STAFF REPORT

Agenda Item No.:	1
Work Plan:	Forest Resources Division
Topic:	Implementing Legislative Direction
Presentation Title:	Submission of the proposed draft Aquatic Habitat Conservation Plan for Private Forest Accord to the Services
Date of Presentation:	December 19, 2022
Contact Information:	Josh Barnard, Chief of Forest Resources Division, ODF, Josh.W.BARNARD@ODF.oregon.gov Jennifer Weikel, HCP Coordinator & Wildlife Biologist, Forest Resources Division, Jennifer.Weikel@ODF.Oregon.Gov

SUMMARY

This agenda item is for the Board of Forestry (Board) to direct the Oregon Department of Forestry (Department) to submit a proposed draft Aquatic Habitat Conservation Plan to the National Marine Fisheries Service and U.S. Fish and Wildlife Service (the Services) and pursue an incidental take permit to meet legislative requirements of Senate Bill 1501.

CONTEXT

In 2021, representatives from conservation and timber groups reached an agreement through mediated discussions known as the Private Forest Accord. Their report to the legislature included recommended changes to Oregon's forest practice laws and the completion of a Habitat Conservation Plan (HCP) to obtain an incidental take permit. The legislature adopted these recommendations in Senate Bill 1501, which sets an expedited timeline for submitting a draft of a proposed HCP to the services by December 31, 2022.

BACKGROUND

Senate Bill (SB) 1501, which includes the Private Forest Accord Report by reference, forms the basis for the draft of the proposed habitat conservation plan. The HCP is one of the required components under SB 1501. This bill included two deadlines in relation to the HCP:

1) a draft HCP be submitted to the Services by December 31, 2022, and
2) an Incidental Take Permit be obtained by December 31, 2027.

Both deadlines are ambitious and put the Department of Forestry on an aggressive timeline to complete the HCP.

A contract was initiated with ICF in May 2022 to develop the HCP, on behalf of the Board of Forestry and the Department. The Department initiated a steering committee to provide feedback on the HCP. The steering committee is comprised of members from both the conservation and forestry coalitions of the Private Forest Accord Authors, Department staff, and representation from the Oregon Department of Fish and Wildlife and Oregon Department of Environmental Quality. The Services are also represented on the steering committee, but their participation during the development of the draft HCP has been limited to meeting attendance and to providing general

direction and feedback. The Department will engage in formal discussions with the Services during the next phase of the project.

ANALYSIS

This draft HCP is a working draft. Due to the tight deadline for submission to the services, the document presented to the Board has placeholders for content yet to be developed. Chapters 1 through 4 contain draft text to describe the overall scope and scale of the HCP, the environmental setting, the covered activities, and the conservation actions. Chapters 5 through 10 will be further developed in Phases 2 and 3 of the project. Language for chapters 5 through 10 is limited to background information to describe the basic content for each chapter. Substantial work remains to further develop and refine all chapters of this HCP. Recent changes not yet incorporated into this draft of the HCP include:

1) the addition of counties and municipalities as covered lands, and
2) minor changes made to FPA rules between the August public comment submission (used for this version of the HCP) and the final rule language approved by the Board.

The steering committee has provided limited input on Chapters 5 through 10 to date. The Services have not reviewed the content of the draft HCP included in Attachment 1. Senate Bill 1501 requires that a draft of a proposed HCP be submitted to the Services by December 31, 2022.

RECOMMENDATION

The Department recommends that the Board direct the Department to submit the attached draft Habitat Conservation Plan to the Services by December 31, 2022.

ATTACHMENTS

(1) Draft of proposed Habitat Conservation Plan for the Private Forest Accord
(2) Draft HCP project schedule for Phases 2 and 3

DECEMBER
2022

Private Forest Accord

Proposed Draft
Aquatic Habitat Conservation Plan

PREPARED FOR:
Oregon Department of Forestry
2600 State Street
Salem, OR 97310

Contact: Jennifer Weikel,
HCP Coordinator & Wildlife Biologist
Phone: 503.945.7398

PROPOSED DRAFT

PRIVATE FOREST ACCORD AQUATIC HABITAT CONSERVATION PLAN

PREPARED FOR:

Oregon Department of Forestry
2600 State Street
Salem, OR 97310
Contact: Jennifer Weikel
503.945.7398

PREPARED BY:

ICF
1200 6th Avenue #1800
Seattle, WA 98101
Contact: Melissa Klungle
360.485.5671

December 2022

ICF. 2022. *Private Forest Accord Aquatic Habitat Conservation Plan*. Proposed Draft. December. (ICF 104528.0.001.) Seattle, WA. Prepared for Oregon Department of Forestry, Salem, OR.

Oregon
Kate Brown, Governor

Department of Forestry
State Forester's Office
2600 State Street
Salem, OR 97310-1336
503-945-7200
FAX 503-945-7212
www.oregon.gov/ODF

"STEWARDSHIP IN FORESTRY"

December 1, 2022

Oregon Board of Forestry
2600 State Street
Salem, OR 97310

Dear Oregon Board of Forestry,

We are pleased to present you with the Proposed Draft Private Forest Accord (PFA) Aquatic Habitat Conservation Plan (HCP). This draft represents a major milestone in the PFA process as described in Senate Bill (SB) 1501. This bill requires the Board of Forestry to submit a draft HCP to the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, collectively the Services, by December 31, 2022.

The timeline for drafting the Proposed Draft PFA HCP was set in SB 1501 to ensure rapid progress of HCP development. The Oregon Department of Forestry (Department) worked between June and October 2022 to develop this draft of the HCP. This draft is based primarily on the 2022 Private Forest Accord Report (PFA Report) and August 24, 2022, draft rules. The final HCP will be based on the adopted administrative rules. Given the early deadline for submission and the need to concurrently draft and develop data needed to inform the HCP, various sections remain largely undeveloped. This draft allows those sections to buildout as the data is collected. The HCP chapters are in various stages of development. Chapters 1 through 4 contain more detail while Chapters 5 through 10 are less developed and present an overall structure and approach.

Following SB 1501 directions, the Department “regularly and closely consulted” with PFA Report author representatives. The Department formed a steering committee to provide feedback on the HCP. The steering committee includes author representatives, staff from the Oregon Department of Fish and Wildlife and Department of Environmental Quality, and the Services. The Services’ role during the development of this draft has been limited to meeting attendance and providing general direction.

The steering committee reviewed and gave feedback on all chapters of this draft. All parties recognize significant work remains to be done to develop the Public Draft HCP and Incidental Take Permit application. The Department will continue to closely consult with PFA Authors and other steering committee members to ensure that the final HCP aligns with the PFA Report.

Sincerely,

Jennifer Weikel and Josh Barnard
Forest Resources Division
Oregon Department of Forestry

Contents

Tables

Figures

Acronyms and Abbreviations

°C	degrees Celsius
°F	Fahrenheit
AMP	Adaptive Management Program
AMPC	Adaptive Management Planning Committee
BMPs	best management practices
BO	biological opinion
BOF	Board of Forestry
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Compliance Monitoring Program
CMZ	channel migration zone
CWA	Clean Water Act
DBH	diameter at breast height
DEQ	Oregon Department of Environmental Quality
DPS	Distinct Population Segment
EFH	essential fish habitat
EIS	environmental impact statement
ELZ	equipment limitation zone
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCA	Forest Conservation Area
FCTC	Forest Conservation Tax Credit
FRIA	Forest Road Inventory Assessment
GIS	geographic information system
GNN	Gradient Nearest Neighbor
HCP Handbook	Habitat Conservation Planning and Incidental Take Permit Processing Handbook
HCP	Habitat Conservation Plan
HCP	Oregon Private Forest Accord Habitat Conservation Plan
HU	hydrologic unit
HUC	hydrologic unit code
IRST	Independent Research and Science Team
ITP	incidental take permit
MAC	Mitigation Advisory Committee
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OAR	Oregon Administrative Rules
OCRF	Oregon Conservation and Recreation Fund

ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OFPA	Oregon Forest Practices Act
OFPBDS	Oregon fish passage barrier database standard
ORS	Oregon Revised Statutes
OWEB	Oregon Watershed Enhancement Board
PCT	precommercial thinning
PFA Report	2022 Private Forest Accord Report
PFAGP	Private Forest Accord Grant Program
PFAMS	Private Forest Accord Mitigation Subaccount
RCA	Road Condition Assessment
R-ELZ	retention equipment limitation zone
RFPs	requests for proposals
RH Max	Retention Harvest maximum
RMAs	Riparian Management Areas
RMB	Road Management Blocks
SB	Senate Bill
SDI	Stand Density Index
SFISH	Small Forestland Investment in Stream Habitat
SFOs	Small Forest Landowners
SFOs	Small Forestland Owners
The Services	NMFS and USFWS
The Services	USFWS and NMFS
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Chapter 1
Introduction

1.1 Overview

1.1.1 Purpose

The purpose of the Oregon Private Forest Accord Habitat Conservation Plan (HCP) is to support the survival and recovery of the covered fish and amphibian species and their habitats, enabling the Oregon Department of Forestry (ODF) to obtain incidental take permits (ITPs) for impacts from forestry activities on threatened and endangered aquatic species on private forestlands subject to the Oregon Forest Practices Act (OFPA). ODF has jurisdiction over nonfederal forestlands in Oregon and is responsible for ensuring the effective administration of the OFPA regulations. The term *forestland*, as used in this HCP, is defined by the Oregon Revised Statutes (ORS) 527.620(7), as "land that is used for the growing and harvesting of forest tree species, regardless of how the land is zoned or taxed or how any state or local statutes, ordinances, rules, or regulations are applied."

The ITPs will legally authorize the incidental take of federally threatened and endangered aquatic species, resulting from the forestry activities specified in this HCP, as well as of covered fish and amphibian species that could become listed during the term of the permit.

Section 9 of the Endangered Species Act (ESA) prohibits the "take" of species federally listed as threatened or endangered. *Take* is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S. Code [U.S.C.] 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).

Congress recognized the need for a process to reduce conflicts between federally listed species and economic development, so it amended the ESA in 1982 to add an exemption for incidental take of listed species that may result from nonfederal activities (ESA Section 10(a)(1)(B)). Incidental take is take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. To obtain a permit for take under this provision, an applicant must develop a conservation plan that meets specific requirements identified in Section 10(a)(2)(A) of the ESA and its implementing regulations in 50 CFR 17.22 (endangered species), 50 CFR 17.32 (threatened species), and 50 CFR 222.25, 222.27, and 222.31.

Among other requirements, the plan must contain the following information.

- The specific impacts that are likely to result from the take of listed species.
- Measures the permit applicant will undertake to minimize and mitigate such impacts.
- The funding that will be available to implement such measures.

Conservation plans under ESA Section 10(a)(1)(B) have come to be known as habitat conservation plans (or HCPs). HCPs can be structured differently and range in scale. This HCP is programmatic in

nature because ODF is the central authority that receives the ITP and then provides coverage to individual landowners through its regulatory oversight and enforcement of the OFPA rules.

ODF is preparing this HCP and applying for ITPs from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS)[1] to provide an efficient and effective regularly framework to avoid, minimize, and mitigate effects on covered species.

1.1.2 Background

This HCP is intended to implement a critical step in an historic set of collaborative agreements between a diverse group of stakeholders, collectively known as the Private Forest Accord, to manage private forestlands in Oregon. The Private Forest Accord negotiation process was established under a Memorandum of Understanding (MOU), which was formalized and funded through Oregon's legislation with the passage of Senate Bill (SB) 1602 in 2020. Negotiations took place from February 10, 2020, through October 30, 2021, and concluded with the presentation of the 2022 Private Forest Accord Report (PFA Report; Appendix A) in conjunction with the passage of Oregon SB 1501 and 1502, and Oregon House Bill 4055.

The signatories of the MOU agreed to participate in a "a science-informed policy development process, rooted in compromise, to evaluate and jointly recommend substantive and procedural changes to Oregon forest practice laws and regulations." A major goal of this process was to obtain an ITP from NMFS and USFWS (collectively, the Services) in association with the changes to the OFPA rules. These changes serve as the basis of this HCP. In preparing recommendations, the authors of the PFA Report balanced biological and economic goals to develop practical recommendations to avoid, minimize, and mitigate the effects for certain forest practices governed by the OFPA (Section 1.2.3, *Covered Activities*) on specific aquatic species (as defined in Section 1.2.4, *Covered Species*).

Activities covered under this programmatic HCP include all activities ODF administers under the OFPA including timber harvest, stand management, road system management, and other activities related to the growth and harvest of trees on participating forestlands in Oregon, except for the application of herbicides, pesticides, and fertilizers. This HCP directly tiers from the legislation and administrative rule changes and associated PFA Report and is intended to be fully consistent with the agreements contained therein.

This HCP is intended to directly achieve one of the stated goals in the PFA Report, which is to "provide greater regulatory certainty" by obtaining ITPs from the Services through the submission of this programmatic aquatic HCP, which will enhance habitat for covered species.

This HCP supports the other goals pursued during the process of developing the Private Forest Accord, including the following:

- **Provide greater business certainty.** Provide a greater level of certainty to forest landowners and industries that depend on Oregon's private working forests without compromising the viability of Oregon's manufacturing infrastructure.

[1] NMFS, in the Department of Commerce, has jurisdiction over all listed marine species and anadromous fish. USFWS, in the Department of Interior, has jurisdiction over all other species listed under the ESA.

- **Provide greater environmental certainty.** Provide a greater level of certainty for the survival and recovery of threatened and endangered species and for the protection of aquatic resources.
- **Provide science-driven adaptive management process.** Support the certainty and durability of Oregon's forest practices laws concerning private forestland and regulations through the establishment of an adaptive management program that involves a rigorous look at the efficacy of existing and future forest practice regulations, and a science-driven process for analyzing the need for any changes.
- **Provide alternatives for small forestland owners.** Address the potential disproportionate impacts that regulatory changes might have on small forestland owners and provide alternative compliance paths and/or financial impact mitigation for these potential disproportionate impacts.

1.1.3 Document Organization

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

- Chapter 1, *Introduction*, discusses the purpose and background of the HCP, describes the scope of the HCP, provides an overview of the regulatory setting, and summarizes the planning process.
- Chapter 2, *Environmental Setting*, describes the plan area relevant to the HCP, with an overview of the physical setting, forest types, covered species, and their existing conditions.
- Chapter 3, *Covered Activities*, describes the forestry activities addressed by the HCP—including those associated with implementing the HCP, such as conservation measures—at a level of detail sufficient for the analysis of effects and determination of mitigation requirements.
- Chapter 4, *Conservation Strategy*, describes biological goals and objectives and the specific conservation actions to be implemented to achieve the biological goals and objectives. The chapter also describes the actions required to minimize and mitigate impacts on covered species, consistent with federal regulations.
- Chapter 5, *Effects Analysis and Level of Take*, presents the impacts of the covered activities on each covered species, including sources, types, and amount of take estimated to occur over the permit term, as well the estimated impact on each covered species that will likely result from the taking, the benefits of the conservation measures, and the net effects on each covered species.
- Chapter 6, *Monitoring and Adaptive Management*, describes the monitoring program that will be used to determine if biological goals are being met and the adaptive management triggers and procedures that will be used to inform and improve future management actions, including corrective actions, as needed.
- 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 regulatory assurances provided to ODF, as well as the procedures for modifying or amending the HCP.
- Chapter 8, *Implementation*, details the administrative requirements associated with HCP implementation and the roles and responsibilities of ODF, participating landowners, and the 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 of one or more of the covered species, and why those alternatives were rejected.
- Chapter 11, *References,* while omitted from the Proposed Draft HCP, will provide the cited references in the HCP.
- Appendix A, *2022 Private Forest Accord*, is the formalized agreement resulting from the Private Forest Accord negotiation process.
- Appendix B, *Species Accounts,* provides listing status and criteria for each of the considered species.

1.2 Scope of the Plan

This programmatic HCP is state-wide and covers forest management activities conducted on private lands regulated by ODF through enforcement and oversite of the OFPA. As such, the HCP applies across a wide geographic scope and covers forestlands within multiple ecoregions, under various land ownerships, that support diverse environmental conditions, histories, forest conditions, and abundances of covered species and associated habitats.

At the same time, the scope of the HCP is narrow and limited to the state regulatory framework established by the OFPA. The HCP ensures that participating landowners that implement forest practices in compliance with the OFPA will be in compliance with the ESA for covered species. As the central permittee, ODF will implement this HCP through administration of the OFPA regulations. This will facilitate participating landowner's compliance with the ESA and associated consultation requirements with the Services.

1.2.1 Plan Area and Permit Area

For this HCP, the plan area is defined as all *nonfederal* and tribal fee lands in Oregon, and the permit area is defined as all *private* lands and tribal fee lands in Oregon (Figure 1-1, Table 1-1).

The OFPA regulations apply to forestlands, as defined in Section 1.1.1, *Purpose*, and include activities conducted on non-forestland in situations where the activity being conducted is related to the growing or harvesting of trees or management of forestlands. The OFPA regulations apply to "forestlands," as defined in Section 1.1.1, *Purpose*, and include activities conducted on non-forestland in situations where the activity being conducted is related to the growing or harvesting of trees or management of forestlands. Thus, activities such as road construction or maintenance of appurtenant road networks used for forest management on nearby non-forested land are covered activities under this HCP.

The permit area includes all private forestlands that intersect with covered species' habitat throughout Oregon. Native American tribes may choose to opt-in their fee land forestland in this HCP, which would then be included in the permit area. The permit area represents the areas where participating landowners can receive incidental take authority for covered species. Chapter 2, *Environmental Setting*, provides additional details regarding the environmental settings of the plan area and permit area.

The nine Federally Recognized Tribes of Oregon are Sovereign Nations. As such, ODF is beginning Government-to-Government communications concerning an HCP participation process, which includes discussion of Tribal land types and existing Tribal government laws and regulations. Possible options for HCP adoption will be consistent with the terms and requirements applicable to private forestlands. Any agreed upon participation process will be described in Chapter 7, *Implementation*.

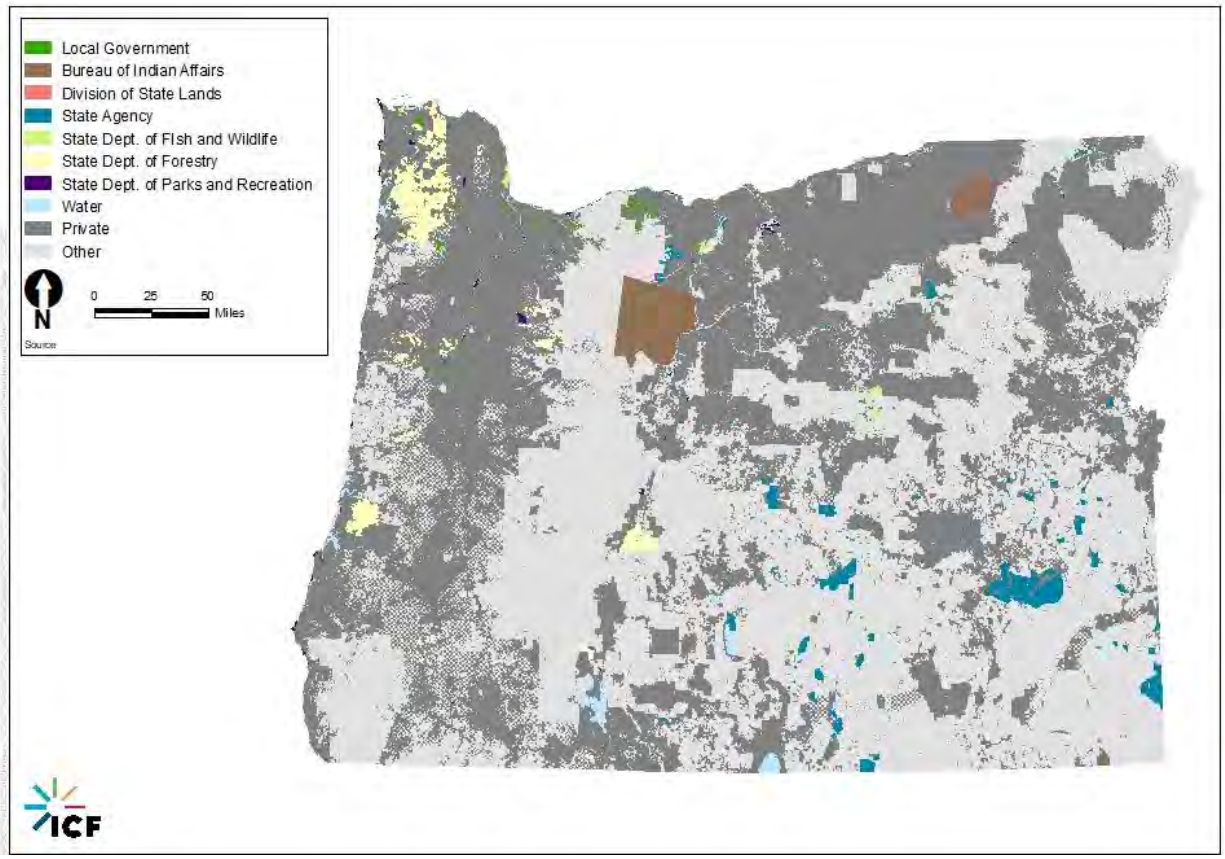


Figure 1-1. Forest Ownership in the Oregon Private Forest HCP Plan Area

[Figure 1-1 is under development]

Table 1-1. Forestland Ownership Acreages in the Oregon Private Forest HCP Plan Area

Ownership	Acres
Private Large Industrial (>5,000 acres per owner)	X
Private Small (<5,000 acres per owner)	X
Tribal Lands	X
State	X
Local Government	X
Total	**X**

[Table 1-1 is under development]

1.2.2 Permit Term

The HCP and associated ITPs will have two different permit terms as recommended in the PFA Report: 50 years for fish species and 25 years for amphibian species (Conservation Coalition and Working Forest Coalition 2022). The shorter permit term for the covered amphibian species accounts for uncertainty in population characteristics in Oregon and the region, including the distribution, productivity, survival, and abundance of the covered species. As result, the shorter permit term will allow for reevaluation of the relationship between forest management and covered amphibian species. Additionally, a successful conservation strategy in a forested landscape relies on improvement of habitat over time, which is only realized as the forest grows older and develops complex forest structure. That happens over many decades and the full 25- and 50-year permit terms will be needed to realize the full benefits of the conservation strategy.

1.2.3 Covered Activities

This HCP and the associated ITPs will cover and provide incidental take authorization for ongoing and planned forest practices as defined in the OFPA statutes (ORS 527.610–527.770, 527.990, and 527.992) and rules (Oregon Administrative Rules [OAR] Chapter 629).[2] Detailed descriptions of the covered activities are provided in Chapter 3, *Covered Activities*.

Activities covered by this HCP include any *operation*, as defined in the OFPA, meaning any commercial activity relating to the establishment, management, or harvest of forest tree species, which includes the following forest practices that could take place adjacent to or otherwise influence the aquatic habitats for covered species.

- Reforestation of forestland.
- Road construction and maintenance.
- Harvesting of forest tree species.
- Disposal of slash.
- Removal of woody biomass.

Operations specifically excluded under SB 1501 are not covered activities, as described in Chapter 3, *Covered Activities*. Covered activities also include the implementation of the HCP, including any conservation measures and mitigation described in Chapter 4, *Conservation Strategy*, as well as all monitoring activities, as described in Chapter 6, *Monitoring and Adaptive Management*.

1.2.4 Covered Species

1.2.4.1 Covered Species Selection

The process of selecting species to be covered under this HCP was conducted within the structured Private Forest Accord negotiation process described in the PFA Report. Over the 18-month negotiation process, the signatories selected the aquatic species to be covered by the HCP. The PFA Report anticipated that the HCP application process would further develop the definition of covered species. Species selection was based on the following criteria.

[2] The application of pesticides or fertilizers is not a covered activity under this HCP.

- **Species range.** Species should be known or expected to occur within the plan area based on a review of species locality and range data, a review of scientific literature, and professional expertise. In addition, species that are not currently known 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 have met this criterion.
- **Species status**. The species should be listed under the ESA as threatened or endangered, or be proposed for listing (candidate), or have a strong likelihood of being listed during the appropriate permit term (25 or 50 years, depending on the species). Potential for listing during the permit term is based on current listing status; interaction with experts, the Services, and Oregon Department of Fish and Wildlife (ODFW) staff; evaluation of species population trends and threats; and best professional judgment.
- **Likely impact.** The species or its habitat would reasonably be likely to be adversely affected by covered activities.
- **Sufficient data**. Sufficient scientific data exists on the species' life history, habitat requirements, and occurrence in the plan area to adequately evaluate potential effects of covered activities on the species and to develop conservation measures to mitigate those impacts. For those species without sufficient data (i.e., amphibians), additional habitat requirement data will be collected as part of the conservation strategy and adaptive management programs.

1.2.4.2 Proposed Covered Species

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

Table 1-2. Proposed Covered Species

Common Name	Scientific Name	Status [a]		Federal Jurisdiction
		Federal	State	
Amphibians				
Columbia torrent salamander	*Rhyacotriton kezeri*	--	SS	USFWS
Southern torrent salamander	*Rhyacotriton variegatus*	--	SS	USFWS
Coastal giant salamander	*Dicamptodon tenebrosus*	--	--	USFWS
Cope's giant salamander	*Dicamptodon copei*	--	SS	USFWS
Coastal tailed frog	*Ascaphus truei*	--	SS	USFWS
Fish				
Oregon Coast coho salmon ESU	*Oncorhynchus kisutch*	FT	SS	NMFS
Lower Columbia River coho salmon ESU	*Oncorhynchus kisutch*	FT	SE	NMFS
Southern Oregon/Northern California Coast Coho Salmon ESU	*Oncorhynchus kisutch*	FE	SS	NMFS
Lower Columbia River (Fall/Spring) Chinook Salmon ESU	*Oncorhynchus tshawytscha*	FT	SS	NMFS
Middle Columbia River ESU Chinook	*Oncorhynchus tshawytscha*	FT	SS	NMFS

Common Name	Scientific Name	Status [a]		Federal Jurisdiction
		Federal	State	
Snake River (Fall and Spring/Summer) Chinook Salmon ESU	*Oncorhynchus tshawytscha*	FT	ST	NMFS
Upper Columbia River (Spring) ESU Chinook Salmon	*Oncorhynchus tshawytscha*	FT	SS	NMFS
Upper Willamette River Chinook Salmon ESU	*Oncorhynchus tshawytscha*	FT	SS	NMFS
Coastal Chinook Salmon ESU	*Oncorhynchus tshawytscha*	--	SS	NMFS
Rogue River Chinook Salmon ESU	*Oncorhynchus tshawytscha*	--	SS	NMFS
Columbia River Chum Salmon ESU	*Oncorhynchus keta*	FT	SS	NMFS
Coastal Chum Salmon ESU	*Oncorhynchus keta*	--	SS	NMFS
Lower Columbia River (Summer and Winter) Steelhead DPS and coastal rainbow trout	*Oncorhynchus mykiss*	--	SS	NMFS
Middle Columbia River (Summer) Steelhead DPS and Columbia Basin redband trout	*Oncorhynchus mykiss*	FT	SS	NMFS
Upper Columbia River Steelhead DPS	*Oncorhynchus mykiss*	FT	SS	NMFS
Snake River Steelhead DPS and redband trout (Summer)	*Oncorhynchus mykiss*	FT	SS	NMFS
Upper Willamette River (Winter) Steelhead DPS and coastal rainbow trout	*Oncorhynchus mykiss*	FT	SS	NMFS
Coastal Steelhead and Rainbow Trout (Summer) ESU	*Oncorhynchus mykiss*	--	SS	NMFS
Rogue Steelhead (Summer) DPS and coastal rainbow trout	*Oncorhynchus mykiss*	--	SS	NMFS
Bull trout	*Salvelinus confluentus*	FT	SS	USFWS
Mountain whitefish	*Prosopium williamsoni*	--	--	USFWS
Pacific eulachon/smelt	*Thaleichthys pacificus*	FT	--	NMFS
Green sturgeon	*Acipenser medirostris*	FT	--	NMFS

[a] Status: FT = federally listed as threatened; FE = federally listed as endangered; ST = state listed as threatened; SE = state listed as endangered; SS = state sensitive species

ESU = evolutionary significant unit; DPS = distinct population segment.

All covered species are treated as if they are federally listed, for the purposes of this HCP. For each covered species, this HCP provides sufficient background information, analysis of effects from covered activities, and appropriate mitigation and monitoring requirements. This approach ensures the Services can provide regulatory assurances for the non-listed covered species consistent with the requirements of the ESA, in the event of their future listing.

1.3 Regulatory Setting

This HCP must be considered within an interrelated set of federal and state laws. The following HCPs and federal and state laws and regulations are relevant to this HCP.

1.3.1 Other Oregon HCPs

The PFA Report was presented in conjunction with Oregon SB 1501 and 1502, and Oregon House Bill 4055. SB 1501, Section 14, states that if a person is party to an agreement with [the Services] under the federal ESA of 1973 (16 U.S.C. 1531 to 1544) and is engaging in a forest practice in compliance with the agreement, to expressly exclude coverage of forestlands already covered by other HCPs that include the covered species, the forest practice is not subject to provisions of ORS 527.610 to 527.770 or rules adopted thereunder that relate to protection of a species addressed in the agreement. In other words, any existing or future agreements that the Services make with an HCP holder are valid and supersede this HCP for the aquatic species that their HCP covers. But, if a private forestland permittee has ITP coverage for different species in their HCP, the entity would still be expected to comply with the OFPA rules and associated ITP conditions associated with this HCP. This exemption was established, in part, to avoid conflict with OFPA rules and other agreed upon conservation measures in approved HCPs that are consistent with the intent of the PFA Report.

1.3.2 Northwest Forest Plan

ESA compliance on federal lands within the range of the northern spotted owl (*Strix occidentalis caurina*) is administered under the framework established by the *Northwest Forest Plan* (United States Department of Agriculture and United States Department of the Interior Bureau 1994). The plan established a coordinated management direction for the lands administered by the United States Department of Agriculture Forest Service and the United States Department of the Interior Bureau of Land Management and established complimentary approaches to forest management by other federal agencies within the range of the northern spotted owl. Policies established under the Northwest Forest Plan are intended to meet the dual needs of forest habitat for a wide range of species, including threatened and endangered species, and the need for forest products.

The Aquatic Conservation Strategy established under the plan provides the framework for conservation of threatened and endangered fish and other aquatic species and associated ecosystems on federal lands within the range of the northern spotted owl in Oregon. The Aquatic Conservation Strategy consists of four components.

- **Riparian reserves:** Lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use.
- **Key watersheds:** A system of large refugia comprising watersheds that are crucial to at-risk fish species and stocks and provide high quality water.
- **Watershed analysis:** Procedures for conducting analysis that evaluates geomorphic and ecologic processes operating in specific watersheds. Watershed analysis provides the basis for monitoring and restoration programs and the foundation from which riparian reserves can be delineated.

- **Watershed restoration:** A comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms.

1.3.3 Federal and State Endangered Species Laws

1.3.3.1 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. NMFS is responsible for enforcing the provisions of the 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, ensure that any action "authorized, funded, or carried out by any agency," is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat (16 U.S.C. 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, and the Services concur, that the project is not likely to adversely affect any listed species or proposed species or not likely to adversely modify designated critical habitat, the consultation is concluded. If the agency determines that a federal agency's project is likely to adversely affect a listed species, 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."

If the BO concludes that the project, as proposed, would result in take of a listed species, but not to an extent that would jeopardize the species' continued existence, the BO is published with an incidental take statement and specifies reasonable and prudent measures and terms and conditions to minimize the impact of the take.

Section 10

This HCP has been prepared to satisfy Section 10(a)(1)(B) of the ESA. Until 1982, state, local, and private entities had no means to acquire incidental take authorizations that federal agencies could under Section 7. Private landowners and local and state agencies undertaking development in areas where federally listed species reside 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 to authorize the issuance of an ITP to nonfederal applicants 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 applicant (such as ODF) may apply to USFWS and/or NMFS 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 conservation 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 intra-service evaluation via the Section 7 consultation process as described above; 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.

1.3.3.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a management system for national marine and estuarine fishery resources. Pursuant to Section 305(b)(2), all federal agencies are required to consult with NMFS regarding any action permitted, funded, or undertaken that may adversely affect *essential fish habitat* (EFH). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Effects on habitat managed under relevant fishery management plans must also be considered. This includes migratory routes to and from anadromous fish spawning grounds. The phrase *adversely affect* refers to the creation of any impact that reduces the quality or quantity of EFH. Federal activities that occur outside of an EFH but that may, nonetheless, have an impact on EFH waters and substrate must also be considered.

1.3.3.3 Oregon Endangered Species Act

The Oregon ESA was adopted in 1987 and included a list of plant and animal species in need of protection, at that time. Under the Oregon ESA (ORS 496.004, ORS 496.171–496.192, and 498.026), all listed species were protected from take from all classes of landowners (see Table 1-2 for state status of covered species).

In 1995, the act was amended to outline additional protection requirements for listed species on state-owned or -leased lands. Since then, newly listed threatened or endangered species, or those uplisted from threatened to endangered status, are protected on state-managed lands by the Oregon Fish and Wildlife Commission's establishment of quantifiable and measurable guidelines 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).

Nothing in ORS 496.004, ORS 496.171–496.192, or 498.026 is intended, by itself, to require an owner of any commercial forestland or other private land to take action to protect a state threatened species or endangered species, or to impose additional requirements or restrictions on

the use of private land. However, other statutes may authorize administrative rules or programs to protect wildlife species, including threatened species or endangered species.

1.3.4 National Environmental Policy Act

The National Environmental Policy Act (NEPA) and its implementing regulations require agencies to identify and consider the environmental impacts of proposed federal actions and to prepare an environmental impact statement (EIS) for any major federal action "significantly affecting the quality of the human environment." EISs are defined as a detailed statement by the responsible official on the following.

- The environmental impact of the proposed action.
- Any adverse environmental effects which cannot be avoided should the proposal be implemented.
- Alternatives to the proposed action.
- The relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity.
- Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

The EIS process requires the responsible federal official (one of the Services for HCPs) to consult with and obtain the comments from the public, tribes, and any local, state, or federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved.

The Services' issuance of ITPs is a major federal action that is subject to NEPA review. A draft EIS will be prepared for this HCP to accompany the issuance of the public draft HCP. The process will include public scoping to determine the scope of the EIS, a draft EIS, and a final EIS that responds to public, tribal, and agency comments to the draft EIS.

1.3.5 Other Relevant State Laws

1.3.5.1 Oregon Forest Practices Act

The OFPA is the body of regulation that provides the basis for this programmatic HCP. The act is the regulatory framework pertaining to the growing and management of forests in Oregon. The OFPA is codified in state statutes and administrative rules. The OFPA statutes established the Board of Forestry (hereafter, the Board) and provides authority to the Board to develop administrative rules pertaining to activities related to forest management. The policy statement for the OFPA is to encourage economically efficient forest management while also providing for sound management of natural and scenic resources:

> [I]t is declared to be the public policy of the State of Oregon to encourage economically efficient forest practices that ensure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land consistent with the sound management of soil, air, water, fish and wildlife resources, and scenic resources within visually sensitive corridors as provided by ORS 527.755 and to ensure the continuous benefits of those resources for future generations of Oregonians. (ORS 527.630 (1))

The body of OFPA statutes and rules relates to all aspects of forest management including, but not limited to, timber harvest, road construction and maintenance, reforestation, use of herbicides, and treatment of slash. At the time of development of this HCP, regulations are in place pertaining to protection of streams, wetlands, and nesting sites of some species of birds. Other regulations exist pertaining to the maximum size of clearcut harvest allowed, protection of scenic corridors, public safety risks from landslides, required tree retention on steep slopes, retention requirements for standing and downed trees in some harvest units, and requirements for reforestation. This HCP describes modifications to the OFPA under the Private Forest Accord and resulting legislation. Those modifications are described in detail in Chapter 4, *Conservation Strategy*.

The OFPA is managed through a notification system and permits are not required prior to beginning a forest operation. Instead, a landowner representative must notify ODF about a proposed forest operation prior to initiating the operation. The notification is submitted using the department's reporting and notification system. The notification is not a permit to operate. The OFPA is managed locally by ODF's Stewardship Foresters, which are located throughout the state. The local Stewardship Forester reviews notifications of operation for resource protection concerns. A 15-day waiting period before conducting the operation allows the Stewardship Forester time to review the operation for resource concerns or requirement of a written plan. If there are resource concerns present, often a written plan is required to be submitted. The plans are reviewed (not approved) by the Stewardship Forester, and comments are provided with regards to whether the operation is likely to meet standards set forth in the OFPA or, if not, what changes are needed. For some protected resources (fish streams, bird resource sites, and significant wetlands) written plans are required by statute and also require a 14-day public comment period. In some cases, the operator may submit a plan for alternate practice, which describes a practice that will be applied that varies from what is prescribed in statute or administrative rule. Plans for alternate practice must contain enough detail to demonstrate that the plan will yield results consistent with statute or rule being applied. In addition, the plan must demonstrate that plan will result in the same effect, meet the same purpose, or provide equal or greater results as the practices specified in the statute or rule being applied (OAR 629-605-0100 (1)). Plans for alternate prescription must be approved by the Stewardship Forester before they are implemented.

Stewardship Foresters conduct OFPA inspections before, during and after forest operations. Communication with operators and landowners about compliance with the OFPA is done through methods such as education, technical assistance, or enforcement. Department staff specialists often provide technical assistance to Stewardship Foresters about wildlife, wetlands, water quality, road construction, geotechnical, technical rule interpretation, and enforcement. Department staff receive training throughout the year to ensure consistent and fair administration of the OFPA.

As previously established, this HCP covers activities conducted by participating nonfederal forestland owners under the OFPA. Legislatively mandated changes to the OFPA rules are described under Section 1.1.2, *Background*. Briefly, the PFA Report was presented in conjunction with Oregon Senate Bill 1501 and 1502, and Oregon House Bill 4055 (Conservation Coalition and Working Forest Coalition 2022). This is also described in Chapter 3, *Covered Activities*, and Chapter 4, *Conservation Strategy*.

1.3.5.2 Oregon Water Quality Standards

The Oregon Department of Environmental Quality (DEQ) uses water quality standards to assess whether the quality of Oregon's rivers and lakes is adequate for fish and other aquatic life, recreation, drinking, agriculture, industry, and other uses. DEQ also uses the standards as regulatory tools to prevent pollution of the state's waters. The Clean Water Act (CWA) requires states to adopt water quality standards designating beneficial uses of the state's waters and setting criteria designed to protect those uses. States submit their standards to the federal Environmental Protection Agency for approval.

The HCP provides species and their critical habitat protection to comply with the ESA, not CWA. However, water temperature is a key water quality parameter for the suitability of aquatic habitat and an important limiting factor for many of the covered species. Therefore, acknowledgment of the water quality standard for temperature for protecting habitat for covered aquatic species may also serve as steps toward achieving CWA water quality standards.

