HCP, Forest Management Plan, or operational policies will be implemented at the management unit level (e.g., geographic area). Implementation plans describe forest management activities for a predetermined period—typically 10 years—and will be revised either at the end of the period or sooner if circumstances warrant. ODF decisions regarding implementation plans will be informed through 10-year comprehensive reviews of HCP implementation and monitoring, supplemented by annual or other periodic reporting within the implementation period. Adaptive management changes to implementation plans will include changing the type and extent of planned management activities, including specific HCP conservation activities that will be implemented in each district. The HCP administrator will weigh the monitoring and scientific information, HCP biological goals and objectives, and successes and challenges of past conservation actions when considering the approval and subsequent adaptive management adjustments to implementation plans.

- **Operation policies** are written and revised on an as-needed basis, and typically include a policy statement, goals, responsibilities, and standards that provide direction to ODF forest planners in developing implementation and operation plans. In response to HCP monitoring results, ODF may revise existing policies or develop new policies, particularly where major deficiencies are identified through monitoring or when significant new science or management techniques become available.

Figure 6-2 summarizes the range of planning levels under which adaptive management will be applied as needed to respond to deficiencies identified through monitoring or to respond to new information and management techniques.

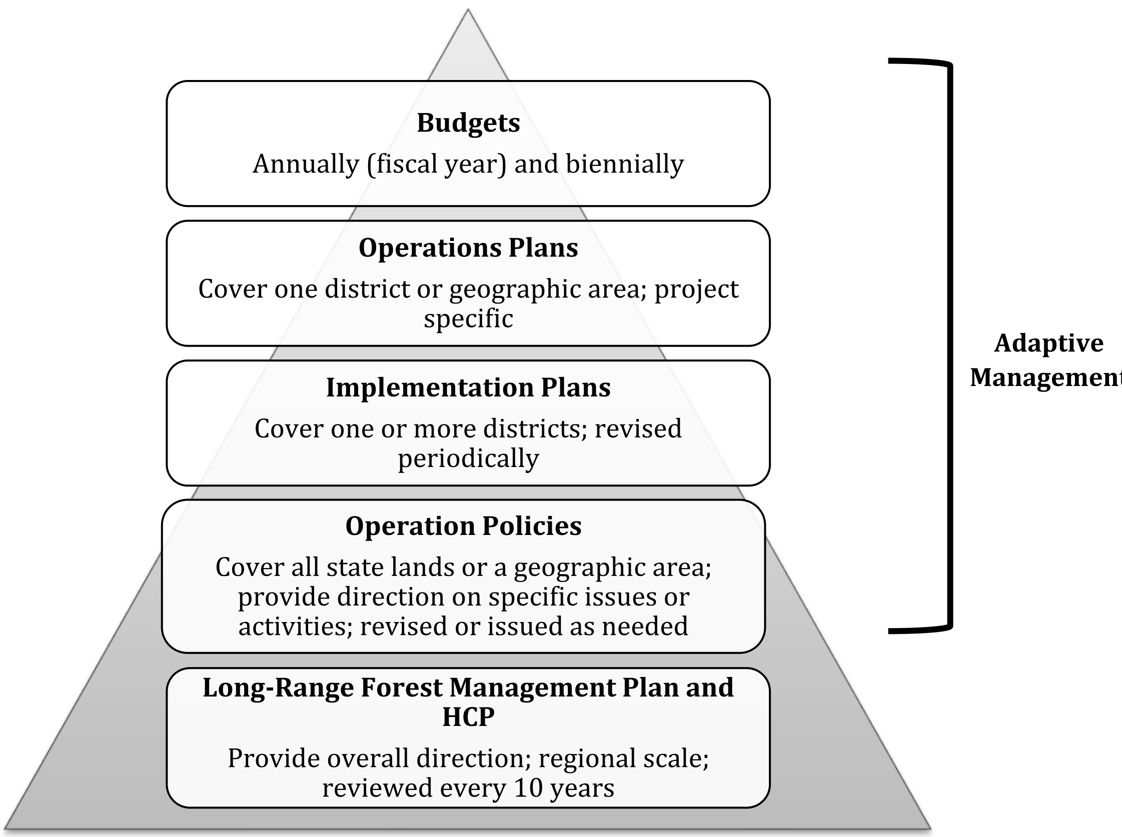

Figure 6-2. Range of Adaptive Management Adjustments Within State Forest Management Planning Levels

It is important to note that the range of adaptive management responses at all planning levels falls within the range of covered activities described in Chapter 3. Adaptive management adjustments will involve modifications to the way covered activities are implemented, including the number, extent, and location of covered activities as well as project-specific designs and specifications.

Any adaptive management adjustments made during implementation of the HCP will be documented in the annual reports ODF will prepare and submit to USFWS and NOAA Fisheries for the duration of the permit. Annual reports will also include details on compliance, impacts, conservation actions, and monitoring activities and results. In addition to documenting changes through adaptive management in annual reports, ODF will complete a 5-year midpoint check in and a 10-year comprehensive review, at which time the entire monitoring program will be assessed along with the efficacy of conservation actions and modifications will be implemented accordingly.

6.3.4 Adaptive Management Triggers

Adaptive management responses will be triggered when monitoring or other information indicates either of the following.

- Existing practices are under- or over-achieving the biological goals and objectives.
- Alternative practices are available that can achieve biological goals and objectives more efficiently and effectively.

Triggers will vary with the level of planning at which adaptive management is being considered, with major adjustments being made at the policy and implementation planning levels and more minor adjustments being made at the operations plan and budget level (Table 6-3). Triggers may also change based on the frequency of new monitoring results, due to the frequency with which data are collected or available (e.g., degree of annual variation in baseline conditions or timescale of the response variable). For instance, species responsiveness or detectability may vary considerably year to year, or habitat response to silvicultural activities may take many years.

Table 6-3. Adaptive Management Triggers at Different Planning Levels

Planning Level	Potential Trigger	Adaptive Management Response Example
Budgets	The conservation fund is not generating sufficient funding to implement conservation actions as described in the HCP or additional actions are needed to respond to monitoring results.	Reevaluate and reallocate budgets and identify opportunities for additional funding sources and partnerships.
Implementation Plans	Deficiencies identified through monitoring	Add corrective actions to implementation plan. Adjust type, number, extent, and location of planned operations.
Operation Policies	Major deficiencies identified through monitoring or based on significant new science or management techniques	Revise existing policy or create new policy

The specific type of adaptive management triggers and associated responses will also vary on the specific monitoring metric indicating potential deficiencies. Table 6-4 provides examples of the range of conservation actions expected to be potential areas for adaptive management and associated metrics, triggers and adaptive management responses. All adaptive management responses will begin with a determination of the underlying causes of deficiencies/triggers identified. Note that while the examples in Table 6-4 focus on deficiencies, the same rationale can be applied where desired outcomes are overachieved, resulting in allowance for increased management flexibility.

Table 6-4. Potential Triggers for Adaptive Management

Aquatic Actions	Potential Trigger	Adaptive Management Response Example
Wood Recruitment in Streams	Trend in large wood frequency/volume in streams is not increasing in watersheds where wood is a limiting factor for covered fish species.	Revise implementation plans during the subsequent 10-year planning cycle to incorporate additional wood enhancement.
Stream Temperature	Temperature increases are detected in perennial streams within or above fish-bearing stream despite implementation of riparian conservation areas.	Consider targeted riparian conservation strategy adjustments in locations where temperature increases are detected and similar stream segments in the permit area. Potentially revise implementation plans during the subsequent 10-year planning cycle to modify amount of harvest in an affected watershed.
Stream Enhancement	Stream enhancement projects are not being completed or are not achieving expected results. Biological return on investments not realized.	Identify and capture additional opportunities to fund and implement stream enhancement. Increase number of stream enhancement projects identified in implementation plans. Apply lessons learned to selection and design of operations plans to improve efficiency and effectiveness of stream enhancement projects.
Road Improvement and Vacating	Sediment and flow impacts from roads identified within a catchment.	Identify opportunities for additional road improvement and vacating as through adjustments to budgets and operations and implementation plans.
Fish Passage	Passage enhancement projects do not achieve intended results. Return on investments not realized.	Rectify specific projects as practicable. Apply lessons learned to selection and design of operations plans to improve efficiency and effectiveness of fish passage improvement projects.
Terrestrial Actions	**Potential Trigger**	**Adaptive Management Response Example**
HCA Habitat for Covered Species	Trends in suitable and highly suitable habitat is below projections for one or more covered species	Increase number and extent of enhancement treatments at the implementation plan level, where and when appropriate. Reevaluate and revise management prescriptions defined in operation and implementation plans and operation policies. Reevaluate habitat models and revise models, operations plans, and implementation plans accordingly.
HCA Management	Results of habitat treatments (e.g., thinning) do not achieve intended trend in habitat improvement. Return on investments not realized (i.e., cost/benefit).	Adjust enhancement treatments through operations and implementation plans. Revise or adjust enhancement treatment prescriptions to improve efficiency and effectiveness.

Aquatic Actions	Potential Trigger	Adaptive Management Response Example
Northern Spotted Owl Dispersal Habitat	Total dispersal habitat is on a trajectory that will eventually fall below 40% at the district level	Reevaluate and revise operations and implementation plans as needed to correct the deficiency.
Leave Trees and Downed Wood	Leave trees or downed wood are not persisting on the landscape as intended.	Apply lessons learned to selection and design of future operations plans. Adjust leave tree and downed wood prescriptions.

Additional triggers may be identified as part of routine annual reporting, 5-year midpoint check-ins, or as part of the 10-year HCP comprehensive reviews. New triggers may also be added due to new science or emerging issues that influence biological outcomes in the permit area. New triggers can be added at any time during implementation and will be set so that they provide a warning of trends in the wrong direction in enough time to make adjustments.

6.3.5 Adaptive Management and Climate Change

The HCP addresses the anticipated effects of climate change in several ways. As described in Chapter 4, measures to increase resiliency of habitats and species have been incorporated into the conservation strategy, including providing adequate habitat to sustain the persistence of covered species within the permit area in the face of potential habitat losses due to fire, wind, drought, insects, and disease. In addition, the distribution of proposed conservation actions occur throughout the planning area, across elevation gradients and diverse forest types, providing a network of areas that would continue to meet biological goals and objectives even if portions of some areas are adversely affected by climate change.

And as described in Chapter 7, climate change is also considered in anticipation of potential changed and unforeseen circumstances, and the HCP includes assurances that changed circumstances due to climate change will be addressed through the triggers and associated remedial measures identified in Chapter 7.

In terms of adaptive management, climate change effects may be detected through monitoring results that will in turn trigger adaptive management responses, following the adaptive management process previously described. This includes effects that may act as stressors for the covered species, as well as those that present risks to the maintenance and enhancement of the quantity and quality of habitat. As such, ODF will use adaptive management to respond to climate change effects at the operational level, including adjustments made to budgets, operations plans, implementation plans, and policies. Due to the broad scope and effects of climate change on covered species, ODF anticipates that adaptive management for climate change will be informed through ongoing discussions and coordination at a state and federal level with other major forest land owners in western Oregon, including private industrial forest land owners, federal land managers (the Bureau of Land Management and U.S. Forest Service), and tribal governments and natural resource agencies.

Chapter 7
Assurances

7.1 Introduction

This chapter discusses the rights and responsibilities of the Permittee (Oregon Department of Forestry [ODF]), U.S. Fish and Wildlife Service (USFWS), and National Oceanic and Atmospheric Administration (NOAA) Fisheries regarding changed and unforeseen circumstances that may occur over the permit term. The No Surprises Regulation limits the scope of a Permittee's requirement to provide additional mitigation under the Endangered Species Act (ESA).

ODF has prepared the Western Oregon State Forest Habitat Conservation Plan (HCP), in part, to obtain the following assurances from the USFWS. Assurances specific to state or federal agencies are described in Sections 10.4.1, *Federal No Surprises,* and 10.4.2, *Federal Section 7 Consultations* (USFWS and NOAA Fisheries), and 10.4.3 (*Federal Critical Habitat Designations*).

7.2 Federal No Surprises

The federal No Surprises Regulation was established on March 25, 1998. It provides assurances to Section 10 permit holders that no additional money, commitments, or restrictions of land or water will be required should unforeseen circumstances requiring additional mitigation arise once the permit is in place. The No Surprises Regulation states that if a Permittee is fully implementing an HCP that has been approved by USFWS and/or NOAA Fisheries, no additional commitment of resources, beyond that already specified in the plan, will be required.

ODF requests regulatory assurances (No Surprises) for all covered species in the HCP. In accordance with No Surprises, ODF will be responsible for implementing and funding measures in response to any changed circumstances, as described in this chapter. ODF will not be obligated to address unforeseen circumstances but will work with the USFWS and NOAA Fisheries to address them within the funding and other constraints of the HCP should they occur.

ODF understands that No Surprises assurances are contingent on the full implementation of the HCP and permits. ODF also understand that USFWS or NOAA Fisheries may suspend or revoke the federal permit, in whole or in part, in accordance with federal regulations (50 Code of Federal Regulations [CFR] Sections 13.27, 13.28, and 222.306 and other applicable laws and regulations) in force at the time of such suspension. See Section 8.9, *Permit Suspension or Revocation,* for more information on requirements related to this process.

7.3 Changed and Unforeseen Circumstances

7.3.1 Changed Circumstances

Changed circumstances are defined in the federal No Surprises Regulation.[1] With respect to HCPs, Congress recognizes that "circumstances and information may change over time and that the original plan might need to be revised" (H.R. Rep. No. 97-835, 97th Congress). Section 10 regulations[2] describe changed and unforeseen circumstances and specify procedures for addressing changed circumstances that may arise during the permit term. Changed and unforeseen circumstances describe what changes can and cannot be anticipated over the permit term and thus bind the Permittees' commitment, as described in Section 7.2.1, *Federal No Surprises*.

7.3.2 Unforeseen Circumstances

Unforeseen circumstances are defined by federal regulation as "changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the USFWS or NMFS [National Marine Fisheries Service] at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of the covered species."

7.3.3 Changed and Unforeseen Circumstances Addressed by this HCP

Under ESA Section 10, an HCP is required to identify anticipated and possible changed circumstances that could arise during its implementation. Identifying strategies and protocols for addressing such anticipated changes allows for appropriate program adjustments. ODF will maintain sufficient financial reserves to fund any remedial actions that may occur throughout the permit term as described in Section 9.2.4, *Remedial Measures for Changed Circumstances*.