1.3.5.3 Oregon Plan for Salmon and Watersheds

In 1997, the Oregon Legislature adopted the *Oregon Plan for Salmon and Watersheds*, which focused on protecting populations of coho salmon. In 1998, the *Steelhead Supplement* was added to that plan. The purpose of the plan and supplement is to restore Oregon's wild salmon and trout populations to sustainable and productive levels that will provide substantial environmental, cultural, and economic benefits, and to improve water quality. The plan 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* and the *Steelhead Supplement* is a cooperative effort led by state, local, federal, tribal, and private organizations and individuals. Although the plan contains a strong foundation of protective regulations, including continuing existing regulatory programs and expediting the implementation of others, an essential principle of the plan involves moving beyond prohibitions and encouraging conservation efforts to improve conditions for salmon through nonregulatory means.

1.3.5.4 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 (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

A Memorandum of Agreement between ODFW and ODF gives ODF jurisdiction over fish passage on their land so long as fish passage meets the requirements of the OFPA.

1.4 The Planning Process

WORK IN PROGRESS

This page intentionally left blank.

Chapter 2
Environmental Setting

2.1 Introduction

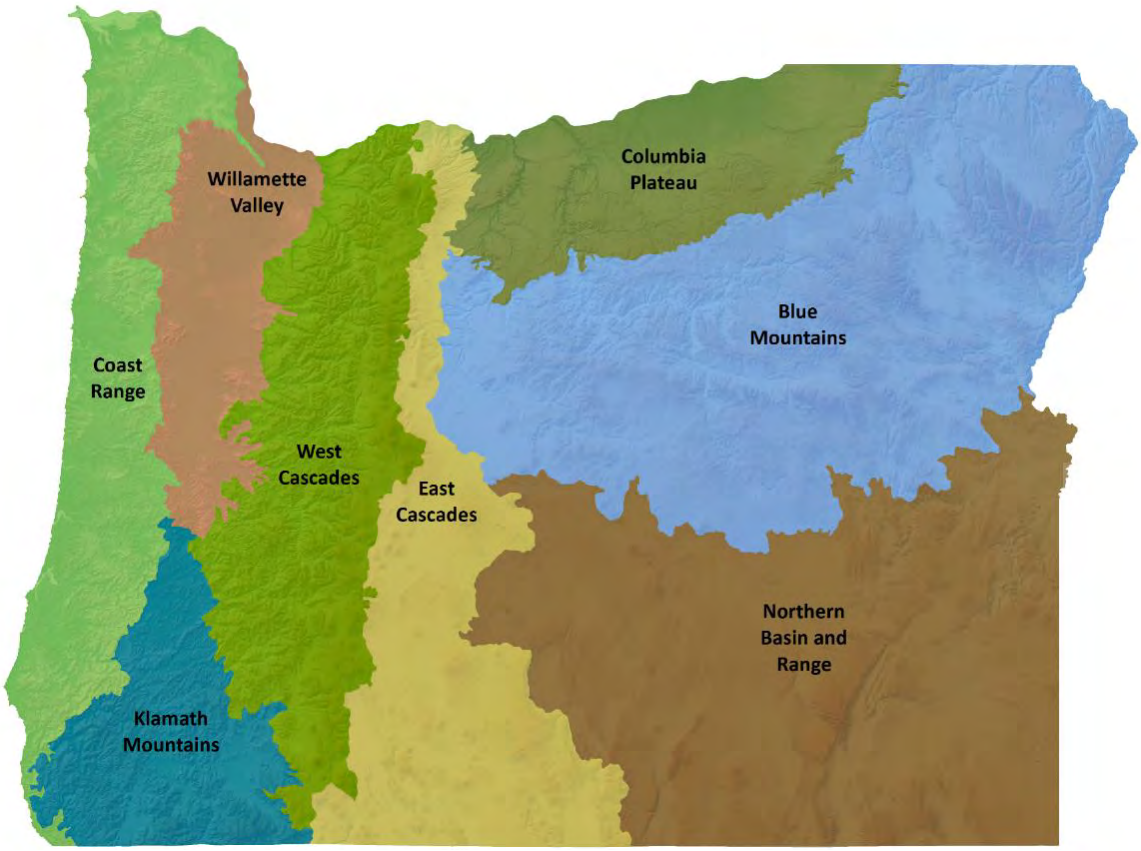
This chapter describes the existing conditions of the plan area and permit area, including the physical context, current forest conditions, and covered species. For this Oregon Private Forest Accord Habitat Conservation Plan (HCP), the plan area includes all *nonfederal* and tribal fee lands in Oregon and the permit area is defined as all *private* lands and tribal fee lands in Oregon. In total, 22 percent of Oregon is included in the permit area. The majority of the permit area (56.9 percent) occurs in western Oregon, the rest (43.1 percent) occurs in eastern Oregon. The Blue Mountains and Coast Range ecoregions have the largest permit area acreage of all of the ecoregions, and the Northern Basin and Range and the Columbia Plateau have the lowest permit area acreage.

Table 2-1. Acreage of Private Land in the Permit Area by Ecoregion

Region	Ecoregions	Ecoregion Area (acres)	Private Permit Area Lands (acres)	Percent of Private Permit Area Lands
Western Oregon	Coast Range	5,827,429	3,225,687	55%
	Willamette Valley	3,413,051	1,424,369	42%
	Klamath Mountains	3,851,339	1,553,434	40%
	West Cascades	7,176,300	1,530,944	21%
Eastern Oregon	East Cascades	6,774,636	1,751,993	26%
	Columbia Plateau	4,368,809	328,001	8%
	Blue Mountains	15,309,020	3,616,441	24%
	Northern Basin and Range	14,692,484	162,743	1%
Total		**61,413,068**	**13,593,611**	**--**

Ecoregions are used as an organizing principle throughout this chapter to describe the plan and permit areas. 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 discussed below are all factors that influence how forestland develops across Oregon and the species it supports.

There are eight ecoregions in Oregon: Coast Range, Willamette Valley, Klamath Mountains, West Cascades, East Cascades, Columbia Plateau, Blue Mountains, and Northern Basin and Range (Figure 2-1) (Oregon Department of Fish and Wildlife 2016a).



Source: Oregon Department of Fish and Wildlife 2016a.

Figure 2-1. Oregon's Ecoregions as Defined in the Oregon Conservation Strategy

- **Coast Range ecoregion.** Includes the Oregon coastline and extends east through coastal forests to the border of the Willamette Valley and Klamath Mountains ecoregions and is primarily spruce-hemlock forest directly along the coast. Over 50 percent of the Coast Range ecoregion is in the permit area.
- **Willamette Valley ecoregion.** 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 West Cascades (Oregon Department of Fish and Wildlife 2016a). The attributes of the western edge of the Willamette Valley ecoregion are similar to those described for the Coast Range ecoregion. Forty percent of the Willamette Valley ecoregion is in the permit area.
- **Klamath Mountains ecoregion.** Covers much of interior southwestern Oregon, including the Umpqua Mountains, Siskiyou Mountains, and interior valleys and foothills between these and the Cascade Range. Forty percent of the Klamath Mountains ecoregion is in the permit area.
- **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. Less than 25 percent of the West Cascades ecoregion is in the permit area.
- **East Cascades ecoregion.** Runs from the Cascade Mountains' summit east to the warmer, dryer high desert and spans the entire north–south length of the state. The southern end of the

ecoregion flares east toward the Northern Basin and Range ecoregion. Just over 25 percent of the East Cascades ecoregion is in the permit area.

- **Columbia Plateau ecoregion.** Sits on the northern edge of Oregon, extending from the eastern slope of the East Cascades, south and east of the Columbia River, to the Blue Mountains. Less than 10 percent of the Columbia Plateau ecoregion is in the permit area.
- **Blue Mountains ecoregion.** Located in the northeastern quadrant of Oregon, this ecoregion stretches from the East Cascades ecoregion east to the Idaho border. It provides a diverse complex of mountains, valleys, and plateaus. Just shy of 25 percent of the Blue Mountains ecoregion is in the permit area.
- **Northern Basin and Range ecoregion.** The largest ecoregion in the state, it covers the southeastern corner of Oregon, bordering Idaho and Nevada. It is a high-elevation desert dominated by sagebrush. Only 1 percent of the Northern Basin and Range ecoregion is in the permit area.

2.2 Physical Setting

This section first provides an overview of the entire state of Oregon—the plan area—describing the physical setting in terms of geology, topography, soils, landslides, climate (and climate change), river basins, and hydrology and water quality. Thereafter, the characteristics of each ecoregion, from west to east, are discussed. Throughout this section, descriptions are based on the *Ecoregions of Oregon* map and descriptions by Thorson et al. (2003) and the *Oregon Conservation Strategy* from the Oregon Department of Fish and Wildlife (ODFW) (2016a), unless noted otherwise.

2.2.1 Plan Area – Physical Setting

This section provides an overview of the geology, topography, soils, landslides, climate, major river basins, hydrology, and water quality in Oregon.

2.2.1.1 Geology and Topography of Oregon

The geologic history and formations of Oregon influence environmental conditions, which, in turn, affect forest growth. Oregon has a variety of bedrock developed from sedimentary, volcanic, and metamorphic processes, and bedrock type is one soil-forming factor contributing to the properties of soils. Topography, including elevation, slope, and aspect, has major impacts on forest climates and can influence temperature, precipitation, sun exposure, and soil moisture. Geology and geomorphology directly affect stream flow regimes by determining hydrological pathways, storage properties, and relief (Tague and Grant 2004), which, in turn, influence covered species and their habitats. Topography is a key factor for landslides, a major erosional process in the mountainous terrain in the Coast Range and Klamath Mountains ecoregions (Balco et al. 2013).

2.2.1.2 Soils of Oregon

Soils are fundamental to forest composition and condition. The long-term productivity of the soil supports tree growth and can affect habitat value for covered species. There are a wide variety of soils in Oregon with distinctive characteristics that reflect the parent rock material from which the soil was formed. Soil is a complex material that consists of decomposed rock, water, nutrients,

organic material, and air, as well as other gases. Organic matter is an important factor for soil productivity and consists of living, dead, and decomposed plants, and animals. Forest-site productivity is also affected by soil type factors such as soil depth, porosity, water-holding capacity, biology, and the availability of nutrients in the soil.

Soil organic matter composition and amount affect soil fertility. Dynamic processes such as forest succession, wind, and fire affect the accumulation of organic matter in the soil, while the composition is affected by the type of litter accumulating on the ground that subsequently decomposes. Small materials such as needles and twigs have the highest concentrations of nitrogen and phosphorus, which are essential elements for tree metabolism and growth (Wang et al. 2022).

Low-intensity fires can improve soil productivity by releasing nutrients from burned organic material. However, in areas recovering from severe fires, soil productivity can be greatly reduced due to the loss of organic matter and nutrients from forest floors, including topsoil, and will have a higher risk of soil loss from increased erosion. In forests where organic material and topsoil were lost due to severe fires as long as 100 years ago, productivity may still be limited because soil formation inherently takes a long time (Hungerford et al. 1990). Over the long term, post-disturbance successional trajectories can have substantial influence on soil creation and productivity.

Soil characteristics also influence erodibility (and, thus, landslides) with the most erosion-prone soils containing high proportions of fine sand and silt, having low amounts of soil organic matter, and having low permeability (O'Geen et al. 2006).

2.2.1.3 Landslides in Oregon

Landslides are the downslope movement of soil, rock, or related debris, and common types include slides, flows, spreads, and topples and falls. Landslides mainly occur throughout western Oregon but also in the East Cascades ecoregion. Landslides can occur on steep slopes throughout Oregon; however, they are most common in western Oregon but also in the East Cascades. Factors that contribute to the occurrence of landslides include intense rainfall, rapid snow melt, freeze/thaw cycles, human activities, volcanic eruptions, and earthquakes (Oregon Department of Geology and Mineral Industries 2008; U.S. Geological Survey 2004).

Environmental disturbances such as severe fires, or in some cases disease or insects killing large areas of trees, increase those areas' susceptibility to erosion because the loss of vegetation cover destabilizes the soil due to a loss of root reinforcement, canopy interception of precipitation, and evapotranspiration. When combined with winter storms (another common natural disturbance event) the likelihood of landslides becomes greater in these areas.

Types of Landslides

Slides. Slides are mass movement that generally occur on moderate to steep slopes, where there is a distinct zone of weakness between the slide material and the more stable underlying material. Triggers include rapid snow melt, heavy rain, earthquakes, grading, or concentrating water onto a slope.

Flows. When there is a slurry of soil, rock, water, and/or debris that moves rapidly downslope it is called a flow. Earth flows are the most common unchannelized flows, while debris flows are the predominant type of channelized flows. Debris flows are often caused by intense precipitation or

rapid snowmelt creating intense surface or subsurface water flow, eroding and mobilizing soil on steep slopes. Vegetation removal on slopes, like from clearcutting or after a severe fire, increases the risk of debris flows.

Spreads. This type of landslide typically occurs on very gentle slopes or flat terrain near open bodies of water and is caused by liquefaction of an underlying layer, usually triggered by earthquakes.

Topples and Falls. Topples and falls normally occur in areas with near-vertical rock cliffs or soil and consist of rapid movements of rock or boulders becoming detached. Topples and falls are heavily influenced by gravity, weathering, and the presence of water.

2.2.1.4 Climate and Climate Change of Oregon

Climate across Oregon is highly variable due to coastal influence, topography, and elevation. Temperatures across western Oregon are largely moderated by coastal influence, which typically maintains mild temperatures year-round, while central and eastern Oregon have higher summer temperatures and a greater diurnal and annual range.

Since the beginning of the 20th century, the average annual temperature in Oregon has increased by 2.5 degrees Fahrenheit (°F) (1.4 degrees Celsius [°C]), a rise driven mainly by increases in winter nighttime temperatures, which affect snowpack and plant phenology (Cox et al. 2020). By 2100, Oregon's temperatures are projected to warm between 1°F (0.6°C) and 13°F (7°C) more than the 1901–1960 average (National Oceanic and Atmospheric Administration 2022). Most models agree that the region will experience warmer, drier summers and likely warmer and wetter winters (Reilly et al. 2018; National Oceanic and Atmospheric Administration 2022). If greenhouse gas emissions continue at current levels, temperature in Oregon is projected to increase on average by 5°F (3°C) by the 2050s and 8°F (5°C) by the 2080s, with the greatest seasonal increases in summer (Dalton and Fleishman 2021).

The predicted rise in temperature from climate change is expected to affect precipitation, hydrology, and plant distribution and abundance across the state. However, regional climate change vulnerability assessments predict the physiographic variability in Oregon will influence the magnitude of these events (Chang et al. 2010). For example, snowpack in the Cascades is especially sensitive to increased air temperatures, which may decrease the duration of snow cover by 7 to 8 weeks. Summer streamflows in the East Cascades are projected to experience the most significant reductions (up to 60 percent by 2040, and up to 80 percent by 2080), due to the fact that snowmelt contributes more to streamflow on the drier eastern slopes of the Cascades than streamflows on the wetter western slopes (Halofsky et al. 2019). Increased air temperature and reduced streamflows will also result in increased water temperatures affecting freshwater ecosystems in Oregon. These changes in hydrology and water quality will have important consequences for cold water fish species, plant and wildlife communities, agriculture, and recreation.

In general, western Oregon receives significantly more annual precipitation than eastern Oregon, which creates a dramatic influence on forest conditions and habitat value for covered species (Reilly et al. 2018). The average annual rainfall in western Oregon ranges from 75 to 90 inches (190 to 229 centimeters) (Western Regional Climate Center n.d.). The Willamette Valley ecoregion and eastern Oregon are drier, receiving an average of 48 inches (123 centimeters) and up to 35 inches (89 centimeters), respectively (Western Regional Climate Center n.d.; Clackamas Soil and Water Conservation District n.d.). Some areas of western Oregon, especially areas in the Coast Range

ecoregion, receive about 160 inches (406 centimeters) of rainfall a year, mostly during the winter. The driest areas of eastern Oregon get less than 8 inches (20 centimeters) annually, although precipitation can vary greatly between years (National Oceanic and Atmospheric Administration 2022).

Precipitation in Oregon also varies by elevation (Allan et al. 2001). The lower elevations receive precipitation mostly as rain, while the highest elevations receive precipitation mostly as snow. The middle elevations are marked with frequent events of rain falling on snow and vice versa. These types of precipitation events often initiate high-magnitude flooding and widespread landsliding (Wemple et al. 2001; O'Connor and Costa 2004), which affect streams and rivers in their paths.

Atmospheric rivers transport most of the water vapor outside of the tropics, and often release water vapor in the form of rain or snow. In the western United States, atmospheric rivers are projected to increase in intensity with climate change. As a result, flood and erosion hazards are anticipated to increase as well. However, atmospheric rivers often provide beneficial rain or snow that is crucial to the water supply, including freshwater ecosystems in Oregon. The variation in rainfall across Oregon is expected to increase over time in response to climate change. Predicting climate-driven changes to precipitation patterns remains difficult, but climate models generally predict an increase in winter precipitation falling as rain, instead of snow, and a decrease in summer precipitation (Reilly et al. 2018). The decrease in snowfall and higher spring temperatures lead to earlier melting of the snowpack, consequently decreasing the amount of water available during the dry season (National Oceanic and Atmospheric Administration 2022). Streams fed primarily by snowmelt are also expected to experience a reduction in flow due to decrease in annual snowpack. Projected decreases in freshwater flows and connectivity are likely to decrease survival and growth of fish species such as salmon. Projected increases in temperature and changes in precipitation also may have negative effects on some protected species. The ability of Oregon's species to adapt behaviorally, physically, or genetically to climate change in part depends on the speed of climate change, the level of other environmental stressors, and genetic diversity (Dalton and Fleishman 2021).

This is expected to result in more flooding events during the wet season, lead to a shift in timing of seasonal stream flows, and decrease stream flows during summer (Reilly et al. 2018). Runoff is expected to begin and peak earlier in the year, decline in summer, and increase in winter, but will vary geographically (Dalton and Fleishman 2021). Climate change–induced increased rainfall and flooding events increase the likelihood of shallow and deep erosion, especially in steep areas, as erosion rates increase with increasing rainfall intensity, slope steepness, and slope length (Jaakko Pöyry 1992).

Changes in precipitation patterns, particularly the more frequent and intense summertime droughts, in combination with rising temperatures, understandably predict more frequent and severe wildfires. Climate models project a growth in high fire risk forests throughout Oregon over the 21st century (Davis et al. 2017). Although the Coast Range ecoregion is expected to experience a relatively lower increase in fire risk, compared to other ecoregions, western Oregon is predicted to have longer fire seasons and increased risk of severe fires due to climate change (Davis et al. 2017).

Climate change is likely to directly and indirectly affect vegetation growth throughout Oregon's forestlands. The response of tree growth to climate change will vary by species and factors limiting their growth (Reilly et al. 2018). Forests have the ability to absorb and store carbon dioxide and prevent it from entering the atmosphere. As described in Section 2.2.4, *Tree Species in the Plan Area*,

some tree species are more tolerant of drought, floods, etc. than others. When forests are clear-cut or thinned their ability to store carbon dioxide is lost and released into the atmosphere. Overall, indirect effects such as frequency, severity, and extent of disturbance (e.g., drought, fire, pathogens) are expected to have a stronger influence on Oregon's forests than direct effects (e.g., increased carbon dioxide and altered diurnal or annual climate on vegetation [Reilly et al. 2018]).

2.2.1.5 Hydrology

Major River Basins of Oregon

A river basin, or watershed, is the land area drained by a network of streams conveying water to a river. A true hydrological watershed has one channelized inlet and one channelized outlet. For the purposes of this HCP, watersheds will be defined using the U.S. Geological Survey's hydrologic unit classification system for water resources throughout the United States, which may or may not be true hydrological watersheds.

Watersheds can be defined at different scales, from the smallest streams to the largest rivers. The U.S. Geological Survey's hydrologic unit classification system defines a nested series of hydrologic units that range from a larger "region" (21 total regions in the United States) to smaller "subwatersheds." Each hydrologic unit (HU) is identified by a unique hydrologic unit code (HUC). Using this scheme, Oregon is divided into 14 (HUC-6) accounting units as shown below, which are described by ecoregion in Figure 2-2. Each accounting unit is subdivided into smaller cataloguing units (HUC-8 areas). There are 91 HUC-8 areas in Oregon. The TerrainWorks data analysis describing the streams used by covered species is based on HUC-8 watersheds (Natural Resources Conservation Service 2008).

Water Quality

Water quality is affected primarily by discharges from both point and nonpoint sources, as well as the surrounding land uses. The Oregon Water Quality Index analyzes a defined set of water quality variables and produces scores describing general water quality throughout Oregon's rivers. Variables included in the index are dissolved oxygen, biochemical oxygen demand, pH, total solids, ammonia, nitrate nitrogen, total phosphorus, temperature and bacteria (*Escherichia coli*). Oregon Water Quality Index results for water years 2011–2020 show 51 percent of sites in excellent or good status, 17 percent in fair, and 32 percent in poor or very poor status for the statewide ambient monitoring network of 160 sites. Over the 30 years of collecting samples, the forest land use type continues to have the highest percentage of excellent and good status water quality sites (Oregon Department of Environmental Quality 2021).[1]

As discussed in Section 1.3.5.2, *Oregon Water Quality Standards,* the Department of Environmental Quality establishes and updates water quality standards for surface water as part of its federal Clean Water Act requirements. The program establishes standards to protect beneficial uses of Oregon surface waters. Beneficial uses include aquatic life, fish consumption, domestic/drinking and industrial water supply, recreation, and others. The Department of Environmental Quality prepares

[1] The "forest land use type" for water quality monitoring purposes encompasses all lands designated under a general umbrella, which could possibly be downstream of private industrial forest lands (some harvested recently, others not), state forests (harvestable and/or non-harvestable), state parks, protected areas and federal forest lands. The Oregon Water Quality Index is not intended to assess water quality in actively managed private timber lands.

an Integrated Report that meets the requirements of the federal Clean Water Act sections 305(b) and 303(d). Section 305(b) requires a report on the overall condition of Oregon's waters while section 303(d) requires states make a list of waters that are not attaining water quality standards and where Total Maximum Daily Loads with pollutant load limits need to be developed. The 2022 Integrated Report was approved by the U.S. Environmental Protection Agency on September 1, 2022.

Stream Categories

Streams in Oregon are classified by the State Forester, as described in the OFPA, into the following categories, based on their beneficial use (Oregon Administrative Rules [OAR] 629-600-0100 and 629-635-0200). As discussed in Section 1.1.2, *Background*, the 2022 Private Forest Accord Report (PFA Report) provided recommendations and associated changes to the OFPA statutes and rules as the basis of this HCP. The PFA Report intended that definitions under the OFPA (Oregon Revised Statutes [ORS] 527.610–527.992) will remain in place consistent with the newly adopted Forest Practice Rules (OAR chapter 629, divisions 600 through 680) finalized in 2023.

- **Type F.** Type F streams may have both fish use and domestic water use.
- **Type SSBT streams.** Type SSBT streams include all streams with salmon, steelhead, or bull trout present or otherwise used by these species at any time of the year.
- **Type N.** Type N streams are those with neither fish nor domestic water use, i.e., those without a designated beneficial use. Type N streams can be perennial or seasonal streams.
- **Type Np.** Type Np streams are all perennial streams that are not Type SSBT or F.
- **Type Ns.** Type Ns streams are seasonal streams (defined as a stream that normally does not have summer surface flow after July 15) that are not Type SSBT, F, or Np.
    - *Lateral Type Np stream* means any Type Np stream that is not a Terminal Type Np stream.
    - *Terminal Type Np stream* means the largest Type Np stream by basin size that is immediately upstream of the end of a Type F or Type SSBT stream.

Additionally, all stream types are further categorized as small, medium, or large based on average annual flow. The following definitions apply to these size categories.

- **Small.** Average annual flow of two 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.

Channel migration zone means the area where the active channel of a stream is prone to move and this results in a potential near-term loss of riparian function and associated habitat adjacent to the stream, except as modified by a permanent levee, dike, railroad lines, or any public transportation infrastructure. For this purpose, *near term* means the time scale required to grow a mature forest.

Seeps means features similar to springs, except without a well-defined point or points of groundwater surface discharge and usually very low flow.

Springs means features where groundwater discharges to the land surface or a surface water body at a well-defined point or points. Spring volumes range from small, intermittent trickles to millions of gallons per day, depending on the groundwater source and hydraulic head.

Water that flows through forestlands sustains ecosystems and provides for out-of-stream uses such as irrigation, livestock watering, household domestic use, and community use. The Oregon Water Resources Department monitors stream flows, issues permits for water withdrawals from streams, and regulates water rights.

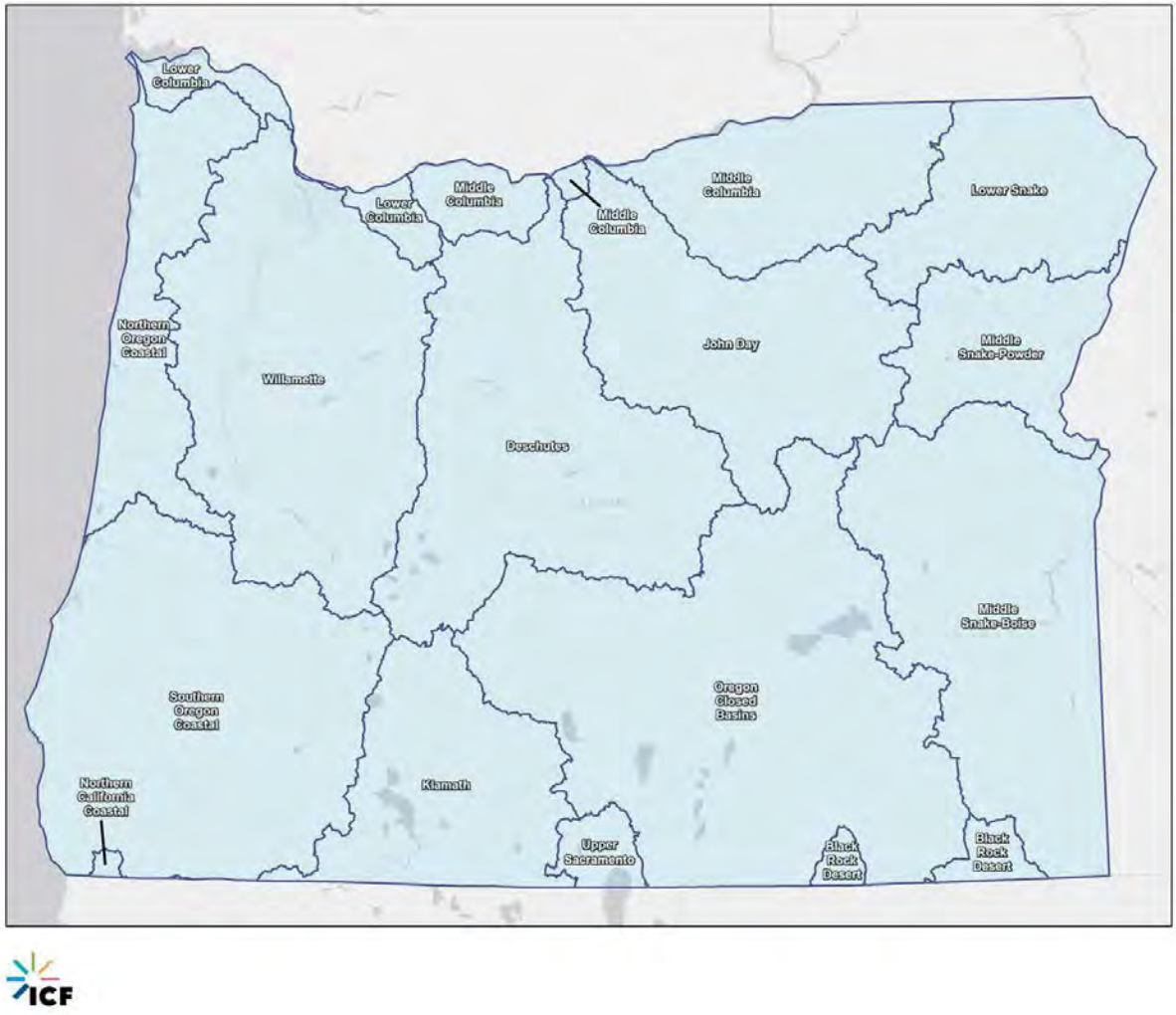


Figure 2-2. HUC-6 Regions in Oregon

2.2.2 Western Oregon – Physical Setting

Western Oregon includes all ecoregions west of the Cascades, which are the Coast Range, Willamette Valley, Klamath Mountains, and West Cascades. Descriptions of the physical settings by ecoregion are provided in this section.

2.2.2.1 Geology and Topography of Western Oregon

Table 2-2. Slope Steepness in the Permit Area of the Western Oregon Ecoregions

	Percent of Permit Area			
Percent Slope	**Coast Range**	**Klamath Mountains**	**Willamette Valley**	**West Cascades**
0–10	29.7	32.1	57.6	33.9
10–20	35.5	34.0	32.9	34.7
20–30	22.2	24.7	8.0	20.1
30–40	10.5	8.5	1.3	9.8
40–50	1.9	0.65	0.10	1.5
50–65	0.10	0.02	0.00	0.08
65+	0.001	<0.001	<0.001	0.001

Source: United States Geological Survey National Elevation Dataset Digital Elevation Model; accessed 2021. https://gdg.sc.egov.usda.gov/Catalog/ProductDescription/NED.html.

Coast Range Ecoregion

The Coast Range geology is largely composed of colluvium, alluvium, and sedimentary rocks, such as sandstone, siltstone, with intrusions of igneous rock, and mudstone, overlying igneous bedrock. Locally, there are basaltic outcrops within the large Tyee Formation (sandstone) in the center of the ecoregion. Topography in the Coast Range ecoregion is steep and highly dissected with relatively uniform ridge and valley terrain, and there is frequent evidence of medium to large-scale ancient slide features. Debris flows typically initiate from shallow landslides, due to the steep topography and rainfall (LaHusen 2020). This is the ecoregion in western Oregon with the highest percentage of steep terrain in the permit area (Table 2-2, Figure 2-3).

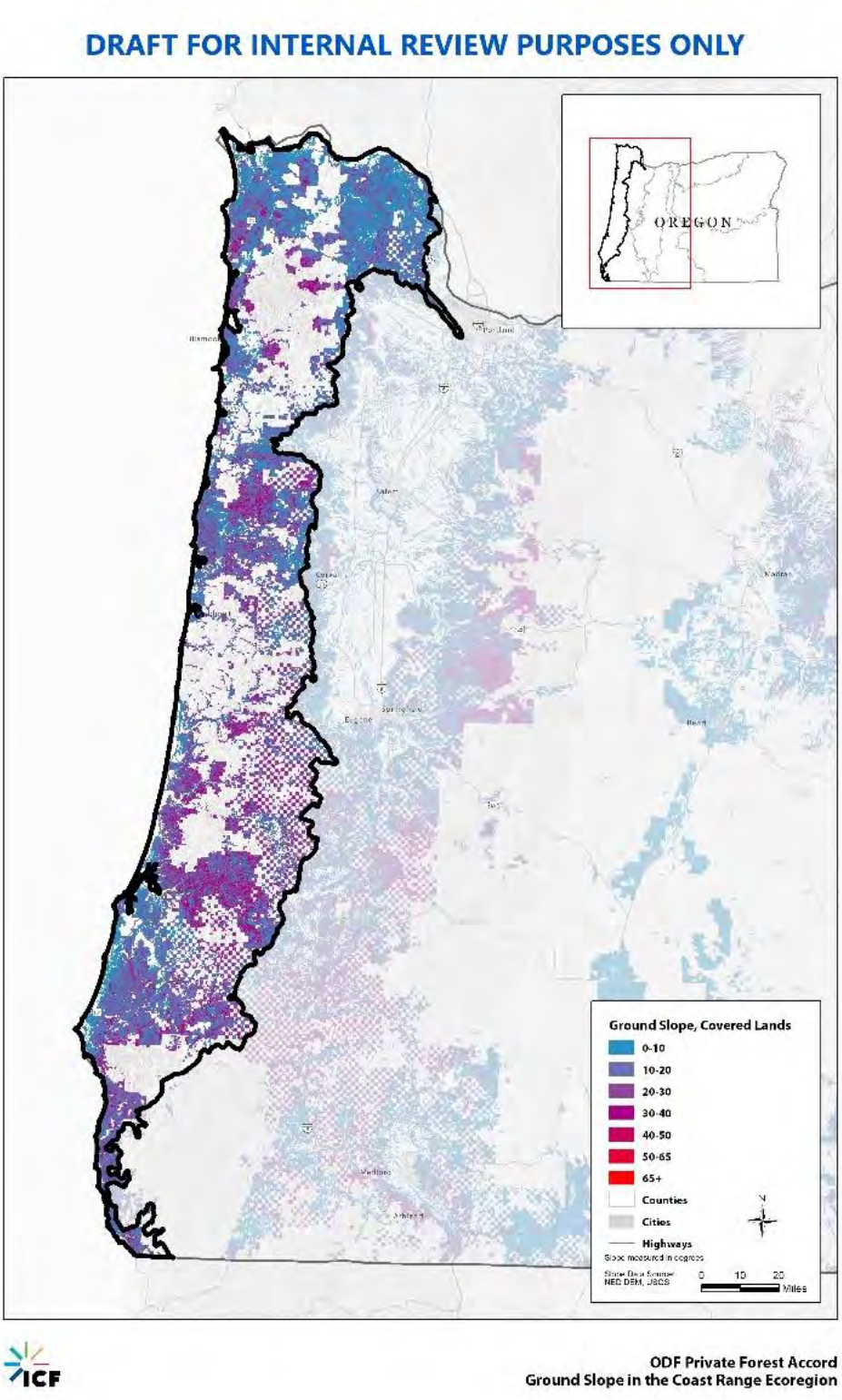


Figure 2-2. Ground Slope in the Coast Range Ecoregion

Willamette Valley Ecoregion

The Willamette Valley ecoregion is mostly a broad, lowland valley with rolling foothills, with a majority of the permit area having a slope of <10 percent (Table 2-2). Elevations range from about sea level to over 2,000 feet (610 meters) on higher peaks, which are located along the southern, western, and eastern borders of the ecoregion, where basalt and sandstone bedrock is found. The rest of the ecoregion is dominated by floodplain alluvial deposits.

Klamath Mountains Ecoregion

The Klamath Mountains ecoregion's underlying bedrock consists of basalt, granite, shale, and sandstone with belts of serpentinite. Most of these serpentinite belts are intruded by granitic rocks or overlain by sedimentary rocks. This region includes the Umpqua Mountains, Siskiyou Mountains, and the foothills and valleys between these and the Cascade Range, and elevation ranges from 400 to 3,000 feet (122 to 914 meters). The mountains are highly dissected with moderately sloping foothills and mountain valleys consisting of terraces and floodplains, with the permit area having a smaller proportion of steep (>40 percent) slopes compared to the other mountainous ecoregions in western Oregon.

West Cascades Ecoregion

The topography of the West Cascades ecoregion has been shaped dramatically by its volcanic past, and still has active volcanoes in the younger volcanic crest. The "old Cascades" exist to the west of the crest, with basalt being the dominating rock type; however, there is also andesite, tuffs, and breccias. There is a large range in elevations from near sea level at the Columbia River to 11,250 feet (3,429 meters) at Mount Hood, with most of the region between approximately 2,130 and 7,220 feet (649 and 2,201 meters). The topography is steep and has somewhat less dissected slopes than the Coast Range mountains; however, slope steepness in the permit area is very similar in the two ecoregions (Table 2-2). The risk of slope instability associated with timber harvest and roadbuilding is somewhat less than that of the Coast Range ecoregion but still substantial.

2.2.2.2 Soils of Western Oregon

Table 2-3. Site Class per Ecoregion for Douglas-Fir, the Dominating Tree Species in the Permit Area for Western Oregon

	Percent of Permit Area			
Site Class *	**Coast Range**	**Klamath Mountains**	**Willamette Valley**	**West Cascades**
I	6.59	0.04	2.96	1.67
II	55.7	10.0	29.7	8.83
III	17.4	16.9	19.7	34.5
IV	2.55	25.2	0.90	9.03
V	0.94	5.98	0	1.15

* 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 as: 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, and Site Class V = Below 75 feet.

Coast Range Ecoregion

Soils in the Coast Range ecoregion are mainly derived from sandstone, siltstone, mudstone, and basalt. These parent materials all have potential to generate highly productive soils, but the productivity also depends on profile depth, stoniness, and topographic position. The soils are predominantly immature, but there are some older, more weathered clay soils as well, ranging 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 (*Pseudotsuga menziesii*) to moderate potential productivity (low Site Class III), depending largely on profile depth, stoniness, topographic position, and to some extent, soil parent material (Table 2-3, Figure 2-4).

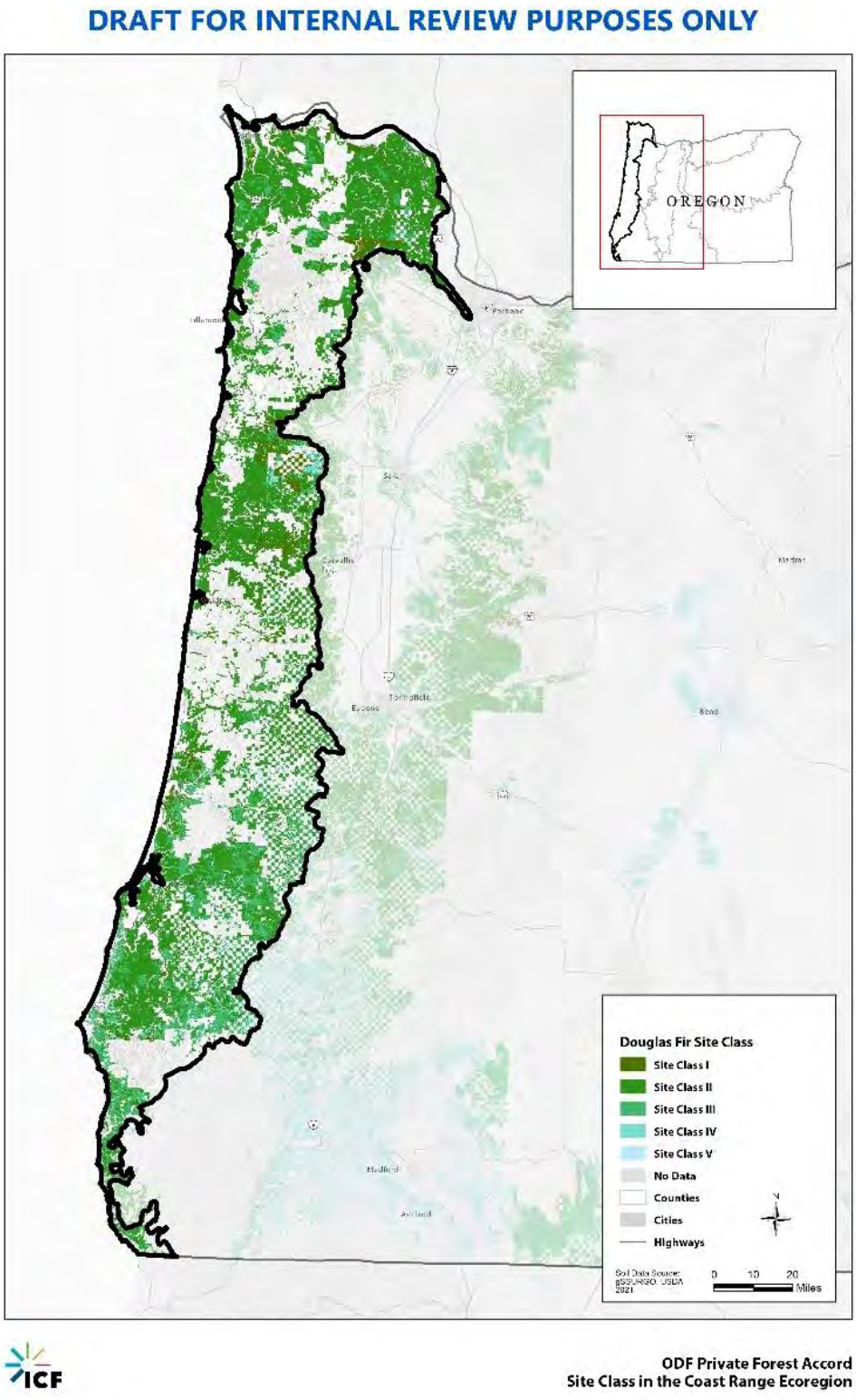


Figure 2-3. Site Class in the Coast Range Ecoregion

Willamette Valley Ecoregion

Soils in the Willamette Valley ecoregion include relatively deep alluvium, colluvium, and glacio-lacustrine deposits (sediment from glaciers deposited into lakes). Soils within the permit area [placeholder to refine and confirm soil conditions from GIS land layer] mostly consist of productive soils with the Site Class II and III for Douglas-fir in most of the permit area (Table 2-3), and temperature and moisture regimes influenced by the Mediterranean climate. This results in annual soil temperature between 45°F (7°C) and 60°F (15°C) and soils that are wet in winter and dry in the mid- to late-summer months.

Klamath Mountains Ecoregion

Soils in the Klamath Mountains ecoregion can be classified as upland or valley soils. There is a mix of more fertile, clay-rich soils, and younger soils where productivity mainly depends on the parent material. The productivity measured by the site class for Douglas-fir varies from Class II–IV (Table 2-3), and the soils can be divided into a western and an eastern group. In the western half of the Klamath Mountains, upland soils are moderately deep with silt loam or silty clay loam surface horizons underlain by silty clay. There is a variety of valley soils, mostly, well-drained silt loam underlain by a silty clay loam subsoil (Franklin and Dyrness 1988).

This western area also has scattered serpentine soils, which are challenging for most plants to grow on due to their high concentration of heavy metals, low calcium-to-magnesium ratio, and low macronutrient content. This has led to high rates of endemism, and the vegetation is usually sparser than in neighboring areas. The only tree species in Oregon that grows well on serpentine soils is Jeffrey pine (*Pinus jeffreyi*). Tolerance to drought and open habitats are suggested as important pre-adaptations to serpentine tolerance (Armbruster 2014). Jeffrey pine is highly windfirm and typically has a deep taproot, and strong and extensive primary lateral roots growing laterally as well as angling downward. In northern Sierra Nevada on serpentine soil, Jeffrey pine roots were encountered up to 100 feet (30 meters) from the nearest trees, which are distances greater than tree height in the area (Jenkinson 1990). This suggests that surrounding soil is relatively well stabilized by Jeffrey pine roots, which could ameliorate erosion in these often-shallow soils in steep terrain. There are also studies suggesting that serpentine bedrock could act as an aquifer, releasing water gradually with more water being available later in the dry season (Kram et al. 2009)

In the eastern part of the ecoregion, the primary upland soils are dry for most of the year and are generally and approximately 3 feet (0.9 meters) deep. The texture tends to be loam underlain by clay loam subsoils. Shallow, gravelly soils of low fertility occur but are less widespread. (Franklin and Dyrness 1988). Soils on floodplains and alluvial fans in the eastern half of the Klamath Mountains are predominantly well-drained fertile soils.

West Cascades Ecoregion

Soils of the West Cascades ecoregion can be placed in two major groups: those derived from basic igneous rock such as basalt and andesite, and those derived from pyroclastic parent material, mainly tuffs and breccias. Soils derived from tuffs and breccias usually consist of gravelly clay loam on steep slopes and are often poorly drained, commonly resulting in slumps and debris flows. On gentler slopes these soils tend to be deep and fine textured with moderately thick, dark brown clay loam underlain by silty clay or silty clay loam (Franklin and Dyrness 1988).

Soils derived from basalt and andesite colluvium tend to be stonier and coarser textured and, therefore, more well drained and stable than the other group of soils in this ecoregion. On steep slopes these soils are usually poorly developed and have gravelly loam or sandy loam surface horizons. On gentler slopes the soils are often deep and well-developed loam to clay loam with a slightly finer textured subsoil. In the south, soils can also be derived from sandstone and siltstone, and there are both older, intensely weathered soils containing clay and having relatively low fertility, as well as moderately leached fertile soils with clay enriched subsoil.

Site quality varies from high Site Class II for Douglas-fir to Site Class V for Douglas-fir (Table 2-3). Forest stands may range from being relatively windfirm to being highly susceptible to windthrow, depending on steepness of slopes, aspect, and soil depth.

2.2.2.3 Climate and Climate Change of Western Oregon

Coast Range Ecoregion

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 is mainly as rainfall, averaging between 50 and 125 inches (1.3 and 3.2 meters) annually along the coast and east of the Coast Range crest, but totaling as much as 200 inches (5 meters) at higher elevations in the northern part of the mountains. In addition, the coastal areas often experience fog. The mean temperature on the coast ranges from a low of 36°F (2°C) to a high of 74°F (23°C).

Willamette Valley Ecoregion

The Willamette Valley ecoregion has a Mediterranean-type climate, with warm, dry summers and mild, wet winters. The mean winter low temperature is 32°F (0°C), while the summer high is 85°F (29°C). The frost-free season is 5 to 7 months long. The mean annual precipitation range is 40 to 50 inches (1 to 1.3 meters), except in the wetter foothills where precipitation ranges from 45 to 60 inches (1.2 to 1.5 meters).

Klamath Mountains Ecoregion

The Klamath Mountains ecoregion has a Mediterranean climate that is typified by hot, dry summers and abundant rainfall in the winter months. The average annual precipitation varies from 25 inches (0.64 meters) per year in the eastern areas, to up to 130 inches (3.3 meters) per year in the coastal Siskiyou's to the west. Nearly 80 percent of the precipitation occurs in the winter months. Mean annual temperatures range from 24°F (-4°C) to 89°F (32°C).

West Cascades Ecoregion

The western slopes of the Cascades receive most of their precipitation as snow from November through March. At higher elevations up to 140 inches (3.6 meters) of precipitation may fall annually, and the lower slopes get 70 to 120 inches (1.8 to 3 meters), while the lower valleys receive 60 to 90 inches (1.5 to 2.3 meters) each year. Temperatures in the West Cascades ecoregion are still influenced by the ocean but are more varied than the Coast Range ecoregion. Mean annual temperatures range from 16°F (-9°C) to 85°F (29°C).

Climate Change

In western Oregon, the moderate, moist coastal climate generates high amounts of rainfall. This contributes to productive growing conditions for conifers, as well as hardwood and ground vegetation, such as sword fern (*Polystichum munitum*) and salal (*Gaultheria shallon*). Dense fog is common, creating lush moss growth within forested canopies. The western Oregon forest exhibits a general drying (lower precipitation) from west to east, though the forest, as a whole, is relatively wet, compared to the valleys between the Oregon Coast Range and the Cascades, and is much more wet than eastern Oregon.

The high-moisture levels in western Oregon reduce the risk of frequent wildfire. However, because fires have been historically rare, dense forests can build up large fuel loads that produce the potential for stand-replacing fires during drought conditions. With hotter, longer, and drier summers projected to occur in the future due to climate change, more severe and long-lasting wildfires are a potential future agent of disturbance for all forests within the Coast Range ecoregion (Agnea et al. 2018). Other risks that are at least partly subject to climate controls include insects, disease, and drought-related mortality.

Western Oregon's relatively moist forests may experience decreased growth and productivity due to climate change, although the northern portion of the Coast Range ecoregion along the Pacific Ocean has been projected to have the lowest amount of climate change effects among Pacific Northwest forest regions (Reilly et al. 2018).

2.2.2.4 Hydrology and Water Quality of Western Oregon

[Information will be updated to reflect stream data when TerrainWorks data is available.]

Coast Range Ecoregion

The Coast Range ecoregion has the state's highest stream density, ranging from 2 to 3 miles (3.2 to 4.8 kilometers) of stream per square mile of land. Coast Range streams and rivers generally have steep gradients in their headwater sections and very flat gradients in their lower reaches. 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. Several streams drain north directly into the Columbia River on the north Coast. 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. Overall, the ecoregion has 8,759 miles (14,096 kilometers) of streams in the plan area (26 percent fish-bearing and 96 percent of Type F streams have perennial flow). Approximately 8,220 acres (3,327 hectares) of wetlands occur in the plan area of the Coast Range ecoregion, the majority of which are riverine (75 percent).

Important Rivers

The ecoregion has several important rivers: Alsea, Chetco, Coos, Coquille, Illinois, Lewis and Clark, Necanicum, Nehalem, Nestucca, Rogue, Siletz, Siuslaw, Trask, Umpqua, Wilson, Yaquina, and Youngs.

Willamette Valley Ecoregion

Surface water in the Willamette Valley ecoregion is dominated by large rivers and numerous streams flowing from the adjacent mountainous regions (Griffith 2010). There are also numerous seasonal wetlands and ponds along with a few reservoirs. Streamflows result from the confluence of

multiple rivers, snowmelt, and runoff from mountains on three sides: the Cascade Range to the east, the Oregon Coast Range to the west, and the Calapooya Mountains to the south. Large rivers in the ecoregion include the Willamette, McKenzie, Santiam, Sandy, Mollala, Clackamas, Tualatin, Yamhill, Luckiamute, and Long Tom. The valley's large rivers continuously deposit highly fertile alluvial soils across its broad, flat plains, which are used primarily for agriculture and are important to the local economy. Overall, the ecoregion's surface water is dominated by large rivers with a wide variety of ecosystems and habitats. There are 70 miles (113 kilometers) of streams in the plan area, with 36 percent of streams identified as fish-bearing. Virtually 100 percent of Type F streams are perennial. There are 70 acres (28 hectares) of wetlands (98 percent are riverine).

Watersheds bordering the Willamette River basin are those of the Little Deschutes River to the southeast, the Deschutes River to the east, and the Sandy River to the northeast; the North Umpqua and Umpqua rivers to the south; coastal rivers including (from south to north) the Siuslaw, the Alsea, the Yaquina, the Siletz, the Nestucca, the Trask, and the Wilson to the west; the Nehalem and the Clatskanie to the northwest; and the Columbia River to the north.

The Willamette River flows the entire length of the valley from north to south and drains a region of 11,478 square miles (29,730 square kilometers), which is 12 percent of the total area of Oregon. There has been widespread loss of the Willamette River's floodplain and off-channel habitat due to human conversion of the floodplain to agriculture, construction of hardened shorelines such as rip-rap and revetments, loss of side channels, and changes in flow regimes. These developments eliminate floodplain-inundating flows and the result has been the Willamette River being largely confined to a single channel and mostly disconnected from its floodplain. These changes have impacted Oregon's native species, resulting in state and federal listings of several plant and wildlife species associated with the Willamette River and its floodplain.

Important Rivers

The ecoregion has several important rivers: Willamette, McKenzie, Santiam, Sandy, Mollala, Clackamas, Tualatin, Yamhill, Luckiamute, and Long Tom.

Klamath Mountains Ecoregion

The Klamath Mountains ecoregion occupies most of southwestern Oregon and extends southward into northern California. The mountains are rugged, having 2,000 to 5,000 feet (610 to 1,524 meters) of relief and mostly high-gradient streams. Its unique geologic conditions and serpentine habitat provides much vegetative and wildlife diversity. The Klamath Mountains are a significant site for diverse salmon populations. They contain rugged terrain with 190 river miles of stream. Within this span, 10 percent of identified streams are fish-bearing, 99 percent of Type F streams are perennial, and there are 366 acres (148 hectares) of wetlands (97 percent riverine). In the foothills, the streams are medium grade. This ecoregion falls in the Rouge, Umpqua, and Chetco River basins.

Important Rivers

The ecoregion has several important rivers: Applegate, Rogue, Chetco, Coquille, Umpqua, and Illinois. Major rivers and lakes in the Klamath Mountains include the Klamath River, Trinity River, Smith River, Salmon River, Rogue River, Scott River, upper Sacramento River, and Castle Lake.

West Cascades Ecoregion

West Cascades ecoregion's streams and rivers usually have high gradients. Streams west of the crest flow westward eventually joining one of the major rivers draining the area (Santiam, Sandy, Willamette, and Clackamas). Elevation, climate, and soils strongly influence the hydrology of the West Cascades. At higher elevations much of the precipitation falls as snow and a significant portion filter into highly permeable soil and rock. There are approximately 491 miles (790 kilometers) of streams in the West Cascades ecoregion. Of those, approximately 20 percent are fish-bearing and 79 percent of the area is perennial flow. There are approximately 359 miles (578 kilometers) of non-fish-bearing streams.

Important Rivers

The ecoregion has several important rivers: Clackamas (Oak Grove Fork), McKenzie, Rogue, Umpqua, Breitenbush, Middle Santiam, and North and Middle Fork of the Willamette.

2.2.3 Eastern Oregon – Physical Setting

Eastern Oregon includes the ecoregions east of the crest of the Cascades: East Cascades, Columbia Plateau, Blue Mountains, and Northern Basin and Range. Descriptions of the physical settings by ecoregion are provided in this section and are largely based on the ODFW's Conservation Strategy (2016).

2.2.3.1 Geology and Topography of Eastern Oregon

Table 2-4. Slope Steepness in the Permit Area of the Eastern Oregon Ecoregions

	Percent of the Permit Area			
Percent Slope	East Cascades	Columbia Plateau	Blue Mountains	Northern Basin and Range
0–10	77.9	37.1	45.7	57.2
10–20	16.7	26.8	34.7	28.7
20–30	4.5	24.1	15.1	11.5
30–40	0.8	11.0	4.1	2.5
40–50	0.045	0.91	0.36	0.15
50–65	0.003	0.061	0.023	0.010
65+	<0.001	0.001	0.001	<0.001

East Cascades Ecoregion

The East Cascades ecoregion includes several peaks and ridges in the 6,000- to 7,000-foot range (1,828 to 2,133 meters), but overall, the slopes on the east side of the Cascade Mountain Range are less steep and cut by fewer streams than the West Cascades ecoregion. The permit area includes very few steep areas, with >75 percent having slopes of 0 to 10 percent (Table 2-4). The East Cascades' volcanic history is evident through numerous buttes, lava flows, craters, and lava caves. The bedrock in the central and northern half of the region is mainly basalt and andesite, while in the southern part there is sandstone and siltstone.

Columbia Plateau Ecoregion

The elevation of the Columbia Plateau ecoregion ranges from 200 to 4,400 feet (61 to 1,341 meters), although most of the landscape sits at 100 to 600 feet (30 to 183 meters). In general, elevations increase from the lowest area along the Columbia River on the northern edge of the ecoregion, south to the foothills of the Blue Mountains. This area is characterized by rolling hills while the eastern portion of the ecoregion is marked by steep canyons formed by several tributaries to the Columbia River, reflected in having the highest percentage of steep slopes within the permit area of the eastern Oregon ecoregions (Table 2-4). The geology of the area is unique because of historic volcanic eruptions, creating a deep layer of tertiary basalt.

Blue Mountains Ecoregion

The Blue Mountains ecoregion includes multiple mountain ranges, valleys, and plateaus. The elevation ranges from approximately 1,000 feet (305 meters) along the Snake River to 9,838 feet (2,999 meters) at Sacajawea Peak. Almost half of the permit area (45.7 percent) in this ecoregion has gentle slopes of 0 to 10 percent, and <5 percent of the area is steeper than 30 percent (Table 2-4). The western half of the ecoregion has large areas of Columbia River basalt, as well as breccias and tuffs along the lower John Day River. The exception is the Deschutes River Valley with sedimentary rock outcrops that are some of the oldest rocks in Oregon. The eastern portion has a higher variety of rock, with basalt and tuffaceous rock, siltstone, limestone, granite, and gabbro. Sedimentary formations are common but not continuous. Scattered over the central area are Cold Basins with tuffaceous sediment. Along the north slope of the Blue Mountains basalt is predominant, while alluvial deposits of sand and gravel cover the floors of many basins.

Northern Basin and Range Ecoregion

The Northern Basin and Range ecoregion is characterized by several flat basins separated by isolated mountains. Elevations range from gorges to 9,700 feet (2,957 meters), although the ecoregion is mostly characterized by nearly level lands at 4,000 to 5,000 feet (1,219 to 1,524 meters), with 57 percent of the permit area in the 0 to 10 percent slope range (Table 2-4). The northeastern part of the ecoregion contains the Snake River Plain, which is mostly flat to rolling with elevations of 2,100 to 3,500 feet (640 to 1,067 meters), and the highly dissected Owyhee Uplands, home to the Malheur River and Lake Owyhee, which have carved deep canyons, badlands, and caves. In small patches in the central part there are volcanic mountain slopes, cones, and buttes, some of which are forested and included in the plan area. The area is dominated by basalt, tuffs, and andesite.

2.2.3.2 Soils of Eastern Oregon

Table 2-5. Site Class per Ecoregion for Ponderosa Pine, the Dominating Tree Species in the Permit Area for Eastern Oregon [a]

	Percent of Permit Area			
Site Class	**East Cascades**	**Columbia Plateau**	**Blue Mountains**	**Northern Basin and Range**
I	0.062	0	0	0
II	0.048	0	<0.001	0
III	13.7	0	0.74	0
IV	48.3	0.26	1.97	2.18

	Percent of Permit Area			
Site Class	**East Cascades**	**Columbia Plateau**	**Blue Mountains**	**Northern Basin and Range**
V	16.8	2.49	3.50	2.19

[a] Except for the Northern Basin and Range where it is the second most common tree species (site class data is extremely limited for eastern Oregon).

East Cascades Ecoregion

There are extensive areas of historical deep ash deposits created by the explosion of Mount Mazama during the creation of Crater Lake. In the northern part of the ecoregion the principal soil is typically a fertile, silt loam. In the central part soils are mostly young, fertile, and more coarse-textured, while in the southern part both of the two soil types are present, as well as some organic soils and desert soils. The productivity is fairly low in the permit area, dominated by Site Classes III and IV for ponderosa pine (*Pinus ponderosa*)(Table 2-5), likely due to water being limited rather than low soil fertility.

Columbia Plateau Ecoregion

Most soils in the Columbia Plateau ecoregion are mollisols, containing ash and organic material, making for productive growing conditions, and typically have a sandy texture. In contrast, the Pleistocene lake basin along the southern bank of the Columbia River is characterized by arid soils with very little organic matter. Soils in the Deschutes and John Day River canyons contain large amounts of rock. Approximately 7,700 years ago, the ecoregion was covered in 15 to 30 inches (38 to 76 centimeters) of volcanic ash from the Mount Mazama eruption, which formed Crater Lake, creating an upper layer of quaternary loess.

Blue Mountains Ecoregion

The Blue Mountains ecoregion has a wide diversity of soils as a result of its volcanic past and its variety of topographies, but soils can be grouped into those at moderate to high elevations, formed under forest vegetation, and those at lower elevation formed under shrub and grassland vegetation. Higher elevations still have thick layers of ash from the Mount Mazama eruption, and on broad ridgetops and north-facing slopes these soils are generally 2 to 3 feet (61 to 91 centimeters) thick, and the texture is fine sandy loam to silt loam. Forest soils developed from loess tend to be deep and composed of silt loam. The soils in the forest-grassland transition area are commonly formed from basalt or other basic igneous rock and loess, are less than 3 feet deep, and have silt loam surface horizons overlaying silty clay loam to clay.

Northern Basin and Range Ecoregion

Throughout the ecoregion, soils are typically rocky, thin, and low in organic matter. Between 40,000 and 10,000 years ago, most of the basins of this ecoregion contained large, deep lakes. When those lakes dried from evaporation, they left behind high salt and mineral deposits in the soils creating alkali flats. These are deeper, silty soils possessing a subsurface horizon of clay and sodium accumulation. On the high lava plains in the northwest, the most widely distributed soils are derived from basalt or tuff and most commonly have very stony loam textures.

2.2.3.3 Climate and Climate Change of Eastern Oregon

Eastern Oregon is characterized as having long hot and dry summers, much drier than western Oregon. The Cascades form a rain shadow over the east by capturing most of the moisture from the coast, with 8 to 100 inches (0.2 to 2.5 meters) of precipitation per year, mostly falling as snow in the winter. The Columbia Plateau ecoregion consists of lowlands shaped by flooding of the Columbia River and hot, windy summers making soil erosion an issue for much of the area. The East Cascades and Blue Mountains ecoregions receive the majority of their precipitation as winter snowfall that feeds the descending rivers. The Northern Basin and Range ecoregion is known for its very dry climate, receiving less than 40 inches (1 meter) of rain per year. This arid climate has historically supported large grass and sagebrush lands throughout the majority of the east. Fire suppression, grazing practices, and increase in winter precipitation have all contributed to the spread of western juniper (*Juniperus occidentalis*) throughout eastern Oregon's rangelands (Gedney 1999; Oregon Department of Fish and Wildlife 2016b).

Historically, eastern Oregon experienced frequent but mild- to moderate-intensity wildfires. This fire frequency maintained a relatively open stand structure among most eastern forests. Over the last 140 years, since European-American settlement began in the area, fires have been largely suppressed. This has resulted in a buildup of density of eastern Oregon's forests, a shift to fire-intolerant species, and an increased risk of large insect and disease outbreaks and stand-clearing wildfires.

East Cascades Ecoregion

The climate of this ecoregion varies considerably from its cool, moist border with the West Cascades ecoregion to its drier and warmer eastern border at the high deserts of the Northern Basin and Range ecoregion. The climate is generally dry, with wide variations in temperature. Mean annual precipitation is 16 to 40 inches (41 to 102 centimeters) in most of the area, and the mean annual temperature has a low of 15°F (-9°C) and a high of 83°F (28°C).

Columbia Plateau Ecoregion

The Columbia Plateau ecoregion is characterized by a dry climate, receiving an average of 7 to 25 inches (18 to 64 centimeters) of rain per year. Temperatures range from a mean low of 24°F (-4°C) to a mean high of 89°F (32°C). The driest and hottest area is the Pleistocene lake basin along the southern bank of the Columbia River, followed by the steep river canyons in the eastern part of the ecoregion. The northwest foothills and uplands of the Blue Mountains receive the most rain: 15 to 25 (38 to 64 centimeters) inches per year.

Blue Mountains Ecoregion

The climate of the Blue Mountains ecoregion varies over broad temperature and precipitation ranges because of elevational differences. Overall, the ecoregion has short, dry summers and long, cold winters, when most of the precipitation falls as snow. Precipitation at high elevation in the mountains is 30 to 80 inches of snow while the Deschutes River Valley (westernmost part) receives only 10 inches (25 centimeters) on average. The mean high temperature is 84°F (29°C) in large areas of this ecoregion.

Northern Basin and Range Ecoregion

In the rain shadow of the Cascades Mountains, the Northern Basin and Range ecoregion is Oregon's driest ecoregion, and is marked by extreme ranges of daily and seasonal temperatures. Much of the ecoregion receives less than 15 inches (38 centimeters) of precipitation per year, although mountain peaks receive 30 to 40 inches (76 to 102 centimeters) per year. The extreme southeastern corner of the state has desert-like conditions, with annual precipitation of only 6 to 12 inches (15 to 30 centimeters). Temperatures range from a mean minimum of 17°F (-8°C) to a high of 88°F (31°C), and some areas have as few as 30 frost-free days per year. Under climate change, drought conditions may become more frequent, resulting in reduced water availability for wetlands in important fish and wildlife areas like Summer Lake, Lake Abert, and Malheur Lake.

Climate Change

Climate change to induced alterations to snowpack and hydrologic regimes in eastern Oregon are expected to have profound effects on certain ecoregions. The proportion of snow to rain will decrease more slowly at higher elevations and in eastern Oregon. Average increased temperatures will lead to a larger number of heat events, and more severe extreme heat events, across the state, with greater increases anticipated in eastern Oregon than in western Oregon. Although stream temperatures are generally projected to increase across Oregon, the increase in stream temperature is projected to be slightly lower in southeastern Oregon. In northeastern Oregon, decreases in summer precipitation, increases in temperature, and increases in drought are likely to decrease minimum flows, which may make some streams intermittent rather than perennial (Dalton and Fleishman 2021). The climate-fire risk in the coniferous forests of the East Cascades is relatively low. However, the climate-fire risk in the dry coniferous forests throughout the rest of the east are high for increased fire frequency, extent, and severity (Halofsky et al. 2020). Due to changes in climate and fire severity, some dry forests and woodlands at low to intermediate elevations in eastern Oregon may not be able to reestablish naturally and could transition to more flammable shrublands or grasslands (Dalton and Fleishman 2021).

2.2.3.4 Hydrology and Water Quality of Eastern Oregon

East Cascades Ecoregion

In general, the East Cascades ecoregion is drier than the West Cascades ecoregion, with fewer rivers flowing down the mountain slopes. However, the ecoregion is characterized by many lakes, reservoirs, and marshes, providing exceptional habitat for aquatic species and wildlife closely reliant on water. The northern two-thirds of the East Cascades ecoregion is drained by the Deschutes River, ultimately flowing into the Columbia River. Most of the southern portion of the East Cascades ecoregion is drained by the Klamath River, with a small portion draining into Goose Lake, a closed basin. Much of the wetlands fed by the Klamath River have been drained and converted to agriculture.

Important Rivers

Important rivers in the ecoregion include the Deschutes, Hood, Klamath, Metolius, Link, Williamson, Sycan, and Sprague.

Columbia Plateau Ecoregion

The Columbia Plateau ecoregion is made up entirely of lowlands, with an arid climate, hot summers, and cool winters. The Columbia River delineates the northern border of the ecoregion in Oregon and has greatly influenced the surrounding area with cataclysmic floods and large deposits of windborne silt and sand. Water availability is a concern in this ecoregion, and water demands include agricultural, irrigation, and domestic use. These demands affect water quality in the Columbia Plateau ecoregion, particularly in summer months when flows are reduced. Restoring flow to headwater streams is essential to maintain ecological connections. Water quantity is a limiting factor for fish, wildlife, and livestock. In streams, seasonal low flows can limit habitat suitability and reproductive success for many fish and wildlife species. As the demand for water increases, the supply of groundwater is decreasing. Water quality can also limit species and habitats.

The Columbia River runs east to west along the northern border of most of this ecoregion, and most of the northern border of Oregon, and facilitates large floods and deposits of silt and sand throughout the floodplain. The Deschutes and John Day Rivers carry runoff and snowmelt to the Columbia River from the northern East Cascades and western Blue Mountains. Streams throughout the rest of the ecoregion are mostly ephemeral except the perennial streams draining the eastern Blue Mountains.

Important Rivers

Important rivers in the ecoregion include the Columbia, Deschutes, John Day, Umatilla, and Walla Walla.

Blue Mountains Ecoregion

The western border of the Blue Mountains ecoregion, and of Oregon, follows the western banks of the Snake River, bringing water from Yellowstone, through Idaho, to the Columbia River. The Snake River used to be one of the most important rivers for anadromous fish; however, the river is no longer passable due to the installation of five dams that inhibit migration. Overall, the Blue Mountains ecoregion experiences short, dry summers and long, cold winters, and, as a result, much of the precipitation falls as snow. Snowmelt from the Blue Mountains peaks is drained by tributaries of the Columbia River. Conversion of native vegetation to agriculture in lower-elevation, valley-bottom habitats, such as riparian areas and wetlands, threatens water quality and quantity. Most floodplain wetlands have been drained for agricultural purposes, but remnants exist in the Grande Ronde Basin.

Important Rivers

Important rivers in the ecoregion include the Deschutes, Grande Ronde, Imnaha, John Day, Malheur, Powder, Silvies, Snake, Umatilla, and Wallowa.

Northern Basin and Range Ecoregion

The Northern Basin and Range is Oregon's driest ecoregion due in part to extreme ranges of daily and seasonal temperatures. Much of the Northern Basin and Range ecoregion receives less than 15 inches of precipitation per year, although mountain peaks receive 30 to 40 inches (76 to 102 centimeters) per year. The extreme southeastern corner of the ecoregion and state has desert-like conditions, with annual precipitation of only 8 to 12 inches (20 to 30 centimeters). Runoff from precipitation and mountain snowpack often flows into low, flat playas where it forms seasonal

shallow lakes and marshes. These shallow wetlands are rich in invertebrates and are extremely important for wildlife. The majority of the aquatic habitats in this ecoregion are affected by altered channel and flow conditions, obstructions, and poor riparian condition. Under climate change, drought conditions may become more frequent, resulting in reduced water availability for wetlands in important wildlife areas like Summer Lake, Lake Abert, and Malheur Lake.

Important Rivers

Important rivers in the ecoregion include the Donner und Blitzen, Malheur, Owyhee, and Silvies.

2.2.4 Tree Species in the Plan Area

This section describes the primary tree species in Oregon.

- **Bigleaf maple** (*Acer macrophyllum*) is found throughout western Oregon in the foothills of the Cascades and Coast Ranges. It tolerates shade well and a wide variety of soils, slopes, and climates. The wood is often used for furniture and cabinets. Wildlife uses the trees for foraging and nesting.
- **Black cottonwood** (*Populus trichocarpa*) is very tolerant of flooding but largely intolerant of shade, drought, and fire. It grows in riparian areas along streams or lakes and provides important shading for streams and the fish and wildlife that use them. Deer, elk, and livestock frequently browse on its leaves and twigs. As timber, it is good for pulp and veneer.
- **Douglas-fir** (*Pseudotsuga menziesii*) has high-value wood, is considered premiere structural wood, is widely used as Christmas trees, and provides important wildlife habitat for birds. It tolerates a little shade and is resistant to rot from stem damage and bark beetle (*Dendroctonus pseudotsugae*) attacks. It is widely grown everywhere with good drainage and sufficient sunlight. But is much more widespread in eastern Oregon than a century ago. Young trees are susceptible to fires, but older trees tolerate light fires. It is not drought tolerant and is susceptible to defoliating insects, dwarf mistletoe (*Arceuthobium pusillum*), and root disease in dense stands.
- **Engelmann spruce** (*Picea engelmannii*) is very frost tolerant and is often found along streams and at higher elevations or north slopes where summer frosts are likely. It can grow in periodically flooded or high-water-table areas, is tolerant of shade, and has a low susceptibility to spruce budworm. It is intolerant of drought, wind, and fire and is susceptible to spruce bark beetle attacks in dense stands. Its wood is valued for having a low weight, being light in color, and being strong.
- **Grand fir** (*Abies grandis*) is sometimes known as white fir. It is very shade tolerant and grows faster than other trees in its habitat. It is very sensitive to drought, root disease, and stem decay and has no tolerance for bark beetles or fire. Affected trees provide important habitat for cavity-dwelling wildlife species. It has white wood, which was historically considered less valuable than ponderosa pine or Douglas-fir.
- **Incense-cedar** (*Calocedrus decurrens*) is found in southern Oregon. It is drought tolerant and prefers drier sites because older trees get pockets of wood rot from fungus. Originally used for wood pencils, today the wood has a low commercial value. It is sun-loving and very susceptible to fire, but provides excellent nesting cavities for birds.

- **Jeffrey pine** (*Pinus jeffreyi*) is limited to southwest Oregon and grows well in the Siskiyou region on serpentine soils that are toxic to most other plants. It is tolerant of drought but intolerant of shade and wet soil. Similar to ponderosa pine, it is commercially valuable for general wood products.
- **Lodgepole pine** (*Pinus contorta*) is the most frost-tolerant tree species in eastern Oregon and is the only species to thrive on pumice soils. Seedlings must have spring/summer frosts to grow. It is shade intolerant and becomes easily suppressed in dense stands. It is susceptible to bark beetle attacks, dwarf mistletoe, and fires. There are local heavy infections of western gall rust fungus. Lodgepole pine historically colonized beetle-killed areas that were intensely burned.
- **Mountain hemlock** (*Tsuga mertensiana*) is found at high elevations, above or mixed with subalpine fir, primarily along the crest of the Cascades and in the Wallowa Mountains. It is very tolerant of shade and frost and intolerant of drought and pest damage. It is susceptible to root disease, stem decay, and dwarf mistletoe. It has a low commercial value and its value for wildlife and watersheds outweighs its value for commercial products.
- **Noble fir** (*Abies procera*) is a true fir, is known for its blue-toned foliage, and is one of the most popular species for Christmas trees. It is common in middle to upper elevations throughout the Cascades and occurs sporadically in the Coast Range. It is tolerant of frost and will grow to heights of up to 200 feet in moist but well-drained soil. It is intolerant of wet soil and susceptible to root rot.
- **Oregon white oak (*Quercus garryana*)** is one of four deciduous oaks native to the West Coast. The massive trunks and wide crowns of older individuals are typical of valley woodlands in the Pacific Northwest, such as the Willamette Valley. It is generally considered shade intolerant and was likely historically maintained by periodic fire. It is particularly suited to exposed, droughty sites on the periphery of coniferous forest.
- **Ponderosa pine** (*Pinus ponderosa*) is the most commercially valuable species in the dry interior western United States because it grows large and has high-quality wood. It is the climax pine type because it regenerates under itself. It is drought tolerant, resistant to fire even when young, resistant to defoliation and root disease, shade intolerant, and susceptible to bark beetle attacks when stands are too thick. Some areas are badly infected with dwarf mistletoe.
- **Port-Orford cedar** (*Chamaecyparis lawsoniana*) is found primarily along Oregon's coast and tolerates shade and wet soil but not drought. The tree is very susceptible to root rot; however, the logs are resistant to rot and the boughs are prized for wreaths and floral arrangements.
- **Quaking aspen** (*Populus tremuloides*) is well known for its colorful fall foliage and white bark. It grows in moist meadows or on rocky slopes and tolerates flooding, wind, and frost. It is intolerant of shade, drought, and fire and prone to stem decay. Deer, elk, and cattle browse the leaves and twigs. It adds important diversity to the forest ecosystem and decayed stems provide cavities for woodpeckers.
- **Red alder** (*Alnus rubra*) is a hardwood that is intolerant of shade and drought but somewhat tolerant of wet soil and is immune to root rot. It is common along streams in the coastal fog belt, Coast Range, and West Cascades below 2,500 feet (762 meters) in elevation. It is well suited to be planted in pockets of root rot within Douglas-fir stands to interrupt the spread of the disease. Red Alder is an important source of nitrogen for forest ecosystems including streams because of

its symbiotic relationship with nitrogen-fixing bacteria.[3] Red Alder has high-value wood used for cabinets and furniture.

- **Sitka spruce** (*Picea sitchensis*) is only found along the coast of Oregon along with western hemlock. It has a very high tolerance for animal browsing and direct ocean spray, but an intolerance for frost. It is harvested for lumber, pulp, and plywood.
- **Subalpine fir** (*Abies lasiocarpa*) is shade tolerant and grows in closed forest stands at higher elevations. It is intolerant of drought and fire, and, if attacked by balsam woolly adelgid insects, can be severely damaged with stem and root decay. Its wood value is marginal.
- **Sugar pine** (*Pinus lambertiana*) is limited to the eastern flank of the Cascades in eastern and southern Oregon at mid-elevations. It is moderately drought and shade tolerant but prefers well-drained sunny sites. It is susceptible to blister rust. It grows well in warm-moist mixed-conifer stands and has moderate wood value.
- **Western hemlock** (*Tsuga heterophylla*) is shade tolerant and is the dominant tree species in the Coast Range and other moist sites in western Oregon. It is intolerant of drought and frost. It has valued wood that is prized for trim, windows, and doors. Old trees are prone to rot and serve as excellent wildlife habitat.
- **Western juniper** (*Juniperus occidentalis*) is slow growing and grows in open stands. It is drought tolerant, pest resistant, shade intolerant, and susceptible to fire. Although slow growing, it has expanded immensely under fire suppression over the last century. It has limited commercial value, decreases grazing opportunities, increases soil erosion and land degradation, and can be easily controlled with prescribed fire.
- **Western larch** (*Larix occidentalis*) is moderately drought tolerant and highly resistant to fire, frost, defoliation, Douglas-fir tussock moth, and root disease. It grows rapidly in open spaces, especially on deep soils and north aspects, but growth slows in dense stands. It is shade intolerant and very susceptible to dwarf mistletoe, needle disease, and larch casebearer insects.
- **Western red cedar** (*Thuja plicata*) favors high-moisture sites along Oregon's coast but is found throughout western Oregon. It is shade tolerant and resistant to rot. Downed logs in streams provide important fish habitat and stream structure. Large woody materials, such as fallen western red cedar trees and limbs, resist rot in streams and create pools, and protective cover—necessary components of fish habitats. As timber, it is considered an excellent wood for outside carpentry, such as decks, siding, and shake roofs.
- **Western white pine** (*Pinus monticola*) is naturally limited to small areas in the Wallowa and Cascade Mountains. It is very frost tolerant and moderately tolerant of drought and shade. It is susceptible to bark beetle attacks and white pine blister rust fungus in dense areas. It grows fast and has high wood value.
- **Whitebark pine** (*Pinus albicaulis*) is very tolerant of wind, frost, and snow and intolerant of shade and drought. It is highly susceptible to white pine blister rust fungus. It is typically found

[3] Symbiotic relationships between nitrogen-fixing tree species and nitrogen-fixing bacteria allow the tree species to access otherwise unavailable atmospheric nitrogen and nitrogen from soil bedrock itself. This increases the availability of nitrogen in the soil, which adds a significant contribution of nitrogen to the nitrogen-budget of forested and aquatic ecosystems. These nitrogen contributions help relieve otherwise nitrogen-limited plant growth and directly influence carbon storage by increasing productivity. This capability releases more mineral nutrients that facilitates the growth of plants and trees and reduces the need for synthetic fertilizers.

at timberline and its seeds are an important source of food for wildlife. It has no commercial value.