7.3.3.1 New Species Listings

Over the course of the permit term (70 years), USFWS or NOAA Fisheries could list species that are not covered under the HCP as threatened or endangered under the ESA. ODF will know when a noncovered species associated with habitat within the Permit Area has been proposed for listing, becomes a candidate for listing, or is emergency-listed (new noncovered species) because it is a publicly noticed process.

Changed Circumstance

This changed circumstance will be triggered when ODF receives public notification that a noncovered species associated with habitat in the Permit Area has been proposed for listing, becomes a candidate for listing, or is emergency-listed (such as a newly listed noncovered species).

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[1] 63 *Federal Register* 35 (1998) (amending 50 CFR 17.22(b)(5), and 222.307(g)).

[2] 50 CFR 17.22(b)(2), 17.32(b)(2), and 222.307.

Remedial Measure

Following such public notification, ODF will take the following measures.

1. **Determine the potential for ODF effects on species newly designated as proposed, candidate, or listed species.** Within 3 months of such notification, ODF will evaluate and determine the potential extent of the newly listed species on ODF managed lands and the necessary coordination with USFWS and/or NOAA Fisheries.
2. **Coordinate with USFWS and/or NOAA Fisheries and implement Agency-provided avoidance measures.** If ODF determines that the new species may be present in the Permit Area, they will initiate coordination as soon as this is determined. Through technical assistance with the USFWS or NOAA Fisheries, the potential effects of covered activities on the newly listed noncovered species will be evaluated, including an assessment of the presence of suitable habitat in the Permit Area. If ODF and USFWS or NOAA Fisheries determine that the noncovered species occurs or could occur in the Permit Area, ODF will identify and implement any necessary measures provided by USFWS (in Habitat Conservation Areas [HCAs]) or NOAA Fisheries (in Riparian Conservation Areas [RCAs]) to avoid the take of the newly listed noncovered species. ODF will implement the interim take avoidance guidelines for the species until the permit amendment is finalized, or an alternate permit is issued to ensure compliance with the ESA. Permit amendments to include additional covered species require amendment to the HCP and the appropriate permit. Such an amendment would require USFWS or NOAA Fisheries to re-initiate Section 7 consultation and conduct a National Environmental Policy Act (NEPA) analysis prior to their decision of whether to approve or deny the amendment.
3. **Apply for permit amendment or alternative take coverage**. If ODF proceeds with activities that will cause take of the newly listed noncovered species, they can only begin those activities after the HCP permit is amended or take authorization is granted through a separate permitting process.

7.3.3.2 Climate Change

Climate change poses the most uncertainty and risk to state forests. Warmer, drier summers with more extreme heat events, and more extreme precipitation events in winter are expected in Western Oregon (Spies et al. 2018). Temperature and precipitation pattern changes may affect forest productivity and health and biodiversity in unforeseen ways, as well as have large but variable effects on species and ecosystems, including increased frequency and severity of fire, invasive species outbreaks, or other disturbances. These more frequent and intense disturbances can dramatically change habitat conditions for covered species within the plan area.

Climate change resulting from increased concentrations of atmospheric carbon dioxide is expected to result in warmer temperatures and changed precipitation regimes during this century. Climate change will generally diminish tree health and improve conditions for some highly damaging pathogens (Kliejeunas et al. 2009). The effects of climate change also are generally expected to predispose forests to wildfires, and insects and disease; reduce growth and survival; and ultimately change forest structure and composition at the landscape scale. Landscapes will adapt to new climatic and biotic environments.

Additionally, if streams and rivers across the northwest U.S. warm this century, it will have serious biological implications for both the quality and quantity of habitats available to species of regional importance like salmonids. Ongoing temperature increases will profoundly influence the ecology of salmonids, in particular. Climate change is projected to alter the flow regimes of streams and rivers, with consequences for physical processes and aquatic organisms (Spies et al. 2018). The volume of available habitat is shrinking as summer stream discharges across the region continue multi-decadal declines that have also been partially linked to climate change (Isaak et al. 2012). Warm water predatory fish, such as bass, will likely impact the survival and recovery of salmonids.

Because of the variability of climate change and because it is so interconnected to fire, storm/wind events, and invasive species, thresholds discussed below for setting changed circumstances will take into account any potential acceleration from climate change.

7.3.3.3 Fire

[**Note to Reader**: *As a result of current events ODF will be reassessing how to address fire as a changed circumstance in the HCP. The information provided below should be considered preliminary and under discussion*.]

State forests have a legacy of repeated, large-scale wildfires. Before fire suppression techniques were introduced to the area, the dominant disturbance to forests was fire. Low-intensity fires were historically frequent in dry interior Oregon forests, and were key to maintaining wildfire resilience, forest structure, and ecosystem health. However, wildfires were typically much less frequent, but much more intense in western Oregon and coastal forests. Forest fires have burned hundreds of thousands of acres in western Oregon over the past century. In August 1933, a wildfire burned approximately 240,000 acres of mostly old growth forest in Tillamook State Forest. Fires again burned the Tillamook area in 1939, 1945, and 1951. Some areas reburned two or three times. By the end of 1945, 355,000 acres had burned. Over the last 20 years, 1,160 acres have burned in the Southwest District.

From 1960–2019 there have been 1,208 fires, burning approximately 4,773 acres of ODF managed land in the permit area (Table 7-1).

Table 7-1. Fire History on ODF Managed Lands by District (1960–2019)

District	# of Fires	Acres Burned	Average Acres Burned per Fire
Northwest Oregon	628	1,176	2
West Oregon & North Cascades	124	439	4
Western Lane & Southwest	456	1,160	3
Total	1,208	2,775	2

Changed Circumstance

In the event of a wildfire, ODF will assess the proportion of an HCA that has burned and likely effects on habitat use by covered species. ODF will make determination of whether the fire constitutes a changed circumstance and notify the USFWS and NOAA Fisheries of the fire event. A fire event will be considered a changed circumstance if less than 50% of any one HCA is burned in 1 year or less than 5,000 acres of HCAs collectively burn in 1 year. If more than 50% of any one HCA burns or more than 5,000 acres of HCAs collectively burn that will be considered an unforeseen circumstance.

Regardless of whether a fire is declared a changed or unforeseen circumstance, ODF will work to rehabilitate the forest over time. The difference would be in the timing. If a burn falls under the changed circumstance threshold (i.e., <50% of an HCA) the expectation will be for ODF to develop and implement post-fire rehabilitation plans within 3 years following the burn. If a burn constitutes an unforeseen circumstance there will be no temporal requirement for when that work needs to be completed.

No changed circumstances are defined for RCAs. ODF will restore forests within RCAs regardless of fire size or acres burned. There will be no salvage logging in RCAs, unless necessary for safety or for access to upland areas where salvage logging is allowed.

Response

To minimize the risk of wildfire, ODF will continually identify stands with a higher risk of fire and implement fire risk reduction measures, including, but not limited to, the following:

- Apply fuels management techniques such as thinning and removal of ladder fuels outside of HCAs and RCAs.
- Apply fuels management techniques such as thinning and removal of ladder fuels within HCAs in stands of non-suitable and marginal habitat that can function as a buffer against wildfire for occupied or suitable habitat.
- Salvage timber outside of the RCAs as rapidly as possibly post-fire to prevent future fire risk.
- Provide an adequate level of protection from forest fires during forest management operations as required by Oregon law.
- Coordinate with state and local fire agencies to improve fire suppression preparedness.
- Develop and implement post-fire monitoring plans.
- Implement post-fire rehabilitation which outlines salvage, reforestation technique, and species mixes used in replanting.

In either circumstance, ODF will implement an appropriate post-fire monitoring plan for a 5-year period following the fire to assess the recovery of vegetation and wildlife for changed circumstances. If, over the course of the monitoring period, it is determined that vegetation is not recovering sufficiently in the burned area to reestablish the functions of the affected habitat, ODF will develop and implement, through the adaptive management process, a habitat restoration plan to enhance recovery of the affected habitat area to the extent practicable. Five-year monitoring may be completed, but is not required, for unforeseen circumstances.

7.3.3.4 Storm Events

Storm events (e.g., ice storms, wind, heavy snow) can lead to under-productive forest conditions and susceptibility to insects and disease. These stands often require immediate action to restore resilient and productive forest conditions.

Northwest Oregon experiences periodic severe windstorms. The Columbus Day storm on October 12, 1962, blew down an estimated 17 billion board feet of timber in western Oregon and

Washington. As is typical of most disturbances, windstorms interact with other events in many ways. After the Columbus Day storm in 1962, Douglas-fir bark beetles killed an additional 2.6 billion board feet of timber by 1965.

The Great Northwest Gale occurred over 3 days in December 2007 and was the most impactful storm event to hit western Oregon since the Columbus Day storm. [*Data on storm damage to be inserted once compiled*]

In addition to those named storms, there have been eight other major storm/wind events since the Columbus Day storm in 1962: in 2016, 2015 (2), 2007, 2006, 1996, 1995, 1993, and 1981.

Changed Circumstance

A storm event will be considered a changed circumstance if less than 50% of any one HCA is impacted by storms in 1 year or less than 5,000 acres of HCAs collectively are impacted in 1 year. If more than 50% of any one HCA is affected by storms or more than 5,000 acres of HCAs collectively are, that will be considered an unforeseen circumstance.

Regardless of whether a storm event is declared a changed circumstance or is unforeseen, ODF will work to rehabilitate the forest over time. The difference would be in the timing. If a storm event falls under the changed circumstance threshold (i.e., <50% of an HCA) the expectation will be for ODF to respond within 3 years following the storm. If a storm constitutes an unforeseen circumstance there will be no temporal requirement for when that work needs to be completed.

No changed circumstances are defined for RCAs. ODF will restore forests within RCAs regardless of storm size or acres impacted by a single storm even or a series of storm events in 1 year. There will be no salvage logging in RCAs, unless necessary for safety or for access to upland areas where salvage logging is allowed.

Response

When natural events such as windstorms affect forest stands, management activities are adjusted to balance harvest goals with conservation objectives. When a major windstorm occurs, the large supply of Douglas-fir breeding logs will allow beetle populations to increase, unless the large (more than 12 inches in diameter) windthrown Douglas-firs are salvaged rapidly.

In the event that large-scale storm and wind events impact trees in the HCAs, ODF response includes the following measures.

- Salvage timber as rapidly as possibly outside of the RCAs to prevent infestation of invasive species.
- Replant windblown areas with appropriate species within 3 years of the storm event.

7.3.3.5 Terrestrial Invasive Species and Disease

Nonnative species and diseases currently occur in the plan area, including exotic weeds, insects, and pathogens. Scotch broom and Himalayan blackberry, the state’s costliest weeds at nearly $80 million annually due to lost timber revenue and direct control measures, are prevalent through most of the region. White pine blister rust, which is caused by the invasive fungus *Cronartium ribicola* has decimated western white pine throughout its range. Other invasive species like spruce aphid and balsam woody adelgid have caused severe tree mortality within the plan area.

There are also nonnative species and diseases that exist in areas outside the plan area that have the potential to spread into the plan area and adversely affect the covered species. Emerald ash borer has caused extensive damage to ash trees across the United States. If it invades Oregon, it would cause local extinction within 10–20 years, likely causing changes in stream temperatures and associated changes in plant animal communities in riparian areas below 2,000-foot elevation. Sudden oak death, caused by the nonnative pathogen *Phytophthora ramorum*, is currently present in Oregon, but is confined to Curry County. Future spread to other counties would impact forest viability. European and Asian Gypsy moth, while not established in Oregon, have the potential to have long-lasting negative impacts on state forests if they were to establish. Increasing popularity of recreational activities in state forests increases the likelihood of new invasive species being introduced, which, in turn, could affect long-term forest health.

A new disease or invasive species that spreads throughout the plan area within the permit term is a foreseeable event. If a disease or nonnative species spreads beyond the thresholds identified below, however, it will be considered an unforeseen circumstance.

ODF will continue to identify and control invasive species across the Permit Area. It is possible the following events may occur, however, despite implementation of the those efforts:

- New and aggressive nonnative species may invade the plan area.
- Existing nonnative species or diseases may expand to unprecedented levels in the plan area (e.g., increased expansion due to climate change).

Changed Circumstance

An invasive species or disease outbreaks will be considered a changed circumstance if less than 50% of any one HCA is impacted in 1 year or less than 5,000 acres of HCAs collectively are impacted in 1 year. If more than 50% of any one HCA is affected by invasive species or disease outbreak or more than 5,000 acres of HCAs collectively are, that will be considered an unforeseen circumstance.

Regardless of whether an event is declared a changed circumstance or is unforeseen, ODF will work to rehabilitate the forest over time. The difference would be in the timing. If an event falls under the changed circumstance threshold (i.e., <50% of an HCA) the expectation will be for ODF to respond within 3 years following the invasive species or disease outbreak. If an outbreak constitutes an unforeseen circumstance there will be no temporal requirement for when that work needs to be completed.

No changed circumstances are defined for RCAs. ODF will restore forests within RCAs regardless of acres impacted by a single outbreak or a series of outbreaks in 1 year. There will be no salvage logging in RCAs, unless necessary for safety or for access to upland areas where salvage logging is allowed.

Response

Remedial measures that address the invasion of nonnative species or disease follow the steps listed below. An invasion would include occurrence at a level where the ecosystem health is at risk in a way that would influence ODF's ability to implement the conservation strategy in the HCP, including those parameters listed in the previous section.

- Determine the best method for measurement and tracking the extent within 3 months of detection.
- Prepare a damage-assessment report within 6 months of detection.
- Recommend and plan actions to address the threat within 6 months of detection.
- Respond in ways that are consistent with the HCP and permit obligations and with the consent of the USFWS and NOAA Fisheries within 3 years of detection.

7.3.3.6 Aquatic Invasive Plants, Nonnative Fish and Disease/Parasites

Nonnative aquatic plant species, disease, and warm water predatory fishes may currently occur in portions of the plan area as well as outside the plan area. Aquatic invasive plant species like Knotweeds (*Polygonum* spp.) can inundate streamside habitat in open areas, where it displaces native vegetation and can increase streambank erosion (OSU 2013).

Introduction and/or expansion of nonnative fish, such as the brook trout (*Salvelinus fontinalis*) complete with the covered species for cold water spawning and rearing habitat. As stream temperatures increase, the range of nonnative warm water predators, such as smallmouth bass that predate upon juvenile salmon and steelhead, expands. Rising stream temperatures also increase the susceptibility of the covered salmon and steelhead to disease and parasitic loads due to increased disease virulence and fish crowding at low flows (Crozier 2016).

The spread of aquatic invasive species can affect native species. Under the HCP ODF will be managing the RCAs in the Permit Area in accordance with the biological goals and objectives to ensure the riparian and aquatic habitat is maintained (e.g., riparian forests, shading, no harvest) to benefit the covered species. If an invasive aquatic plant(s) were to expand its range significantly within the Permit Area ODF will work with the Department of Agriculture to identify measures necessary to eradicate the plant. Similarly, if expansions of nonnative fish (warm or cold water) into the Permit Area begin to outcompete the covered salmon and steelhead ODF will coordinate with the Oregon Department of Fish and Wildlife (ODFW) on what measures, if any, should be taken to address the species expansion.

Changed Circumstances

Under the HCP, the changed circumstances are only considered for aquatic invasive plants, for which ODF will fund remedial measures:

- Spread of aquatic invasive plants species withing an RCA that affects up to 25% of stream miles, above conditions at the beginning of HCP implementation, within any given hydrologic unit code (HUC) 10 independent population of salmon or steelhead within a 3-year time period. Any new invasion that expands beyond 25% within a 3-year time period will be considered unforeseen.
- ODF will establish assumptions about the distribution of aquatic invasive plants, nonnative fish, and disease by Year 5 of HCP implementation. This will occur based on existing information and will not rely on a new survey effort.

Response

ODF will address changed circumstances using manual, mechanical, cultural, chemical, and biological treatments to manage new occurrences of aquatic invasive plant infestations within the permit area.

For unforeseen circumstances ODF may still coordinate a response with ODFW and other state and federal agencies, but it would not be required by the HCP.

7.3.3.7 Stream Temperature Changes

Climate change is projected to raise temperatures and alter the flow regimes of streams and rivers within the plan area, which will have consequences for physical processes and aquatic organisms, including covered fish species and their habitats. Water temperature plays a critical role for fish and other aquatic organisms in river and stream because their biological processes are directly controlled by ambient water temperatures (Neuheimer and Taggart 2007, Buisson et al. 2008, Pörtner and Farrell 2008, Durance and Ormerod 2009). As climate change continues to impact normal weather patterns in the Pacific Northwest, the effects of climate change increasingly manifest through changes in air temperature (Barnett et al. 2008, Walsh et al., 2014), seasonal patterns of snow accumulation and stream runoff (Luce et al. 2013, Mote et al. 2005, Stewart et al. 2005), and increasing wildfires (Littell et al. 2016, Westerling et al. 2006). All of these changes, increases in air temperature, changes in seasonal rain and snow patterns and run-off, and wildfires also impact stream temperature and flow.

Changed Circumstance

While water temperature varies over time based on location, time of day, and season, stream temperatures across the Pacific Northwest averaged 58°F (14.2°C) from 1993–2011 (Isaak et al. 2018). Based on climate change model scenarios water temperature in streams and rivers can be expected to increase on average by 2°F and 3.5°F (0.73°C and 1.4°C) by 2040 and 2080, respectively (Isaak et al. 2017).

Based on this modeled climate scenario, average annual water temperatures rising more than 3.5°F (1.4°C) during the Permit Term would be considered unforeseen.

Response

In response to potential changes in water temperature and flow from climate change, ODF will take preventative measures for streams and rivers in the RCAs. These measures include, but are not limited to, the following.

- Maintain stream buffers to keep rivers and streams shaded by maximizing shade from vegetation.
- Consider expansion of stream buffers in key locations to further minimize risk of temperature rise should the HCP monitoring program establish that stream temperatures are rising despite use of stream buffers thought to be adequate.
- Reconnect streams to floodplains to facilitate flow.
- Create high quality freshwater habitat to maintain future smolt production.

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Chapter 8
Plan Implementation

8.1 Overview

This chapter describes how the Western Oregon State Forest Habitat Conservation Plan (HCP) will be implemented, including the roles and responsibilities of participating state and federal agencies, data tracking and reporting, coordination during implementation, and plan modifications.

8.2 Implementation Roles and Responsibilities

8.2.1 Oregon Department of Forestry

The Oregon Department of Forestry (ODF) will oversee HCP implementation, including staffing internal positions, hiring consultants, reporting, monitoring, and maintaining all program records. ODF staff includes biologists, foresters, administrators, and other natural resource specialists who will carry out planning, monitoring, adaptive management, and periodic coordination with and reporting to U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries. To implement the HCP, ODF will assign HCP implementation responsibilities to staff within the State Forests Division.

8.2.1.1 HCP Administrator

ODF will assign HCP implementation responsibilities to the Resource Support Unit Manager within the State Forests Policy and Technical Support Team, who will serve as the HCP Administrator. The HCP Administrator will serve as a point of contact for HCP-related issues between ODF, USFWS, NOAA Fisheries, and the Oregon Department of Fish and Wildlife (ODFW). The HCP Administrator is expected to report to the Deputy Chief of Policy and Technical Support, and will also provide support for and oversee the following tasks.

- Develop and maintain annual budgets and work plans for HCP implementation. Annual budgets will be incorporated as specific line items into the State Forests Division's fiscal budgeting process and Fiscal Year Operating Plan.
- Coordinate communication and decision-making within ODF on HCP implementation and between ODF, USFWS, NOAA Fisheries, and ODFW, as needed.
- Coordinate compliance and effectiveness monitoring activities.
- Maintain effectiveness and compliance monitoring and survey data reports and archives, including monitoring results, and produce an annual report.
- Coordinate the development of policies needed to communicate HCP expectations and requirements to staff.

- Coordinate updates to existing policies, guidelines, and business practices to align with HCP requirements, as needed.
- Ensure adequate training for ODF staff on HCP implementation, including all compliance requirements.
- Answer internal HCP-related questions.
- Coordinate the conservation funding and priority of projects.

HCP Administrator responsibilities are estimated to require 50% of one full-time employee's time annually.

8.2.1.2 Data Analyst

The State Forests Division Information Management Specialist will serve as the lead Data Analyst for the HCP and will develop a geographic information system (GIS) and other database systems to collect, store, and use spatial data necessary for HCP implementation. Compliance and effectiveness monitoring will be tracked in part through the GIS database system. In addition, the status and trends of covered species habitat across the plan area will be tracked through this system, combined with timber stand inventory data.

Tracking and database updates related to program administration will require, on average, approximately 30% of a full-time employee's time annually.

8.2.1.3 Staff and Field Biologists

The Staff Biologist and Staff Aquatic and Riparian Specialist, of the State Forests Resource Support Unit, will serve as the lead biologists for the terrestrial and aquatic HCP strategies, respectively. They will provide policy direction and technical assistance for implementing HCP conservation actions within the permit area, help guide key monitoring and adaptive management, and assist in the selection and prioritization of projects that will receive conservation funds. This will require approximately 50% of each full time position.

Two lead field biologists will be primarily responsible for implementation of HCP conservation actions as part of ODF's regular planning cycles and providing direct technical assistance to field foresters. These positions are within the Planning Unit of the State Forests Planning and Coordination Team, but will work closely with the lead biologists to ensure consistency in application of conservation actions. This will require 100% of each full time position.

8.2.1.4 Other Specialists

Other specialists will collaborate with the positions listed above to implement the HCP conservation actions. These positions include the following.

- State Forests Engineer (Resource Support Unit): Consults with field Roads Specialists to minimize road effects in Habitat Conservation Areas (HCAs) and Riparian Conservation Areas (RCAs), consults on best management practices in road design and fish passage structures, and helps prioritize and implement restoration activities related to vacating of roads.

- State Forests Geotechnical Specialist (Planning and Coordination Team): Evaluates potential landslide initiation areas or other features that may affect RCAs, and buffers features to ensure RCA strategies for unstable slopes function as intended.
- State Forests Adaptive Management Specialist and Monitoring Specialist (Resource Support Unit): Plans, coordinates, and implements monitoring and adaptive management activities for the HCP, and suggests improvements to conservation actions to more efficiently and effectively achieve the Biological Goals and Objectives.
- State Forests Forest Analyst (Resource Support Unit): Conducts modeling and analysis of habitat suitability, using metrics derived from forest inventory data.

8.2.2 Oregon Board of Forestry

The Board of Forestry will approve this HCP prior to permit issuance by USFWS and NOAA Fisheries. During implementation, ODF and the HCP Administrator will provide the Board of Forestry with periodic updates on the status of HCP implementation and progress towards achieving the biological goals and objectives of the HCP.

The Board of Forestry is also responsible for approving Forest Management Plans (FMPs) that guide the operations of ODF. All FMPs will be aligned with the requirements of the HCP and therefore consistent with the HCP. FMPs cannot alter the requirements of the HCP without an HCP modification as described in Section 8.8, *Modifications to the HCP*.

8.2.3 Oregon Land Board and Department of State Lands

As described in Chapter 1, *Introduction*, the HCP permit area includes 25,826 acres of Common School Forest Lands (CSFL) outside of the Elliott State Forest that are managed by ODF. The Oregon Land Board oversees these lands through the Department of State Lands (DSL). The DSL Real Estate Asset Management Plan (2012) directs DSL to manage forestland "in accordance with plans adopted by the Land Board in cooperation with the Board of Forestry." As described above, in conjunction with this HCP, ODF will be adopting a new FMP consistent with the HCP. Therefore, the State Land Board needs to adopt the new FMP so that ODF can manage these lands consistent with the FMP and this HCP.

8.2.4 U.S. Fish and Wildlife Service and National Marine Fisheries Service

USFWS and NOAA Fisheries will be responsible for overseeing HCP implementation. Each federal agency will collaborate with ODF on the following tasks as needed.

- Receive annual reports submitted by ODF.
- Determine if ODF is properly implementing the HCP in compliance with the HCP and any additional terms and conditions of each permit, based on the annual report and other information provided by ODF.
- Respond to requests by ODF for HCP amendments (see Section 8.8).

- Notify ODF of the potential for unforeseen circumstances and possible voluntary remedial measures to address them, as described in Chapter 7, *Assurances*.
- Enforce the provisions of the incidental take permits, as needed.

8.2.5 Oregon Department of Fish and Wildlife

ODFW will play a key role in the implementation of the aquatic monitoring program (see Chapter 6, *Monitoring and Adaptive Management*) on behalf of ODF. ODFW will also serve as technical advisors to ODF during HCP implementation, advising on implementation of conservation actions, the monitoring program, and application of the adaptive management program to inform changes in either.

8.3 Technical Assistance

During HCP implementation ODF may seek technical assistance from USFWS, NOAA Fisheries, or ODFW in order to most effectively comply with the HCP and permits and implement the conservation strategy. Technical assistance will be most valuable in situations not clearly defined by the HCP or permits, where ODF needs assistance determining how to proceed with a particular action while remaining in compliance. Every instance cannot be fully understood and anticipated in a long-term planning process. For situations that are not clearly articulated in the HCP or permits, or as new situations arise, ODF will work with USFWS, NFMS, and ODFW to develop and implement practical solutions to emerging issues in a manner that is consistent with the intent of the HCP and permits, and that allow for logistically feasible decisions on the ground. If it is determined during technical assistance that there needs to be a clarification to the HCP or a modification to the permit, up to and including an amendment, the process described in Section 8.8 will be followed.

8.4 Data Tracking

Proper data management, tracking, analysis, and reporting are critical to HCP implementation, including the monitoring and adaptive management program. Data on monitoring methods, results, and analysis must be managed, stored, and made available to staff, decision makers, USFWS and NOAA Fisheries, and others, as appropriate. ODF will maintain the following data to support HCP implementation.

- The location, extent, and timing of impacts on modeled habitat.
- The location, extent, and timing of implementation of all conservation measures.
- The results of all HCP monitoring, including status and trends monitoring, described in Chapter 6, including changes in species habitat quality and quantity over time.

The comprehensive data repository for tracking will be operational within 12 months of permit issuance. These reports and other data will be stored and archived electronically whenever possible. When electronic archiving is not available or feasible, ODF will retain hard copy records, which, along with electronic records, will be available for inspection by USFWS and NOAA Fisheries, as requested.

8.5 Reporting

Reporting will occur on three timescales during implementation: (1) annual reports, (2) 5-year check-ins, and (3) 10-year comprehensive reviews. The timing of reports serve multiple purposes, including some annual accounting of compliance with the HCP and permits and longer term, 5- and 10-year reviews of implementation of conservation actions. The 10-year comprehensive reviews are specifically designed to inform the 10 year implementation planning process, which guides forest management planning for the State Forests Division.

8.5.1 Annual Reporting

ODF will prepare and submit an annual report for the duration of the permit term detailing, among other things, compliance, impacts, conservation actions, and monitoring. The annual reports will summarize the previous state fiscal year's implementation activities (July1–June 30) and be provided to USFWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries by October 15 of each year. Annual reports will require synthesis of data and reporting on important trends. A due date of October 15 will allow time for the data to be assembled, analyzed, and presented in a clear and concise format. If ODF requires more time to prepare and submit the annual report, ODF may request from USFWS and NOAA Fisheries a 30-day extension of this deadline. In addition to submitting to USFWS and NOAA Fisheries, annual reports will be made available to the public and posted on the ODF website. An annual meeting reviewing the above submitted information and addressing any other issues will be held between October 15 and December 15.

The goals of the annual reports are to demonstrate to Board of Forestry, USFWS, NOAA Fisheries, and the public that the HCP is being implemented properly. If any implementation problems have occurred, they will be disclosed with a description of corrective measures planned or measures that have been taken to address the problems. The reports will also identify past and expected future changes to the management and monitoring program, through adaptive management, and remedial actions needed to address changed circumstances.

The minimum required content of the annual reports is as follows.

- Description of covered activities implemented during the reporting year as well as cumulative total (i.e., from the start of the permit term). Examples include:
    - Acres of management activities in RCAs and HCAs, by species' habitat suitability class.
    - Roads constructed and vacated in RCAs and HCAs.
    - Barriers to fish passage removed.
    - Recreational facilities constructed in RCAs and HCAs.
- Documentation of any instances where deviations/exceptions from standard practices occurred in RCAs or HCAs (Chapter 4, *Conservation Strategy*).
- Documentation of any known instances of direct mortality of covered species.
- Progress toward achieving the biological goals and objectives by implementation of conservation actions (including avoidance, minimization, and mitigation).