2.2.5 Forest Types in the Plan Area

Grouping stands into forest types based on species composition is a useful means of facilitating 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. Oregon's forest stands are predominantly conifer, although some portions of the landscape are dominated by hardwood stands, and many stands across the landscape have a hardwood component. Forest types are identified within the western and eastern Oregon subheadings below.

2.2.5.1 Western Oregon Forest Types

Forest types in western Oregon can be broadly classified into spruce-hemlock, Douglas-fir-dominant, mixed-conifer, oak woodland/savannah, subalpine, and riparian. Due to a variety of geographic and historic factors, these forest types are not distributed evenly across the western ecoregions.

- **Spruce-hemlock** stands occur in high-moisture areas directly along the western coast of Oregon and predominantly contain Sitka spruce and western hemlock. These stands are also home to red alder, bigleaf maple, and western red cedar and cover less than 10 percent of western Oregon's forestland.
- **Douglas-fir-dominant** stands cover roughly 50 percent of western Oregon's forestland and are found predominantly in the Coastal Range and the lower elevations of the West Cascades ecoregions. These stands are also home to red alder, bigleaf maple, and western red cedar.
- **Mixed-conifer** stands cover roughly 25 percent of western Oregon's forestland, in the Klamath Mountains ecoregion, and contain a diversity of microclimates. These stands typically include some combination of ponderosa pine, incense-cedar, Douglas-fir, grand fir, sugar pine, Port-Orford cedar, western hemlock, black cottonwood, and red alder.
- **Oak woodland/savannah.** Oak woodlands prefer open savannah areas with 20 to 30 percent tree canopy cover for survival. This forest type prefers drier soils with better drainage. Oak woodlands and savannahs are fire-resistant communities. The oaks are characterized by wide sprawled branches and leaves creating shade. Underneath is a variety of shrubs and prairie grasses. Fire is the primary disturbance, and is usually set by lightning or, in the past, by early Native Americans as a management tool to maintain open areas. The bark on large oaks such as white oaks have the ability to withstand intense fires with very little harm to the trees. Oaks do not tolerate a lot of shade or areas with little sunlight. The younger oaks would often remain small under the canopy and build substantial root systems. When fires would break out and burn the forest and young trees, the young trees would resprout from the root collars. When a larger oak would fall over or die out, the younger tree would take its place and continue the ecosystem. Oak savannahs provide habitat and food for countless species of wildlife. Oak woodland/savannah populations decline as more clearcutting occurs and shade tolerant species move in and impact the younger oaks and disturb the ecosystem.

- **Subalpine** stands cover approximately 15 percent of western Oregon's forestland and are found at the highest elevations of the West Cascades ecoregion. These stands are characterized by subalpine fir, mountain hemlock, and whitebark pine.
- **Riparian Forests** play an important role in the ecosystems of western Oregon. Black cottonwood, Oregon ash, and white and red alders are common in riparian areas, especially those prone to flooding. Many riparian areas throughout the region have been converted or reduced due to agricultural development. The loss and fragmentation of riparian habitats is one of the biggest conservation concerns for the region.

  The Coast Range ecoregion contains the highest density of streams in the state. The surrounding riparian areas have deciduous vegetation distinct from the rest of the ecoregion's dominant coniferous forests. In the West Cascades ecoregion, riparian areas are dominated by hardwoods such as bigleaf maple and red alder. The Klamath Mountains ecoregion has suffered the loss of riparian habitats, but ongoing watershed conservation efforts have restored riparian areas and improved water quality in some areas. Restoration of summer streamflow and riparian vegetation throughout western Oregon is important for the recovery of covered species populations.

2.2.5.2 Eastern Oregon Forest Types

Forest types in eastern Oregon can be broadly classified into ponderosa pine, lodgepole pine, warm-dry mixed-conifer, cool-moist mixed-conifer, and riparian.

- **Ponderosa pine** stands cover approximately 55 percent of eastern Oregon's forestland. They are composed almost entirely of ponderosa pine but may also contain western juniper. These stands grow in very dry conditions that are unsuitable for other commercial tree species. Regeneration is very slow due to long summer droughts and long periods between cone crops. Historic fire intervals are 5 to 25 years and maintain open stands.
- **Lodgepole pine** stands cover approximately 5 percent of eastern Oregon's forestland. They are composed of more than 90 percent lodgepole pine, are found in frost-prone areas, and are low productivity. These stands typically dominate in pumice flats, frost pockets, high-elevation plateaus, and in or on the margins of wet meadows.
- **Warm-dry mixed-conifer** stands cover approximately 30 percent of eastern Oregon's forestland. They have high productive potential thanks to fast regeneration, especially of ponderosa pine, and are not historically limited by drought or spring/summer frosts. The stands are dominated by ponderosa pine and western juniper when young and western larch when soils are deep. Douglas-firs and grand firs are the most common species to regenerate in the understory. The eastern flank of the Cascades may also have some incense-cedar and sugar pine.
- **Cool-moist mixed-conifer** stands cover approximately 10 percent of eastern Oregon's forestland. They have low productive potential due to short growing seasons. These stands are characterized by moisture-demanding and cold-tolerant species such as subalpine fir, western white pine, and Engelmann spruce. Early stages are dominated by lodgepole pine or western larch, but they become shaded out as the stand ages. Ponderosa pine, Douglas-fir, and grand fir may also be present. Upper elevations and streamside/riparian areas have almost pure Engelmann spruce. The eastern flank of the Cascades has western white and sugar pines.

- **Riparian Forests.** The conditions of riparian forests throughout eastern Oregon vary widely due in large part to overgrazing, development, shrub encroachment, and recent implementation of watershed protection mechanisms. When Europeans settled in eastern Oregon at the end of the 19th century, cattle and sheep grazing joined the list of factors disturbing the area's forests, especially in the Columbia Plateau and Northern Basin and Range ecoregions. For about 100 years, large herds of sheep and cattle spread across the landscape, often concentrating around water sources in riparian areas. This severely degraded riparian forest ecosystems and affected their ability to filter water, resulting in impacts on the watershed.

  Other threats to riparian forests in eastern Oregon include the conversion of riparian habitats to urban and agricultural development and shrub encroachment. In the East Cascades ecoregion, residential development in riparian areas is an emerging major conservation issue. Conversions of valley bottoms, including riparian areas, to agriculture is a growing concern in the Blue Mountains ecoregion. The spread of western juniper in southeast Oregon has degraded riparian habitats throughout the Northern Basin and Range ecoregion. At the beginning of the 20th century, overgrazing was recognized as a problem when negative impacts on a large proportion of the region's streams were identified. Federal regulations and livestock best management practices were implemented to help protect riparian areas, including fencing off the areas and distributing water tanks to minimize concentrations of livestock. However, overgrazed riparian habitats are slow to recover and susceptible to invasive species infestations, further complicating the matter. Many riparian areas need restoration, and the need for continued livestock management is ongoing.

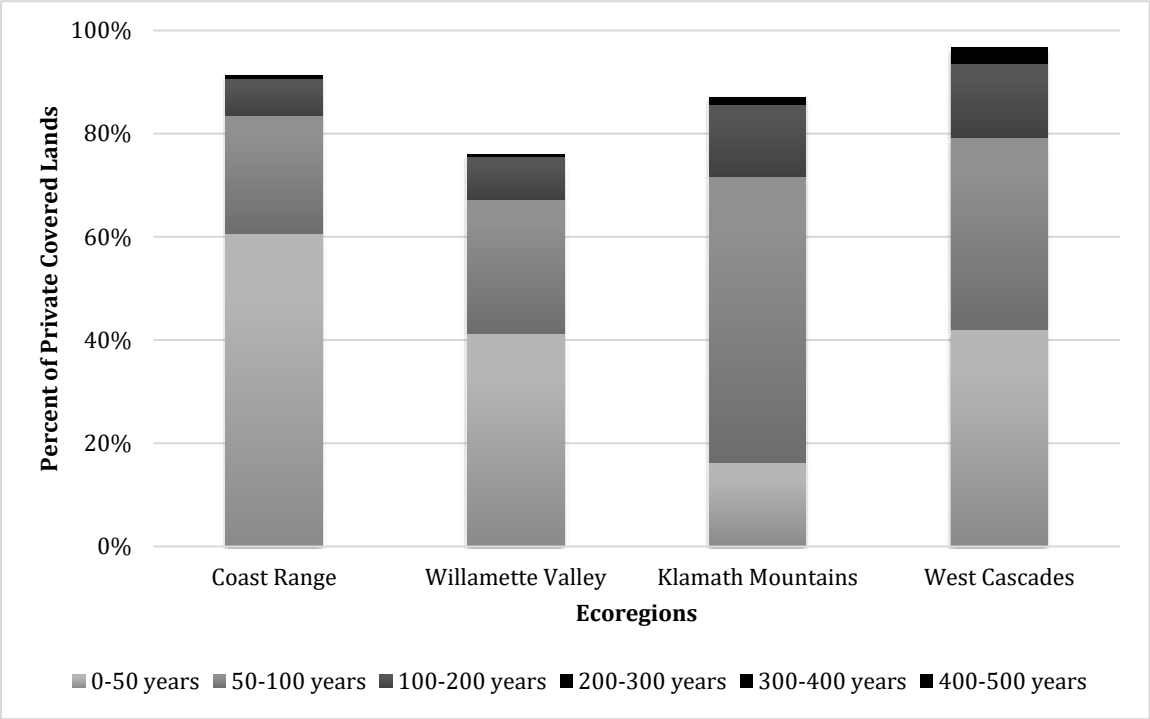
2.3 Forest Conditions in the Permit Area

2.3.1 Methods

Gradient Nearest Neighbor (GNN) data from Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) research group was used to describe all forest conditions below. LEMMA is a collaborative research group of the U.S. Forest Service Pacific Northwest Research Station and Oregon State University. GNN imputation methods are effective tools for characterizing vegetation structure and species composition in forested landscapes across large regions. This analysis used GNN data on stand age, stand height, canopy cover, and tree size to represent vegetation structure. Permit area forest conditions are discussed below for each ecoregion.

2.3.2 Western Oregon

2.3.2.1 Stand Age



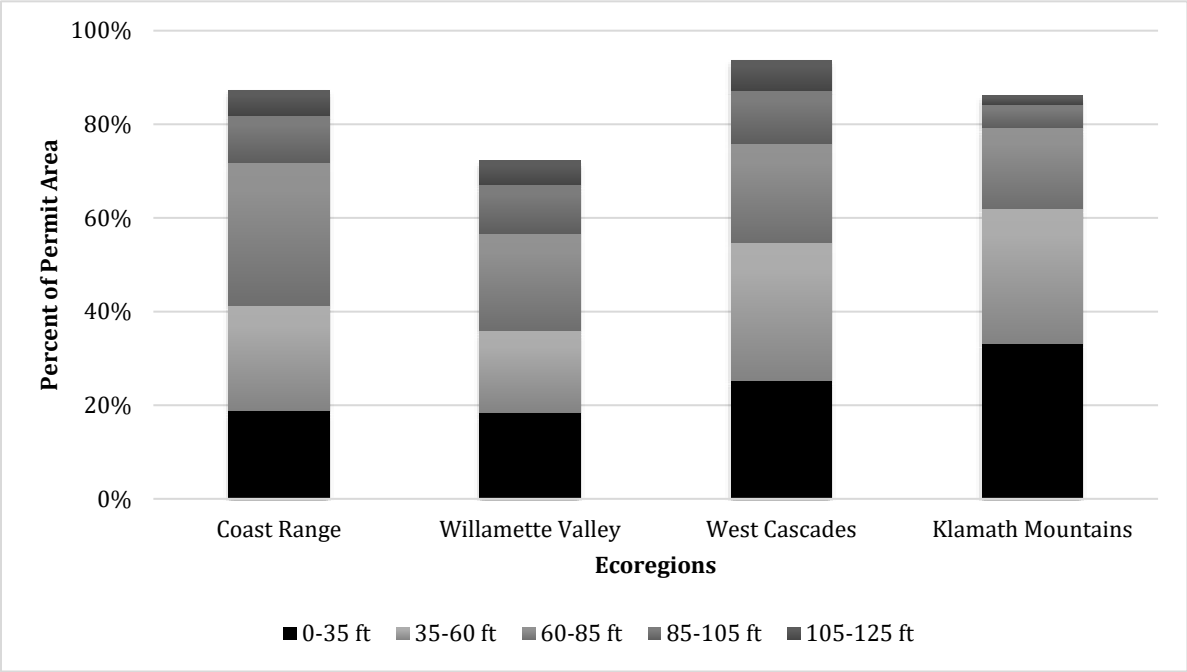
Note: The remaining permit area is not forested.

Figure 2-4. Stand Age in the Western Oregon Permit Area by Ecoregion

The stand age of western Oregon's private permit area lands is younger than eastern Oregon, with the majority of the stands being less than 100 years old. Approximately 60 percent of the Coast Range ecoregion's stands, and 40 percent of the Willamette Valley and the West Cascades ecoregion's stands, are less than 50 years old.

Fourteen percent of the stands in the Klamath Mountains and the West Cascades are 100 to 200 years old, and 7 and 8 percent of the stands in the Coast Range and the Willamette Valley, respectively, are the same age. There is a very small percentage of stands that are 200 to 300 years old, with 1 percent in the Coast Range and Klamath Mountains and 3 percent in the West Cascades. Only the West Cascades has stands 300 to 400 years old (1 percent).

2.3.2.2 Stand Height



Note: The remaining permit area is not forested.

Figure 2-5. Stand Height in Western Oregon's Ecoregions

Stand heights are the average heights of all dominant and codominant trees. The stand heights of western Oregon's permit area forests are mostly well distributed, up to 105 feet tall, as compared to eastern Oregon's stand heights (Figure 2-10). Over half (53 percent) the Coast Range stands in the permit area are between 35 and 85 feet; 19 percent are young short stands (0 to 35 feet) and 15 percent are taller (85 to 125 feet). Only 4 percent are between 125 and 200 feet.

Thirty-six percent of the Willamette Valley's forests are between 0 and 60 feet tall. Willamette Valley has 21 percent of its permit area forests measuring 60 to 85 feet, and 15 percent are between 85 and 125 feet. Only 4 percent are 125 to 200 feet.

Both the West Cascades and the Klamath Mountains ecoregions are composed of shorter trees than the other two ecoregions in western Oregon. The West Cascades have 54 percent between 0 and 60 feet, and 32 percent between 60 and 105 feet. Just 6 percent reach 105 to 125 feet, and 3 percent reach 125-200 feet. The majority of stand heights in the Klamath Mountains (62 percent) are 0 to 60 feet. Another 22 percent are between 60 and 105 feet. Just 3 percent reach 105 to 200 feet.

2.3.2.3 Canopy Cover

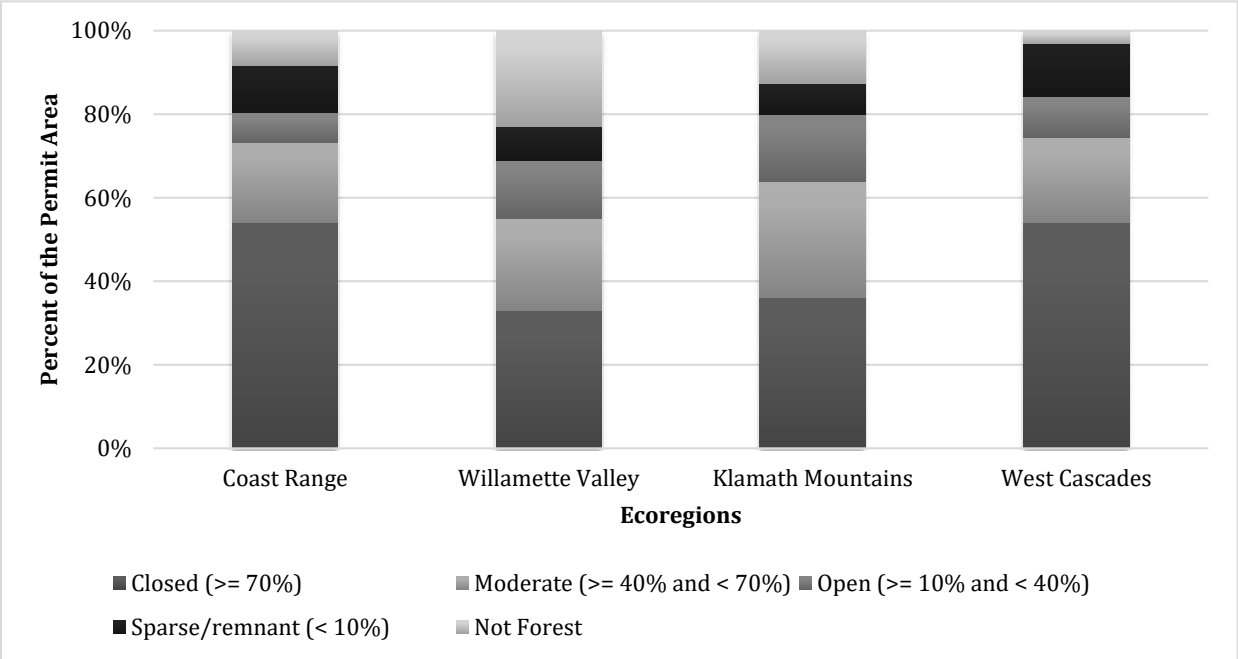
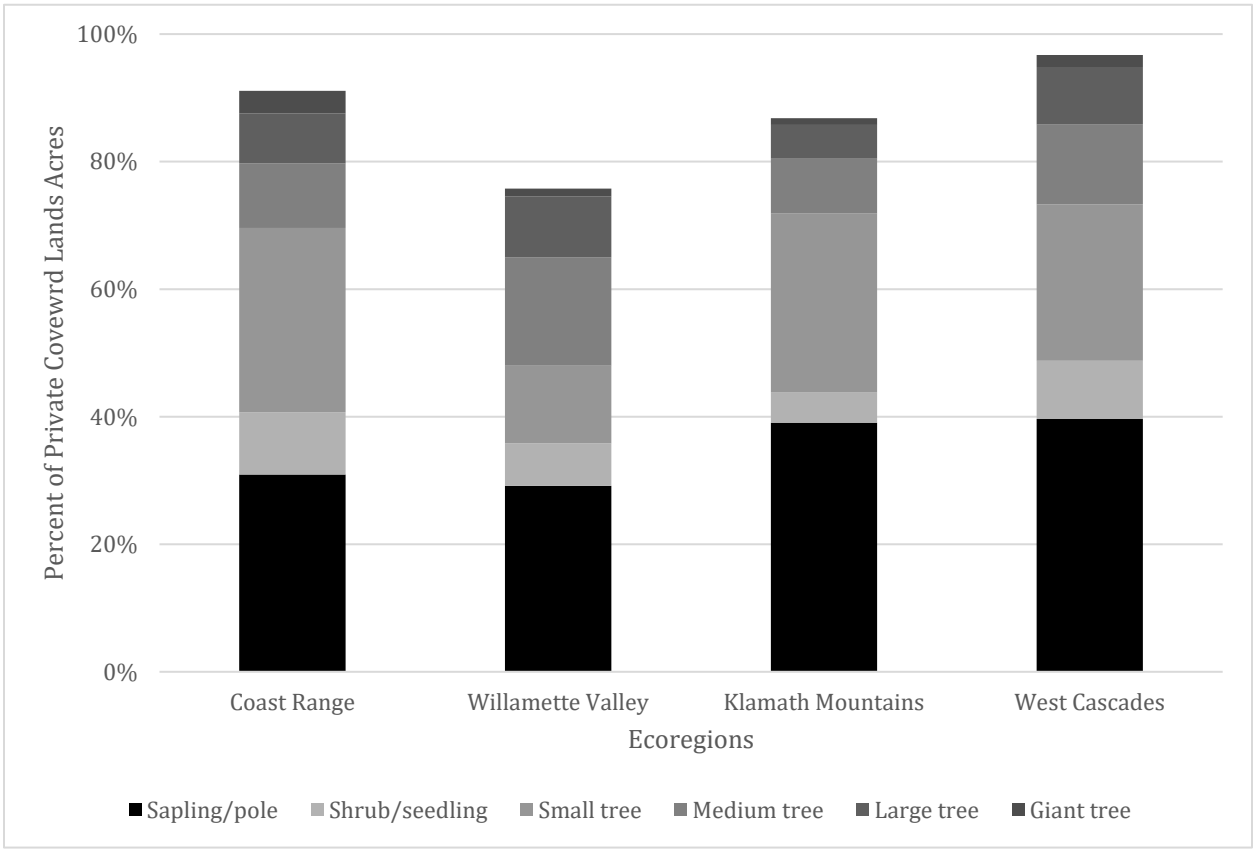


Figure 2-6. Canopy Cover in Western Oregon's Ecoregions

Western Oregon, due to higher rainfalls and forest productivity, is more densely forested than eastern Oregon (Figure 2-11). Fifty-four percent of western Oregon's permit area forests in the Coast Range and the West Cascades have a closed canopy (≥70 percent canopy cover), whereas 33 and 36 percent of the permit area in the Willamette Valley and Klamath Mountains permit, are closed, respectively. The Klamath Mountains have the highest percentage (28 percent) of moderate canopy cover, whereas the other three ecoregions range from 19 to 23 percent.

Open and sparse canopies are more common in the Willamette Valley and Klamath Mountain than in the Coast Range and West Cascades permit area.

2.3.2.4 Tree Size

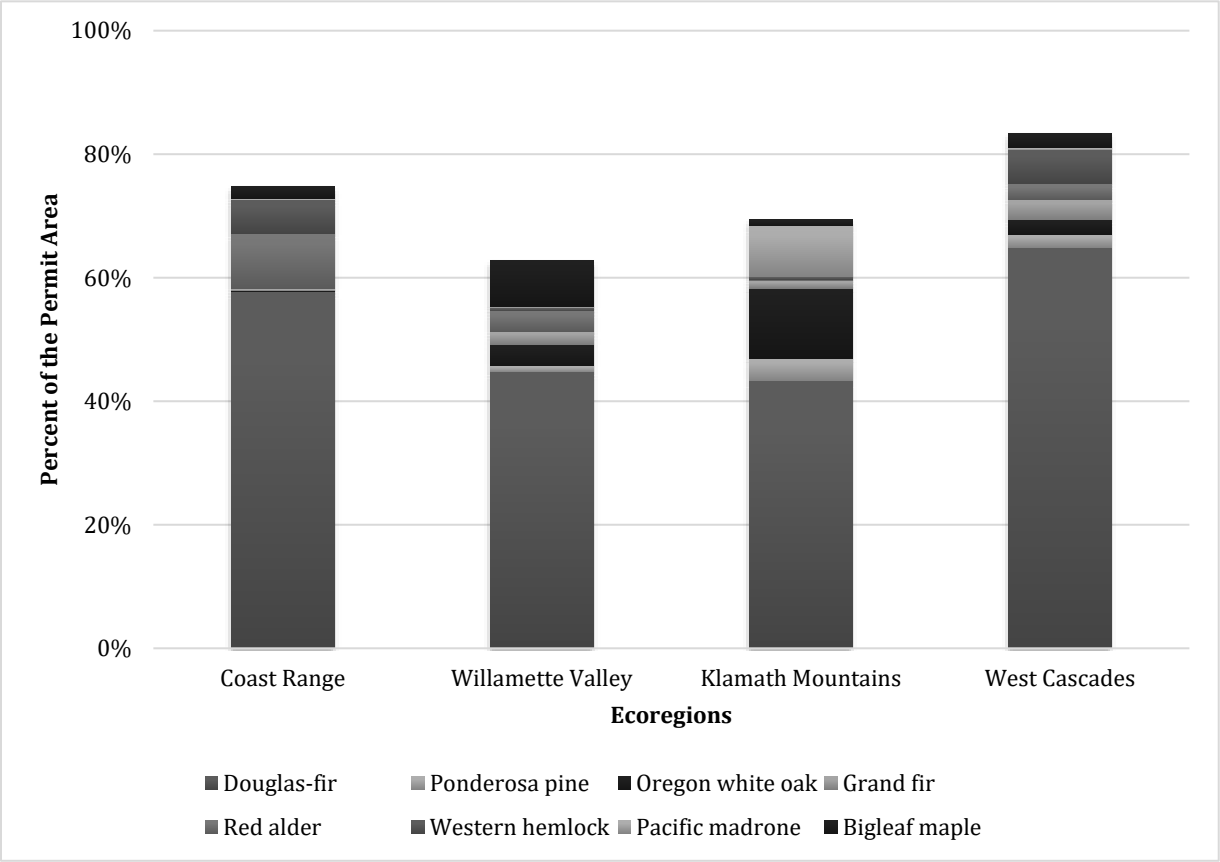


Note: The remaining permit area is not forested.

Figure 2-7. Tree Size in Western Oregon's Ecoregions

Roughly one-third of the permit area in western Oregon consists of sapling/pole size trees (i.e., 29 to 40 percent). Another 5 to 10 percent of the permit area consists of shrub/seedlings and 9 to 17 percent comprises medium trees. The Klamath Mountains have the lowest percentage of large trees (5 percent); the rest of the ecoregions have 8 to 9 percent. The Coast Range has the highest percentage of giant trees (4 percent), while the West Cascades has 2 percent and the Willamette Valley and Klamath Mountains have 1 just percent.

2.3.2.5 Tree Species



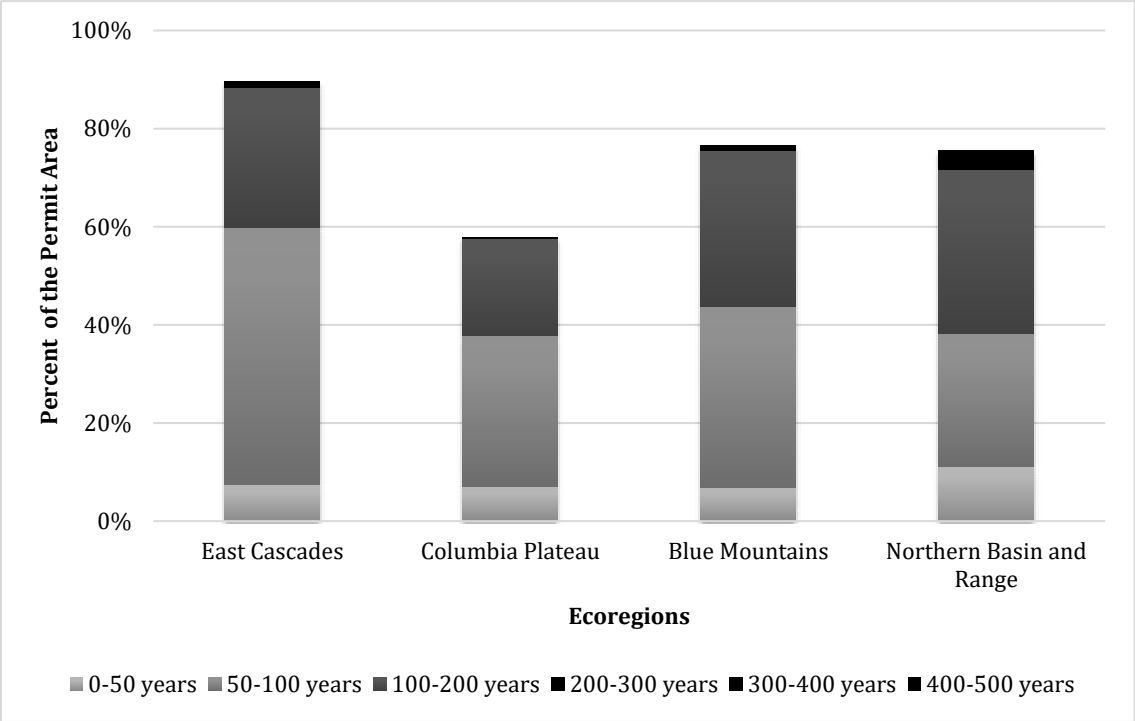
Note: The remaining permit area is not forested.

Figure 2-8. Dominant Tree Species in Western Oregon's Ecoregion

Douglas-fir is the dominant tree species in all ecoregions across western Oregon—ranging from 65 percent in the West Cascades, 58 percent in the Coast Range, 45 percent in the Willamette Valley, and 43 percent in the Klamath Mountains. In the Coast Range's permit area, the remainder of the subdominant trees are red alder (9 percent), western hemlock (5 percent), and bigleaf maple (2 percent). The Willamette Valley forests subdominants consist of bigleaf maple (7 percent), red alder (3 percent), Oregon white oak (3 percent), and grand fir (2 percent). The Klamath Mountains have slightly more variation in subdominant tree species including 11 percent Oregon white oak, 8 percent Pacific madrone, and 3 percent ponderosa pine. The West Cascades have 6 percent western hemlock, 3 percent grand fir, and 2 percent each of ponderosa pine, Oregon white oak, red alder, and bigleaf maple.

2.3.3 Forest Condition in Eastern Oregon

2.3.3.1 Stand Age

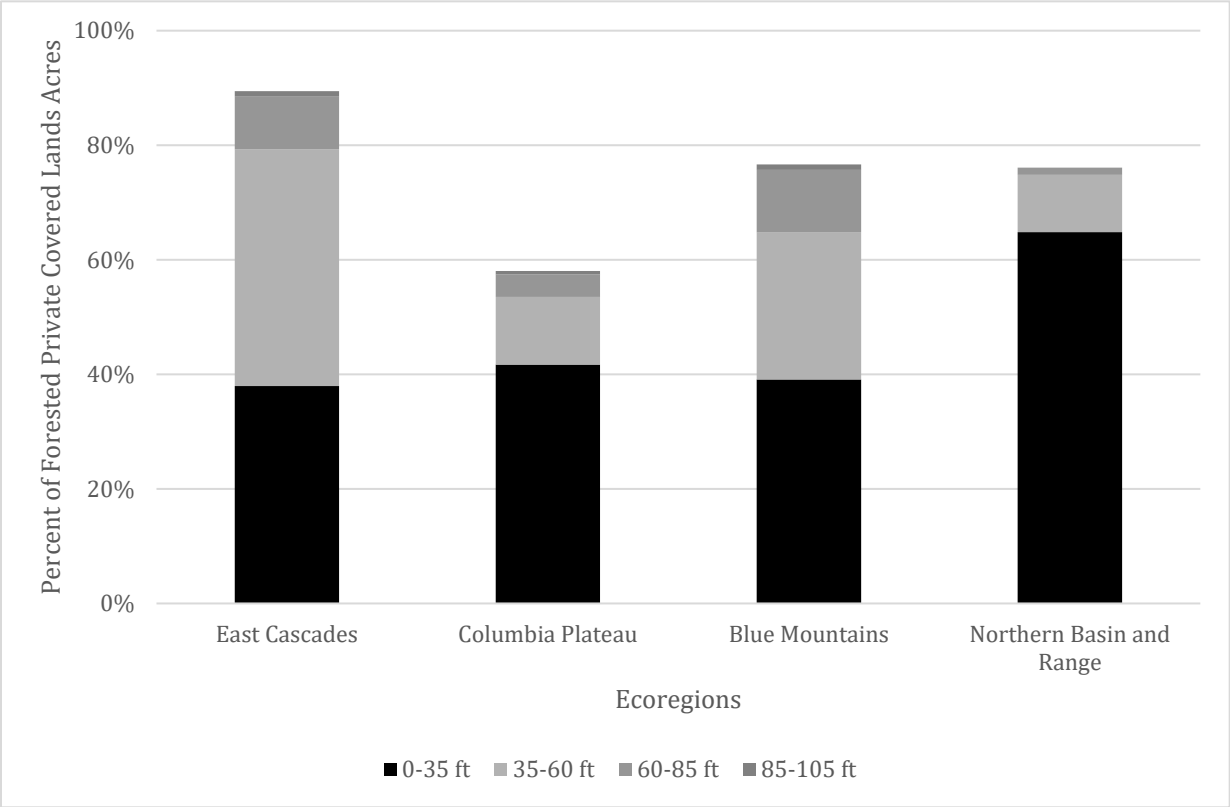


Note: The remaining permit area is not forested.

Figure 2-9. Stand Age in Eastern Oregon's Ecoregions

In general, forest stands in the eastern Oregon permit area are older than in western Oregon (Figure 2-4). Only 10 percent of stands in eastern Oregon's ecoregions are less than 50 years old. Over 50 percent of the East Cascades ecoregion is 50 to 100 years old, and about a third of the Columbia Plateau, the Blue Mountains, and the Northern Basin and Range ecoregion's stands are the same age. Two-fifths (20 percent) of the Columbia Plateau's permit area stands are 100 to 200 years old and about a third of the East Cascades, Blue Mountains, and the Northern Basin and Range are the same age. While neither side of Oregon has a large percentage of stands older than 300 years, eastern Oregon has more than western Oregon, with 1 percent in the East Cascades and the Blue Mountains, and 4 percent in the Northern Basin and Range.

2.3.3.2 Stand Height



Note: The remaining percent of the permit area is not forested.

Figure 2-10. Stand Height in Eastern Oregon's Ecoregions

Stand heights are the average heights of all dominant and codominant trees. In general, stand height in eastern Oregon's permit area is shorter than western Oregon (Note: The remaining permit area is not forested.

Figure 2-5). The majority of forests in eastern Oregon's permit area are 0 to 60 feet tall (79 percent in East Cascades, 54 percent in the Columbia Plateau, 65 percent in the Blue Mountains, and 75 percent in the Northern Basin and Range). The East Cascades and the Blue Mountains contain the tallest stands in eastern Oregon at 11 percent and 9 percent in the 60 to 85 foot range, respectively; the Columbia Plateau and Northern Basin and Range have just 4 and 1 percent, respectively. All eastern Oregon ecoregions have 1 percent of permit area stands that are 85 to 105 feet tall except the Northern Basin and Range, which has 0 percent.

2.3.3.3 Canopy Cover

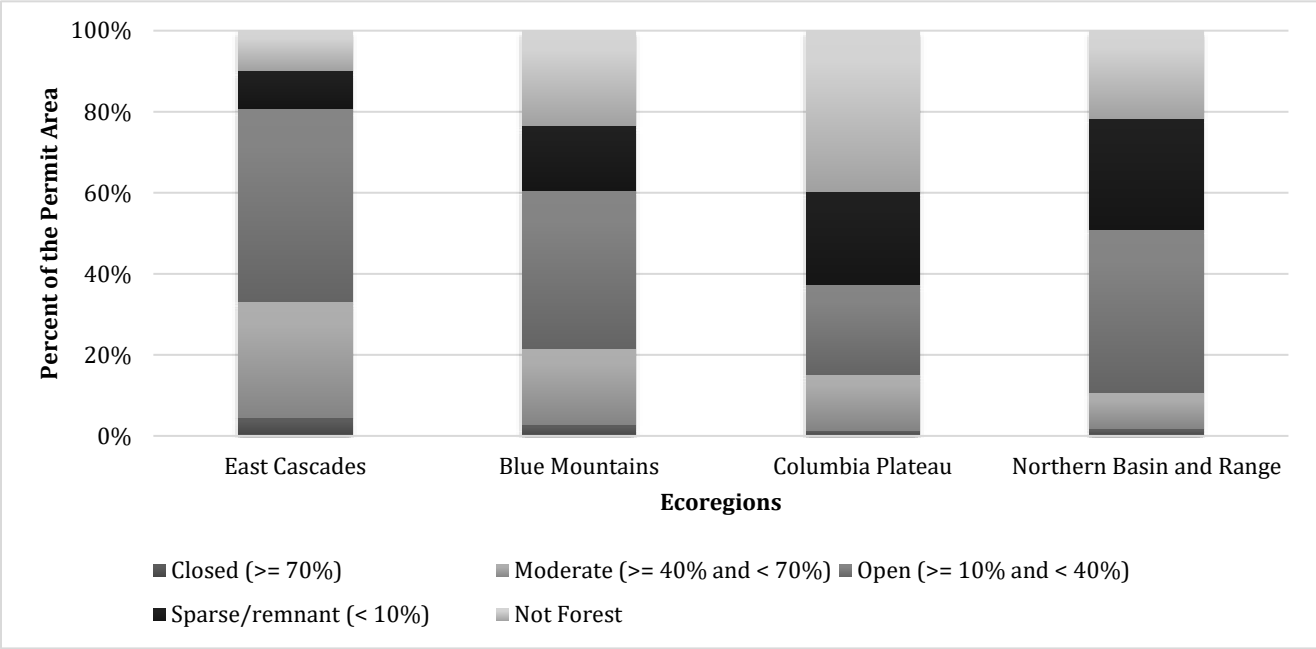
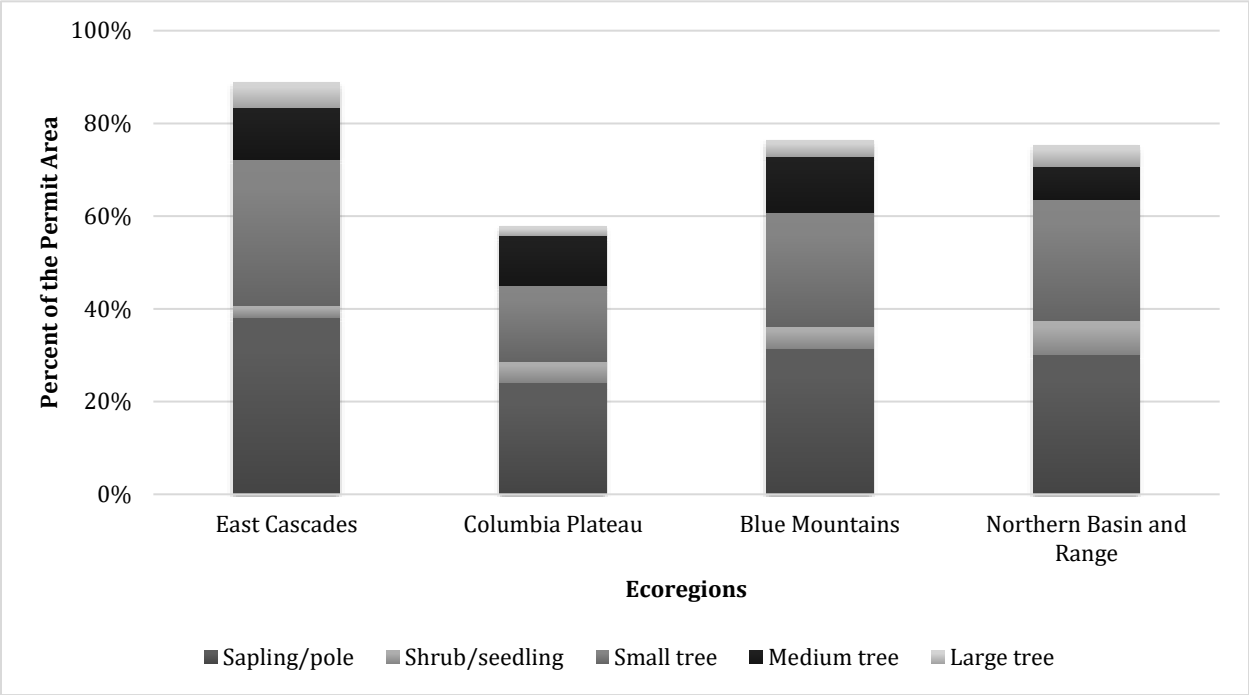


Figure 2-11. Canopy Cover in Eastern Oregon's Ecoregions

Owing to the overall aridity of eastern Oregon, very little forest in the permit area is categorized as closed canopy (≥70 percent canopy cover) with just 5 percent in the East Cascades, 3 percent in the Blue Mountains, 1 percent in the Columbia Plateau, and 2 percent in the Northern Basin and Range. The majority of the permit area in eastern Oregon exhibits an open canopy (48 percent in the East Cascades, 39 percent in the Blue Mountains, 22 percent in the Columbia Plateau, and 40 percent in the Northern Basin and Range). Similarly, less than a third of eastern Oregon's ecoregions has moderate canopy cover (40 to 70 percent): 28 percent in the East Cascades, 19 percent in the Blue Mountains, 14 percent in the Columbia Plateau, and 9 percent in the Northern Basin and Range.