- Description of any changes in HCP implementation resulting from the adaptive management process during the reporting year, as applicable. This description will include the information that triggered the change, the rationale for the planned responses, and the results of any applicable monitoring actions.
- Summary of surveys conducted through the monitoring program for the reporting year, including a description of surveys conducted, protocols used, and survey results.
- Discussion of possible changes to the monitoring and research program based on interpretation of monitoring results and research findings, if applicable.
- Documentation of any changed circumstances described in Chapter 7 that were triggered during the reporting year, if applicable. If any such circumstances were triggered, the report shall also include any responses implemented (i.e., remedial measures) and resulting monitoring.
- If changed circumstances were triggered in prior years, document on-going responses to those past changed circumstances in the current reporting year, and the on-going results of remedial measures.
- Any administrative changes or amendments proposed or implemented during the reporting year (see Section 8.8).

8.5.2 5-Year Mid-Point check in

ODF operates on 10-year implementation planning cycles that guide forest management activities at the district level. Halfway through any given implementation plan cycle there will be a mid-point check in on HCP implementation. The following will be summarized during the mid-point check ins.

- Amount and general location of modeled habitat for covered species lost to covered activities, and amount and general location of modeled habitat gained through management actions and natural succession.
- A summary of expenditures from the conservation fund, including an accounting of the proportion of funds expended on aquatic and terrestrial species conservation actions.
- A justification of how expenditures from the conservation fund are addressing the limiting factors for covered species and offsetting the impacts of habitat loss that may have occurred from covered activities.

8.5.3 10-Year Comprehensive Review

In order to inform the implementation planning process, and to make adjustments accordingly in order to continue to comply with the HCP and permits, ODF will undertake a 10-year comprehensive review. The 10-year comprehensive review will include information from the annual reports in the intervening 10 years and the summary provided in the 5-year mid-point check in, and examine whether any program-level or systemic changes need to occur to adjust the level or location of habitat loss, the type of management activities, or the type or location of conservation actions that are being implemented. For example, if different choices need to be made regarding how habitat is managed inside of HCAs or where conservation fund dollars are spent for aquatic enhancement projects, the need for those decisions could emerge during the 10-year review, and changes that result could be codified in implementation plans or other State Forests Division operational policy changes as described in Chapter 6. Information generated during the 10-year comprehensive review process will be informed by ODF staff along with USFWS, NOAA Fisheries, and ODFW.

8.6 Timber Sale Contracts

Several conservation measures will be implemented wholly or in part by timber operators contracted to ODF through a formal timber sale bidding process. After Incidental Take Permit (ITP) issuance by USFWS and NOAA Fisheries, ODF will modify all future bid specifications and contracts for timber sales to conform to the requirements of the HCP. These future timber sale specifications and contracts will require all timber operators to implement the appropriate avoidance, minimization, and mitigation measures described in Chapter 4.

Timber contracts are typically awarded for 3 years with the expectation that a timber operator will harvest at some point during the 3-year contract period. Timber sale contracts awarded prior to HCP implementation (i.e., prior to ITP issuance by USFWS and NOAA Fisheries) may therefore be implemented either prior to or just after HCP implementation begins. Beginning July 1, 2021, ODF will modify their timber harvest bid specifications and contracts to allow timber operators who harvest after HCP permit issuance (expected in 2022) to harvest either (1) under requirements pre-HCP to avoid take of listed species or (2) under the new requirements of the HCP, as applicable to each timber sale. If a timber operator chooses to harvest consistent with the requirements of the HCP, it will be the responsibility of the timber operator to comply with the HCP and permits, with assistance from and approval by ODF.

ODF retains the responsibility for ensuring that all covered activities are carried out in compliance with the HCP. ODF will also retain the right and ability to field-verify implementation of any timber sale to ensure its compliance with the HCP and any additional terms and conditions of the ITPs.

8.7 Decision Making in Implementation

As described in this chapter, ODF is responsible for day-to-day implementation of this HCP. ODF will be making almost all decisions related to HCP implementation within the authority provided to them by USFWS and NOAA Fisheries through the ITPs.[1] ODF will coordinate regularly with USFWS and NOAA Fisheries on HCP implementation to ensure that any issues that arise are addressed quickly and with the input of USFWS and NOAA Fisheries. In rare instances, ODF may need to deviate from the HCP requirements for practical reasons that cannot be predicted over the 70-year timeframe. In those instances, ODF, USFWS, and NOAA Fisheries will confer to discuss and reach agreement on those deviations. In those rare instances where an agreement cannot be reached, a formal *dispute resolution process* is available, as described below.

8.7.1 Dispute Resolution

ODF intends that disputes arising from HCP implementation be resolved as expeditiously and informally as possible. This may be done at any management level, including at a level higher than

[1] Some decisions will be the responsibility of USFWS or NOAA Fisheries, such as whether to approve or deny a request for an HCP amendment (e.g., see Section 8.8.2, *Amendments*).

the persons directly responsible for administration of the HCP. In addition, ODF may agree to utilize a jointly selected mediator or arbitrator to resolve dispute short of litigation. Agreement will be sought by all parties engaged in dispute resolution. Each party shall implement promptly all final agreements reached through the dispute resolution procedures, consistent with the party's applicable statutory and regulatory responsibilities.

8.8 Modifications to the HCP

The HCP and associated ITP may be modified in accordance with the Endangered Species Act (ESA), USFWS and NOAA Fisheries implementing regulations, and the provisions outlined in this section. HCP or permit modifications are expected to be rare. Modifications to the HCP or ITPs may be requested by either ODF, USFWS, or NOAA Fisheries. USFWS or NOAA Fisheries also may amend their permit at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 Code of Federal Regulations (CFR) Section 13.23(b) and the No Surprises assurances described in Chapter 7. HCP modifications are considered either an administrative change or an amendment, as described below.

8.8.1 Administrative Changes

Administrative changes are minor internal changes or corrections to the HCP that may be made by ODF, at their own initiative, or approved by ODF in response to a written request submitted by USFWS or NOAA Fisheries. Requests from USFWS or NOAA Fisheries will include an explanation of the reason for the change as well as any supporting documentation.

Administrative changes to the HCP must be consistent with the scope of the analysis in the HCP and the original National Environmental Policy Act (NEPA) document. Administrative changes will address small errors, omissions, or language that may be too general or too specific for practical application. Administrative changes can be made by ODF alone and do not require approval by USFWS and NOAA Fisheries. However, ODF must notify USFWS and NOAA Fisheries of administrative changes made and the reasons for each change.

Examples of administrative changes to the HCP are as follows.

- Corrections of typographical, grammatical, and similar editing errors that do not change the intended meaning or obligations.
- Corrections of any minor errors in maps or exhibits.
- Corrections of any maps, tables, or appendices in the HCP to reflect approved amendments (Section 8.8.2) to the HCP or incidental take permit.
- Changes in the extent of ODF managed lands that are inside of the plan area and where the new extent of ODF managed lands allows for the full implementation of the conservation strategy as described in the HCP and ITPs. These changes could include land transfers, land sales, or land purchases consistent with the plan area boundary described in Chapter 1.
- Minor adjustments to conservation actions in order to more effectively and efficiently implement the action as long as that change is consistent with its intent and with the same or improved likelihood of achievement of biological objectives.

- Clarifications of implementation where the HCP was vague or internally inconsistent.

8.8.2 Amendments

Changes to the HCP or ITPs that do not qualify for an administrative change can be accomplished through an amendment requested by ODF. Once an amendment is requested by ODF, USFWS and NOAA Fisheries will decide the level of review needed to satisfy ESA, NEPA, and other regulatory requirements. HCP amendments require written approval by USFWS and NOAA Fisheries.

Depending on their scope and effects, amendments to the HCP can be approved by USFWS and NOAA Fisheries through an exchange of formal correspondence, addendum to the HCP, revision to the HCP, or a formal permit amendment. Substantial changes would likely require a formal amendment to the HCP and relevant permit, which would include a *Federal Register* notice and review to ensure NEPA compliance for the amendment. Examples of changes that would require an amendment include, but are not limited to, the following actions.

- Addition or deletion of covered species.
- Increase in the allowable take limit for existing covered activities or the addition of new covered activities.
- Modifications of any important action or component of the conservation strategy under the HCP that may substantially affect levels of authorized take, effects of the covered activities, or the nature or scope of the conservation strategy.
- Changes in the extent of ODF managed lands that would remove lands from the permit area that were deemed essential for the full implementation of the conservation strategy, as described in the HCP. The amendment would include a revision to the conservation strategy, and possibly the authorized level of take, that is practicable considering the new extent of ODF managed lands.
- Changes in the extent of ODF managed lands to add any lands outside of the plan area.

8.9 Permit Suspension or Revocation

The USFWS and NOAA Fisheries have the ability under federal law to suspend or revoke all or a portion of the permits if ODF is out of compliance with the HCP or ITPs. USFWS and NOAA Fisheries each have the ability to suspend or revoke all or a portion of the Section 10(a)(1)(B) permit it issues if continuation of covered activities would appreciably reduce the likelihood of the survival and recovery of a covered species in the wild (50 CFR 17.22(b)(8), 17.32(b)(8)) or if ODF does not comply with the conditions of their permits (50 CFR 13.27, 13.28).

If the Permit is revoked, ODF will have to fulfill all outstanding mitigation requirements for any take impacts that occurred prior to the revocation, including land management actions and restoration/enhancement actions. For example, if ODF had removed more modeled habitat for covered species than they had created through management to that point, they would need to continue to manage HCAs or RCAs consistent with the HCP and ITPs until that deficient was reduced and the habitat loss was offset.

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Chapter 9
Costs and Funding

9.1 Introduction

The Endangered Species Act (ESA) requires that habitat conservation plans specify, "the funding that will be available to implement" conservation actions that minimize and mitigate impacts on covered species (16 United States Code [U.S.C.] 1539(a)(2)(A)). The ESA also requires the U.S. Fish and Wildlife Service (USFWS) and the National Atmospheric and Oceanic Administration (NOAA) Fisheries to find that the applicant will ensure that adequate funding is available to implement the Western Oregon State Forest Habitat Conservation Plan (HCP). This chapter outlines the estimated costs to implement the HCP over the proposed 70-year permit term and provides assurances that the Oregon Department of Forestry (ODF) will pay for those costs.

9.2 Implementation Costs

As described in Chapter 8, *Plan Implementation*, ODF staff will oversee implementation of the HCP. Staff includes administrators, data analysts and other natural resource specialists who will carry out the conservation strategy, monitoring, adaptive management, and coordination with USFWS and NOAA Fisheries. The cost to implement the HCP is divided into five categories, summarized in the following subsections. All estimated costs are expressed in 2021 dollars.

- Plan Administration and Staffing
- Conservation Strategy
- Monitoring
- Adaptive Management
- Remedial Measures for Changed Circumstances

All costs were estimated based on cost estimates provided by ODF staff for the same or similar actions conducted currently. In cases where actual ODF cost data was unavailable (e.g., HCP costs that are new), costs were estimated based on similar actions conducted by other entities in the state, or with data from comparable HCPs in other states.

It is important to note that these cost estimates are planning-level estimates only for the purpose of demonstrating assured funding for the HCP. ODF will prepare an annual budget to implement the HCP that may differ from these cost estimates (either more or less). These cost estimates are not requirements of funds ODF must spend, but rather reasonable estimates of total HCP costs over the entire permit term.

The implementation costs outlined in this section are expressed in 2021 dollars. These costs are not adjusted for inflation because funding is expected to increase at the same rate as costs are expected to increase due to inflation. All revenue sources that fund ODF operations, including HCP implementation, are reevaluated each year and adjusted for inflation, as necessary. This is discussed further in Section 9.4, *Implementation Funding*.

Details on cost assumptions and calculations are found in Appendix G, *Cost Model*.

9.2.1 Plan Administration and Staffing

Program administration involves ongoing or yearly costs associated with staff time for coordination, agency meetings, activity tracking, and reporting. The HCP administrator, staffed by ODF, will be responsible for oversight of all administration including contract management and leading coordination efforts with USFWS and NOAA Fisheries. A data analyst will maintain and update a database(s) of spatial data necessary for tracking covered activities and conservation actions. The HCP conservation program will be overseen by a half-time supervising biologist and implemented by two full-time staff biologists. Other specialists will be involved in HCP implementation as needed but will average a total of one full-time position annually. See Section 8.2, *Implementation Roles and Responsibilities*, for more details on the roles and duties of these positions.

The costs of the supervising biologist, staff biologist, and other specialists are split between several cost categories to recognize their roles in HCP implementation (Table 9-1). Program administration costs are estimated to average $566,844 per year over the life of the permit (Table 9-2). It is expected that the actual staffing needs of the HCP program will vary seasonally and from year-to-year. For example, staffing costs during the first several years of HCP implementation are expected to be greater than costs at other times because of the need to establish new procedures and new data tracking systems, and when coordination with state and federal partners may be more extensive. This cost estimate therefore represents a long-term average of staffing needs and costs used only for the purposes of the HCP cost estimate. ODF will provide staff and staff time necessary at all times to properly implement the HCP.

Table 9-1. HCP Staffing Assumptions

Labor Category	FTEs	Years Needed	Cost Category
HCP Administrator	0.5	70	Plan Administration
Data Analyst	0.3	70	Conservation Strategy
Staff Biologist	1.0	70	Conservation Strategy (50%) Monitoring (50%)
Field Biologist	2.0	70	Conservation Strategy (50%) Monitoring (50%)
Other Specialists	1.0	70	Plan Administration (25%) Conservation Strategy (75%)

FTE = full-time employee

Table 9-2. Estimated ODF Staff Time and Costs During Permit Term (2021 dollars)

Labor Category	FTEs	Monthly Salary + OPE (FY 2021)	Average Annual Cost Today	Total Cost Over 70 Years
HCP Administrator	0.5	$12,322	$73,933	$5,175,310
Data Analyst	0.3	$9,934	$35,761	$2,503,270
Staff Biologist	1.0	$8,404	$100,846	$7,059,220
Field Biologist	2.0	$7,300	$175,200	$12,264,000
Other Specialists	1.0	$9,277	$111,318	$7,792,260
Total	**4.8**	**$47,237**	**$566,844**	**$39,679,080**

OPE = Other Payroll Expense; FY = fiscal year

9.2.2 Conservation Strategy

As stated in Chapter 4, *Conservation Strategy*, the conservation program implements the biological goals and objectives and fulfills the HCP requirement to avoid, minimize, and mitigate impacts of the taking to the maximum extent practicable. Costs associated with the conservation strategy include the following conservation measures:

1. Aquatic restoration activities (e.g., in-stream wood enhancement projects, fish barrier removals).
2. Upland restoration activities (e.g., treatment of stands with Swiss needle cast; converting stands to higher quality covered species habitat).
3. Strategic terrestrial species conservation strategies.