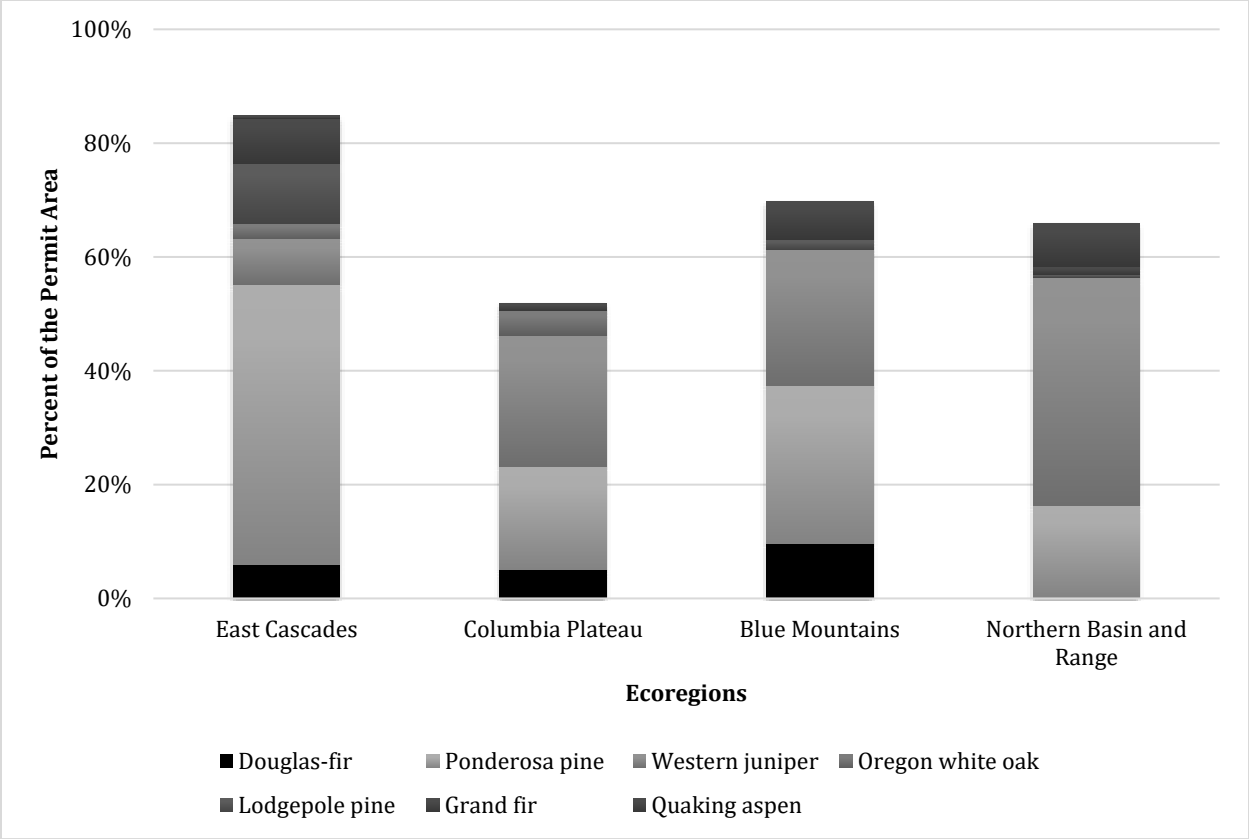
2.3.3.4 Tree Size



Note: The remaining permit area is not forested.

Figure 2-12. Tree Size in Eastern Oregon by Ecoregion

Eastern Oregon's trees have a similar size distribution to western Oregon, despite a smaller stature. Sapling/pole tree sizes make up 24 to 38 percent of the permit area in eastern Oregon, with the Columbia Plateau being on the low end (24 percent) and the East Cascades being on the high end (38 percent). Medium and large trees make up just 10 to 18 percent of the ecoregions.



Note: The remaining area is not forested.

Figure 2-13. Dominant Tree Species in Eastern Oregon's Ecoregions

2.3.3.5 Tree Species

The primary tree species in the relatively more-arid eastern Oregon are ponderosa pine and western juniper. Most of the East Cascades ecoregion is dominated by ponderosa pine (49 percent), lodgepole pine (11 percent), western juniper (8 percent), and grand fir (8 percent), Douglas-fir (6 percent), and Oregon white oak (3 percent). The Columbia Plateau is dominated by western juniper (23 percent) and ponderosa pine (18 percent), with some Douglas-fir (5 percent) and Oregon white oak (4 percent). The Blue Mountains are dominated by ponderosa pine (28 percent), western juniper (24 percent), Douglas-fir (10 percent), grand fir (7 percent), and lodgepole pine (2 percent). The Northern Basin and Range is dominated by western juniper (40 percent), ponderosa pine (16 percent), and quaking aspen (8 percent).

2.3.4 Agents of Change on Forests and Streams

Oregon's forests were shaped by historic landscape-scale disturbance events, in particular fire and storms (U.S. Geological Survey 2012). Fire and storm history not only influences the ecology of forests today, but also contributes to the current patterns of forest ownership. An overview of fire susceptibility, storm occurrence, wildlife, insect, and disease prevalence is provided in this section.

2.3.4.1 Wildlife

Beavers

Beavers, specifically the American beaver (*Castor canadensis*), are a keystone species thought to have played key roles in shaping western and eastern Oregon's riparian ecosystems (Nash et al. 2021). Beavers often create dams that stop or slow water flow and create ponds, wetlands, and associated back water habitats. As a result, the flow is blocked behind the dam, creating aquatic habitats that can serve directly as nurseries for fish and indirectly as sources of cooling water over longer periods of time in the dry summers. This process is especially helpful in maintaining protected cold water species such as Columbia River steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*). During forest fires, wildlife can retreat to these wetter areas for refuge (Braizer et al. 2021).

A decrease In downstream water temperatures increases dissolved oxygen, improves the habitat for fish, and provides additional water storage for late-season wildlife use. Beavers create pathways around their dams, and eventually these pathways become inundated with water, change the hydrology, and divert the original water flow along the pathways. Over time this diversion creates wetlands, filters pollution, and attracts wildlife, aquatic invertebrates, and more fish. Others benefits of beaver dams include enhanced groundwater recharge and storage, improved water quality, amelioration of flooding and reducing runoff, and enhanced carbon capture in the form of organic sediment that settles to the bottom of beaver ponds.

Increasing the number of beaver dams in key areas could create high-quality rearing habitat that promotes stream complexity and increases smolt capacity for salmonids (Oregon Department of Fish and Wildlife 2009).

2.3.4.2 Western Oregon Disturbance Agents

Fires

The cooler and wetter climate in western Oregon exhibits historic fire intervals of approximately 100 to 450 years. Although lower than eastern Oregon, when wildfires do start, the dense forest stands provide a lot of fuel, and the result can be severe or even stand-replacing fires that dramatically change the landcover. Fire-suppression efforts, in combination with the lack of fuels management, has led to the accumulation of biomass, which increases the risk of large, catastrophic fires.

In the Willamette Valley ecoregion, Native Americans maintained open conditions by burning the prairies of the valley floor, as well as the savannas and oak woodlands extending into the foothills. This stopped when Europeans settled the area in the late 19th century. Since then, most of the valley floor has been converted to agriculture and the savannas with some oak and pine evolved into oak woodlands. Over time, continued fire suppression allowed Douglas-fir and grand fir to grow and start to replace the oak in these woodlands.

The fire interval in southwestern Oregon, particularly the Klamath Mountains and the southern end of the West Cascades ecoregions, is more frequent than the rest of western Oregon. This is due to the southwestern region's drier climate despite having similar fuel loads as the rest of the western portion of the state. As a result, the area has an historic fire frequency of once every 5 to 50 years, burning at moderate intensity. Recently, the intensity of fires in these drier forests has increased.

Storms

Extreme wind and precipitation events can have lasting impacts on forest health. Western Oregon, especially the Coast Range, experiences storms that come off the Pacific Ocean. In northwest Oregon, periodic severe windstorms typically occur between October and March and result in financial losses and forest disturbances. Effects of high wind velocities can be exacerbated by heavy rainfall that saturates soils, reducing tree resistance to windthrow and causing landslides. Insects and disease have a reciprocal relationship with storms where sickness and infestations make trees less resilient to storms, and storms may snap off the tops of trees leaving them more vulnerable to insects and disease. Lower density stands and those that have been thinned have stronger, more wind-resistant trees and suffer less damage during storms than high-density stands because the trees have grown with less competition and more wind exposure

Winter rainstorms coming off the Pacific Ocean may result in severe floods when heavy rain falls on snow and/or when soils are saturated and stream systems are at high flows, swelling the streams with runoff. Flooding is more likely in areas previously disturbed by fire or timber harvest. Debris flows and major flooding cause localized disturbances that are important for forest regeneration and habitat creation.

Insects and Diseases

Several diseases have caused noticeable levels of damage in Oregon in recent decades. Dense stands are more prone to diseases, which increases their risk of wildfire. 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 forest lands is caused by the Douglas-fir bark beetle, 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 (*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 historic 1933 Tillamook burned area with Douglas-fir seed from other areas, which may have 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 offsite 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 or otherwise heterogeneous 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. Recent incorporation of multiple species into tree-planting efforts may help decrease the impact of insects and disease in monocultures. Retaining, encouraging, and creating habitat for predators (e.g., birds and predatory insects) of pest species can reduce the extent and intensity of outbreaks and serve as a low-cost management strategy for these disturbances.

2.3.4.3 Eastern Oregon Disturbance Agents

Fires

Before European settlement, fires in eastern Oregon set by Native Americans or lightning burned the forests at regular intervals, approximately every 2 to 50 years, at low to mixed intensity. During this period, fire interacted with insects, diseases, etc. to create a distribution of successional stages across the landscape.

When European settlers arrived, they cleared land and began to suppress fire by restricting ignitions and fighting wildfire. As a result, over the last century and a half, fire suppression caused forest stands in eastern Oregon to undergo dramatic changes and become extremely dense, facilitating the movement of bark beetles, defoliators, and root diseases throughout the landscape. Dense stands are more prone to diseases, which then increases their risk of wildfire. These changes were so gradual that they went largely unnoticed until the late 1980s when wildfires, previously unseen in terms of size and intensity, spread across Oregon and the western United States. These types of large and severe wildfires are now an annual event and reduce the ability of watersheds to absorb and filter rain and snowmelt, contribute to mud and landslides, and negatively affect both the financial and wildlife uses of forests.

In the East Cascades and Blue Mountains ecoregions, timber harvest practices, grazing, and fire suppression have altered the distribution and structure of many historical ponderosa pine forests and oak woodlands and degraded many riparian and wetland habitats. The once open park-like ponderosa pine stands are now young, dense, mixed-species stands. In the Northern Basin and Range ecoregion, fire suppression, heavy grazing, and a decrease in precipitation is thought to be contributing to the spread of western juniper east from the East Cascades ecoregion. At the same time, fire risk throughout the ecoregion has increased as result of the spread of invasive grasses, which threaten to replace native sagebrush communities.

Storms

Eastern Oregon is not subject to rain and windstorms to the same extent as western Oregon. The Cascades form a rain shadow over eastern Oregon, catching the moist air from the West Coast, cooling it, and removing the moisture before the then-drier air moves east. Historic storm effects on eastern Oregon's forests were negligible. However, the relatively recent increased density of the area's forests makes them more susceptible to insect infestations and disease outbreaks, which increases their risk for windthrow and other wind damage in high wind events.

Insects and Diseases

Historically, insects, diseases, and parasites (e.g., dwarf mistletoe) were a natural part of the disturbance pattern of eastern Oregon's forests and often interacted with wildfire to create a

distribution of successional stages across the landscape. Stands with large numbers of trees killed by beetles or root disease became especially prone to intense, stand-replacement fires.

However, decades of fire suppression have created dense stands, changed forest composition, and facilitated the movement of bark beetles, defoliators, and root diseases. Stands are now more vulnerable to a host of insects and diseases that can kill or degrade trees over large areas in a matter of a few years. Manageable issues such as overstocking and species composition problems make the region susceptible to insect outbreaks. In the last couple of decades, eastern Oregon 's forests have been affected by large insect outbreaks. Controlling these can only be achieved by landscape-level management.

Species composition plays an important role in the susceptibility and management of insect infestations. Bark beetles and defoliators—including spruce budworm, Douglas-fir tussock moth, larch casebearer, and balsam woolly adelgid—can attack mixed-species stands in mixed-conifer types. Properly thinned stands are resistant to beetle attacks, but they are still susceptible to defoliator attacks if the stands contain a high proportion of Douglas-fir, grand fir, or subalpine fir. It is possible, however, to avoid these threats by maintaining a high proportion (more than 70 percent of the basal area) of ponderosa pine or larch on more moist sites. This strategy is effective in minimizing damage even during outbreaks of Douglas-fir tussock moth and spruce budworm.

Dwarf mistletoe is a common parasite on many tree species in eastern Oregon that reduces tree vigor and growth and can kill the tree. Dwarf mistletoe seeds are windborne, but they can only infect trees of the same species from which they grew initially. For example, if ponderosa pine in an area has a severe problem with mistletoe, switching to Douglas-fir and larch as the main species will help. Maintaining a variety of species and a diverse stand structure, and selectively thinning to remove mistletoe-infected trees, can help solve mistletoe problems.

Root diseases affect all tree species in eastern Oregon, slowing growth and sometimes killing the tree. However, each species has a different susceptibility to each disease. Knowing the differences between species and how to identify root diseases in the field will help manage species composition to avoid root disease problems.

2.4 Covered Species

The physical characteristics of forest streams and the surrounding riparian environment contribute to habitat suitability for covered species. All covered species require cold, clean, and flowing water in complex riparian habitats. Because all covered species are ectotherms, water temperature directly controls their physiology and activity. Natural streams have complex temperature regimes, and so native species have developed behaviors and adaptations to resist temperature stress, such as seeking out deep, shaded pools or areas with upwelling groundwater that provide colder temperatures. Streamside vegetation also provides an important temperature controlling mechanism for streams in the form of shade.

During migration, adult anadromous fish must reach their spawning grounds at the appropriate time and with enough energy to spawn. Although the spawning schedule is flexible, it has evolved to occur at times when stream flows are adequate for egg incubation so that fry emerge at the right time to feed and grow. Dams, debris jams, waterfalls, and other obstacles create barriers to upstream migration that disrupt this schedule, threatening the fishes' abilities to reproduce successfully. Stream flows also impact the amount and quality of spawning habitat by regulating the

depth and velocity of the water in natal streams. For migration, streamflows should be at least 30 to 70 percent of the mean annual flow, and water depth should be between 7 and 9 inches (18 and 24 centimeters), depending on the species (Bjornn and Reiser 1991).

Diverse and well-vegetated riparian areas further influence the covered species' habitat quality by protecting water quality, providing cover, and sustaining insect populations upon which the covered species feed. The riparian vegetation surrounding covered species' streams is an important factor in maintaining water quality in the streams by filtering runoff and other potential pollutants. Riparian vegetation, large woody debris, boulders, and undercut banks provide an important source of cover necessary for predator avoidance. Fallen trees and large woody debris can create deep, cold pools that shelter young fish and provide a place to rest away from strong currents. Both conifer and hardwood species contribute to habitat quality. Conifer species—like spruce, fir, and cedar—tend to resist drift and decay better than hardwood species (Oregon Department of Fish and Wildlife 2010) and so provide a more stable aquatic environment. However, the invertebrates that fish and amphibians consume require the nitrogen-rich deciduous leaves of hardwood species, rather than the carbon-rich needles of conifers (Murphy and Meehan 1989).

The characteristics of the streambed substrate are also important to the habitat quality of covered species. Salmonids require permeable medium-sized gravel substrate for spawning. High concentrations of fine sediment can reduce dissolved oxygen and be detrimental to embryo survival, whereas larger sediment may be too difficult for spawning salmon to penetrate.

Forest-management practices associated with timber production can change the forest characteristics described above and exert strong influences on covered species' habitat quality. Clearcutting causes significant changes to abiotic conditions in streams by producing large increases in light and greater variability in temperature. Forestry machinery may compact the soil and break deadwood into smaller pieces. Many clearcutting operations also include removal of deadwood and plant debris for safety reasons or to promote stand regeneration. This removal may result in degradation of the soil character and residual vegetation, which may in turn, increase sediment in streams through erosion. Logging roads also increase soil erosion and sediment in the streams. Road creation often requires the installation of culverts, which if not properly installed can impact streamflows and upstream and downstream migration.

Fire has obvious immediate short-term effects on stream temperature but can also produce long-term changes to streams that may have positive or negative effects on covered species' habitats. Removal of vegetation by wildfire increases incident solar radiation to streams and destabilizes soils, increasing sediment input into streams, and thereby reducing the spawning habitat. The fallen woody debris that remains post-fire can also increase cover for covered species in the streams, potentially improving habitat quality. Streams carry the fire debris downstream expanding the effects of wildfires throughout the watershed.

See the species accounts below for information describing the riparian forest characteristics for each Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS).

(Placeholder- We will conduct this analysis for all covered species once we receive the TerrainWorks data.)

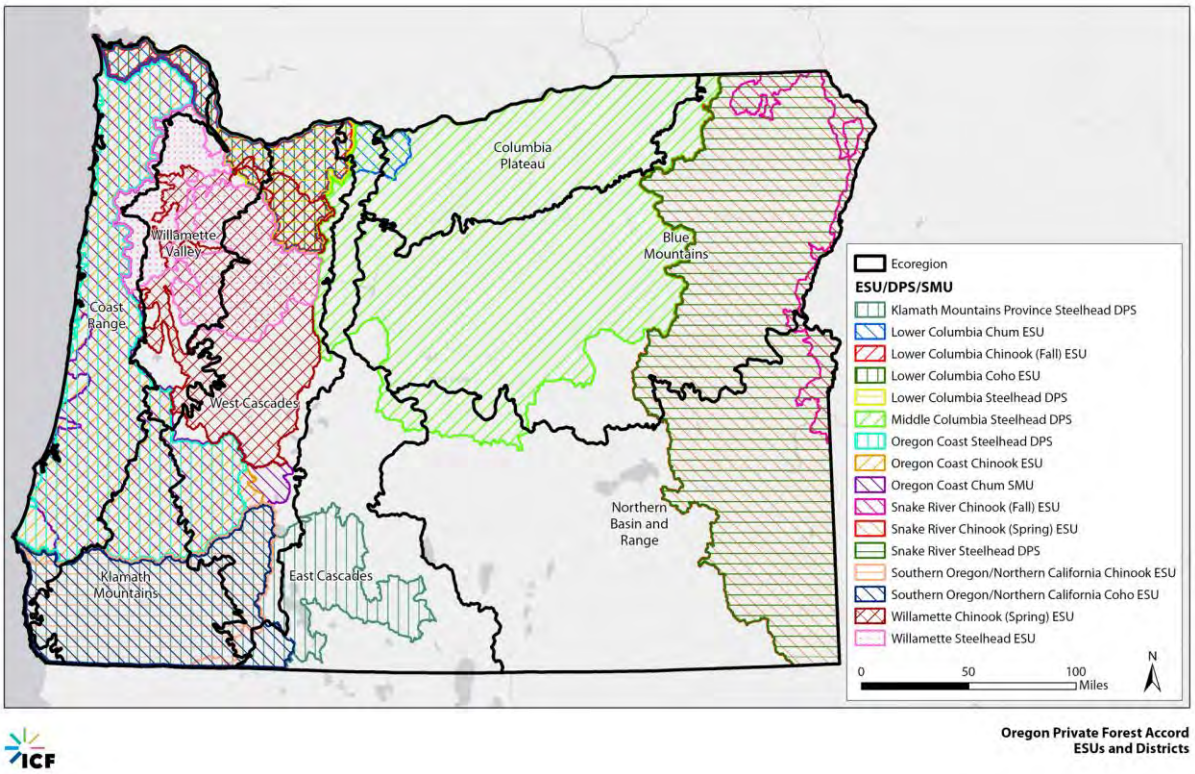


Figure 2-14. The Intersection Between Ecoregions and Covered Species' ESUs and DPSs

Table 2-6.Covered Species Expected to Occur in Each Ecoregion

Ecoregion	Covered Species
Blue Mountains	Middle Columbia Steelhead DPS
	Snake River Chinook (Fall) ESU
	Snake River Chinook (Spring) ESU
	Snake River Steelhead DPS
Coast Range	Klamath Mountains Province Steelhead DPS
	Lower Columbia Chinook (Fall) ESU
	Lower Columbia Chum ESU
	Lower Columbia Coho ESU
	Lower Columbia Steelhead DPS
	Oregon Coast Chinook ESU
	Oregon Coast Chum Species Management Unit (SMU)
	Oregon Coast Steelhead DPS
	Southern Oregon Northern California Chinook ESU
	Southern Oregon Northern California Coho ESU
	Willamette Chinook (Spring) ESU
	Willamette Steelhead ESU
Columbia Plateau	Lower Columbia Chum ESU
	Middle Columbia Steelhead DPS

Ecoregion	Covered Species
East Cascades	Klamath Mountains Province Steelhead DPS
	Lower Columbia Chinook (Fall) ESU
	Lower Columbia Chum ESU
	Lower Columbia Coho ESU
	Lower Columbia Steelhead DPS
	Middle Columbia Steelhead DPS
	Southern Oregon Northern California Chinook ESU
	Southern Oregon Northern California Coho ESU
Klamath Mountains	Klamath Mountains Province Steelhead DPS
	Oregon Coast Chinook ESU
	Oregon Coast Chum SMU
	Oregon Coast Steelhead DPS
	Southern Oregon Northern California Chinook ESU
	Southern Oregon Northern California Coho ESU
Northern Basin and Range	Middle Columbia Steelhead DPS
	Snake River Chinook (Fall) ESU
	Snake River Chinook (Spring) ESU
	Snake River Steelhead DPS
West Cascades	Klamath Mountains Province Steelhead DPS
	Lower Columbia Chinook (Fall) ESU
	Lower Columbia Chum ESU
	Lower Columbia Coho ESU
	Lower Columbia Steelhead DPS
	Middle Columbia Steelhead DPS
	Oregon Coast Chinook ESU
	Oregon Coast Chum SMU
	Oregon Coast Steelhead DPS
	Southern Oregon Northern California Chinook ESU
	Southern Oregon Northern California Coho ESU
	Willamette Chinook (Spring) ESU
	Willamette Steelhead ESU
Willamette Valley	Lower Columbia Chinook (Fall) ESU
	Lower Columbia Chum ESU
	Lower Columbia Coho ESU
	Lower Columbia Steelhead DPS
	Oregon Coast Chinook ESU
	Oregon Coast Chum SMU
	Oregon Coast Steelhead DPS
	Willamette Chinook (Spring) ESU
	Willamette Steelhead ESU

2.4.1 Covered Amphibians

The five stream-associated amphibians covered by the HCP fill an important ecological role as mid-trophic level predators. The covered amphibians are strongly associated with streams and associated riparian buffer habitats. They are specifically included in this HCP because their ranges extend into the upper reaches of the stream network, above the highest point of fish presence, including the non-fish-bearing headwater streams. The PFA Report authors chose to include these species because their upper-reach habitat is not well covered by the current OFPA and other regulations. The covered amphibians will benefit from protection of habitat that includes strategies to enhance water quality and reduce delivery of sediment to streams that will support persistence and productivity of local populations throughout their range in Oregon.

Table 2-7. Covered Amphibians and Justifications for Inclusion as Covered Species

Amphibian	Justification
Columbia torrent salamander (*Rhyacotriton kezeri*)	U.S. Fish and Wildlife Service Fiscal Year 2022 At-Risk Species List, state sensitive species, ODFW Conservation Strategy species, and covered species in PFA Report
Southern torrent salamander (*Rhyacotriton variegatus*)	State sensitive species, ODFW Conservation Strategy species, and covered species in PFA Report
Coastal giant salamander (*Dicamptodon tenebrosus*)	Covered species in PFA Report
Cope's giant salamander (*Dicamptodon copei*)	State sensitive species, ODFW Conservation Strategy species, and covered species in PFA Report
Coastal tailed frog (*Ascaphus truei*)	State sensitive species, ODFW Conservation Strategy species, and covered species in PFA Report

2.4.2 Covered Fish

The covered fish species will benefit from contributions to conservation of substantial portions of populations. The conservation strategies will support enhancement of water quality and improvements to stream habitat. The mitigation program will support projects that actively restore stream habitat though a variety of stream restoration techniques.

Table 2-8. Covered Fish and Justifications for Inclusion as Covered Species

Fish	Justification
Coho Salmon (*Oncorhynchus kisutch)*	
Oregon Coast coho	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Lower Columbia River coho	Federally listed threatened, state listed endangered, ODFW Conservation Strategy species, and covered species in the PFA Report
Southern Oregon/Northern California Coast coho	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report

Fish	Justification
Chinook Salmon (*Oncorhynchus tshawytscha*)	
Upper Willamette chinook	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Lower Columbia River chinook	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Snake River Spring/Summer chinook	Federally listed threatened, state listed threatened, ODFW Conservation Strategy species, and covered species in the PFA Report
Snake River Fall chinook	Federally listed threatened, state listed threatened, ODFW Conservation Strategy species, and covered species in the PFA Report
Oregon Coast Spring chinook	State sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Southern Oregon/Northern California Coast Spring chinook	State sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Chum Salmon (*Oncorhynchus keta*)	
Columbia River	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Steelhead (*Oncorhynchus mykiss*)	
Lower Columbia River steelhead	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Upper Willamette River steelhead	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Snake River steelhead	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Middle Columbia River steelhead	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Other Species	
Eulachon (*Thaleichthys pacificus*)	Federally listed threatened, ODFW Conservation Strategy species, and covered species in PFA the Report
Bull trout (*Salvelinus confluentus*)	Federally listed threatened, state sensitive species, ODFW Conservation Strategy species, and covered species in the PFA Report
Mountain whitefish (*Prosopium williamsoni*)	Covered species in the PFA Report
Green sturgeon (*Acipenser medirostris*)	Federally listed threatened, ODFW Conservation Strategy species, and covered species in the PFA Report

This page intentionally left blank.

Chapter 3
Covered Activities

3.1 Introduction

This chapter describes the covered activities on private and participating tribal forest fee lands for which the Oregon Department of Forestry (ODF) proposes to receive take coverage under this Oregon Private Forest Accord Habitat Conservation Plan (HCP). This chapter describes the baseline covered forest management activities in the plan area. New forest laws resulting from the 2022 Private Forest Accord Report (PFA Report), as codified in revisions to the Oregon Forest Practices Act (OFPA) and related administrative rules, include covered activities but also form the basis for the conservation strategy in Chapter 4, *Conservation Strategy*. The descriptions 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*.

Baseline activities to be covered under this programmatic HCP include timber harvest, stand management, road system management, and other activities related to the growth and harvest of trees in Oregon, as defined in the OFPA, and where they occur on private or applicable tribal fee lands within the permit area. As mentioned in Section 1.2.1, *Plan Area and Permit Area,* the permit area includes all privately owned forestlands subject to regulation under the OFPA in the state of Oregon, with the exception of lands that are covered under their own incidental take permit for the aquatic species covered under this HCP (Figure 1-1). *Forestlands* is defined in Section 1.1.1, *Purpose,* to include locations where forest management activities occur on both forested and appurtenant unforested land. The permit area is synonymous with *covered lands* in the PFA Report and represents the areas where private landowners can receive incidental take authority for the effects of covered activities on covered species.

Covered activities include forest practice activities occurring in the permit area within the state of Oregon that are subject to the OFPA (Oregon Revised Statutes [ORS] 527.610–527.770, 527.990, and 527.992) and associated applicable rules that apply to the aquatic species covered by this HCP (Oregon Administrative Rules [OAR] Chapter 629). This HCP directly tiers to the PFA Report, Senate Bill 1501 (codified in statute, Chapter 33, Oregon Laws 2022), and the resultant revised OFPA rules (*add new rule citation here*), and is intended to be fully consistent with the agreements and intent contained within the PFA Report.

Activities must meet the following five criteria to be identified as a programmatically covered activity in the HCP.

1. **Control or Authority.** The covered activity must be under the direct control of the central permittee (ODF) as a project or activity that the permittee implements directly, implements through contracts or leases, or controls through regulatory instrument (e.g., ODF's regulatory authorization issued to private landowners in a programmatic fashion and the enforcement and penalty framework established by that authority). Oregon law gives the Board of Forestry primary responsibility to interpret the OFPA and set rules for forest practices. ODF is responsible for enforcing those requirements by:
    - Reviewing pre-operations plans

- Overseeing operations
- Ensuring reforestation
- Investigating complaints
- Enforcing corrective actions when violations occur

2. **Location.** The covered activity must occur in the HCP permit area, as defined at the time the activity is executed.
3. **Timing.** The covered activity must occur during the proposed permit term.
4. **Impact.** The covered activity may result in take of one or more covered species.
5. **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.

The activities described in this chapter are intended to be as inclusive as possible of the activities related to forest management that are currently occurring or are 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 involves any of the following.

- Is under the oversight and regulatory authority of ODF as defined in the first criterion above.
- Does not preclude achieving the biological goals and objectives of the HCP (Chapter 4, *Conservation Strategy*).
- Is within the bounds and types of impacts and take limits evaluated in the effects analysis of the HCP (Chapter 5, *Effects Analysis and Level of Take*).

Covered activities are described in this chapter using five categories: harvest activities, stand management activities, road system management activities, quarry development, and plan implementation. The descriptions of covered activities are based on the OFPA (OAR 629) and the PFA Report (Conservation Coalition and Working Forest Coalition 2022).

3.2 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 OFPA, specifically including those identified in OAR 629 Division 630, *Harvesting*, and all other applicable rules.

3.2.1 Timber Harvest Methods

Harvest activities and logging systems include felling, bucking, yarding or skidding, processing, and loading timber. Operators select a logging method and type of equipment appropriate to the given slope, landscape, and soil properties.

3.2.1.1 Felling and Bucking

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 into logs on a landing or road. Operators are required to minimize the effects

of slash from felling and bucking practices by felling trees away from streams and streamside vegetation and by removing slash that inadvertently enters the water (OAR 629-630-0600). The following techniques are used to fell and buck trees.

- In some situations, particularly on steep terrain, or for trees too large to be mechanically felled, operators may use hand-held chain saws to fell and buck trees.
- Mechanical felling may be done using heavy equipment such as a feller-buncher when terrain allows. These hydraulic machines use an articulated attachment to grab, fell, and bunch the trees with other trees or logs for subsequent skidding or yarding (transporting) to the landing.
- In most modern harvesting systems and for most forest types, trees are bucked by a dangle-head log processor. These machines are similar to a log loader and are equipped with a specialized processing head that measures, delimbs, and cuts logs to length at the landing.
- Cut-to-length harvesting is used to grab, fell, delimb, and buck trees into logs using processor heads where they fall. These machines can operate on moderate slopes and have no blade or attachments capable of moving soil, which minimizes soil disturbance and compaction. These systems typically involve two types of machines: mechanical harvesters and forwarders. Mechanical harvesters are built on articulated wheeled chassis and equipped with processing heads. Forwarders are also built on articulated wheeled chassis but equipped with grapple and bunks designed to transport multiple small logs to the landing.

3.2.1.2 Yarding/Skidding

Yarding or *skidding* means moving whole trees or logs from where they are felled to a landing using cable systems, ground-based equipment, helicopters, or other means. The following techniques are used for yarding or skidding. Division 630, *Harvesting*, requires operators to employ many techniques 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 are to minimize gouging and soil displacement.

Cable yarding employs steel cables to move trees or logs to a truck road or log landing and is most often used to move logs uphill over steep terrain. Yarders use powered drums filled with wire 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 "tailhold," which is typically a stump or tree, or can be another machine. 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 sometimes used to fly haywire (synthetic rope) above the canopy to tailhold points, after which wire rope is pulled through. When operators cannot use existing roads or other practical alternatives, cable yarding allows trees or logs to be yarded above streamside vegetation, streams, and other water bodies, minimize ground disturbance.

Tractor logging can be accomplished by tracked or rubber-tired tractors (skidders). These machines handle trees or logs using powered grapple attachments or wire rope winch lines and skid them along designated "skid trails" to the landing. Skidders usually operate on flat terrain under 35 percent slope. Operators are required to use water bars and other effective means to disperse surface water runoff from skid trails to ensure water is filtered before entering any water body.

Log loaders, also known as log shovels, are structurally similar to excavators and can be used both for loading log trucks and for yarding in what is commonly called "shovel logging." In this logging system, log shovels lift and swing whole trees or logs multiple times to move them closer to the landing. Modern log shovels can be built on highly specialized self-leveling tracked undercarriages designed for shovel logging on terrain that previously would have required cable yarding.

With "cut-to-length logging systems," logs are yarded with a forwarder. This logging system carries logs clear of the ground to the landing, and can generate less ground disturbance than other ground-based yarding systems.

Aerial yarding may require the use of a helicopter. This more costly technique typically occurs on terrain that is inaccessible by roads that would allow for cable yarding or ground-based yarding. In helicopter yarding, a cable extending from the helicopter is attached to the trees or 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.

OFPA rules in OAR 629-630-0800 address harvesting using ground-based equipment and cable yarding equipment, harvesting on steep slopes, drainage systems, and treatment of waste materials when near waters of the State. Where operations traverse federal lands, the operations are also to comply with the HCP and OFPA rules.

3.2.1.2 Processing

Processing includes limbing and bucking trees 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. Processing practices that occur adjacent to waters of the State must follow the OFPA rules in OAR 629-630 to minimize effects on streams, lakes, or wetlands.

3.2.1.3 Tethered Logging/Steep Slope Machine Logging

[INCLUSION PENDING AFTER RULEMAKING]

3.2.1.4 Landings and Loading

Loading involves loading logs from the landing area to a truck for transport. *Landings* are cleared areas along roads where logs are stored (yarded, swung, skidded, lowered, or forwarded) for subsequent loading onto trucks for transport. Logs are loaded onto trucks using equipment such as hydraulic trackhoes, log loaders, or heel-boom loaders, which may be used without leaving the road grade. Some log trucks are self-loading and are equipped with a log loader on the truck to both load and transport logs. Similar to roads, landings should be hydrologically disconnected from waters of the State to the maximum extent practicable to minimize sediment delivery. Landings are specifically addressed in OAR 629-630-0200.

3.2.1.5 Post-Disturbance Harvesting

[INCLUSION PENDING AFTER RULEMAKING]

3.2.2 Firewood Operations

Commercial operations for firewood cutting are covered under the OFPA. Firewood cutting involves removal of trees or excess logs or large pieces of logging slash by use of chainsaws. Most firewood removal is often done near existing roads and in or near recent harvest operations. Removal of live or dead trees (including downed logs) otherwise required to be retained under the OFPA statutes or rules is prohibited (e.g., trees in stream riparian management areas and trees or downed logs used to meet the leave tree statutes [ORS 527.676]).

Removal of firewood on a landowner's own property for personal use is not a covered activity as it is not regulated under the OFPA.

3.2.3 Harvest Types

In Oregon, trees are harvested in a variety of ways by private forest landowners, and these landowners must comply with the OFPA. Operators must communicate to ODF which of the specified harvest types described in the OFPA rules they intend to use on a given operation. These are briefly described in this section. The OFPA rules define minimum stocking standards within harvest type categories allowed across six productivity-based site classes. Site Classes I, II, and III forestlands are capable of producing at least 120 cubic feet per acre per year, Site Classes IV and V forestlands are capable of producing between 50 and 119 cubic feet per acre per year, and Site Class VI forestlands are capable of producing between 20 and 49 cubic feet per acre per year. Operators would provide a written plan describing how detrimental impacts would be minimized in riparian management areas when burning within 100 feet of Type F, Type SSBT, and Type D streams[1]; large lakes; and significant wetlands.

3.2.3.1 Harvest Type 1

Harvest type 1 is typically referred to as a "shelterwood cut" or a very heavy commercial thinning. Harvest type 1 is an operation that requires reforestation but does not require wildlife leave trees or downed wood retention if an adequate basal area of 11-inch diameter at breast height (DBH) trees or larger is left standing. Harvest type 1 is an operation that leaves a combined stocking level of free-to-grow seedlings, saplings, poles, and larger trees that are less than the stocking level established by the Oregon Board of Forestry that represents adequate utilization of the productivity of the site.

3.2.3.2 Harvest Type 2

Harvest type 2 is typically referred to as a "green clearcut." Harvest type 2 is an operation that requires wildlife leave trees but does not require reforestation because it has an adequate combined stocking of free-to-grow seedlings, saplings, poles and larger trees, but leaves one of the following.

- On harvest units with Site Classes I, II, or III, fewer than fifty 11-inch DBH trees or less than an equivalent basal area in larger trees, per acre.

[1] Stream Type F: fish-bearing; Type SSBT: a subcategory of Type F 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); Type N: not fish-bearing; and Type D: Not fish-bearing but near a domestic water supply with an approved water right.

- On harvest units with Site Classes IV or V, fewer than thirty 11-inch DBH trees or less than an equivalent basal area in larger trees, per acre.
- On harvest units with Site Class VI, fewer than fifteen 11-inch DBH trees or less than an equivalent basal area in larger trees, per acre.

3.2.3.3 Harvest Type 3

Harvest type 3 is typically referred to as a "clearcut." Harvest type 3 is an operation that requires reforestation and wildlife leave trees. This represents a level of stocking below which the size of operations is limited under ORS 527.740 and 527.750. Harvest type 3 units are routinely conducted in even-aged management in western Oregon and less commonly in eastern Oregon. The size of clearcuts under single ownership contain limitations in size (not to exceed 120 acres) and adjacency (not allowed within 300 feet of a prior harvest type 3 that is not yet reforested), although exceptions are made up to 240 acres in size when approved by the State Forester.

3.2.3.4 Harvest Type 4

Harvest type 4 is typically referred to as a "light thinning." Harvest type 4 is an operation that does not required reforestation or retention of wildlife leave trees.

3.2.4 Timber Harvest on Steep Slopes

Pacific salmon, steelhead, bull trout, and aquatic amphibians have evolved under the natural disturbance regime characteristic of watersheds throughout Oregon. Many of these lands are steep and naturally prone to landslides and debris flows that contribute wood and sediment to drainage networks downslope.

Landslides and debris flows can deliver large volumes of sediment and wood to streams. Landslides most frequently initiate within headwall (debris flow) channels that may not have a clearly defined channel (May and Gresswell 2004) rather than within stream habitats occupied by fish (Benda et al. 2005). However, debris flows can travel long distances, increasing in size as materials scoured along the way are incorporated before depositing downstream at lower gradients and/or channel junctions, often in fish-bearing channels. Sediment and large woody debris delivered by landslides and associated debris flows can create pools and channel complexity and provide gravel usable for spawning, but delivered sediment can also bury or otherwise adversely affect fish habitat and macroinvertebrates, particularly if the frequency and magnitude of inputs are too high or lack large wood (Hartman et al. 1996; Jensen et al. 2009; Kobayashi et al. 2010).

The PFA Report commitments and the revised OFPA rules define the mapping and incorporation of Designated Debris Flow Traversal Areas and Designated Sediment Source Areas into all Timber Harvest Prescriptions occurring on private lands. Incorporation of these conservation measures are described in Chapter 4, *Conservation Strategy*. Briefly, harvest restrictions apply to Designated Debris Flow Traversal Areas identified by the Slopes Model,[2] which can be viewed from ODF maps at the time of a harvest notification. Harvest restrictions apply to field-identified Slope Retention Areas selected from prioritized Designated Sediment Source Areas. Harvest restrictions also apply upslope to field-identified Stream Adjacent Failures associated with the edge of fish streams.

[2] Refers to ODF's computer-generated model to identify designated debris flow traversal areas, designated sediment source areas, and trigger sources.

3.3 Stand Management Activities

Stand management activities are those performed between the time when a stand has been harvested and the intervening time when the stand is actively managed prior to another harvest. Such activities include erosion control, site preparation, replanting, and other treatments, as shown in Table 3-1.

Table 3-1. Typical Timing of Harvest and Stand Management Activities [a]

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

[a] Timing and activities are typical for western Oregon and more likely to vary for eastern Oregon.

Stand management includes silvicultural practices designed to manage the establishment, composition, growth, health, and quality of stands to achieve forest management objectives. Silvicultural activities also typically include slash management, precommercial thinning, vegetation control, and other stand management activities. Stand management activities are described in this section in the order in which they are typically performed.

3.3.1 Site Preparation

3.3.1.1 Treatment of Slash

Treatment of slash is recognized as a necessary tool for protecting residual stands from fire, insects, and disease to prepare the site for replanting and to minimize the risk of slash entry into streams and wetlands. Treatments can use mechanical processes, burning, or other means to achieve management objectives. During site preparation, many techniques are available for protecting soils from compaction or from ponding water and causing excessive erosion.

Operators typically plan and conduct forest operations in a manner that would provide adequate consideration to treatment of slash to optimize conditions for reforestation of forest tree species, and maintain productivity of forestland, forest health, and fish and wildlife habitat. Logging residue (limbs, tops, cull logs, etc.) is retained to levels that do not prohibit reforestation and do not create an unacceptable fire hazard.

Applicable rules and regulations would be followed, specifically OAR 629-615-0000 to -0300, collectively known as the Treatment of Slash rules in the OFPA.

3.3.1.2 Mechanical Site Preparation

Mechanical site preparation is a method of reducing competing vegetation, removing logging or storm-damaged debris, or preparing the soil by using large machinery such as bulldozers, skidders, or tractors with attached implements. Because large machinery most often is needed in mechanical site preparation, it is most efficient in treating large areas and is therefore best suited for even-aged

regeneration systems using artificial regeneration (Löf et al. 2012). Mechanical practices are reliable methods of preparing an area to be reforested either by direct seeding or planting seedlings. However, use can be restricted somewhat by wet weather, distances to sensitive habitats, poor drainage, or extremes in topography. Other problems include negative impacts on erodible or fragile soils and the potential for abundant hardwood sprout development.

When mechanical site preparation is necessary in riparian management areas or near waters of the State, the private forestry operations would be conducted in a manner that prevents sediment or debris from entering aquatic resources. Adequate distance between disturbed soils and aquatic resources would act to filter sediment from runoff water.

Operators would not use mechanical site preparation in riparian management areas that have slopes over 35 percent (except for excavator-type equipment used during dry periods), on sites with evidence of surface or gully erosion, or where exposure or compaction of the subsoil is likely to occur. Operators would not place debris or soil in waters of the State or where it may enter waters of the State during mechanical site preparation. Where mechanical methods would be used, compaction and movement of topsoil would be minimized to protect soil productivity on land-clearing projects.

Applicable rules and regulations would be followed, specifically OAR 629-630-0800.

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, it does not compact the soil, and it 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, prescribed burning 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 amphibian species of concern. Burning can also increase the amount of unwanted vegetation, such as buckbrush (*Ceanothus* spp.), scotch broom (*Cytisus scoparius*), gorse (*Ulex* spp.), and ragwort (*Senecio spp*. and *Jacobaea vulgaris*), in certain parts of the permit area.

As outlined in OAR 629-615-0300, when planning and conducting prescribed burning, operators must do the following.

a) Comply with the rules of Oregon's "Smoke Management Plan;"

b) Adequately protect reproduction and residual timber, humus, and soil;

c) Consider possible detrimental effects of prescribed burning upon riparian management areas, streams, lakes, wetlands, and water quality, and how these effects can be best minimized;

d) Lay out the unit and use harvesting methods that minimize detrimental effects to riparian management areas, streams, lakes, wetlands, and water quality during the prescribed burning operation;

e) Fell and yard the unit to minimize accumulations of slash in channels and within or adjacent to riparian management areas; and

f) Minimize fire intensity and amount of area burned to that necessary to achieve reforestation, forest health or hazard reduction needs.

Operators would provide a written plan describing how detrimental impacts would be minimized in riparian management areas when burning within 100 feet of Type F, Type SSBT, and Type D streams, large lakes, and significant wetlands. Minimization measures are detailed in OAR 629-635-0310 through 629-655-0000.

3.3.2 Manual Vegetation Control

Release treatments are designed to reduce competition on desirable tree species from economically undesirable, usually overtopping, vegetation in young stands. They can sometimes be used to modify species structures under stress from insect and disease and favor species that are tolerant or resistant to the disease.

3.3.3 Tree Planting

3.3.3.1 Initial Planting

Initial planting must occur within 2 years of a clearcut harvest. Planted seedlings are to be adapted to the reforestation site, and, where appropriate, a mixture of species would be planted to increase diversity across the permit area. Planting density would vary from 250 to 536 trees per acre depending on the site quality and expected survival rate to meet certain post-harvest stocking standards defined in the OFPA reforestation rules (OAR 629-610-0000 to 629-610-0090). Stock type would be site specific and consider factors such as soil type, soil quality, and animal browse potential. Species selection would be on a site-by-site basis with the goal of increasing species diversity across the landscape for increased resiliency to the uncertainty of climate change and wildfire risks. In areas of disease, such as Swiss needle cast (*Phaeocryptopus gaeumannii*) or laminated root rot (*Phellinus weirii*), planted species would be of tolerant stock or from a resistant species with an emphasis on resistant species.

3.3.3.2 Interplanting

Interplanting may be necessary to meet or exceed minimum free-to-grow stocking levels for the OFPA. In certain instances, interplanting would occur to increase stocking on high quality sites to better capture the capability of the site. In other areas, lower stocking would be acceptable as it would provide high quality early seral habitat while still meeting OFPA requirements. Tree stocking would be site dependent but range from 100 to 200 trees per acre or stocking equivalents.

3.3.4 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 reduce drought, insect, and disease issues and increase overall forest health. Trees felled during a precommercial thinning are typically left on the ground because they are too small to meet current merchantable standards. This operation may be performed only once in the life of a stand and only in those stands with an excess number of trees per acre. Trees may be felled using chainsaws or feller-bunchers. Felling by chainsaws is used across the state, but use of feller-bunchers is more common in eastern Oregon. These machines are capable

of executing precommercial thinning more efficiently and with less risk of injury to workers than chainsaws.

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. Generally, the purpose of a PCT operation is to release the biggest and best-growing trees so they can maintain their growth trajectories free from competition. In areas of disease, such as Swiss needle cast, PCT can be used to favor western hemlock (*Tsuga heterophylla*) and other resistant species over Douglas-fir (*Pseudotsuga menziesii*) to help ensure a healthy future stand.

Hardwood release is used when ingrowth of hardwoods, mainly red alder (*Alnus rubra*) in the northwest and madrone (*Arbutus* spp.) and tanoak (*Notholithocarpus densiflorus*) in the southwest, threaten to change the stand from conifer-dominated to hardwood-dominated. In this hardwood release treatment, most hardwoods are removed, moving the residual stand towards a conifer-dominated stand. This differs from PCT in that conifer spacing and species are not manipulated.

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; for example, in western white pine stands, removing the lower limbs decreases the severity of white pine blister rust infection. Pruned trees must maintain a minimum of 50 percent of their live crowns. To maintain the live crown and minimize the core, trees are typically pruned several times as they grow. Pruning is usually conducted manually with hand tools or a chainsaw.

Precommercial thinning and pruning would be performed in accordance with restrictions placed by all applicable OFPA rules. Notwithstanding the requirements indicated in the rules, operators may conduct precommercial thinning and other release activities to maintain the growth and survival of conifer reforestation within riparian management areas. Such activities would contribute to and be consistent with enhancing the stand's ability to meet the desired future condition.

Harvest type 3 unit size limitations and reforestation rules do not apply to treatments for stand growth enhancement, as defined by the Oregon State Forester, such as thinning or precommercial thinning (ORS 527.736 [2]).

3.3.5 Commercial Thinning

3.3.5.1 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 remove dead trees while the wood is still merchantable. A stand may be partially 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 envisioned across the permit area; 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 promote multi-aged (horizontal) diversity within a stand and variable densities that promote structural heterogeneity.

The structure of a stand immediately after a partial cut (1 to 3 years) is 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. However, initial conditions result in canopy gaps, increased wind, and reductions in moisture that could prove detrimental in the short term to amphibians and other species dependent on adjacent aquatic resources. However, increased dead wood and structural diversity may have long-term positive impacts.

Heavy Thinning

Heavy thinning approaches contain relatively high harvest intensities of a harvest type 1 "shelterwood cut" predominantly focused on developing a new cohort of trees in the understory. A heavy thinning results in the fast growth of individual trees but reduces the total volume of growth. Heavy thinning can also alter the trajectory of the stand composition. Heavy thinning retains an SDI percent of <30.

Moderate Thinning

A moderate thinning provides for optimal stand growth and allows vigorous growth of individual trees freed from competition. Stand structure will continue to develop with moderate thinning, and depending on species composition and site index, a new cohort of trees may be initiated. Moderate thinning retains an SDI percent from ≥30 to 40.

Light Thinning

A light thinning focuses on maintaining stand growth and health; however, to achieve these goals, it must occur more frequently than a heavy or moderate thinning in the same stand. A more complex stand structure might not be developed with light thinning, and a new cohort of trees might not be initiated. Early commercial thinning falls under a light thinning. Light thinning retains an SDI percent of ≥40 to 50.

3.3.6 Water Drafting and Storage

There are water developments throughout private lands, such as small water catchment basins and impoundments that 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 and to compact soils during forest road rocking and maintenance work. Water developments are mainly located at streams and rivers, with some at springs. Many have been in place for years. 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 OFPA (OAR 629) and other applicable statutes regarding water quality protections. Only water developments that are part of a stream or form junctions with natural surface or underground waters fall under the OFPA rules. Water developments not part of a stream do not receive any protection under the OFPA.

3.4 Road System Management Activities

Road system management activities are those associated with the construction, reconstruction, use, and maintenance of forest roads and their associated facilities such as landings, drainage structures, and quarries. The abandonment or decommissioning of roads and associated facilities are also covered under this category of activities. Forest roads and stream crossings can affect covered species by hindering or blocking access to habitat. Roads have the risk of delivering sediment and other pollutants to streams and wetlands, as well as increasing the hydrological connectivity between road surfaces and watercourses.

The Forest Road Inventory Assessment (FRIA) program establishes an inventory process for landowners to assess their ownership road network. The goal is to identify whether roads meet the revised OFPA rules and prioritize updating roads to the new standards to be completed within 20 years. The FRIA timelines for replacing or maintaining road infrastructure to the OFPA rule standards and how this program may not apply to Small Forest Landowners (SFOs) is described in Chapter 4, *Conservation Strategy*. Culverts will be replaced consistent with Oregon law.

All road construction, reconstruction, use, maintenance, and vacating would be performed in accordance with the OFPA (OAR 629-625). Additional implementation guidance for managing roads in the permit area is provided in the following Forest Practices Technical Guidance documents, which will be reviewed and updated for compliance with the new rules:

- *Replacing Stream Crossing Structures Outside Normal In-Water Working.* Forest Practices Technical Note Number 3 (Oregon Department of Forestry 2001).
- *Fish Passage Guidelines for New and Replacement Stream Crossing Structures.* Forest Practices Technical Note Number 4 (Oregon Department of Forestry 2002a).
- *Determining the 50-Year Peak Flow and Stream Crossing Structure Size for New and Replacement Crossings.* Forest Practices Technical Note Number 5 (Oregon Department of Forestry 2002b).
- *Avoiding Roads in Critical Locations.* Forest Practices Technical Note Number 7 (Oregon Department of Forestry 2003a).
- *Installation and Maintenance of Cross Drainage Systems on Forest Roads.* Forest Practices Technical Note Number 8 (Oregon Department of Forestry 2003b).
- *Wet Weather Road Use.* Forest Practices Technical Note Number 9 (Oregon Department of Forestry 2003c).

Seasonal road restrictions for purposes other than wet weather hauling are outside OFPA regulations, but something individual forestland owners may practice as part of their forest management.

In addition, *Anadromous Salmonid Passage Facility Desig*n (National Marine Fisheries Service 2022) and *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife* (Oregon Department of Fish and Wildlife 2022) will be followed for the construction of stream crossing structures.

3.4.1 Road Location and Design

Road location and design are the most important elements for reducing impacts on water quality from roads while safely accommodating the expected road use. Therefore, roads should be located where potential impacts on waters are minimized and where hydrological connectivity is reduced to

the maximum extent practicable. This also includes avoiding construction in and road drainage to critical locations such as steep and unstable slopes, wetlands, and stream channels. Additionally, stream crossings will be minimized, and existing roads should be used whenever possible to reduce impacts.

Applicable rules and regulations would be followed, specifically OAR 629-625-0200, *Road Location;* OAR 629-625-0300, *Road Design;* OAR 629-625-0310, *Road Prism;* OAR 629-623-0450, *Restriction of Road Construction – Substantial Public Safety Risk;* and OAR 629-625-0100, *Written Plans for Road Construction*.

3.4.2 Road Construction and Reconstruction

Road construction in the permit area typically involves felling and yarding timber along a predetermined road alignment, followed by excavating or filling hillslope areas. Road reconstruction generally includes widening or opening a road that has not been used recently, but also may involve alignment and grade changes as well as drainage system improvements. Road reconstruction may involve any individual or combination of elements needed for road construction. Roads also include vehicle turnouts and timber harvest landings. Road alignments sometimes include water crossings where culverts and bridges would be installed.

Blasting may be needed to allow road construction in a specific area. To ensure stability and safety of the roadbed, blasting of rock and/or removal of excess material to offsite waste areas is required at times. Road construction may also involve surfacing native surface roads with rock, lignin, pavement, or other surface treatments for stability and to minimize erosion, especially in erosion-prone areas. Appropriate surfacing can be combined with compaction to further increase bearing strength and resistance to erosion. Road construction can be scheduled to avoid disturbance during wet weather conditions when increased erosion and fine sediment delivery to streams are most likely to occur.

Applicable rules and regulations would be followed, specifically OAR 629-625-0400, *Road Construction,* referencing OARs 629-625-0400 through 629-625-0440, which provide standards for disposal of waste materials, drainage, stream protection, and stabilization to protect water quality during and after road construction.

3.4.3 Road Use

The road system will predominantly be used to provide access for forest management activities and fire suppression. Roads will also allow occasional access that will be needed for conducting biological studies, water quality monitoring, recreation, and other HCP effectiveness monitoring activities. Roads in the permit area are primarily used by utility vehicles accessing parts of the forest(s) and heavy equipment (log trucks and heavy equipment trailers hauled by similar tractors). All such use is a covered activity under this HCP. Road use by private landowners is a year-round activity and is unrestricted by ODF. Controlling the timing of road use can avoid severe disturbance of forest roads, such as deep rutting, which would contribute to erosion and sediment load to waters resources. Applicable rules and regulations would be followed under OAR 629-625-0700, *Wet Weather Road Use*.

3.4.4 Road Maintenance

Road maintenance includes the upkeep and repair of existing roads accessible to motorized vehicle use. Road maintenance should be timely, provide stable surfaces while avoiding unnecessary disturbance, and keep drainage systems working as needed to protect road networks and water quality. Road maintenance can include activities such as felling trees or snags that are safety hazards, grading surfaces, repairing slumping or sliding fills and cutbanks, clearing ditches, adding surface material, performing dust abatement, and installing or replacing surface drainage structures. Road maintenance for fire prevention and timber management may include mechanical control of roadside vegetation, including grading, hand cutting, and using a brush hog–type mechanical device.,

Applicable rules and regulations would be followed, specifically OAR 629-625-0600, *Road Maintenance,* and OAR 629-625-0700, *Wet Weather Road Use.* Roads owned by an SFO used to haul timber are to be maintained to the standards of the OFPA rules and must satisfy the same standards that apply to all landowners. However, the SFO is not required to undertake three types of road improvements by themselves unless required prior to the PFA, instead these are to be funded by the state of Oregon:

- Replacing fish stream culverts (Type F and Type SSBT).
- Repairing abandoned roads.
- Reconstructing, vacating, or relocating roads with a perched fill that present a significant hazard to fish-bearing streams.

These road improvements for SFOs would be coordinated through the new Small Forestland Investment in Stream Habitat (SFISH) Program detailed in Chapter 4, Section 4.4.5, *Conservation Measure 5: Small Forestland Owners,* and Chapter 9, *Costs and Funding*.

3.4.5 Road Vacating

Road vacating refers to the process of making a road impassable by effectively blocking it to vehicular use and leaving the roadbed hydrologically disconnected to adjacent streams or other aquatic resources. This is achieved by activities such as removing all water crossing structures and imported fill materials, ensuring that vacating does not result in a fish passage barrier, and re-establishing the natural drainage so that no additional maintenance is required. Additionally, ditches and roads should be left in a state that minimizes erosion, and sediment delivery from exposed slopes should be addressed using erosion control (OAR 629-625-0650, *Vacating Forest Roads)*.

Abandoned roads constructed prior to 1972 do not meet the criteria of active, inactive, or vacated roads as defined under OAR 629-600-0100. Abandoned roads do not include skid trails. The number and condition of abandoned roads on private timberlands in Oregon is uncertain, but abandoned or "legacy" roads have been cited by the U.S. Environmental Protection Agency (EPA) and National Marine Fisheries Service (NMFS) as an area of concern. Landowners will identify and report abandoned roads under the FRIA program or the Road Condition Assessment[3] for forestland managed by the SFO when a harvest operation occurs. Landings would be constructed at the minimum size necessary for safe operation: on average 0.25 acre. Construction, maintenance, and decommissioning of landings would use the same techniques, would be subject to the same

[3] Small forestland owners will submit a road condition assessment when filing a notification, in lieu of the forest road inventory and assessment (OAR 629-625-0920).

regulatory constraints, and likely would occur at the same time as road construction, maintenance, use, and abandonment.

Landing construction would be performed in accordance with restrictions placed by the OFPA, specifically including those identified in OAR 629 Division 630, *Harvesting*, and 629-630-0200, *Landings*, but also including all other applicable rules.

3.4.6 Drainage Structure Construction and Maintenance

This activity includes the installation, maintenance, and removal of drainage structures associated with roads, such as culverts, roadside ditches, dips, and waterbars. Besides avoiding or reducing sediment delivery to waters of the State, drainage systems would also minimize alteration of stream channels. Roadway drainage would be maintained to be effective, and measures to minimize drainage interference would be implemented, including on temporary and unfinished roads. One of the requirements for stream crossing structures is to allow migration of fish during conditions when fish movement would normally occur and to allow for adequate space during peak flow conditions.

Applicable rules and regulations would be followed, specifically OAR 629-625-0320, *Stream Crossing Structures*; OAR 629-625-0330, *Drainage*; and OAR 629-625-0430, *Stream Protection*.

3.5 Quarry Development

Many landowners have rock pits and quarries located on their property that are within the permit area and are currently being used or projected to be used to produce various sizes of crushed rock for placement on road systems and as slope protection material. Quarry development includes the use of drills, explosives, bulldozers, loading equipment, and trucks. Quarries typically remain active for several years and are managed using practices that maintain stable slopes and protect water quality. Quarry siting and operations in the permit area are required to be compliant with the OFPA rules (OAR 629-625-0500, *Rock Pits and Quarries*) and other applicable rules. Only development of noncommercial quarries under the authority of the OFPA are covered under this HCP.

3.6 Plan Implementation Activities

Plan implementation activities are those activities that are required as part of the HCP's conservation strategy (including the monitoring and adaptive management program detailed in Chapter 6, *Monitoring and Adaptive Management*) 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 and the decommissioning of roads, crossings, and associated facilities, have been described in the preceding sections. This section summarizes other plan implementation activities associated with the conservation strategy, such as aquatic habitat restoration, monitoring, and adaptive management activities. For a complete description of these actions, see Chapter 4, *Conservation Strategy*.

3.6.1 Aquatic Habitat Restoration

Riparian areas are the interface between terrestrial and aquatic ecosystems and most directly affect or are affected by the aquatic environment. These areas include buffers along 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. Riparian area boundaries can appear diffuse with many of the same tree species as found on hillslopes in wetter forested areas typical for western Oregon. In drier parts of the state, riparian forests can exhibit abrupt transitions to non-forested habitat when composed of trees dependent on water during the summer months.

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.

For state-led abandoned road surveys for potential remediation/restoration, the remediation part would be the activity.

The FRIA program or the Road Condition Assessment for forestland managed by the SFO when a harvest operation occurs will identify restoration projects, which will be prioritized for funding in consultation with ODFW.

3.6.2 Electrofishing

Under the HCP, electrofishing surveys can be used to establish fish absence for OFPA regulatory purposes. All electrofishing surveys will follow NMFS (2000) electrofishing guidelines and any subsequent updates made to those guidelines. OFPA regulations will be updated in the future to expand extent of fish sampling requirements from the current 150-foot requirement to 1,320 feet upstream of the last observed fish.

3.6.3 Monitoring and Adaptive Management Activities

The adaptive management program, as specified in the OAR 629-603 rule division, will conduct effectiveness monitoring by assessing the degree to which the OFPA rules achieve the biological goals and objectives, including cumulative effects. An Adaptive Management Program Committee (AMPC) will develop an initial list of research topics for approval or modification by the Board of Forestry (BOF) and further refinement and peer review by an Independent Research and Science Team (IRST).

3.6.3.1 Development of Monitoring Requirements

The IRST will design and oversee effectiveness and validation monitoring with the adaptive management program, as specified in the rule division 603 of the OFPA. In addition to adaptive management, a compliance monitoring program would also be conducted on private forestlands through ODF's process, detailed in Chapter 6, *Monitoring and Adaptive Management*.

3.7 Activities Not Covered

Lands in the permit area are owned by private entities and are not generally accessible to the public for recreational activities. There are several large landowners who routinely grant open or limited

access to the public for recreation, especially hunting. In instances where access is granted to the public, recreational hunting and fishing are not covered activities under this HCP because recreational hunting and fishing activities in the plan area are not regulated by ODF. Other legal recreational activities are also not covered.

Herbicide and fertilizer application using either aerial application methods (i.e., fixed-wing airplane, helicopter, unmanned aerial system) or ground methods as part of reforestation site preparation or release treatments is not a covered activity under this HCP. The application of rodenticides and pesticides are also activities not covered under this HCP.

This page intentionally left blank.

Chapter 4
Conservation Strategy

This chapter describes the conservation strategy to be implemented as part of the Oregon Private Forest Accord Habitat Conservation Plan (HCP) to avoid, minimize, and mitigate impacts of take on listed species as required under Section 10(a)(2)(A) of the federal Endangered Species Act (ESA). The conservation measures described in the following sections were developed collaboratively among the authors of the 2022 Private Forest Accord Report (PFA Report), and refined based on conversations with the Oregon Department of Forestry (ODF), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and Oregon Department of Fish and Wildlife (ODFW), among others.

The chapter is organized around the following topics.

- Section 4.1, *Conservation Approach and Methods*, describes the relation of the conservation strategy to other conservation plans in the region. The approach and methods used to develop the specific conservation strategies and actions are also described in this section.
- Section 4.2, *Research and Advisory Committees,* identifies and describes the entities that will periodically evaluate the effectiveness of the HCP's conservation strategy at meeting biological goals and objectives.
- Section 4.3, *Draft Biological Goals and Objectives*, describes the specific long-term biological goals and measurable objectives for each covered species as well as the development process.
- Section, 4.4, *Conservation Measures*, describes the specific conservation measures developed in the PFA process that will be implemented as part of the HCP to meet biological goals and objectives.

4.1 Conservation Approach and Methods

The conservation approach was developed collaboratively among authors of the PFA Report and informed by feedback during mediated sessions by representatives of the USFWS and NMFS (collectively, the Services). The PFA Report was submitted to the Oregon Legislature and published on the ODF website on February 2, 2022. The conservation measures described in the PFA Report were then drafted into rules to be adopted by the Board of Forestry (BOF) in October 2022. Finally, the revised rules and commitments laid out in the PFA Report were translated to the HCP through consultation with PFA authors, ODF, and ODFW, as well as the Services to meet federal and state regulatory requirements. The revised and new rules are contingent on approval of the HCP and issuance of an incidental take permit (ITP) from the Services. Should the HCP fail to gain approval and an ITP is not issued, the changes to the Oregon Forest Practices Act (OFPA) to reflect the PFA agreement will be rescinded and regulations will revert back to those in place prior to the PFA agreement. The conservation measures were designed specifically for private forestlands in the state of Oregon and designed to maintain the economic viability of the private forest industry and small forest landowners while also minimizing harvest effects and increasing protections for covered fish and amphibian species.

The overarching goals of the PFA agreement carry over to the HCP conservation strategy, including providing greater business, environmental, and regulatory certainty while relying on science-driven adaptive management to improve and protect aquatic habitats throughout private forestlands in Oregon. Moreover, the conservation strategy is designed to maintain and enhance functions in riparian areas, including the recruitment of large wood, removal of fish passage barriers, and protection from increased sediment delivery and stream temperature. The conservation strategy also includes measures to ensure the ecological functions of landslides (e.g., delivery of large wood and boulders to streams) are maintained, and sedimentation to fish-bearing waters from landslides is minimized by regulating harvest on steep slopes; regulating construction; maintenance, use, and vacating of roads; and providing a framework to remediate abandoned roads. The strategy also includes tax credits and grants for Small Forestland Owners (SFOs) to conserve riparian forest Riparian Management Areas (RMAs), improve fish passage, and reduce delivery of sediment to streams by forest road systems. A new mitigation fund and grant program will be used to address limiting factors for listed species across the permit area. New regulations and emphasis on nonlethal management of beavers for large landowners may promote the presence of beavers and beaver dams, which may result in improvements to stream habitat for some of the covered aquatic species. Lastly, the strategy calls for closer coordination between ODF and ODFW on a variety of habitat-related matters, from stream typing to fish passage to beaver management. Together the changes in forest practices, state and private investments in roads and habitat projects, and a strong multi-agency approach to adaptive management and implementation promises significant benefit to the covered species, and to effectively minimizing and mitigating the effects of the covered activities.

The OFPA rules (Appendix X, *Title to Come*) have been revised to reflect the agreements made amongst PFA signees and form the basis of the primary conservation measures for this HCP. Specifically, updates were made to the following rule divisions.

- Division 600, *Definitions*
- Division 605, *Planning Forest Operations*
- Division 610, *Forest Practices Reforestation Rules*
- Division 625, *Forest Road Construction and Maintenance*
- Division 630, *Harvesting*
- Divisions 635 and 655, *Water Protection Rules*
- Divisions 670 and 672, *Forest Practices Administration*

To reflect the PFA Report and associated legislation, three new rule divisions were developed (a fourth was rewritten in its entirety).

- Division 603, *Adaptive Management*
- Division 607, *Small Forestland Owner*
- Division 678, *Compliance Monitoring*

These new divisions established technical and research advisory committees to support an adaptive management program, provided new support and incentives for SFOs, and defined priorities and reporting responsibilities for the compliance monitoring program. The fourth division, Division 643, *Water Protection Rules: Vegetation Along Streams,* replaced the prior vegetation retention rules for

riparian areas (formerly Division 642). Rules updates most relevant to this HCP are identified in the following sections.

The terms used in the following sections to describe conservation measures are consistent with the definitions provided in Oregon Administrative Rules (OAR) 629-625-0100 and are listed and defined in Appendix X, *Glossary*.

4.2 Research and Advisory Committees

Implementation of the conservation measures described in Section 4.4 will require research and monitoring to ensure they are having the intended effect on habitat conditions for covered species in the permit area. ODF, the Adaptive Management Program Committee (AMPC), and the Independent Research and Science Team (IRST) will periodically evaluate the effectiveness of the conservation strategy to meet biological goals and objectives. The AMPC will set the research agenda for the IRST and guide the overall implementation and adaptive management strategy (as discussed in more detail in Chapter 6, *Monitoring and Adaptive Management*). Committee roles, responsibilities, and membership are described in Table . Roles and responsibilities of the two groups are discussed throughout the following sections where applicable.

Table 4-1.Roles, Responsibilities, and Membership of the Adaptive Management Program Committee and the Independent Research and Science Team

Role and Responsibilities	Membership
Adaptive Management Program Committee	
• Set the research agenda, including priorities, for the IRST and guide the overall adaptive management process • Prepare a budget for the IRST for BOF consideration and approval • Assess the scientific outcomes reported by the IRST and prepare a report for BOF that identifies alternatives that could address identified problems • Help BOF in the ongoing process of identifying and modifying resource objectives • Review Compliance Monitoring Program and enforcement reports and prepare any recommendations to BOF for rule adjustment, guidance, or training • Use the results of the baseline and trend monitoring to develop regional goals consistent with that monitoring • Prepare reports for BOF detailing effectiveness monitoring • Oversee modifications and updates to the stream classification system • Evaluate the economic implementation of the new OFPA rules in 2024 on SFOs	• Industrial forest landowner representative • Timber operator • SFO representative • Conservation Landowner nominated • Tribal representative • Conservation community representative • Commercial or recreational angling representative • County government representative • ODF (nonvoting member) • ODFW • Oregon Department of Environmental Quality • NMFS (nonvoting member) • USFWS (nonvoting member)

Role and Responsibilities	Membership
Independent Research and Science Team	
• Oversee the research projects that the AMPC prioritizes and delineates • Set up IRST operating protocols emphasizing peer-review findings and testable hypotheses • Conduct inquiries through literature review, field monitoring, original research, commissioned studies, and other means of scientific studies • Evaluate alternative models/approaches for stream classification system • Evaluate baseline and trend monitoring for hydrologic disconnection • Prepare reports for BOF detailing effectiveness monitoring • Assess an alternative fish distribution model to inform the regulatory database • Assess the suitability of the Probability of Streamflow Permanence (PROSPER) model to comprise the regulatory stream layer and database • Identify development indicators to determine whether roads are contributing sediment to waters of the state	• Membership will be determined by the AMPC and BOF • Members must be qualified in subjects such as forestry, silviculture, ecology, hydrology, wildlife, fisheries, and geology

4.3 Draft Biological Goals and Objectives

[The Proposed Draft HCP includes draft goals to illustrate the overarching intent of HCP implementation. These goals represent early draft language and are subject to change. A full set of biological goals and objectives are under development and will be included in a subsequent draft of the HCP.]

Overarching Goal: Forest practices that support the survival and recovery of the covered species by providing clean, cool, connected, and complex habitats.

While the following goals and objectives are organized for clarity, it is recognized that a single objective may support more than one goal and that there are often interactions between objectives to support goals. These objectives facilitate monitoring of the conservation measures and guide the adaptive management program. Thus, any effectiveness monitoring or studies of conservation measures will target lands managed under the OFPA to identify signals within the control of forest landowners.

- **Goal 1:** Provide clean water and substrate for the covered species.
    - **Objective 1.1** - Forest practices near streams minimize sediment delivery.
    - **Objective 1.2** – Slope Retention Areas reduce episodic sediment delivery to fish-bearing streams.
    - **Objective 1.3** – Road runoff directly to streams is minimized.
    - **Objective 1.4** – Roads are not a significant source of episodic sediment delivery to streams.

- **Goal 2:** Shade and watershed processes controlling stream temperature provide cool water compatible with the needs of the covered species.
  - **Objective 2.1** – Forest practices maintain stream shade sufficient to support desired cool water temperatures on fish-bearing streams.
  - **Objective 2.2** – No-harvest RMAs maintain stream shade sufficient to support desired cool water temperatures for covered amphibians.
  - **Objective 2.3** – Forest practices near non-fish-bearing perennial streams do not notably increase water temperatures in fish-bearing streams.
- **Goal 3:** Stream network connectivity satisfies freshwater habitat needs for covered species.
  - **Objective 3.1** – Road crossings on fish-bearing streams are passable by the covered fish species.
  - **Objective 3.2** – Forest practices maintain the hydrologic continuity of stream-associated wetlands and stream-adjacent seeps and springs to stream habitats.
  - **Objective 3.3** – Timber harvest maintains stream-associated connectivity in riparian areas along non-fish streams sufficient to support covered amphibians.
- **Goal 4:** Riparian areas function to support complex habitats for the covered species.
  - **Objective 4.1 –** Mature, complex riparian forests are fostered in no-harvest zones of RMAs.
  - **Objective 4.2 –** Forest practices within tree retention areas of RMAs promote delivery of large wood.
  - **Objective 4.3 –** Designated Debris Flow Traversal Areas function to deliver large wood to fish-bearing streams.
  - **Objective 4.4 –** Forest practices maintain stream-associated wetlands and stream-adjacent seep and spring habitat for amphibians.

4.4 Conservation Measures

This section describes the conservation actions that will be implemented as part of the HCP to achieve the biological goals and objectives described in Section 4.3. The following conservation measures are intended to minimize and mitigate the effects of the covered activities (see Chapter 3, *Covered Activities*) on covered fish and amphibian species throughout the permit area. The conservation measures reflect updated forest practices regulations and include active restoration and mitigation actions intended to protect important habitats and ecosystem functions necessary to support covered species. These conservation strategies will be applied across private forestlands in the state of Oregon and represent a significant shift in private forest practices benefiting ESA-listed and native fish and amphibian species.

4.4.1 Conservation Measure 1: Riparian Management Areas

Conservation Measure 1 is intended to reduce effects on riparian areas from human disturbance and maintain and enhance freshwater habitats for fish and amphibian species in the permit area. Highly functional riparian corridors support and provide numerous ecological and biological processes

necessary to support thriving aquatic ecosystems. Specifically, the main purpose of this conservation measure is to enhance the delivery and function of large wood, improve and enhance stream shade, minimize the delivery of fine sediment to the aquatic environment, maintain and enhance gravel storage, improve and protect streambank stability, and maintain optimal water quality conditions for covered species. RMAs are intended to increase the resilience of the riparian forest ecosystem by limiting streamside equipment activity, which will reduce the risk of negative effects from forest management activities on aquatic resources.

No-harvest zones within the RMAs (see Section 4.4.1.3, *Standard Practice Riparian Prescriptions*) will ensure retention of riparian trees and key riparian functionalities. The RMAs described in this HCP are expected to ensure, over the course of the HCP permit term, that large wood available for recruitment to the aquatic environment remains high; delivery to the aquatic environment is dependent on other processes such as significant weather and wind events or landslides and debris flows. Over time as riparian trees and vegetation develop and mature, it is expected that RMAs will regain functionality consistent with mature streamside forest stands (OAR 629-643-0000) and provide a high net benefit to covered species. Large wood recruitment from riparian and upland areas to the aquatic environment occurs over a long period of time, and the benefits would not be realized until many years after HCP implementation.

4.4.1.1 Ecological Functions of Riparian Areas

Large Wood

Large wood is essential to maintaining natural stream processes and is an important component of high-quality aquatic habitats for all the fish and amphibian species covered in this HCP. The physical and biological roles large wood play in shaping stream ecosystems have been well studied and documented (e.g., Maser and Sedell 1994; Gurnell et al. 2003; Swanson et al. 2021). Large wood is generally defined as logs with a diameter greater than 4 inches and at least 6 feet in length. Large wood originates from trees in streamside forest stands and enters the channel following floods, erosion, windthrow, beaver activity, and disease or natural mortality. Large wood can include whole trees with limbs and intact root-wads or portions of trees with or without limbs or root-wads. Large wood promotes instream channel complexity by facilitating the creation of vital hydrologic features including pools, gravel bars, and off-channel areas like side channels and backwaters, all of which provide essential habitats for covered fish species. Large wood is especially important for the formation of pool habitats. For example, Reeves et al. (2016) found that large wood formed roughly 65 percent of pool habitat in a study on an Oregon coast stream.

Large woody material also influences the storage and movement of sediments through the aquatic environment. Hydrologic features created by large wood increase the capacity of a stream or river to store fine sediments and gravels by slowing bedload movement and promoting deposition across the floodplain. Tree roots and large wood can also improve streambank stability by slowing water velocity, thereby reducing or preventing channelization and bed and bank scour. Moreover, the presence of instream wood has been shown to improve habitat conditions for juvenile salmonids, such as coho salmon, by stabilizing streambed substrate and reducing velocities (Bair et al. 2019) and creating important summer and winter rearing habitats. Large wood creates refuge areas where fish can avoid predators and warm temperatures during the summer. Similarly, pools with large wood have been shown to be important refuge habitat for juvenile salmonids during the winter when high flows and flooding occurs (Bustard and Naver 1975). Studies have also consistently found that higher densities of large wood leads to improved habitat complexity and higher densities

of rearing salmonids. For example, Jones et al. (2014) found coho salmon rearing densities increased by 32 percent 6 years following large wood augmentation in western Oregon streams. Finally, juvenile salmonids residing in areas with abundant and complex large wood features have been observed moving shorter distances and less frequently than those residing in wood deprived areas (Roni and Quinn 2001). Higher densities of large wood increases habitat complexity, improves channel stability, increases nutrient input, and increases aquatic invertebrate habitat (e.g., food for covered fishes and amphibians) meaning rearing juveniles do not need to migrate to locate food or refuge when large wood is abundant.