HCP staff will implement the conservation strategy by overseeing each of the conservation measures, including designing and implementing mitigation actions, as well as overseeing implementation of avoidance and minimization measures. ODF staff expected to support the conservation strategy are listed in Table 9-1.

Within each category, the levels of annual funding necessary to implement conservation actions under the conservation fund are estimated based on historical patterns of likely future needs. These estimates are included merely to demonstrate that the average annual amount of funding of $1 million will more than adequately cover the costs of implementation. The annual estimates shown for each category are neither a maximum nor a minimum that will be spent each year, but an average. Year-to-year spending on conservation fund projects will vary based on the type of projects being implemented and their complexity that year. Levels of conservation spending will also be relative to the level of effect on covered species from covered activities. By linking the conservation fund to harvest volume there will inherently be more funding available in years of higher harvest, and thus potentially more effects on covered species.

9.2.2.1 Aquatic Restoration Activities

Section 4.7.3, *Conservation Action 3: Stream Enhancement,* describes stream enhancement activities that ODF will carry out during the permit term. These activities generally fall into three categories: wood enhancement projects, stream restoration projects, and fish barrier removal projects. ODF has implemented similar projects over the course of 23 years (1995–2018)—over 1,100 projects, with an average of 8 projects per year. During that time annual costs of aquatic restoration projects varied between $28,000 and $900,000, with an average annual cost of $310,000/year. These ODF costs were combined with funding from other agencies and grant sources to implement the restoration projects. Under the HCP, the assumption is that the level and type of restoration activities will be similar to what has been done in the past, with a slight increase to account for additional reporting needed under the HCP. It is estimated that ODF will spend, on average, $325,000 annually during the permit term on aquatic restoration activities, and a total of $22,750,000 over the permit term.

9.2.2.2 Upland Restoration Activities

ODF will be investing in upland restoration activities that will benefit covered species inside of HCAs. These activities will primarily include harvest of stands that have marginal habitat suitability or are not currently suitable and that are unlikely to develop into better habitat during the permit term. Typically this occurs when a stand is stunted (e.g., infected by Swiss needle cast) or otherwise not suitable for covered species (e.g., hardwood-dominated stands).

Conservation Fund dollars will not be spent to subsidize or otherwise pay for harvest of these stands. The Conservation Fund will be utilized to pay for reforestation activities needed to establish healthy forests that will grow into covered species habitat over time. ODF will manage 600 acres of stands like this annually (on average) during the permit term at an average reforestation cost of $400/acre, resulting in an annual average reforestation cost of $240,000/year. These activities are largely expected to occur during the first 25 years of the permit term so that they can contribute to covered species habitat value before the end of the 70-year permit term. Reforestation of covered species habitat in HCAs will cost approximately $6,000,000 over that time period.

9.2.2.3 Contribution to Strategic Terrestrial Species Conservation Action

Section 4.7.9, *Conservation Action 9: Strategic Terrestrial Species Conservation Actions*, outlines ODF's commitment to contributing funds to address strategic conservation actions for terrestrial covered species. At any point during the permit term priorities for strategies that are most important may change, but the intention is to use the conservation fund to address key issues or constraints that were limiting the effectiveness of the remainder of the conservation strategy described in the HCP. The conservation strategy will result in an increase in habitat for all of the terrestrial covered species, but if there are other factors that limit the ability of covered species to take advantage of the new habitat, this fund could be used to address those limiting factors.

For example, regardless of the amount and type of habitat that is in the permit area barred owls continue to stress northern spotted owl populations. One potential use of the fund would be to establish and/or support regional barred owl removal projects/programs. ODF could work in concert with regional partners, including the Oregon Department of Fish and Wildlife (ODFW), USFWS, Bureau of Land Management (BLM), and U.S. Forest Service (USFS) to conduct barred owl removal across private, state, and federal lands. Additionally, at some point in the future, provided barred owl removal can be successful, there may be interest in reintroducing northern spotted owls onto Oregon forests or creating a captive breeding program to boost owl numbers in western Oregon. The HCAs would be possible locations for those releases, and ODF could partner with other organizations and agencies to create such a program. Finally, one of the limiting factors for red tree vole, Oregon slender salamander, and coastal marten is a lack of understanding of population stressors and in some cases a basic understand of how species use habitat on state lands and what conservation actions are likely to be most successful. Conservation funds could be used to strategically address research questions needed to more effectively execute the conservation strategy over time for these species.

ODF's contribution to strategic terrestrial species conservation actions will be an average annual contribution of $250,000. This money will most likely be spent during the first 20 years of HCP implementation in order to increase the effectiveness of the terrestrial conservation strategies generally. However, the timing of the expenditure of these dollars will be dependent on the need and opportunities presented by regional partners. The activities discussed above are just examples of the type of programs or projects that could be implemented; others will likely be identified during implementation. These activities are not defined in more detail in the HCP because the need and efficacy of them is not known at this time, but ODF will continue to explore these activities in collaboration with USFWS, NOAA Fisheries, BLM, USFS, and ODFW during HCP implementation.

9.2.3 Monitoring and Adaptive Management

9.2.3.1 Monitoring Actions

The HCP monitoring program is described in Chapter 6, *Monitoring and Adaptive Management*. Monitoring the outcomes of conservation measures is the foundation of the HCP's conservation program and adaptive management approach, and can help advance scientific understanding to better achieve the HCP's biological goals and objectives. The monitoring actions will result in the costs shown in Table 9-3.

Table 9-3. Estimated Costs of Monitoring Actions Annually and During the Permit Term

	Estimated Cost	Frequency	Total for 70-year Permit Term	Average Annual Cost
Contribution to ODFW Aquatic Inventory Program[a]	$200,000	Annual	$14,000,000	$200,000
Terrestrial species monitoring	$1,500,000	Annual	$105,000,000	$1,500,000
Aquatic restoration monitoring	Included in costs estimates for restoration projects	--	--	--
Upland restoration monitoring	Included in costs allocated to conservation fund			
Barred owl management effectiveness monitoring	Included in costs for barred owl management program	--	--	--
Total cost of monitoring program	**$1,700,000**	**--**	**$119,000,000**	**$1,700,000**
Estimated cost of adaptive management (10% of total)	$170,000	--	$11,900,000	$170,000

[a] The ODFW AIP includes monitoring for stream temperature, sediment, and large woody debris.

9.2.3.2 Adaptive Management

Chapter 6 describes the processes for addressing the specific uncertainties associated with the conservation strategy, and the adaptive management measures and potential responses associated with those measures. Proposed adaptive management triggers, and measures that are likely to be implemented to address necessary program changes, must be documented up front so ODF will know when and how to respond to monitoring results. The costs are shown in Table 9-3. Costs for adaptive management are included as a 10% contingency on all monitoring actions. This funding will be accessed if the monitoring program demonstrates a need to change conservation actions to better address covered species needs. This would be funded out of the State Forest Reserve Fund (Section 9.4.1.2, *Reserve Fund Balance*).

9.2.4 Remedial Measures for Changed Circumstances

Section 7.3, *Changed and Unforeseen Circumstances,* describes the actions and remedial measures associated with anticipated and possible circumstances that could change during implementation and that may affect the status of the covered species. Remedial measures may also be necessary if foreseeable changes occur that may alter the assumptions or information upon which the HCP is based (see Chapter 7, *Assurances*, for a description of changed circumstances). The cost of remedial measures is calculated as 5% of the cost of the conservation strategy. This cost is included as a contingency in the total cost estimate. This funding will be accessed if changed circumstances do occur and need to be addressed. This would be funded out of the State Forest Reserve Fund (Section 9.4.1.2).

9.3 Total HCP Program Costs

Table 9-4 summarizes all costs for the HCP program over a 70-year permit term. Details for each cost category can be found in Section 9.2, *Implementation Costs*.

Table 9-4. Total Costs for the Western Oregon State Forest HCP

Cost Category	Annual Cost	Cost Over 70-Year Permit Term
HCP Administration	$101,763	$7,123,410
Conservation Strategy	$1,257,273[a]	$88,009,110
Monitoring	$1,838,023[b]	$128,661,610
Adaptive Management	$183,802[c]	$12,866,140
Remedial Measures	$62,864[d]	$4,400,480
Total	**$3,443,725**	**$241,060,750**

[a] Costs consist of $1,000,000/year for the Conservation Fund and $257,273/year for staff to oversee and implement the conservation strategy.

[b] Costs consist of $138,023 for staff time to oversee the monitoring program and summarize and report results, plus $1,700,000 to fund the monitoring activities.

[c] Costs are estimated to be 10% of monitoring costs over the permit term.

[d] Costs are estimated to be 5% of the cost of the conservation strategy over the permit term.

9.4 Implementation Funding

This HCP will be implemented by the State Forests Division of ODF. The State Forests Division is responsible for the management of all state forestlands, including those owned by the Board of Forestry. The State Forests Division of ODF also manages the Common School Forest Lands owned by the Department of State Lands and covered by this HCP (see Sections 1.2.1, *Plan Area,* and 1.2.2, *Permit Area,* for details).

The State Forests Division of ODF is unique within ODF and other state agencies in that almost 100% of its revenue comes from timber sales on state forestlands. In some years, the State Forests Division obtains small amounts of state General Fund money for supplemental capital expenditures such as land acquisition or debt service on past acquisitions. The State Forests Division also supplements its own funds with limited federal matching grants for special projects such as riparian and stream restoration.

Despite this unique external funding source the State Forests Division must still request an annual budget and get it approved by the Legislature and signed by the Governor. Budgeting for state forests is accomplished by a biennial budget process. Biennial budgets are prepared every 2 years for a 2-year period and submitted to the Oregon Legislature through the Governor's Office for legislative approval. ODF prepares a balance budget to ensure expected revenue covers anticipated expenses. Biennial budgets provide spending authorization for the State Forests Division to spend money over the 2-year period on Forest Management Plan (FMP) implementation, of which HCP implementation is a part.

On Board of Forestry Lands, current state law[1] mandates that 63.75% of the gross revenues is returned to the county and local taxing districts where the revenue was generated. The remaining 36.25% is used by the State Forests Division for state forestland management to implement all aspects of Greatest Permanent Value, which will include almost all HCP implementation. The next section describes the sources and history of timber sales and other revenue to the State Forest Division.

9.4.1 Revenue to State Forest Division

Timber sales are, by far, the largest revenue source to the State Forests Division and are expected to remain so for the foreseeable future (Table 9-5). More details on timber sale revenue are provided in Section 9.4.1.1.

The State Forests Division occasionally receives a small amount of funding from the State General Fund for one-time capital expenditures such as land transfers or acquisitions. Federal funds to the State Forests Division are provided in the form of competitive grant awards, including for stream restoration projects (see section below for more details). Recreational fee revenues are currently only 1% of the revenue to the State Forests Division but are expected to increase as facilities are upgraded or added and as the population grows. Alternative revenue sources continue to be examined but are currently not considered viable for planning purposes. Therefore, only current revenue sources are considered available to support HCP implementation. Each of these revenue sources is discussed further below.

[1] Oregon Revised Statute 530.110.

Table 9-5. Revenue Sources to the State Forest Division

Revenue Source	Biennial Budget for State Forest Division (2 years)[a] 2015–2017 Biennial Actual Revenue	2017–2019 Approved Budget	2019–2021 Legislative Adopted Budget
State General Fund	$ 0	$ 0	$200,000 (<1%)
Federal Funds	$3,041,880 (4%)	$ 878,085 (1%)	$909,381 (<1%)
Recreational Fees	$1,221,747 (1%)	$1,254,042 (1%)	$1,591,857 (1%)
Timber Sales	$80,792,866 (95%)	$91,716,648 (98%)	$106,513,000 (98%)
TOTAL	**$85,056,493 (100%)**	**$93,848,775 (100%)**	**$109,214,238 (100%)**

[a] Source: ODF

9.4.1.1 Timber Sale Revenue

Since 1949 ODF has been harvesting timber and selling timber through timber sale contracts. The Board of Forestry Land base has continued to increase since 1949. The State Forests Division's mission has not changed and continues to provide a full range of economic, environmental, and social benefits. A summary of timber sale revenue to the State Forests Division from 2000–2019 is shown in Table 9-6. Revenue generated is largely due to changes in timber prices. The variations in timber prices from 2000–2019 are shown in Table 9-7.

Timber sales are sold annually to the highest bidder. Bids reflect current market conditions. ODF's operating costs are adjusted to ensure a target fund balance. Annual operating cost are adjusted to align with expected revenue whenever possible; in severe market downturns ODF strives to reduce expenditures to minimize deficit spending out of the operational reserve and investment account. The FMP has levels of implementation that allows for budget fluctuations though all market conditions.

Table 9-6. Revenue Sources to the State Forest Division (2000–2019)

Fiscal Year	Dollars	Fiscal Year	Dollars
2019	$53,819,957	2009	$24,217,089
2018	$47,174,928	2008	$29,319,099
2017	$34,914,595	2007	$33,000,415
2016	$34,748,095	2006	$33,761,492
2015	$31,958,423	2005	$27,985,988
2014	$27,679,219	2004	$27,400,765
2013	$26,976,098	2003	$26,314,199
2012	$21,409,368	2002	$25,053,874
2011	$21,787,543	2001	$24,159,544
2010	$24,467,207	2000	$27,177,101

Timber is a commodity, which is affected by goal market conditions. Oregon's state forests produce a high quality product, and the lumber manufacturing industry is well established in the Pacific Northwest. OSF gets high value for the trees it sells due to the quality and local marked demand. As with all commodities prices can fluctuate greatly from year to year, but over time continue to gain value in line with inflation (Table 9-7).

Table 9-7. Revenue Sources to the State Forest Division (2000–2019)

Fiscal Year	Average Timber Sale Sold Stumpage Price/MBF (BOF)
2019	$419
2018	$536
2017	$397
2016	$382
2015	$366
2014	$391
2013	$336
2012	$309
2011	$315
2010	$257
2009	$211
2008	$250
2007	$348
2006	$365
2005	$361
2004	$277
2003	$284
2002	$306
2001	$308
2000	$347

MBF = 1,000 board feet; BOF = Board of Forestry

9.4.1.2 Reserve Fund Balance

ODF maintains a reserve fund balance to maintain operations, including HCP implementation, regardless of revenue generated from harvest and market conditions. ODF's reserve fund balance is currently $47.5 million. The target fund balance is 6–12 months of operating funds, and is based on historic trends over the past 20 years. Figure 9-1 shows the change in ODF's reserve fund balance from 2000–2020.