Large wood is also a key habitat component for the covered amphibian species. Large wood is positively associated with torrent salamander (*Rhyacotriton spp*.) densities (Olson and Burton 2014), and is an important component of cover, foraging, and nesting habitat for coastal and Cope's giant salamanders (*Dicamptodon copei*) (Nussbaum et al. 1983; Petranka 1998). Both instream and riparian large woody debris contributes positively to instream habitat conditions for coastal tailed frogs (*Ascaphus truei*) (Nussbaum et al. 1983; Wahbe and Bunnell 2001). Collectively, the covered amphibian species can be found throughout the stream system across the portion of the covered lands extending from the Cascades west to the Oregon coast. Known ranges for some of the covered species extend east of the of the crest of the Cascade Mountains, but none of the covered amphibians occur in far eastern Oregon. The coastal giant salamander (*D. tenebrosus*) inhabits the widest range of aquatic habitats including rivers to headwater streams, and lakes, ponds, and seeps while the torrent salamanders are the most restricted and occur primarily in low-order streams such as headwaters and forested seeps. Columbia (R. kezeri) and southern torrent (*R. variegatus*) salamanders typically occur in the system above fish presence, but the other three covered species (tailed frog, coastal giant salamander, and Cope's giant salamander) are distributed throughout the system, both co-occurring with fish and occupying fishless reaches higher in the system. All five species utilize the upper reaches of the stream network with torrent salamanders and tail frogs being closely associated with headwater streams. Some species are known to utilize adjacent streambanks and can occasionally be found in forested uplands (e.g., tailed frogs and coastal giant salamanders). Thus, the conservation actions that affect the uppermost portions of the stream network and occur above fish presence are specifically important for this group of covered species (Figure 4-2).

Water Quality

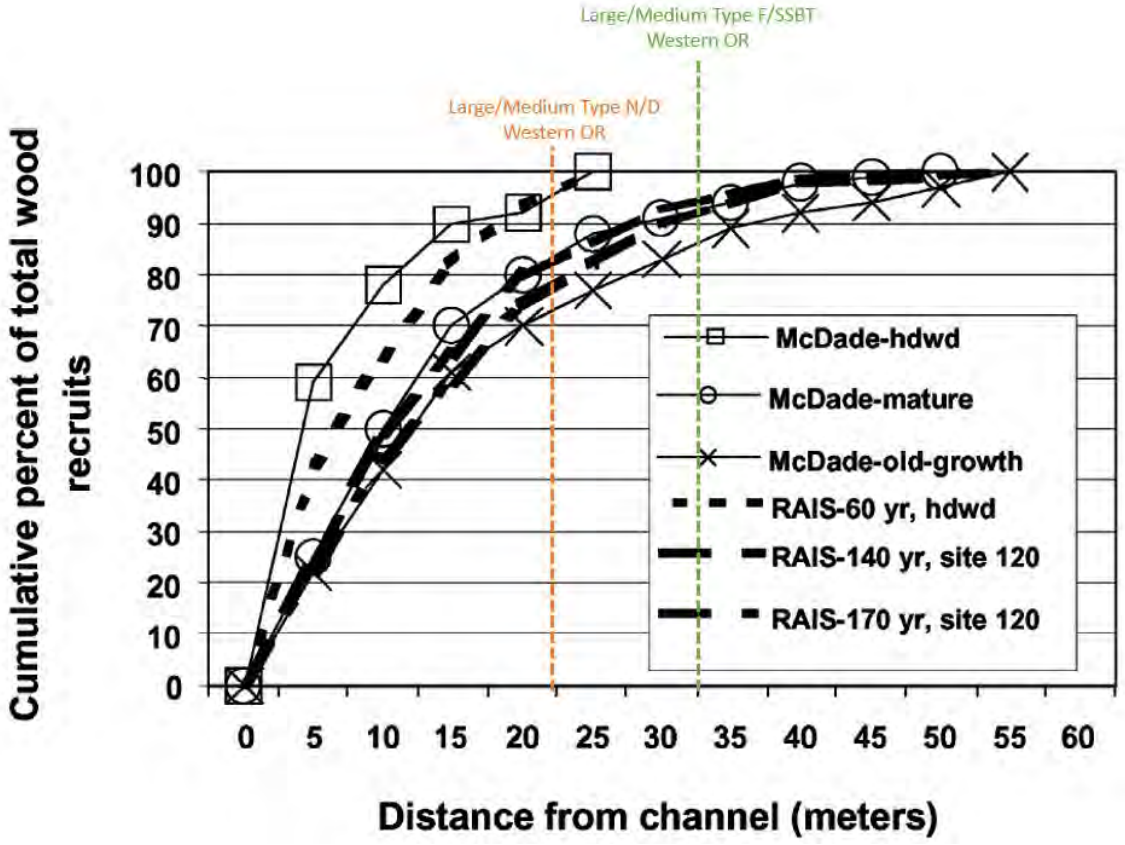
Forested riparian corridors are crucial for regulating and maintaining suitable water temperatures and preventing lethal or harmful water quality conditions from developing. Thermal tolerances and thresholds vary by species, but in general, native fish and amphibian species in Oregon require cool water temperatures to thrive. Tree harvesting in riparian forests adjacent to streams can reduce canopy cover and stream shading, thereby leading to increased solar radiation and heating, which can reduce water quality. The RMAs are expected to provide streamside canopy cover and shading that will regulate stream temperatures, keeping water conditions cool and suitable for covered cold-water fish and amphibian species. Ultimately, the conservation strategy for RMAs is intended to enhance the functionality of riparian areas at levels comparable to mature streamside forests.

Intact and functional riparian areas also regulate the amount of fine sediment delivered to the system by slowing runoff during storm events and stabilizing stream-adjacent soils, improving the system's capacity to store and transport fine sediment. When fine sediment delivery rates exceed storage and transport capacity, essential habitat features such as deep pools or gravel interstitial space can be filled in, reducing the quantity, quality, and functionality of these features. Riparian

areas also function to help maintain water quality and prevent turbidity and suspended sediment levels from exceeding species thresholds. Rashin et al. (2006) suggests that RMAs of 30 feet should be sufficient to protect against most sediment delivery from overland flows. They found that 95 percent of erosion features located at least 30 feet from streams in forested areas in Washington did not deliver sediments.

Defining RMA Widths

Widths of RMAs along fish-bearing streams, as well as medium and large perennial streams, were designed primarily with regard to large wood delivery. Other riparian functions are generally provided within source distances for large wood (FEMAT 1993; Reeves et al. 2016). Based on data from the Oregon Coast Range and Cascades, approximately 90 percent of the total wood inputs from areas adjacent to fish-bearing streams were found to originate 82 feet (horizontal distance) for mature conifer forests and 121 feet (horizontal distance) for old growth forests measured from the edge of the stream channel (McDade et al. 1990; Welty et al. 2002) (Figure 4-1). Streamside forest RMA prescriptions were developed primarily based on the relationships described by Welty et al. (2002). No-harvest RMAs (100–110 feet) on fish-bearing streams established in the HCP and OARs are designed and expected to provide adequate wood recruitment. Wood recruitment is evaluated as part of the adaptive management program described in Chapter 6, *Adaptive Management and Monitoring*.



As reported by Welty et al. (2002). The data shown in the figure is a combination of observations made by McDade et al. (1990) and predictions from the Riparian Aquatic Interaction Simulator model developed by Welty et al. (2002). Examples of streamside RMA widths included in the HCP are indicated by the vertical dashed lines.

Figure 4-1. Cumulative Percent of Total Wood Recruits as a Function of Linear Distance from Stream Channel

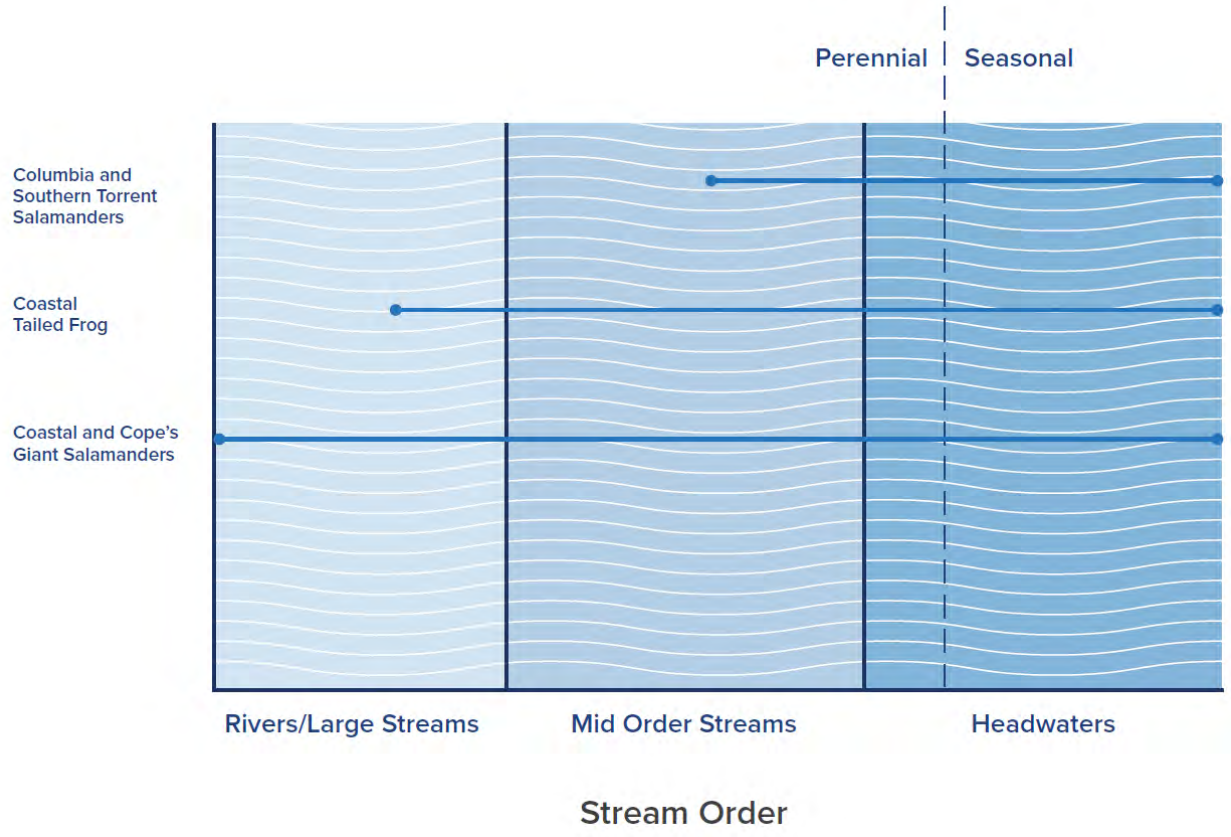


Figure 4-2. Expected Distribution of Covered Amphibian Species Across Stream Orders in the Permit Area

4.4.1.2 Regulatory Stream Classification Database

This conservation measure will impose updated riparian area management strategies based on revisions to OAR 629-635-0200 *Water Classification* to ensure physical characteristics and beneficial uses of a water body are considered when setting the appropriate protection measures (OAR 629-635-0200(1)). A comprehensive synthetic stream network for the permit area will provide the basis for harvest unit review and initial identification of RMA prescriptions. The stream classification system will utilize beneficial stream classes as defined by OAR 629-635-0200 and described in Chapter 2, Section 2.2.2.4, *Hydrology and Water Quality of Western Oregon*. The RMA prescriptions will be applied based on beneficial stream classes including the presence of fish species, stream seasonality, and average annual flow.

Currently, information regarding stream location, fish presence, and flow duration used to inform harvest layouts is known to be incomplete (e.g., U.S. Geological Survey [USGS] National Hydrography Dataset high resolution attributes and ODF's regulatory stream data layer). The synthetic stream network to be developed and implemented with the HCP is intended to provide timber operators with advanced technical tools that identify a high proportion of streams across the permit area based on the best available science and modeling. Over the course of the HCP's life the stream classification system and database will be actively managed by ODF in coordination with ODFW and updated as needed based on scientific and technological advancements.

Classifying Fish Use

Type F and Type SSBT (hereafter, fish-bearing) streams will be identified using a combination of modeling (e.g., Fransen et al. 2006 or Penaluna et al. in press) and field verification, as necessary. Field surveys, including electrofishing, described in Chapter 3, Section 3.6.2, can be used to correct or verify modeled fish distribution as outlined in OAR 629-635-0200(11)(c). Determination of fish-bearing streams that include distribution of the defined SSBT species will be determined by ODF pursuant to OAR 629-635-0200(12), which relies on the farthest upstream distribution as determined by observation, presence of suitable habitat, or professional opinion. Initially Type SSBT stream distribution will be based on data in the Fish Habitat Distribution Database as of July 1, 2017 (OAR 629-635-0200(13)(a)). Updates to the SSBT habitat distribution layer will be made and maintained by ODFW consistent with OAR 629-635-0200(13)(b). Fish distribution data will be updated as new technologies and modeling approaches are developed and deemed appropriate for regulatory purposes by ODFW. Modeled extent of fish-bearing streams will be modified to account for end of fish information obtained from physical habitat surveys or direct sampling of fish presence that were completed under ODFW approved protocols. Field verified data will be reviewed and approved by ODF and ODFW, before incorporation into the regulatory database.

Classifying Flow Permanence

For non-fish-bearing streams (Type N), the perennial or intermittent status of a stream is determinative of RMA prescriptions. The extent of perenniality is often difficult to identify in the field. There is also a high degree of uncertainty in current statewide stream layers. Identifying the extent of perenniality prior to harvest operations is imperative to ensuring RMA prescriptions are applied accurately. Thus, a new model that returns probabilistic estimates of flow permanence is necessary for both western and eastern Oregon. Models will be developed by USGS, and outputs approved by ODFW, in consultation with ODF, for inclusion in the ODF electronic reporting and notification systems no later than July 1, 2025. Approval requires that outputs are deemed sufficiently accurate to comprise a regulatory layer and completion of a stakeholder process to determine probabilistic thresholds for flow permanence. Until the models are approved harvest layouts will rely on a verification survey to determine the end of perenniality (OAR 629-643-0130(1)(a)) or an operational field survey (OAR 629-643-0130(1)(c)). Field surveys will be conducted per ODFW protocols described in Appendix XX, *Title* [in prep]. Once outputs of the stream permanence modeling are available, landowners can define RMA boundaries using model results or based on either operational or verification field surveys. The process for field verification is more rigorous than for operational field surveys, but results from either may be used to update and inform the streamflow permanence model and regulatory database (see Appendix XX, *Title,* for details on field protocols).

4.4.1.3 Standard Practice Riparian Prescriptions

RMAs will be established adjacent to aquatic features including streams, seeps, stream-associated wetlands, side channels, and the channel migration zone (CMZ). RMAs are defined under OAR 629-600-0100 as “an area along each side of specific waters of the state within which vegetation retention and special management practices are required for the protection of water quality, hydrologic functions, and fish and wildlife habitat.” The purpose of forested RMAs along streams is so that over time average conditions across the landscape develop into mature riparian forests (OAR 629-643-0000(3)). Oregon has a tremendous diversity of forest tree species and stand density along waters of the state. The age of mature streamside stands varies by tree species, but generally occurs

between 80 and 200 years with hardwood, and some conifer stands maturing sooner. Mature forests provide ample shade over the channel, an abundance of large wood in the channel, channel-influencing root masses along the edge of the high-water level, and regular inputs of nutrients through litter fall. Mature forests are composed of multi-aged trees of appropriate and varied density, native tree species well suited to the site, a mature understory, snags, and downed wood. Streamside areas without required tree retention areas are intended to have sufficient streamside nonforested vegetation to support the functions and processes important to downstream waters with fish and domestic use, and to provide components of habitats important for the covered amphibians as well as other wildlife across the landscape (OAR 629-643-0000(5)).

The RMAs will be laid out during harvest unit planning and are specific for western and eastern Oregon and vary by fish use (fish or non-fish), stream size (based on average annual flow), and flow permanence (perennial or seasonal) with fish-bearing large and medium streams having the widest no-harvest stream RMAs in western Oregon. All RMA widths will be measured using the slope distance from the edge of the active channel, or CMZ[1] when present. In situations where the slope adjacent to the stream channel is steep exposed soil, a rock bluff, or talus slope, operators will measure the RMA as a horizontal distance until the top of the exposed bank, bluff, or talus slope is reached (OAR 629-635-0310(2)). Although the lengths and widths of RMAs for small Type Np streams differ between western and eastern Oregon, the field protocols for determining retention requirements are the same (OAR 629-643-0130). RMA prescriptions for small Type Np streams may include retention equipment limitation zone (R-ELZ), where all trees less than 6 inches in diameter at breast height (DBH) and shrubs are retained, that is 35 feet wide in western Oregon (OAR 629-643-0105 (4)(c)) and 30 feet wide in eastern Oregon (OAR 629-643-0125 (4)(d) and (5)(c)).Unless otherwise designated, the entire length of all small Type Ns streams will have a 35-foot-wide equipment limitation zone (ELZ) in western Oregon (OAR 629-643-0105(11)) and a 30-foot wide ELZ in eastern Oregon (OAR 629-643-0125(6)(b)).

Western Oregon

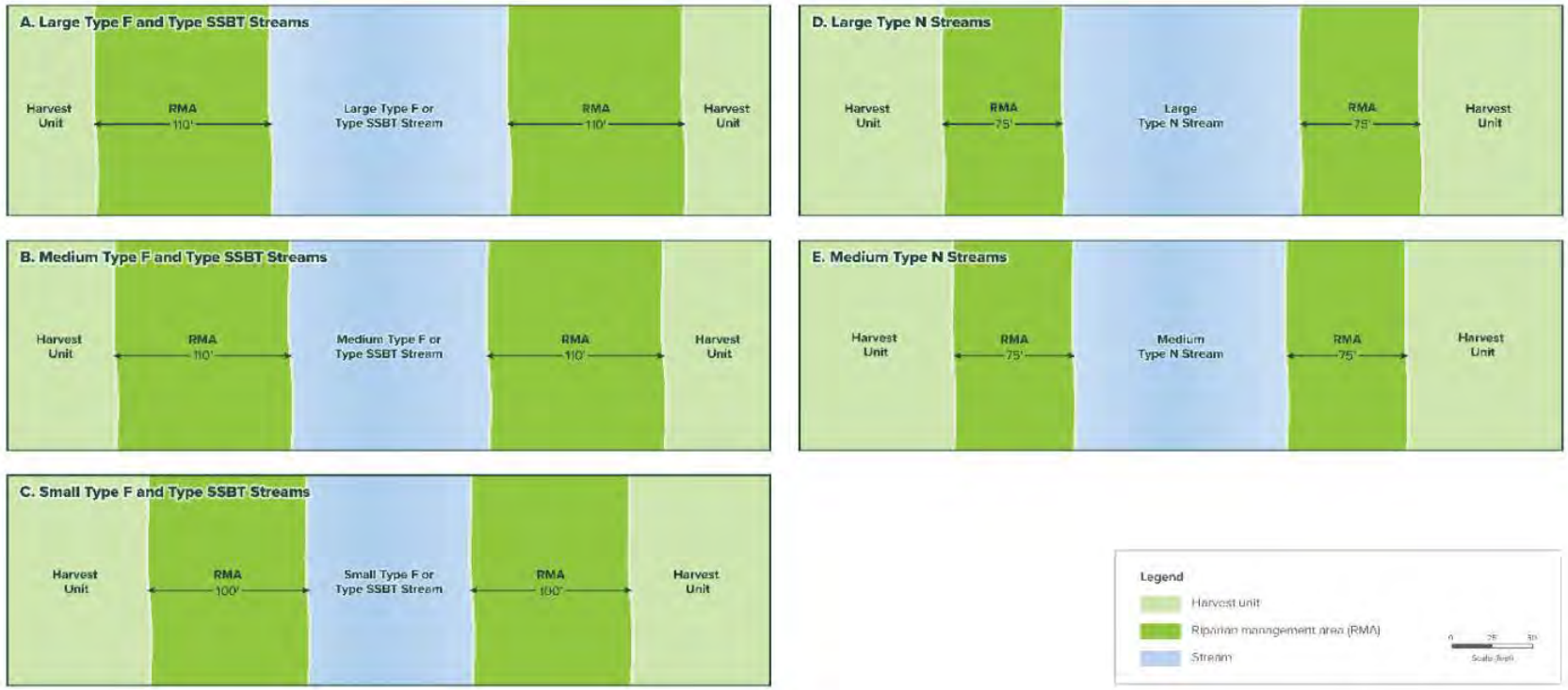
Standard Practice RMA width prescriptions in western Oregon (OAR 629-643-0100) are summarized in Table 4-2.Standard practice RMAs are applied unless the area to be harvested is owned by a small forest landowner or qualifies for other alternative prescriptions (OAR 629-643-0300 and 629-643-0400). All fish-bearing streams as well as all large and medium Type N streams will include no-harvest RMAs for their entire length. Similarly, small Type Np streams will include no-harvest areas near the confluence with fish-bearing streams. The tree retention areas will extend for a defined distance based on the end of perenniality, but are not required to extend beyond a maximum upstream distance, known as the Retention Harvest maximum (RH Max). Small Type Np streams tributaries to Type SSBT streams will receive a no-harvest RMA that extends to a RH Max of 1,150 feet (OAR 629-600-0100) upstream from the confluence. The RMA will be 75 feet wide for the first 500 feet, and then a 50-foot-wide RMA will extend for the next 650 feet to the RH Max (Table 4-2). A similar approach will be applied to small Type Np streams tributary to Type F streams. In this case a 75-foot no-harvest RMA will extend for 600 feet (RH Max) upstream from the confluence. For all small seasonal (Type Ns) streams in western Oregon, a 35-foot ELZ or an R-ELZ will be applied to each side of the channel (OAR 629-643-0105(11)). The ELZ is defined as a zone in which disturbance from equipment will be minimized and an R-ELZ adds the requirements that trees less

[1] 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 habitats adjacent to the stream. *Near term* in this context refers to the time scale required to grow a mature streamside forest.

than 6 inches and shrub species are retained. Corrective action(s) are required when soil disturbance from cabled logs exceed 20 percent or ground equipment exceeds 10 percent of the total area within any R-ELZ or ELZ associated with a harvest unit. Corrective action(s) will be designed to replace the equivalent of lost functions in consultation with the State Forester. Examples include, but are not limited to, water bars, grass seeding, logging slash, mulching, and downed log placement in accordance with Oregon Revised Statutes (ORS) 527.676(1), with a preference for utilizing onsite materials.

Table 4-2. Western Oregon Standard Practice Riparian Management Areas

	RMA Width (feet) by Stream Size			
Stream Type	**Large**	**Medium**	**Small**	**Upstream Distance**
F	110	110	100	Entire feature
SSBT	110	110	100	Entire feature
N	75	75	See Type Np	See Type Np
D	75	75	75 or 20	See OAR 629-643-0150
Np, tributary to SSBT	NA	NA	75 and 50	Up to 75 feet for the first 500 feet, then 50 feet for 650 feet RH Max = 1,150 feet
Np, tributary to Type F			75	Up to 600 feet. RH Max = 600 feet
Ns	NA	NA	35 ELZ	Entire feature

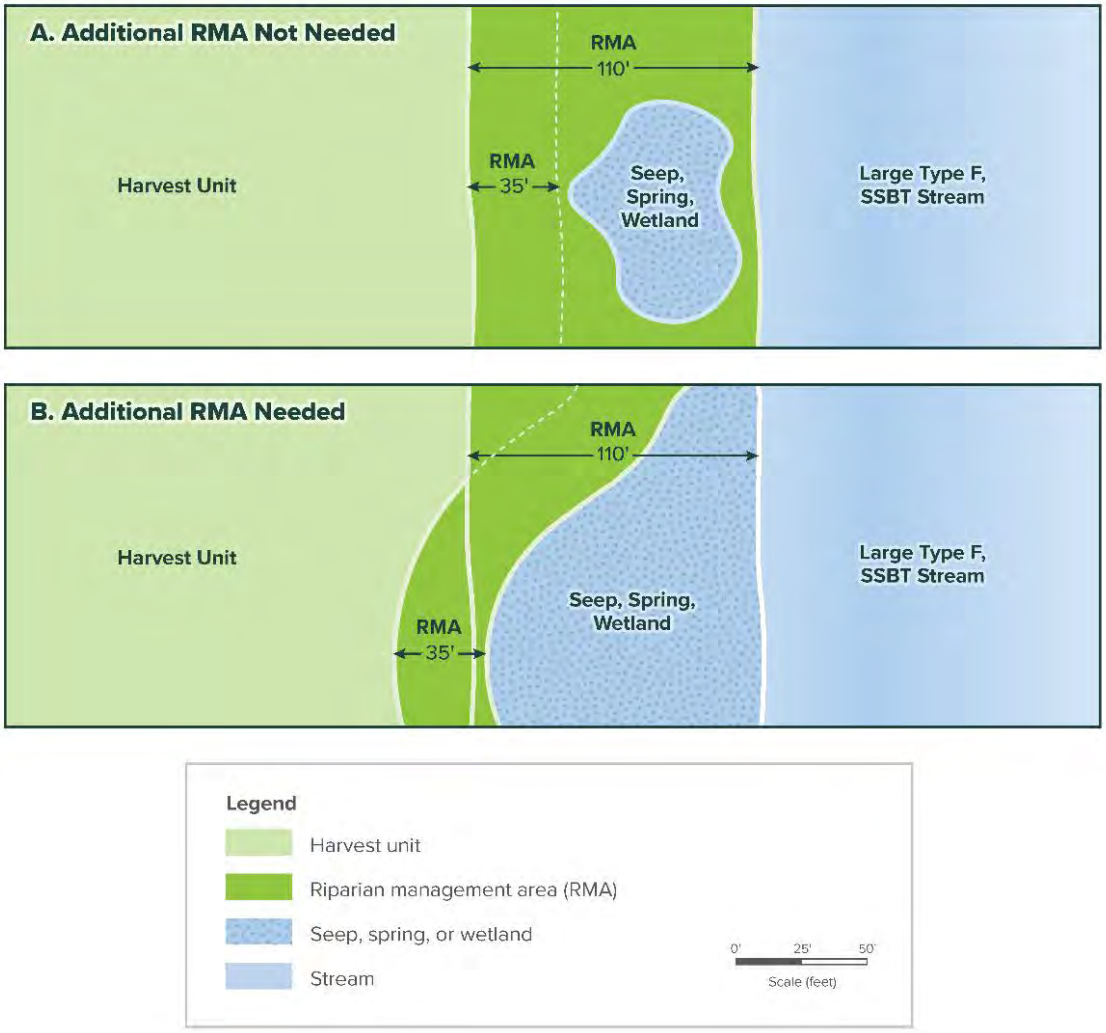


Graphic is for informational purposes only. Additional graphics will be developed and provided in ODF RMA technical guidance currently in development.

Figure 4-3. Western Oregon RMA Prescriptions

Seeps, Springs, Side Channels, and Stream-Associated Wetlands

All trees will be retained within 35 feet of seeps and springs in western Oregon that are located within a no-harvest RMA of stream types in OAR 629-635-0200 (Table 4-2). If necessary, an RMA will be extended up to 35 feet beyond the seep or spring (OAR 629-643-0135). If the 35-foot tree retention requirements can be fully contained within the existing RMA, then no extension is needed. The RMA will extend for the length of the seep or spring feature. Side channels and stream-associated wetlands that extend beyond RMAs will include an additional 25-foot tree retention area for the entire feature (OAR 629-643-0135(3)). RMAs are not included for seeps, springs, or wetlands not associated with stream types defined in OAR 629-635-0200. Specific protections for "other wetlands," seeps, and springs are described in OAR 629-655-0000.



These prescriptions apply to any stream with the no-harvest area; the large Type SSBT and F stream is provided as an example. Graphic is for informational purposes only. Additional graphics will be developed and provided in ODF RMA technical guidance currently in development.

Figure 4-4. Seeps, Springs, Side Channels, and Stream-Associated Wetland RMA Prescriptions

Eastern Oregon

RMAs in eastern Oregon are different from those in western Oregon in that most streams have an inner no-harvest zone and an outer managed harvest zone (Table 4-3). Within the inner no-harvest zone, no thinning or management will occur. The outer managed harvest area, which extends from the edge of the inner zone, varies in width by stream type, and includes both an ELZ and basal area retention requirement. The ELZ extends into the outer zone for 30 feet from the outer edge of the inner zoner (OAR 629-643-0120(4)). A minimum of 60 square feet of basal area per acre must be retained within the outer zone (OAR 629-643-0120(3)(c)) and must consist of 27 trees from the largest diameter class per acre with the remaining trees exceeding 8 inches DBH. In some situations, the stream RMA may be naturally sparse and lack the minimum required basal area required to be retained. In these situations, timber harvest will not be allowed. When possible, fire-resilient species such as ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), and hardwoods will be retained in the outer zone and be as evenly distributed as possible to promote overall stand health.

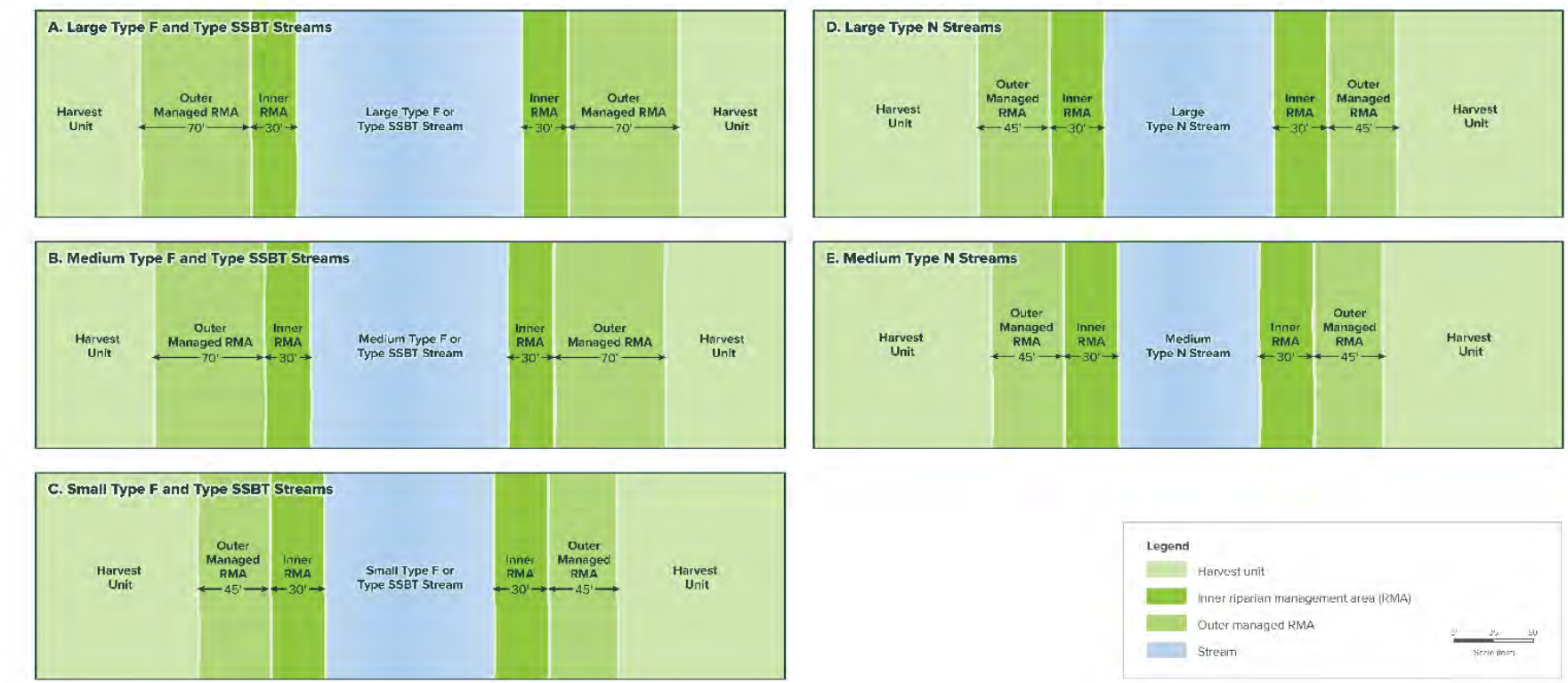
Small Type Np streams will be classified as lateral, or terminal, and RMAs will vary based on the designation (OAR 629-643-0125). For a small terminal Type Np stream flowing into fish-bearing streams the RMA will extend for up to 500 feet upstream of the confluence, the RH Max (OAR 629-643-0125(4)(a)). Requirements for the outer management zone are as previously described for ELZs and basal area retention. For small lateral Type Np streams flowing into a fish-bearing stream all trees will be retained within a 30-foot no-harvest zone for 250 feet upstream from the confluence (OAR 629-643-0125(5)). An ELZ will also be included in the inner zone.

Finally, small Type Ns (seasonal) streams flowing into Type F or SSBT will receive a 30-foot-wide R-ELZ for 750 feet measured from the confluence. All shrubs and trees less than 6 inches DBH will be retained in this area (OAR 629-643-0125(6)(a)). A 30-foot-wide ELZ (30 feet) will extend the remaining length of the channel (OAR 629-643-0125(6)(b)). As described in the western Oregon section above, all RMA prescriptions for Type N streams will include R-ELZ and ELZ restrictions upstream of the RH Max or the farthest upstream identified perennial feature.

Table 4-3. Eastern Oregon Standard Practice Riparian Management Areas

Stream Type	RMA Width (feet) by Stream Size						Upstream Distance
	Large		Medium		Small		
	Inner	Outer	Inner	Outer	Inner	Outer	
F	30	70	30	70	30	45	Entire feature
SSBT	30	70	30	70	30	45	Entire feature
N	30	45	30	45	NA	NA	Entire feature
D	30		30		30 or 20		See OAR 629-643-0150
Np, Terminal	NA	NA	NA	NA	30	30	Up to 500 feet above Type F/SSBT junction RH Max = 500 feet
Np, Lateral	NA	NA	NA	NA	30	NA	Up to 250 feet above Type F/SSBT junction RH Max = 250 feet
Ns					30 ELZ		750 feet from confluence with Type F or SSBT
Seeps and Springs[1]	35						Length of feature parallel to the stream

[1] Occurring within the no-harvest portion of an RMA.



Graphic is for informational purposes only. Additional graphics will be developed and provided in ODF RMA technical guidance currently in development

Figure 4-5. Eastern Oregon RMA Prescriptions

Seeps, Springs, Side Channels, and Stream-Associated Wetlands

Seeps and springs in eastern Oregon located within the inner RMA zone of the stream types defined in OAR 629-635-0200 may include an additional 35-foot no-harvest RMA from the edge of the feature (OAR 629-643-0135). The inner no-harvest RMA will be expanded as necessary to retain all trees within 35 feet of the seep or spring. If the 35-foot retention requirement can be met fully within the existing RMA, then no extension is needed. The inner no-harvest RMA extension will be for the length of the seep or spring feature. Side channels and stream-associated wetlands that extend beyond RMAs will include an additional 25-foot tree retention area to include the entire feature (OAR 629-643-0135(3)). RMAs are not included for seeps, springs, or wetlands not associated with stream types defined in OAR 629-635-0200. Specific protections for "other wetlands," seeps, and springs are described in OAR 629-655-0000. Some springs in eastern Oregon are considered as *Important Springs in Eastern Oregon* and are protected as significant wetlands under Division 645 of the Oregon Administrative Rules. These springs are characterized as having established wetland vegetation, flow year-round in most years, and are used by a concentration of diverse animal species (OAR 629-645-0000). Important springs in eastern Oregon may be isolated but can be associated with a stream; they are most likely to be found at stream headwaters. Wherever they exist, these springs are protected under Division 645 rules and receive an RMA of 50–100 feet (OAR 629-645-0000(6)), which can be partially harvested with a minimum of 50 percent of the trees by species and diameter class required to be retained (OAR 629-645-0010).

Graphic is for informational purposes only. Additional graphics will be developed and provided in ODF RMA technical guidance currently in development.

Figure 4-6. Seeps, Springs, Side Channels, and Stream-Associated Wetland RMA Prescriptions for Eastern Oregon

Existing Roads Within RMAs

In both western and eastern Oregon trees may be removed within a no-harvest RMA when it spans an existing road and trees are determined by an ODF stewardship forester to present a windthrow risk or safety hazard to users of the road. The stewardship forester may authorize removal provided that the width of the area where trees may be harvested is less than 15 feet from the upslope edge of the road and an equivalent basal area is retained elsewhere in the harvest unit adjacent to an RMA (OAR 629-643-0125(8)) or Designated Debris Flow Traversal Area (discussed in more detail in Section 4.4.3, *Conservation Measure 3: Roads*).

4.4.1.4 Relation to Biological Goals and Objectives

Section under development.

4.4.2 Conservation Measure 2: Timber Harvest on Steep Slopes

Conservation Measure 2 is intended to provide the beneficial elements of landslides while mitigating the potential negative effects of forest management activities on shallow, rapid hillslope failures. Specifically, Conservation Measure 2 would ensure large wood and sediment delivery is maintained to improve and maintain aquatic habitats within large basins[2] over time. Sediment sources and debris runout paths will be identified and managed during timber harvest activities to retain trees and other vegetation with the intent of providing and conserving high-quality habitats to recover aquatic species covered by the HCP.

Salmonids and amphibians have evolved adaptations to natural disturbances characteristic of watersheds in the Pacific Northwest, including landslides, debris flows, floods, wildfires, and others. Landslides and debris flows are particularly common on land with steep slopes. Much of the private forestlands in western Oregon exist in areas prone to landslides and debris flows. Landslides and debris flows provide important ecological functions including delivering wood and sediment to streams and river downslope (Burns et al. 2016; May and Gresswell 2003) but can also degrade instream habitat, especially when lacking large wood.

Forest management activities, principally road construction, road maintenance, and timber harvest on steep slopes, can affect the frequency and magnitude of slope failures (Sidle et al. 1985; Swanson and Dyrness 1975). Roads are often associated with a large fraction of management-related landslides (Montgomery et al. 1998) and can generate larger landslides than harvest-related failures (Robison et al. 1999). Conservation measures specific to road-related effects implemented in rule and Forest Practices Technical Guidance following these studies and additional measures are included in Section 4.4.3, *Conservation Measure 3: Roads*.

Shallow, rapidly moving hillslope failures, which include undifferentiated colluvial landslides and channelized debris flows, are common in headwater areas (Benda et al. 2005; Hungr 2014). Such failures initiate from bedrock hollows, convergent headwalls, and other steep slopes, including channel-adjacent features (Highland and Bobrowsky 2008). Initiation typically occurs within the rooting zone of vegetation (Schmidt et al. 2001) and is often associated with prolonged high precipitation events (Baum et al. 2011; Smith et al. 2014).