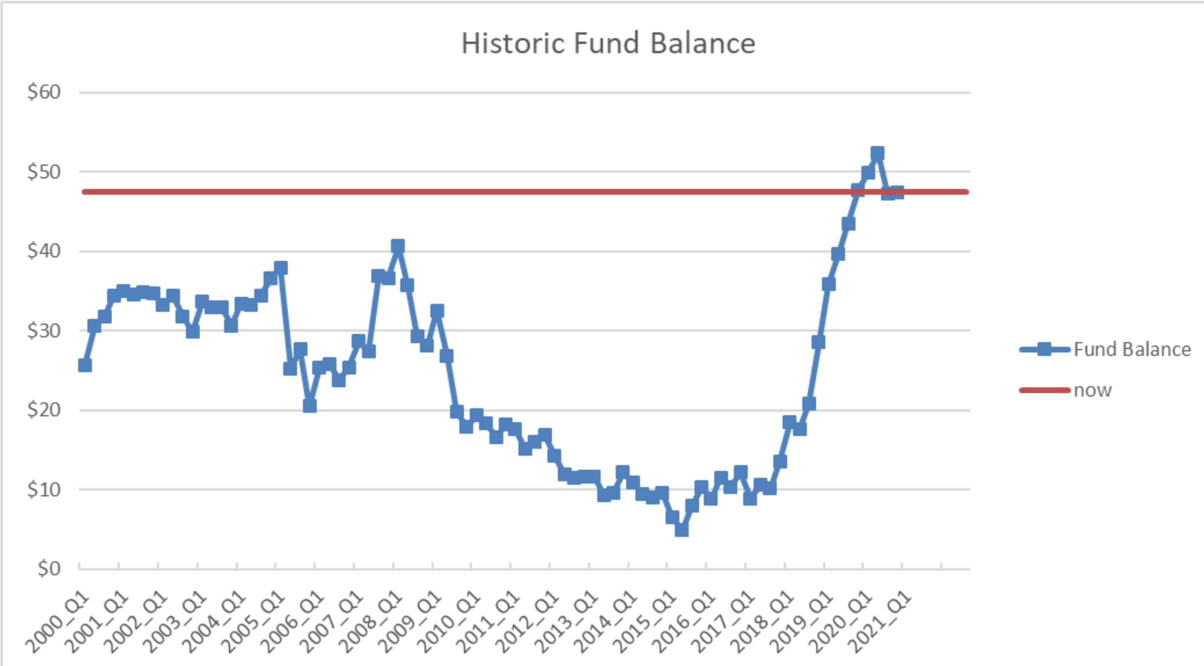

Figure 9-1. State Forest Division Reserve Fund Balance (2000–2020)

HCP Conservation Fund

Several conservation actions will be funded by ODF wholly or in part through an "HCP conservation fund" that will be established and maintained by a fixed proportion: $5 per 1,000 board feet (MBF) of all timber sold will be allocated to the HCP conservation fund. This amount will be adjusted every 5 years based on the consumer price index. This HCP conservation fund will be used to ensure implementation of the following conservation actions:

- Conservation Action 3: Stream Enhancement
- Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers
- Conservation Action 7: Manage Habitat Conservation Areas
- Conservation Action 9: Strategic Terrestrial Species Conservation Actions

Implementation of restoration projects and strategic terrestrial species conservation actions will vary over time. Funding these conservation actions through a dedicated HCP conservation fund will help to ensure that these projects can be implemented when their planning and any necessary site-specific permitting is complete. This approach also insulates these projects from fluctuations in timber harvest revenue as a result of stumpage price fluctuations or other decisions by ODF regarding the pace of timber sales. Funds will be expended from the HCP conservation fund consistent with the requirements of these conservation actions described in Chapter 4.

9.4.2 Funding Assurances

As a state governmental agency with expenditures approved biennially by the Legislature, ODF and the State Forests Division cannot guarantee the use of state funds, which are not yet appropriated by the Legislature, for the requirements set forth in the HCP over its entire permit term. However, as a commitment of this HCP, ODF will incorporate in its biennial budget request to the Legislature a budget sufficient to fulfill its obligations under this HCP, including all expected costs associated with the administration of the HCP, implementation of the conservation program, monitoring, reporting, adaptive management, changed circumstances, and contingency costs. Each biennial budget request will be adjusted for inflation of capital and operational costs, including salaries and benefits.

ODF will provide to USFWS and NOAA Fisheries evidence (1) of its biennial budget requests to the Legislature and (2) that the Legislature has appropriated sufficient funding to implement this HCP for the 2-year period. In addition, HCP commitments will be reflected in the dedication of staff resources through ODF's annual budget, adjusted for inflation, and documented in the HCP annual report. ODF recognizes that failure to annually ensure adequate funding to implement the HCP may be grounds for suspension or partial suspension of the incidental take permits until adequate funding is restored (see Section 8.9, *Permit Suspension or Revocation*, regarding this process).

ODF is confident that it can successfully fund HCP implementation, despite expected fluctuations in the timber market and consequently timber sale revenue. ODF and the HCP itself have safeguards in place to ensure flexibility in HCP implementation:

- Several of the key conservation actions have little or no direct cost associated with them because they involve land designations that forgo timber harvest to conserve, enhance, and restore suitable or occupied habitat for the covered species. Conservation Action 1: Establish Riparian Conservation Area, Conservation Action 5: Standards for Road Improvement and Vacating, and Conservation Action 6: Establish Habitat Conservation Areas are three examples.
- Several conservation actions will occur, in part, in conjunction with timber sales because of the operational efficiency that provides. For example, downed wood to supply Conservation Action 3: Stream Enhancement projects would come from nearby timber harvest activities. Similarly, Conservation Action 4: Remove or Modify Artificial Fish-Passage Barriers would tend to occur with timber harvest activities to ensure operational and cost efficiencies of using heavy equipment in the field. These conservation actions will therefore occur more often (or be more robust) when timber sales increase and less often (or less robust) when timber sales decrease. Fluctuations in timber sales may or may not be in response to timber markets, as explained below.
- Timber sales by ODF do not necessarily track the timber market. In years of depressed timber prices (stumpage price), for example, ODF maintains the level of timber sales necessary in order to maintain a target fund balance and continue to provide critical revenue to local communities and to protect timber jobs that rely on harvest in state forests. In years of high timber prices ODF may increase the level of timber sales, which increases revenue to the ODF operational reserve fund and provides additional benefits to local communities. Conservation actions tied to the amount and location of timber sales (Conservation Actions 3, 4, and 7) therefore may occur somewhat independently from timber market prices.
- Several conservation measures are designed so that they are insulated against fluctuations in the timber market and in timber harvest revenue. This conservation fund will be used when conservation projects are ready to be implemented. Funding for the following project types will come from the conservation fund:
    - Stream enhancement projects (Conservation Action 3)
    - Fish-passage barrier removal projects (Conservation Action 4)

  - Upland restoration projects (Conservation Action 7)
  - Strategic terrestrial species conservation actions (Conservation Action 9)
  - Research and other conservation activities
- ODF maintains substantial operational reserve funds to ensure a more consistent and stable revenue source in the face of fluctuating timber markets. For the last 20 years, ODF has maintained a reserve fund of approximately $4.5 to $52.3 million, with an average of $24.6 million. ODF intends to maintain similar reserves into the future. This reserve fund provides additional guarantees that HCP implementation costs can be paid for even during times of economic downturns.

Chapter 10
Alternatives to Take

[Note to Reader: *This chapter explores alternative projects or project scenarios that were considered that reduced or avoided take of listed species. This chapter is currently under development*.]

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Chapter 11
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Attachment A

Habitat Conservation Area Maps

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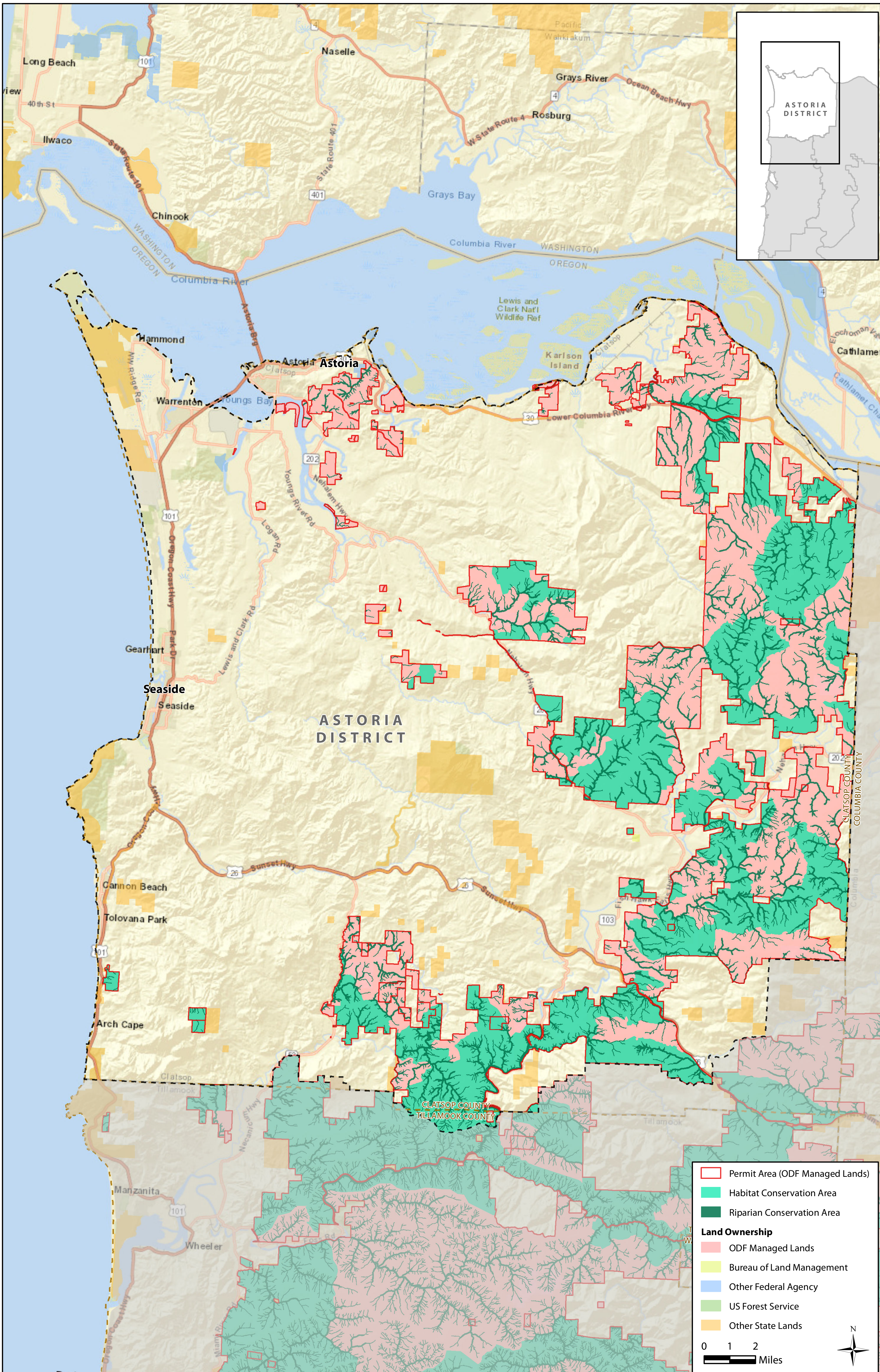
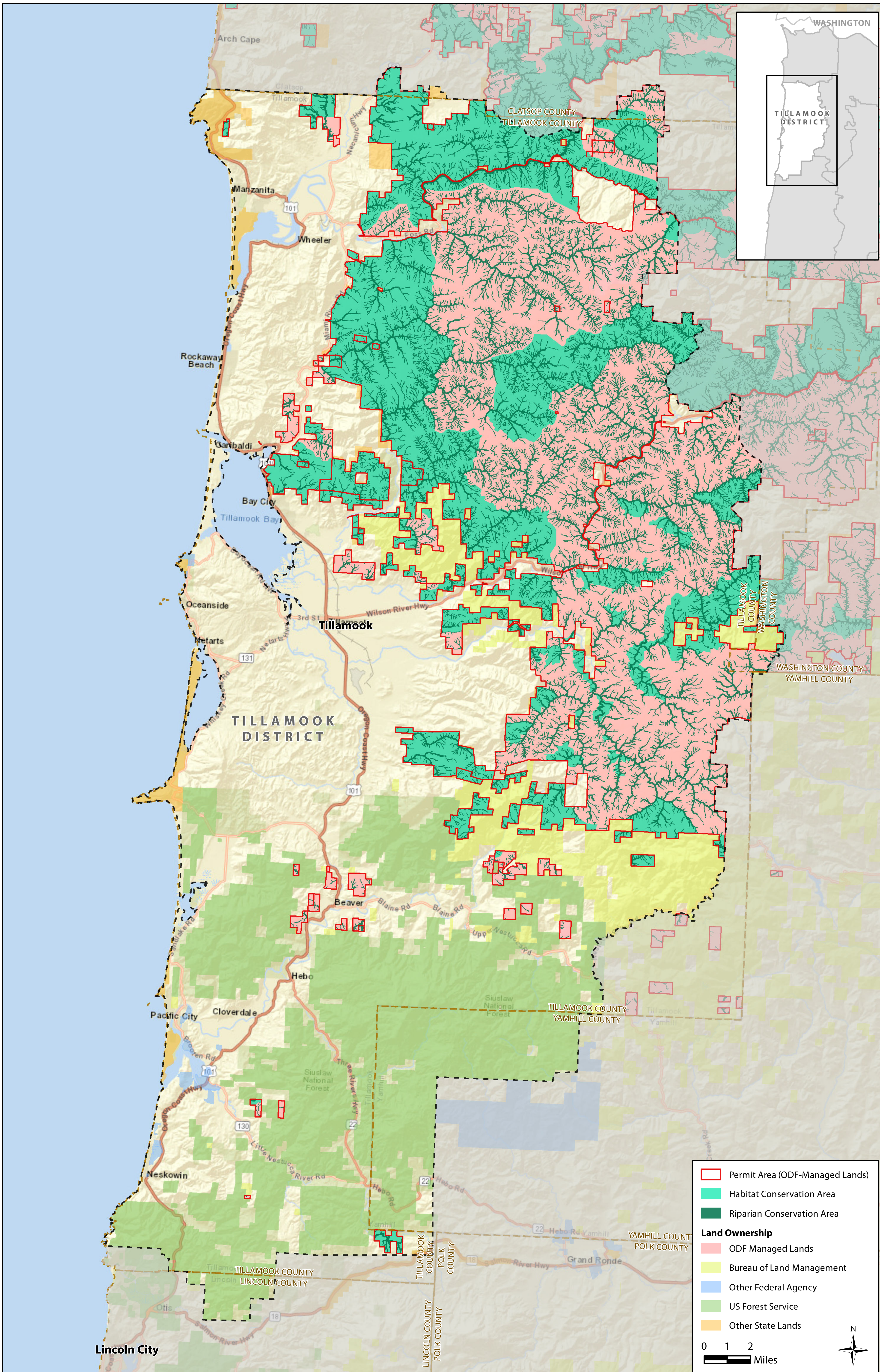


Western Oregon State Forest HCP – Habitat Conservation Areas, Astoria District



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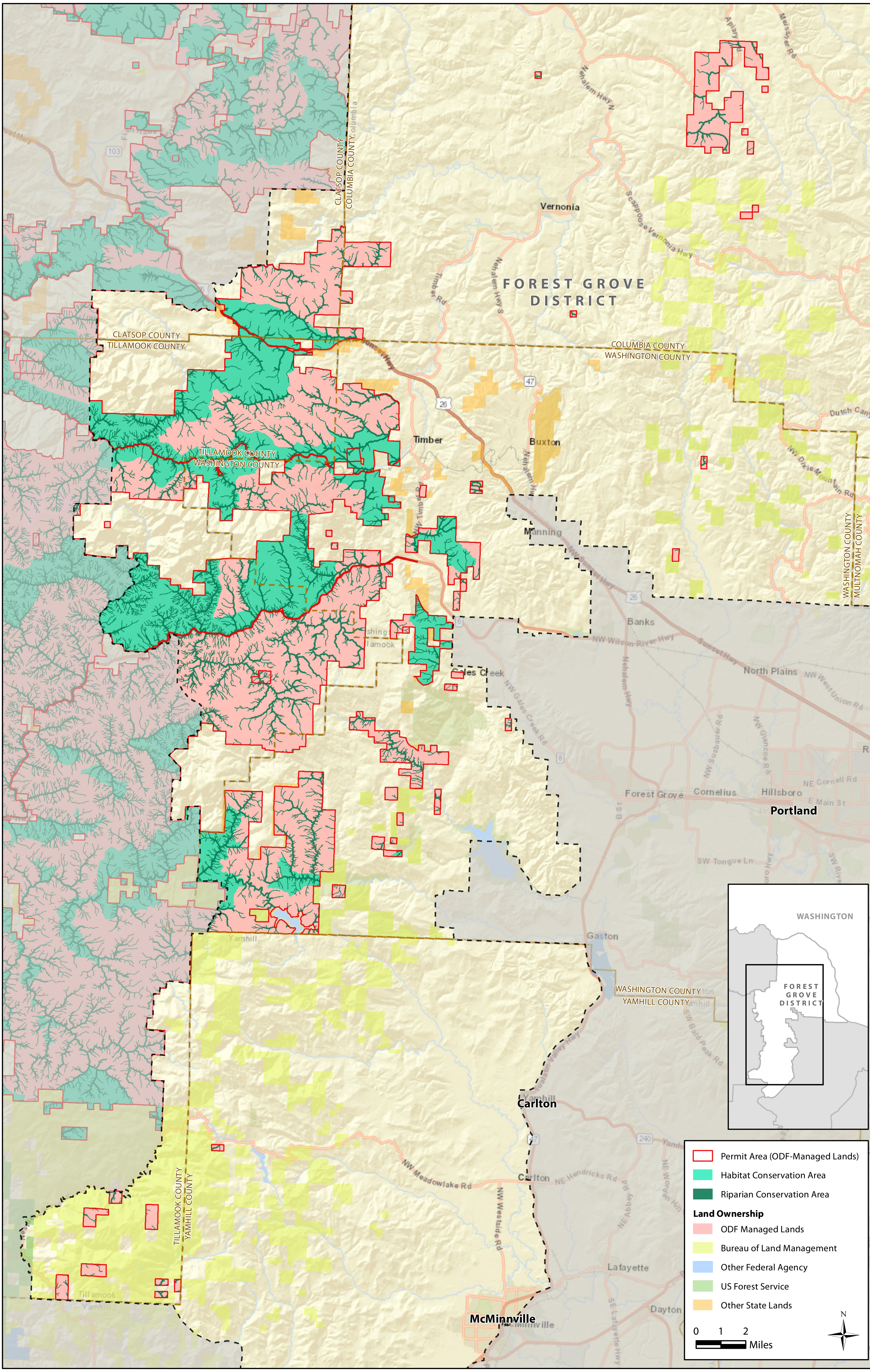
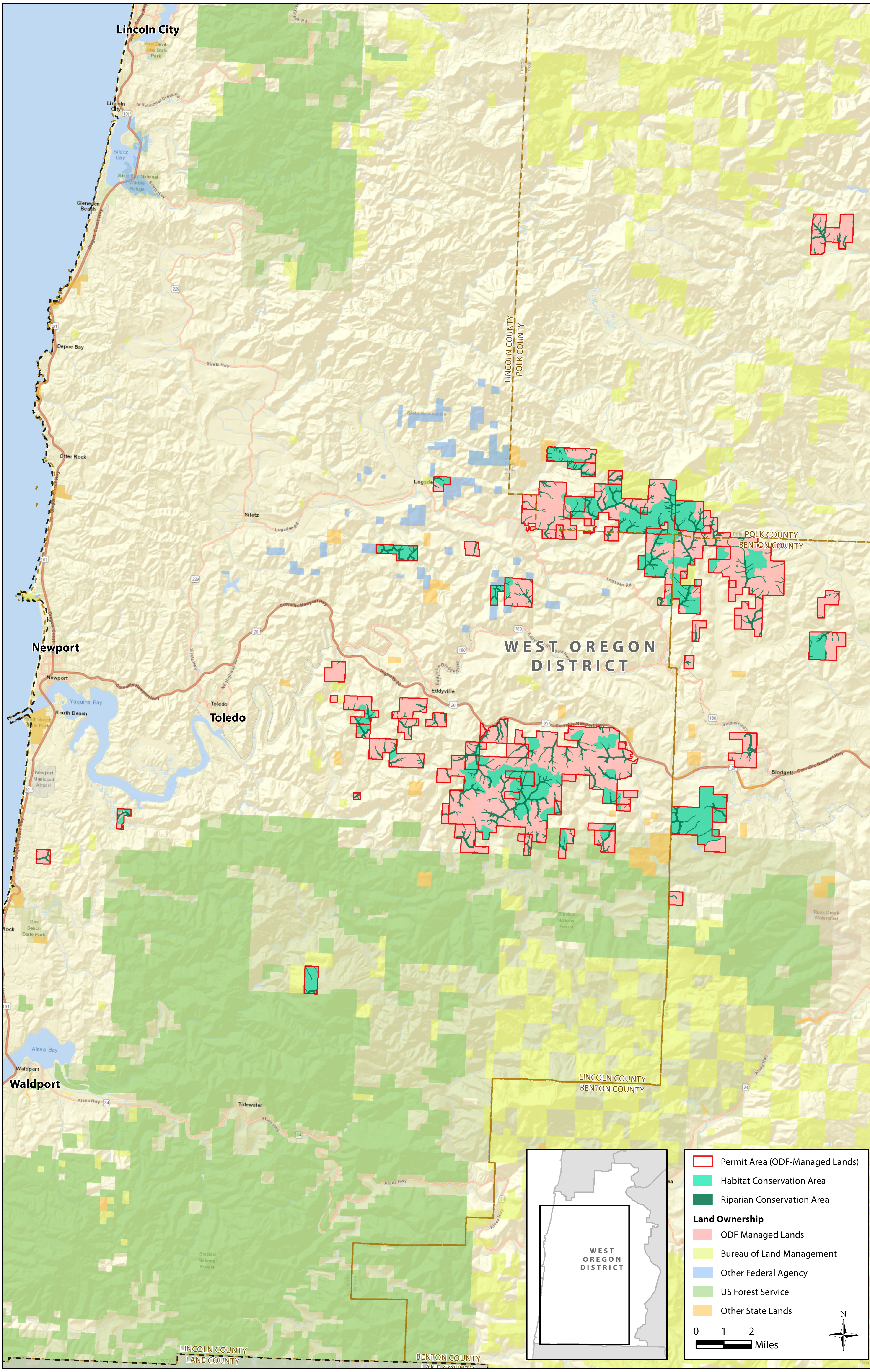


Western Oregon State Forest HCP – Habitat Conservation Areas, Forest Grove District



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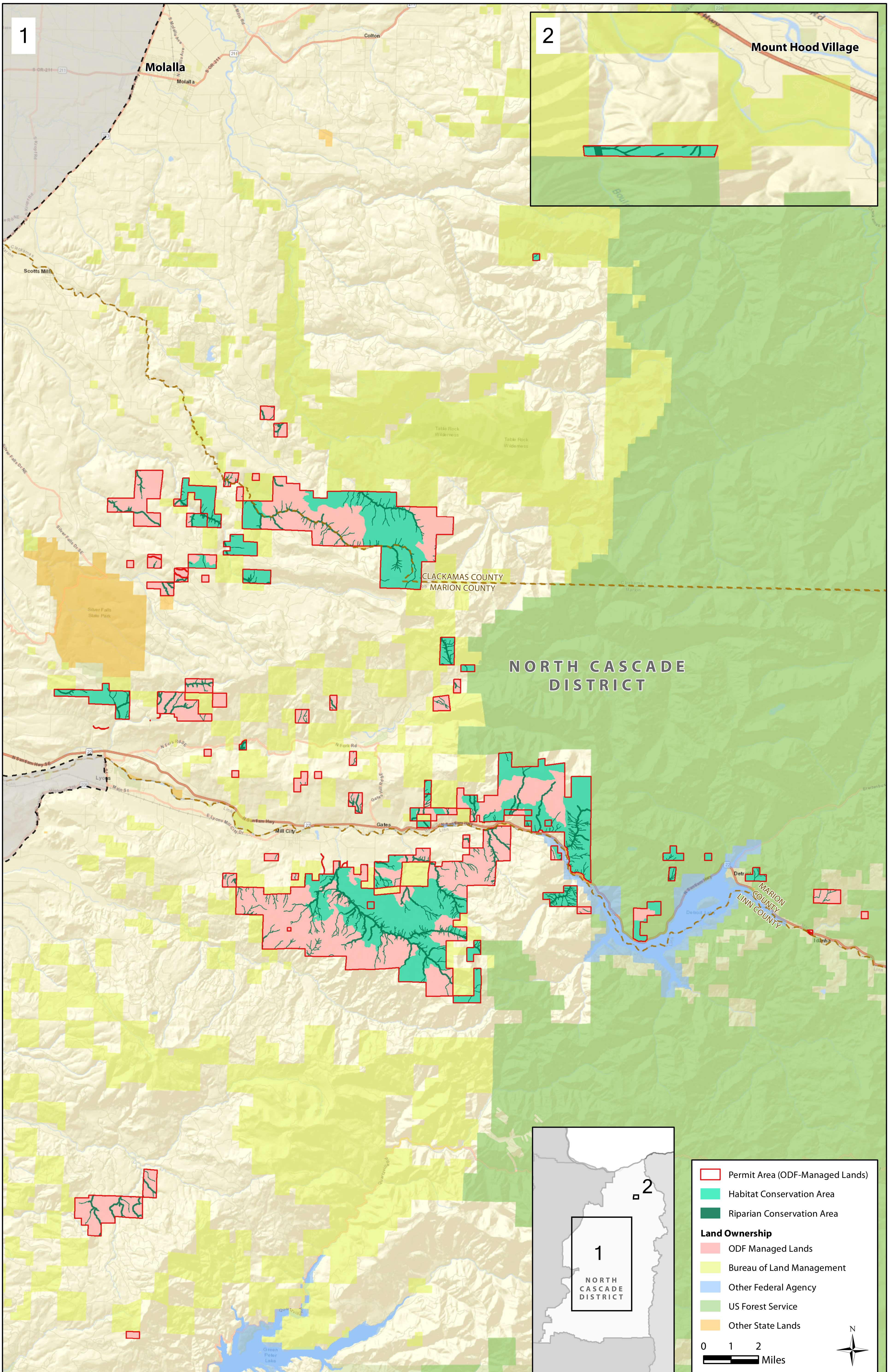
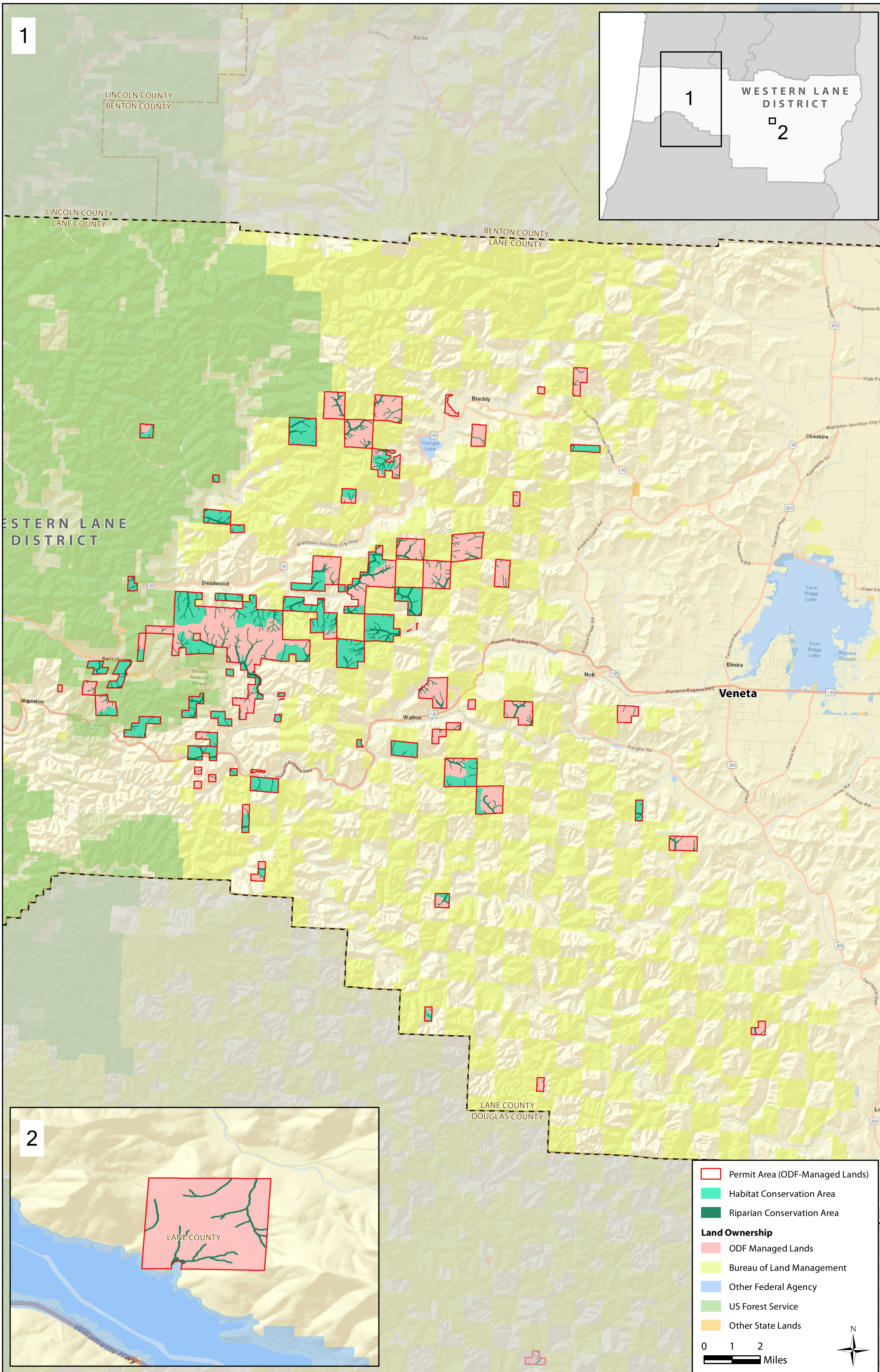
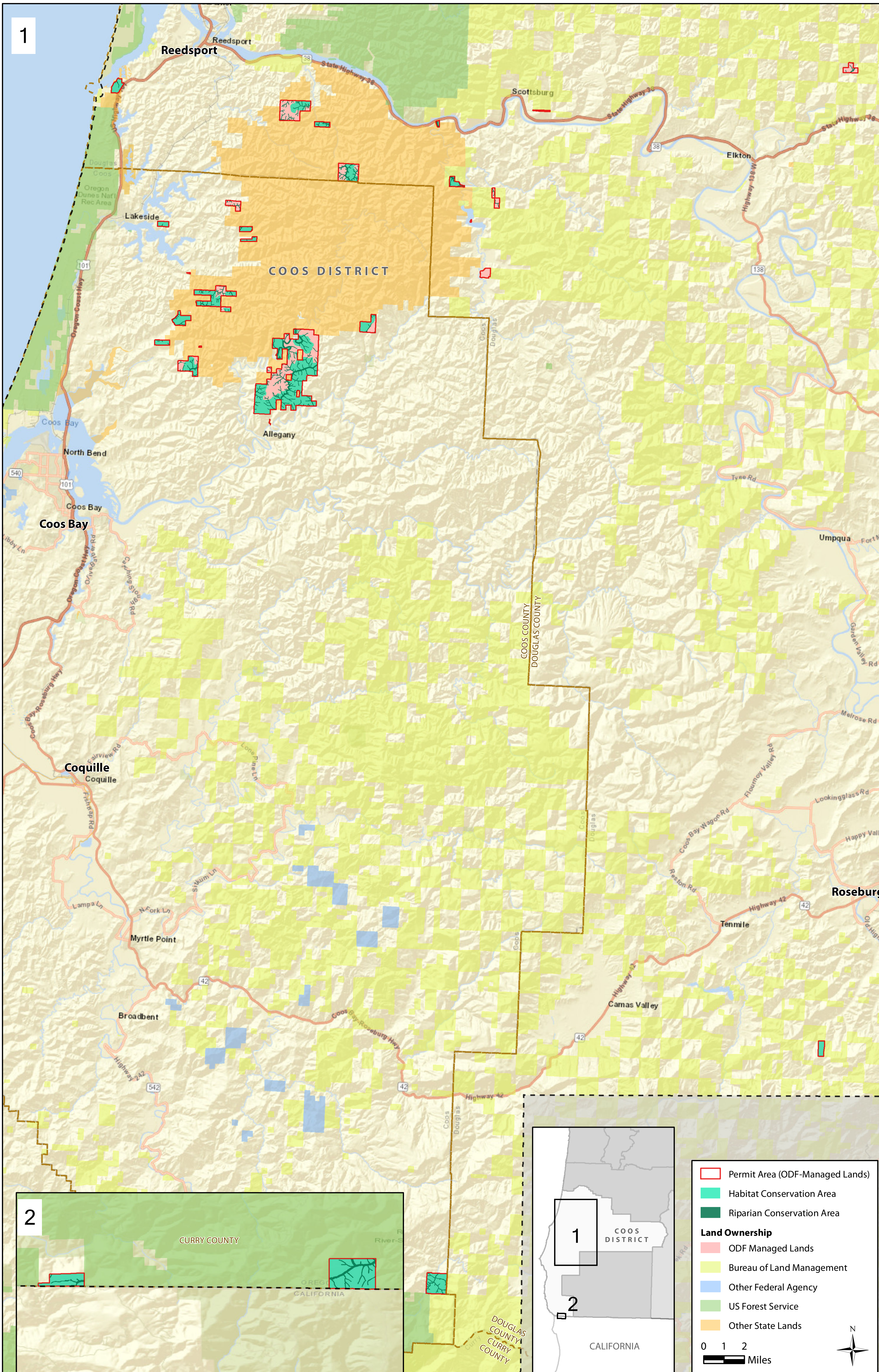
Western Oregon State Forest HCP – Habitat Conservation Areas, West Oregon District



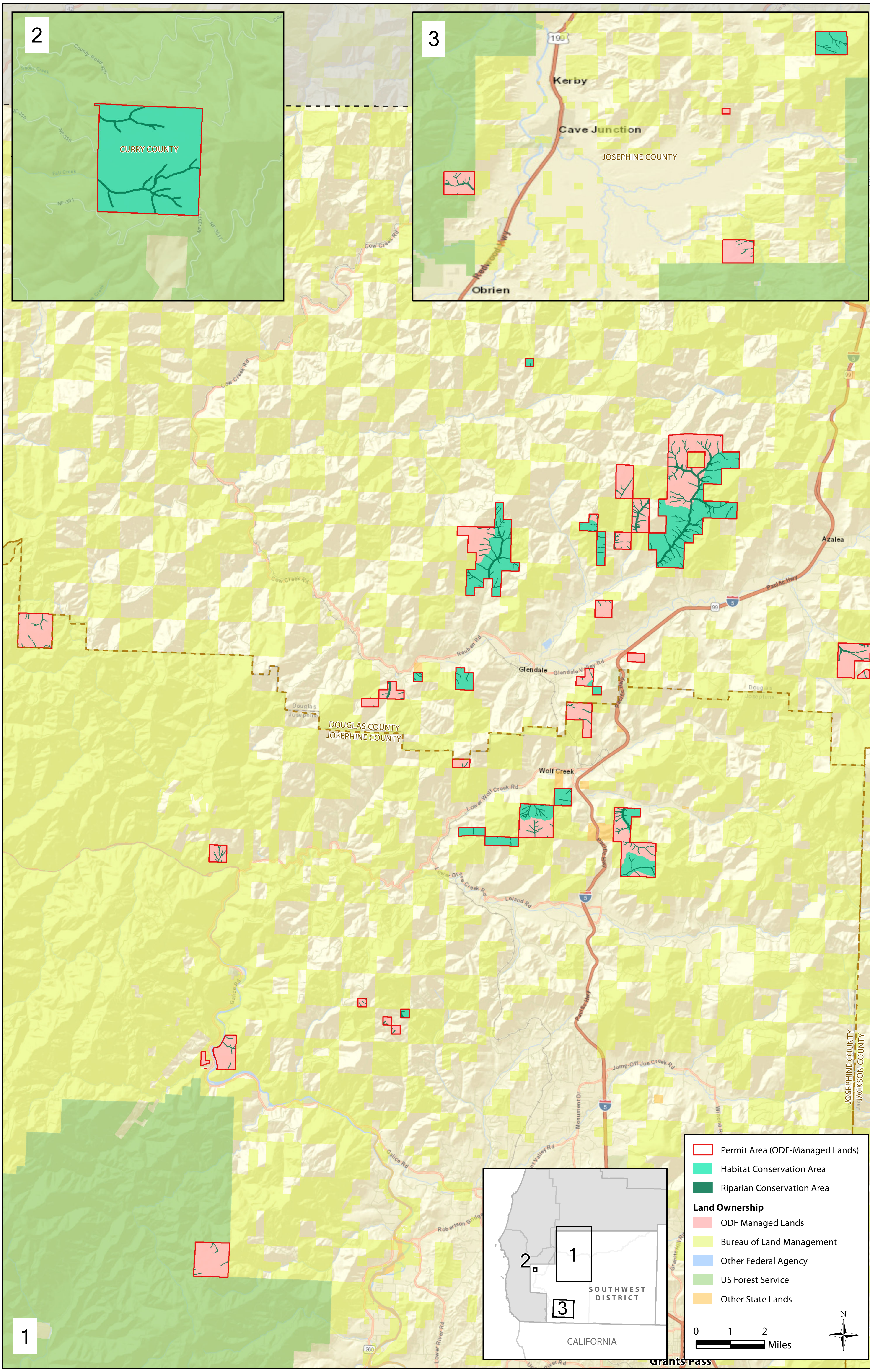
Western Oregon State Forest HCP – Habitat Conservation Areas, North Cascade District



Western Oregon State Forest HCP – Habitat Conservation Areas, Western Lane District



Western Oregon State Forest HCP – Habitat Conservation Areas, Coos District



2
CURRY COUNTY
3
Kerby
Cave Junction
JOSEPHINE COUNTY
Obrien
Azalea
Glendale
DOUGLAS COUNTY
JOSEPHINE COUNTY
Wolf Creek
JOSEPHINE COUNTY
JACKSON COUNTY
Grants Pass
1
SOUTHWEST DISTRICT
CALIFORNIA
Permit Area (ODF-Managed Lands)
Habitat Conservation Area
Riparian Conservation Area
Land Ownership
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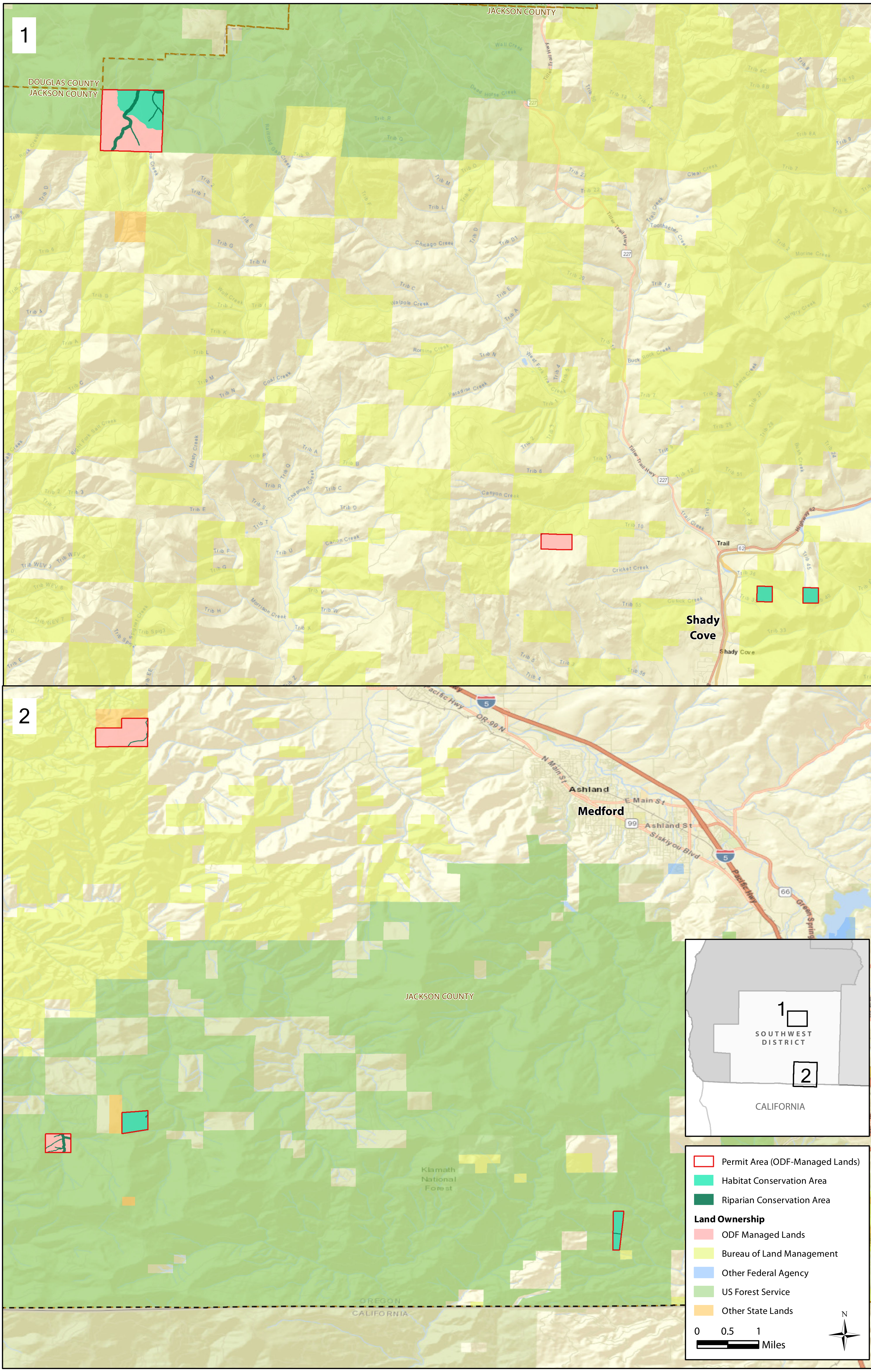

Western Oregon State Forest HCP – Habitat Conservation Areas, Southwest District, Page 2