Landslides and debris flows can deliver large volumes of sediment and wood to streams. Debris flows typically initiate in zero order[3] headwater areas (Benda et al. 2005). However, debris flows can travel long distances, increasing in size as materials scoured along the way are incorporated, before depositing downstream (May and Gresswell 2004). Depending on the scale, landslides and debris flows can adversely affect habitat and kill organisms along their travel paths (Bigelow et al. 2007; Everest and Meehan 1981; Reeves et al. 1995). However, as noted above, disturbances such as landslides and debris flows provide important natural processes over the long term that create and maintain productive habitats for salmonids and other aquatic organisms, when these processes deliver large quantities of large woody debris (e.g., Reeves et al. 1995; Bisson et al. 1997, 2009; Gomi et al. 2002; Montgomery et al. 2003; Foster et al. 2020).

[2] Large basins are those of a size equivalent to those supporting independent populations of Oregon coastal coho salmon or USGS hydrologic unit code (HUC) fourth field (8 digits) basins.

[3] Zero order refers to undefined channels such as hollows, swales, and headwalls.

Fish and amphibian habitat quality and quantity across mountainous regions of the Pacific Northwest are shaped by the frequency and delivery of sediment, boulders, and large wood over time (Bisson et al. 2009). Large wood and boulders increase habitat complexity, store spawning gravels, and regulate transport of fine sediments downstream (Bilby and Bisson 1998; Naiman et al. 2002). Sediment delivered by landslides and associated debris flows can create pools and provide gravel usable for spawning but can also adversely affect fish habitat and macroinvertebrates if the frequency and magnitude of inputs are too high or large wood delivery is low (Hartman et al. 1996; Jensen et al. 2009; Kobayashi et al. 2010). Numerous field studies have identified terrain features that are prone to landslide initiation and determine how far debris flows may travel (Benda et al. 2005; Korte and Shakoor 2020; Robison et al. 1999). Landslides that are most likely to initiate debris flows originate from headwalls—steep areas of topographic convergence (Dietrich and Dunne 1978). Once a landslide enters a stream channel, a debris flow will proceed downstream until the channel gradient becomes too gentle or reaches a stream junction angle that is too large for it to continue (Benda and Cundy 1990; May and Gresswell 2004).

Timber harvest and wildfire can increase the frequency of landslides and the amount and composition of the material delivered to aquatic habitats (Benda et al. 2005; Korte and Shakoor 2020). For example, harvesting trees from shallow landslide-prone areas and debris flow runout paths decreases the amount of large wood available for delivery to fish-bearing streams. Harvest of trees can decrease the cohesion of roots available to hold soil on hillslopes and remove the moderating effect canopy cover has on precipitation (Keim and Skaugset 2003). The lowest root cohesion in the Oregon Coast Range was observed in the first 5–15 years post-harvest while understory vegetation and trees reestablished (Schmidt et al. 2001; Jackson and Roering 2009). Debris flows can transport large wood from the initiation site and along or within their path. The number of obstacles (e.g., large wood, boulders) in and along channel determines the distance the debris flow will travel; an unimpeded debris flow can travel long distances, depositing large amounts of sediments. As the ratio of sediment deposition to large wood volume increases, the potential for contributing to future habitat quality typically declines (May 2002; Lancaster et al. 2003; Reid et al. 2016). Large wood is important for regulating sediment deposition and dispersal during and following debris flows.

Models can predict likely landslide and debris flow behaviors from digital elevation data (Miller and Burnett 2007, 2008) and identify hillslopes most susceptible to timber harvest–induced landslides. Modeling can also inform where large tree retention is most likely to benefit aquatic habitats along non-fish-bearing stream channels (Burnett and Miller 2007). Several strategies can be applied to hillslopes most susceptible to timber harvest–induced landslides to reduce and mitigate the effects of forest management. These include leaving standing and downed trees and other vegetation in landslide- or debris-flow–prone areas, adding wood to debris-flow–prone streams, reducing timber harvest volumes, avoiding potentially unstable slopes, and modifying operations to reduce soil compaction.

Specific provisions of Conservation Measure 2 include the following:

- Leaving trees in Designated Debris Flow Traversal Areas to help create and maintain riparian areas that can deliver large wood and maintain high-quality habitats for fish and amphibians.
- Creating and maintaining high-quality habitats for fish and amphibians in the form of shade and cover.

- Leaving trees in Slope Retention Areas to reduce the frequency and volume of sediment delivery from mass wasting events to fish-bearing streams.
- Leaving trees on Stream-Adjacent Failures to stabilize steep slopes (>70 percent, i.e.) adjacent to fish-bearing streams.
- Locating steep slope skid trails at least 100 feet away from any stream channels, so water can drain off skid trail and onto undisturbed soil (OAR 629-630-0150(4-5)).
- Locating skid trails so they are not located straight up and down steep or erosion-prone slopes for a distance exceeding 100 feet unless effective drainage and sediment filtration can be achieved (OAR 629-630-0150(6)).
- Ensuring skid trails occurring on steep slopes are installed with effective cross ditches (OAR 629-630-0150(7)).
- Prohibiting construction of skid trails on high landslide hazard locations (OAR 629-630-0500(3)).
- Prohibiting ground-based equipment operation on high landslide hazard areas (OAR 629-630-0500(4)).
- Preventing deep or extensive ground disturbance on high landslide hazard area during log felling and yarding operations (OAR 6290630-0500(5)).

4.4.2.1 Timber Harvest Prescriptions

Western Oregon

Timber harvest prescriptions that address landslide initiation and debris flow runout apply to private forest ownership classes west of the crest of the Cascade Mountains. Written plans for harvesting are required for units containing the steep slope classifications below. The locations of areas classified as steep slopes will be added to ODF's department reporting and notification system, and landowners will use mapped locations to develop written plans for harvesting. Changes in stream classification for a stream, based on field surveys for fish use consistent with OAR 629-635-0200, will not immediately change ODF's maps used for notifications of operations that Slopes Model identifies as Designated Debris Flow Traversal Areas and Designated Sediment Sources Areas.

Timber harvest prescriptions west of the Cascades are intended to minimize landslide and debris flow risk and associated adverse effects on fish and amphibians and are subject to OAR 629-630-0000 through OAR 629-630-0925. Designated Debris Flow Traversal Areas, Slope Retention Areas within Designated Sediment Source Areas, and Trigger Sources must be identified and mapped prior to harvesting timber. These designated areas and Trigger Sources will be identified using the peer-reviewed Slopes Model (developed by TerrainWorks 2022). The Slopes Model results will be incorporated into a regulatory layer in ODF's electronic reporting and notifications systems to be used for harvest unit planning and layouts. Timber harvesting is also dependent on field identification of Slope Retention Areas located within Designated Sediment Source Areas. Slope Retention Areas will represent at least 50 percent of the Designated Sediment Source Areas.

Designated Debris Flow Traversal Areas

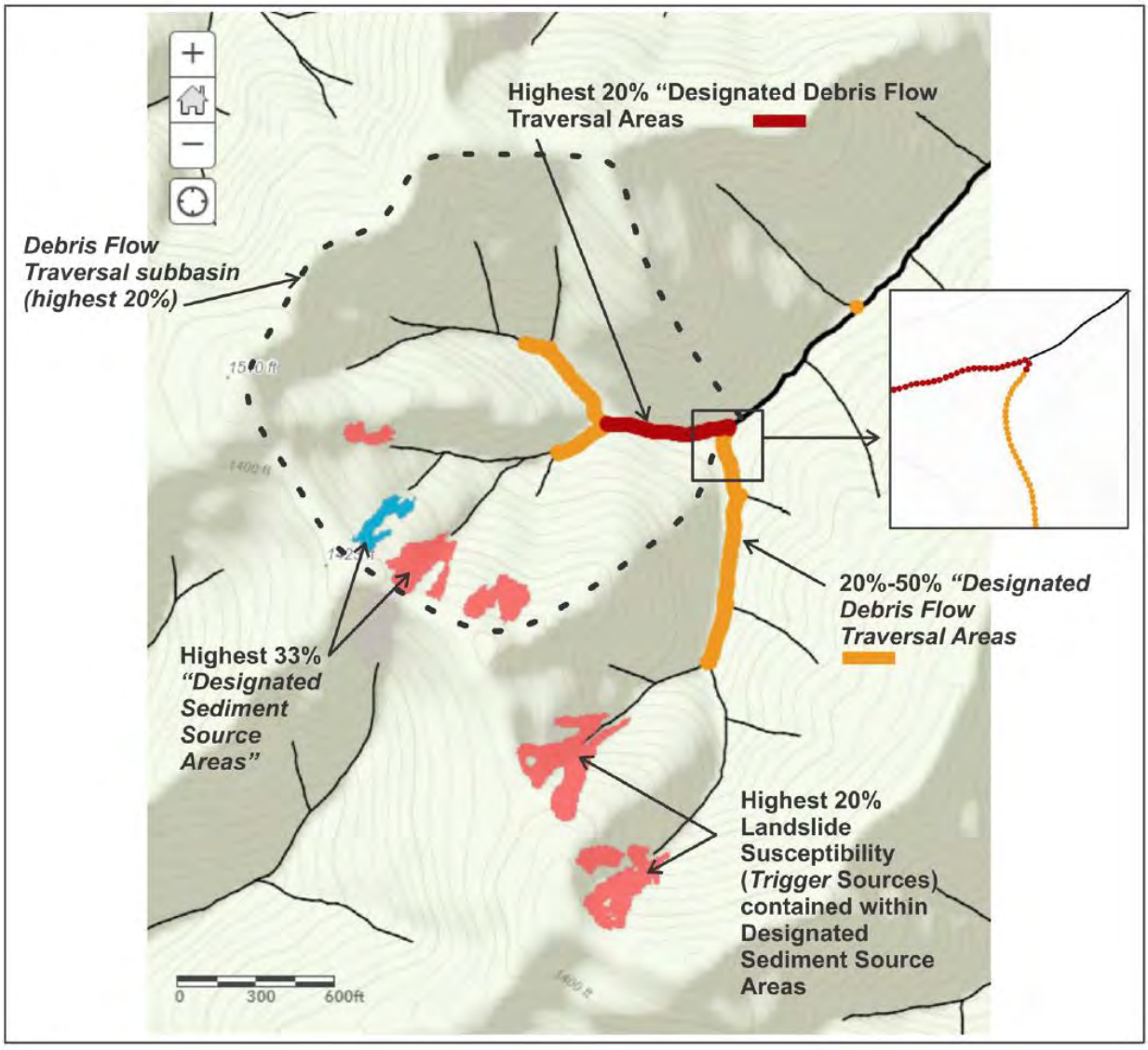
Debris Flow Traversal Areas are limited to non-fish-bearing streams (Type N) and are, generally, headwater channels that: (1) have a probability of traversal by a debris flow of greater than zero and (2) when traversed will reach fish-bearing waters downslope (Source TerrainWorks 2022 in Appendix XX, *Title* (in prep).

Figure 4-7)(see Appendix X, *Title,* for a more detailed discussion). Designated Debris Flow Traversal Areas are a subset of Debris Flow Traversal Areas that have a probability of traversal greater than 50 percent as calculated by the Steep Slopes Model. A 25-foot no-harvest RMA will be applied to each side of a Designated Debris Flow Traversal Area for either (OAR 629-630-0905):

- The entire length of the feature that has a probability of debris flow traversal greater than 20 percent; or
- No more than 1,000 feet upstream of the confluence with a fish-bearing stream if the probability of traversal is between 20 percent and 50 percent or in combination with a Designated Debris Flow Traversal Area that has a probability of traversal in the upper 20 percent.

Yarding is allowed through Designated Debris Flow Traversal Areas, but the number, size, and location of yarding corridors will be designed to minimize effects.

Some of the amphibian species, particularly the torrent salamanders, covered by this HCP have distributions that typically extend above fish occurrence and into headwater or small Type N streams. Managing small Type N streams that also serve as Designated Debris Flow Traversal Areas will support amphibian habitat quality by reducing the impact of forest management activities on sediment and wood delivery patterns to headwater streams (OAR 629-630-0905 and OAR 629-630-0920). The timber harvest prohibition along Designated Debris Flow Traversal Areas will also retain trees that provide shade and cover for amphibian species occupying the targeted Type N streams.



Source TerrainWorks 2022 in Appendix XX, *Title* (in prep).

Figure 4-7. Conceptual Diagram Identifying Designated Debris Flow Traversal Areas (orange and red channels), Designated Sediment Source Areas (blue and coral polygons), and Debris Flow Traversal Sub-basins (dashed areas)

Designated Sediment Source Areas and Slope Retention Areas

Debris Flow Traversal Area Sub-basins are catchments that contain Debris Flow Traversal Areas that have a probability of traversal in the upper 20 percent as calculated in the Steep Slopes Model (TerrainWorks 2022) (Source TerrainWorks 2022 in Appendix XX, *Title* (in prep).

Figure 4-7). Within the Debris Flow Traversal Area Sub-basins, Designated Sediment Source Areas are hillslope areas greater than a quarter of an acre in size that are modeled to provide the top 33 percent of the landslide-derived sediment to fish-bearing streams. At least 50 percent of Designated Sediment Source Areas will be selected as Slope Retention Areas where timber harvest will be prohibited (OAR 629-630-0910).

Slope Retention Areas are selected to prioritize larger areas and/or areas that include Trigger Sources. Trigger Sources are defined as Designated Sediment Source Areas with the greatest

expected sensitivity to tree removal and highest probability of initiating a landslide. Yarding is allowed through Slope Retention Areas that do not contain Trigger Sources, but the number, size, and location of yarding corridors will be designed to minimize soil and vegetation disruptions that may increase slope instability. The operator will not remove trees cut for yarding corridors unless these are deemed safety hazards. The distribution and location of Slope Retention Areas can be adjusted for safety reasons or if an increased risk to fish-bearing streams and covered species is identified. Specific minimization measures and best management practices (BMPs) include the following.

- Operators will not construct skid roads or operate ground-based equipment in Slope Retention Areas.
- ODF will develop Forest Practices Technical Guidance and State Forester certification training for landowner representatives to delineate Slope Retention Areas.

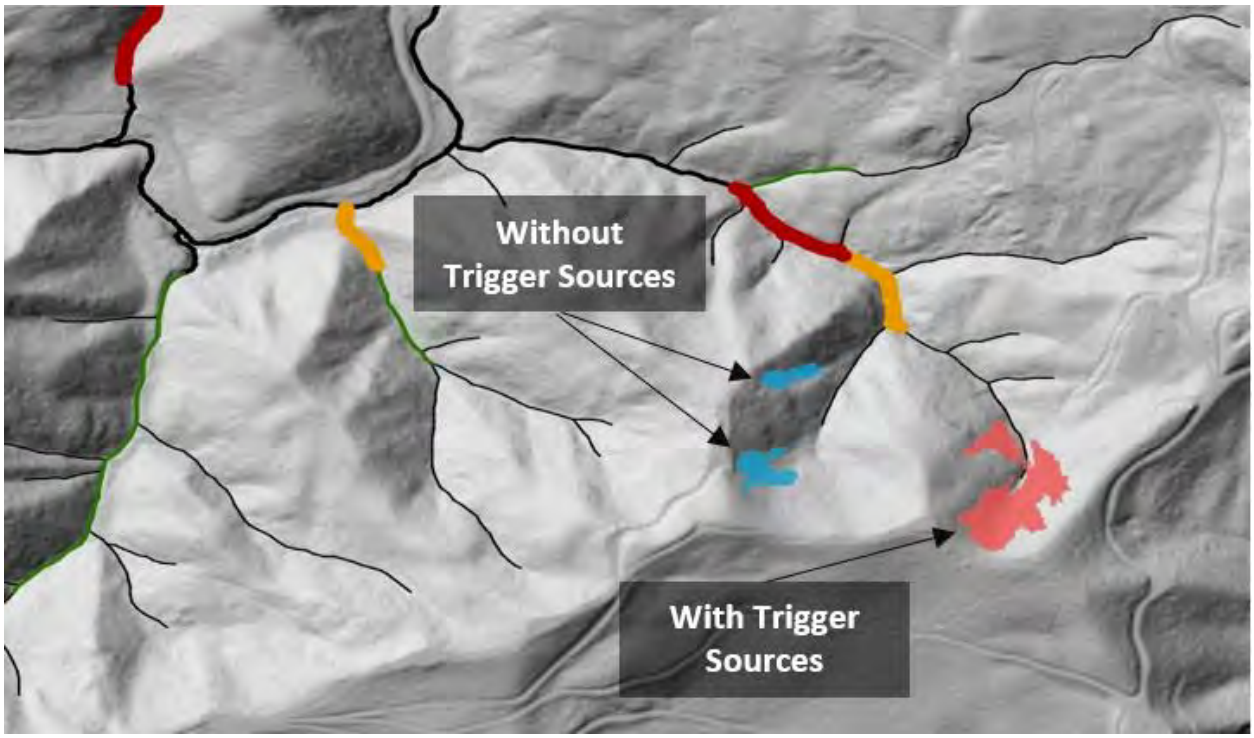


Figure 4-8. Conceptual Diagram Depicting Designated Sediment Source Areas with (red shaded polygon) and without (blue shaded polygons) Trigger Sources

Stream-Adjacent Failures

RMA prescriptions described in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas,* are designed to maintain and enhance healthy and intact riparian areas to benefit fish and amphibian species. *Stream-Adjacent Failures* are defined as steep slopes (>70 percent) immediately adjacent to fish-bearing streams that are actively failing[4] and delivering sediment or are unstable due to direct interaction with erosive forces of a stream, such that a slope failure extending beyond

[4] *Actively failing* indicates that erodible material and exposed soils are present and prone to continued shallow-rapid slope instability, with active features such as tension cracks, scarps, ground surface shearing, and oversteepened toes.

the standard RMA width is likely (OAR 629-600-0100). Unstable steep slopes are typically indicated by streambank sloughing into and beyond the floodplain and into the steep slope. Once a landowner identifies a Stream-Adjacent Failure in the field, the no-harvest area will encompass the perimeter of the Stream-Adjacent Failure in the field; however the RMA will be extended to the lessor of 170 feet from the edge of a Type F or Type SSBT channel, or to the slope break.[5] Stream-Adjacent Failure next to fish streams will be field identified by the landowner representative for each notification of operation.

The landowner representative will make all RMA width measurements using the slope distance and measure them from the edge of the active channel or CMZ. The State Forester will publish Forest Practices Technical Guidance to assist landowner representatives in identifying channel migration zones.

Yarding is allowed through Stream-Adjacent Failures, but the number, size, and location of yarding corridors will be designed to minimize the effect on the integrity of the feature. The operator will not remove trees cut for yarding corridors unless these are deemed safety hazards. Specific minimization measures and BMPs include the following.

- When cable yarding across waters listed in OAR 629-635-0200, such work will be done by swinging the yarded material free of the ground in the aquatic riparian areas (OAR 629-630-0700(4)).
- Operators will take corrective action when soil disturbance exceeds 20 percent from cabled yarding or exceed 10 percent for ground-based yarding of the total area within any R-ELZ or ELZ within an operation unit. Correction action includes, but is not limited to, water bars, grass seeding, logging slash, mulching, downed log placement in accordance with ORS 527.676(1), with a preference for utilizing onsite materials (OAR 629-630-0700(6)(b)).

[5] A slope break in this context is defined as at least a 20 percent difference in slope gradient.

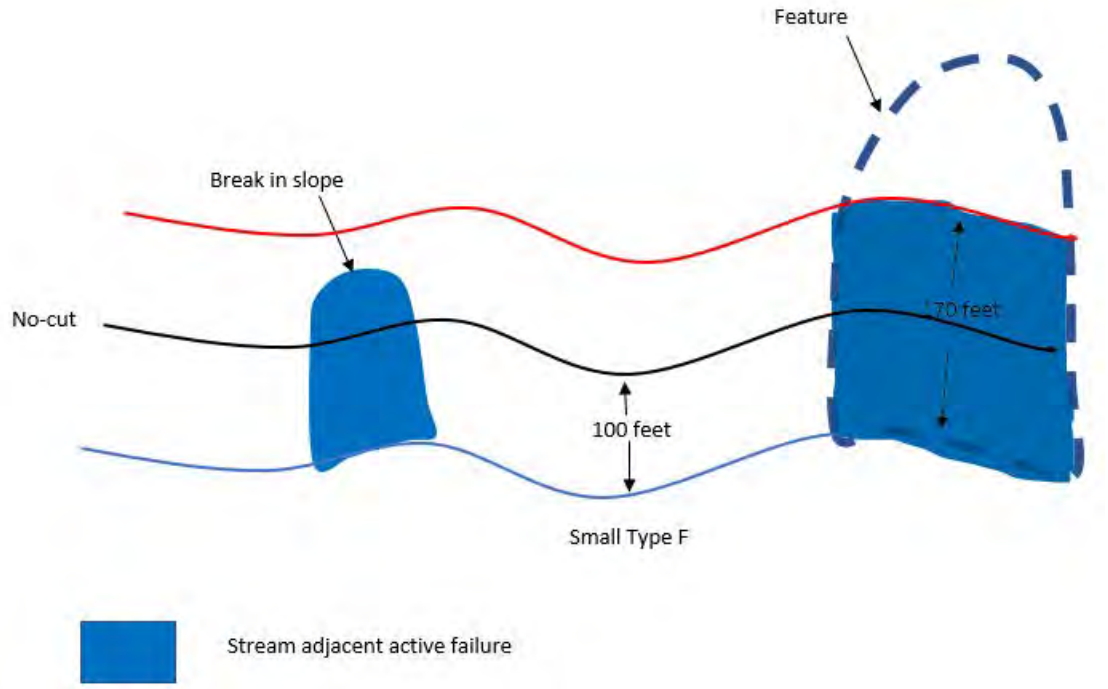


Figure 4-9. Stream-Adjacent Failures Relative to Limitations Imposed on Extending the Width of RMA on Fish Streams

Eastern Oregon

The timber harvest prescriptions for steep slopes established under *Stream-Adjacent Failures* described above apply to all private forest ownership classes in the state. The other steep slope timber harvest prescriptions are not included as part of Conservation Measure 2 for eastern Oregon. Due the differences in geology and climate, the magnitude and frequency of landslides in eastern Oregon differs from the western part of the state and thus the effect to covered species differs. The timber harvest prescriptions for steep slopes established for Designated Debris Flow Traversal Areas and Slope Retention Areas identified from Designated Sediment Source Areas do not apply to any private forest ownership class east of the crest of the Cascade Mountains.

4.4.2.2 Relation to Biological Goals and Objectives

Section under development.

4.4.3 Conservation Measure 3: Roads

Conservation Measure 3 addresses the impacts forest roads have on the covered species, including habitat fragmentation, hydrological alterations, and degradation of water quality through sediment and chemical deliveries. Forest roads have the potential to affect the covered species by blocking access to habitat, delivering sediment and road-derived chemicals to stream networks, and altering hydrologic characteristics across watersheds. Networks of forest roads can affect hydrology by increasing overland flow, increasing drainage density, and intercepting subsurface flow (Wemple et al. 2001; Trombulak and Frissell 2000; Gucinski 2001; Van Meerveld et al. 2014). Forest roads can increase surface runoff and alter stream flow, although these effects vary in time and space

depending on how recently the road was constructed and where the road is located on the hill slope (Wemple et al. 2001).

Forest roads can also be an area of potentially high hydrologic connectivity between the road surface and streams (La Marche and Lettenmaier 2001) and are a source of fine sediment (NCASI 2001; Reid and Dunne 1984). Hydrologically connected roads can deliver increased runoff, sediment, and chemicals associated with roads, including spills, tire debris, or oils generated on the road surface or cutslope. At the watershed scale, connections between roads and streams can also alter the drainage density of the watershed and change runoff frequency and magnitude (Furniss et al. 2000; Weaver et al. 2015; Wemple et al. 2001).

The effects of forest roads on erosional processes are not limited to chronic sources of sediment. Forest roads can lead to accelerated rates of landslides compared to unmanaged forested areas (Ice 1985; Montgomery 1994; Swanson and Dyrness 1975). Roads built on steep slopes, especially using sidecast construction methods, can generate debris flows, also termed shallow-rapid landslides, that may impact streams. Roads can increase stormwater runoff to destabilize downslope hillsides and fill slopes and trigger large sediment pulses, especially when roads are constructed on steep, unstable slopes (Wemple and Jones 2003). Fine sediment can fill pools, cover spawning gravel, and aggrade stream channels (Furniss et al. 1991). Collectively, proper placement, construction, and maintenance of forest roads may minimize the frequency and magnitude of mass wasting events, and their associated delivery of sediment to streams.

Road drainage systems that deliver runoff directly to streams can affect sediment loads, peak flows, and transport of pollutants to streams. Furniss et al. (2000) showed that hydrologically connected roads can deliver increased runoff, sediment, and chemicals associated with roads, such as spills, or oils generated on the road surface. Hydrologic connectivity occurs when road and ditch runoff has a direct path to the stream channel. Roads can generate overland flow due to the relatively impermeable surface of the road prism and can also intercept subsurface flow at cutslopes, effectively converting subsurface flows to surface flows. When these surface flows have a continuous flow path between the road prism and a natural stream channel, hydrologic connectivity occurs (Furniss et al. 2000:5–6). At the watershed scale, connections between roads and streams can also alter the drainage density of the watershed and change runoff frequency and magnitude (Furniss et al. 2000; Weaver et al. 2015).

Connections between roads and streams can also alter the drainage density of watersheds and change runoff frequency and magnitude (Furniss et al. 2000; Wemple et al. 1996). Several older surveys documented high rates of road-stream connectivity. For example, in western Washington, Bilby et al. (1989) found that 34 percent of road drainage systems discharged directly to streams. Dubé et al. (2010) found 11 percent of the road network in Washington state to be hydrologically connected. Martin (2009) conducted a survey of private forest roads covering 1,047 miles in eastern and western Washington and found that 73 percent of the road network had low delivery potential (roads located on ridgelines, in shallow terrain, or without crossing defined channels). About half of the road system with high delivery potential was disconnected. Based on that survey, about 12 percent of the road network was hydrologically connected. Both studies were conducted prior to all of the road networks being upgraded to the standards required under the current Washington Forest Practice Rules. Hydrologic disconnection of forest roads to the aquatic environment will improve habitat conditions and water quality for covered fish and amphibian species. ODF and Oregon State University found during a monitoring effort between 1995 and 1996 that 31 percent of surveyed roads (285 miles) were directly connected to streams (ODF 1998).

Roads in Oregon have been shown to alter landslide and debris flow characteristics, including increasing the likelihood of occurrence, sediment volumes, and runout lengths above those for intact forests or harvested areas (Amaranthus et al. 1985; May 2002; Miller and Burnett 2007). A study by Swanson et al. (1977) found that these factors led to sediment production from roads that was 49 times greater than from forested areas in the Oregon Coast Range. In the Oregon Coast Range, Sessions et al. (1987) found landslides associated with both mid-slope and ridgetop roads but observed fewer landslides with smaller volumes where road layout attempted to minimize mid-slope positions. They noted that most of their inventoried road-related landslides were initiated by storms with a return interval of 3 to 5 years and thus by relatively low rainfall amounts typical of such storms.

Roads are also known to prevent or restrict the movement of aquatic species. Road crossings over streams can create barriers to fish passage that may result in the loss of upstream habitat for spawning or rearing, isolated genetic populations, inability to access refuge habitats during environmental disturbances, or extirpation (Price et al. 2005; Bates et al. 2003; Beechie et al. 2006; Reiman and Dunham 2000; Wofford et al. 2005; Neville et al. 2009; Reeves et al. 1995). Barriers placed by humans that restrict or eliminate the movement of aquatic organisms can have multiple effects, including fragmenting and isolating populations, increasing vulnerability to disturbances, reducing habitat connectivity, and lowering genetic diversity (Hoffman and Dunham 2007; Hotchkiss and Frei 2007; Rolls 2011). The movement of aquatic organisms is an essential component of their distribution across the landscape and the persistence of populations and species. As life history needs shift, different movements for foraging, reproduction, growth, and refuge are required (Hoffman and Dunham 2007). Biological corridors and habitat connectivity are critical to the survival and reproduction of covered species (ODFW 2019). Naturally occurring barriers may limit movement of aquatic organisms due to physical constraints, such as channel slope or stream size, limits on food resources, or environmental disturbances (Hoffman and Dunham 2007).

Barriers to aquatic organism passage related to culverts can include outlet or inlet drops, clogged or collapsed culverts, excessive water velocities and turbulence, loss of bank-edge area, and lack of natural substrate (U.S. Forest Service 2008). Road management strategies implemented as part of the HCP will reduce the effects of human-placed passage barriers, such as culverts, by mitigating the effects on ecological processes. An ecosystems-based approach to road-stream crossings, such as stream simulation, prioritizes maintaining habitat diversity and quality, the connectivity of watersheds, and key ecological processes (U.S. Forest Service 2008). Kemp and O'Hanley (2010) state that "evaluation of habitat restoration techniques have shown that the removal or mitigation of barriers that block fish dispersal lead to some of the largest increases in fish production." Most recently, fish passage restoration at the watershed scale has been utilized to increase total accessible habitat (ODFW 2019).

The overarching goal of Conservation Measure 3 is to operate roads as necessary to support timber harvest, minimize construction of new roads, and design necessary new roads to minimize negative effects to the covered species. Additionally, roads will be managed to increase distribution of the covered aquatic species in the covered lands, to maintain or enhance water quality, and minimize delivery of sediment from forest roads to waters of the state. To accomplish this the following will be implemented as feasible (OAR 629-625-0000).

- Remove anthropogenic barriers to fish passage on active and inactive forest roads.
- Remove or stabilize unstable road fills on active and inactive forest roads.

- Avoid or minimize erosion on forest roads.
- Prevent or minimize hydrologic alterations of river or stream channels.
- To the maximum extent practicable, hydrologically disconnect forest roads and landings from waters of the state.
- Prevent or minimize effects from existing, new, and abandoned roads to streambank stability, existing stream channel, and riparian vegetation.
- Avoid, minimize, and mitigate loss of wetland function.
- Assess and treat abandoned roads, including properly vacating or fully decommissioning roads as needed.

4.4.3.1 Road Design, Construction, Maintenance, Standards, and Best Management Practices

Proximity and hydrologic connectivity to the aquatic environment is one of the most important factors that can minimize water quality degradations from roads. Therefore, the following requirements for locating roads will be followed as part of HCP implementation (OAR 629-625-0200; ODF 2003a; NCASI 2009, 2012).

- Use existing roads whenever practicable.
- Locate roads on well-drained soils and avoid wetlands, seeps, and other wet areas.
- Avoid steep, unstable slopes to minimize potential for land sliding.
- Minimize the number of stream crossings.
- Designate road locations that minimize the risk of materials entering waters of the state and minimize disturbance to channels, lakes, wetlands, and floodplains.
- Ensure roads are located where potential effects on waters of the state are minimized and hydrologic connectivity between roads and waters of the state is reduced to the maximum extent practicable (OAR 629-625-0200(1)).

Additionally, when feasible new road construction will avoid critical locations including the following (OAR 629-625-0200 (3)(a-i)).

- High landslide hazard locations.
- Slopes over 60 percent with decomposed granite-type soils.
- Within 50 feet of stream channels or lakes, excluding crossings and approaches to crossings.
- Within significant wetlands, stream-associated wetlands, or other wetlands greater than 0.25 acre in size.
- Any active stream channels, exclusive of stream crossings in compliance with OAR 629-625-320.
- Locations parallel to, and within, an RMA for a distance exceeding a cumulative 500 feet of road length measured from the first point of entry into the RMA to last point of exit from the RMA.
- High landslide hazard locations where rock is likely to be highly sheared or otherwise unstable so that it is not possible to excavate a stable cutslope.

- Locations cutting through the toe of active or recently active deep-seated landslide deposits and where a reactivated landslide would likely enter waters of the state.
- Highly dissected steep slopes where it is not possible to fit the road to the topography with full bench end haul construction.

Roads may be constructed in critical locations if no feasible alternatives exist, although written plans describing protection measures and alternative investigations must be provided to ODF, Oregon Department of Environmental Quality (DEQ), and ODFW for onsite field review before implementation (OAR 629-625-0200(4)).

Timing of road construction also has a significant influence on effects on the aquatic environment. Construction during wet periods increases the likelihood of delivering fine sediment and chemicals to the stream network. Road construction can be scheduled to avoid disturbance during wet seasons when increased sediment and delivery are most likely to occur. Similarly, limiting road use to periods when erosion risk is low is another approach for avoiding road-induced effects on the aquatic environment. For example, in the strongly seasonal climate of Oregon, native-surface forest roads typically are used only during dry summer months to avoid the types of erosion and sediment loss that would occur during winter use. Regulations governing use of roads during wet weather in the western United States have become increasingly restrictive to protect water quality and aquatic communities (ODF 2003b; Toman and Skaugset 2011). As noted by Sugden and Woods (2007) in western Montana, reducing the frequency of grading can significantly reduce sediment yields from roads. Road slope, time since last road grading, roadbed gravel content, and precipitation explained 68 percent of variability in sediment yields from native-surface forest roads. Additionally, the spacing of cross drains has been positively correlated with the length of sediment travel along and below roads (Packer 1967). A wet period is defined for the purposes of the HCP as any period in which enough precipitation falls on the landscape to initiate overland flow. Overland flow is surface flow that occurs outside of a defined channel. Overland flow can occur when rainfall exceeds soil infiltration rates or when rain falls on already fully saturated soils. Therefore, effective spacing of drainage structures is critical, particularly for steeper road gradients at lower elevations. Installing cross drains in closer proximity to one another will reduce rill erosion rates along the road's surface (50 percent to 97 percent control reported by Packer 1967).

BMPs for forest roads in erosion-prone areas typically include surfacing with gravel, rock, asphalt, or other materials to provide bearing strength and reduce deterioration and erosion from the road surface, and to achieve durable road drainage configurations. Appropriate surfacing can be combined with compaction to further increase bearing strength and resistance to erosion. For example, Swift (1984) found that 6 inches (15 centimeters) of crushed rock reduced sediment by 78 percent compared to a bare road surface. Kochenderfer and Helvey (1987) found an 87 percent reduction in sediment yield from roads with 6 inches (15 centimeters) of rock compared to bare soil roads. More recently, Coe (2006) found 16-fold greater median sediment production from unrocked forest roads than from rocked roads in the Sierra Mountains. Even rocked roads can produce sediment during wet weather hauling. To reduce sediment production, managers should design road surfaces that resist rut formation and consider the aggregate level of fine sediment (Toman and Skaugset 2011).

Treatment of bare cut-and-fill slopes with mulch and seeding are effective BMPs to reduce erosion rates (Bethlahmy and Kidd 1965; Megahan and Kidd 1972). Burroughs and King (1989) reviewed studies from around the United States where dense grass was used for erosion control of bare soils and found an 86 percent to 100 percent reduction in sediment with establishment of dense grass. On

native soil roads with light traffic, Swift (1984) found 45 percent lower sediment yields with grass cover. Furthermore, combinations of seeding, mulching, slash application and water diversion BMPs (i.e., waterbars) provide redundancy and increase the effectiveness of erosion prevention and road stabilization practices (Wear et al. 2013; Wade et al. 2012; Sawyers et al. 2012).

4.4.3.2 Forest Road Inventory and Assessment

The Forest Road Inventory and Assessment (FRIA) process will take place over 20 years beginning January 1, 2024, when the updated administrative rules become effective. This date marks year 0 in the process. Only landowners who meet the definition of large landowners will be required to complete the FRIA process; small landowners will complete a Road Condition Assessment when notifying for a proposed harvest (discussed in more detail in Section 4.4.5, *Conservation Measure 5: Small Forestland Owners*).

Large landowners covered by this HCP will map all roads within managed timber areas and identify high-risk or problematic roads within 5 years of implementation of the new OFPA regulations (by January 1, 2029). Once identified the landowner will take actions to reduce risks to, and effects on, aquatic communities. The FRIA process establishes an inventory process for large landowners to document and assess the entire road network within their ownership. The goal is to identify roads out of compliance with the OFPA and bring those roads into compliance and minimize chronic and catastrophic sediment entry to waters of the state and ensure passage for covered fish (OAR 629-625-0900). In short, the FRIA process requires identification and implementation of high conservation value projects by January 1, 2025 (pre-inventory) (Figure 4-10). By Year 5, landowners must submit an initial inventory to ODF that describes the status of the road network and a plan to bring OFPA-noncompliant roads into compliance. Over the following 15 years landowners will bring roads into compliance and submit annual reports and plans to ODF. ODF will manage all data submitted by landowners.

Roads to be inventoried include active and inactive forest roads (see Appendix X, *Glossary*). Large landowners do not need to seek out abandoned roads but will disclose any known abandoned roads within their ownership (OAR 629-625-0910). To the extent known, abandoned roads and roads vacated pursuant to OAR 629-625-0650 should be included in an FRIA inventory. Large landowners must classify all inventoried roads as one of the following.

- Meets OFPA standards
- Does not meet OFPA standards
- Vacated (per OAR 629-625-0650)
- Abandoned6

FRIAs will be conducted for distinct ownership blocks referred to as Road Management Blocks (RMB). The FRIA process includes the following steps and is completed for each RMB.

- **Pre-Inventory**: Identify, prioritize, and conduct high conservation value projects from the outset of the FRIA.
- **Initial Inventory**: Complete road network inventory and submit to ODF January 1, 2029.

[6] Abandoned roads are those that were constructed prior to 1972 and do not meet the criteria of active, inactive, or vacated roads. Skid trails are not considered abandoned roads.

- **Implementation and Annual Report/Plan**: Submit annual reports to ODF that track the work completed and that demonstrate progress toward the FRIA goals. These reports must be submitted between Years 5 and 20 of the FRIA process (Figure 4-11).
- **Annual Reporting of FRIA Process to Services**: Include statistics of road improvements and remediations in annual HCP progress reports to the Services.

Figure 4-10. In Development - General FRIA Process to Occur During the First 20 Years of HCP Implementation

Figure 4-11. In Development - FRIA Process for Individual RMBs from Inception (Year 0) to Culmination (Year 20)

Pre-Inventory

The purpose of the pre-inventory step (Table 4-4) is for landowners to identify, prioritize, and address high conservation value sites within the first 5 years of FRIA and HCP implementation. In general, high conservation value sites are those sites that are currently degrading or represent significant risk to aquatic resources at a scale beyond the site itself and, if resolved, would result in both ameliorating that risk and providing significant ecological benefit at a scale beyond the site itself. High conservation value sites are defined for the purposes of the pre-inventory process as follows.

- Areas of known chronic sedimentation. Consideration will be given to areas where log hauling will occur during the 5-year inventory phase.
- Fish passage barriers known to be of significant concern. Prioritization will be based on locations where fish passage would provide the greatest benefit to native migratory fish and will be done in a manner consistent with the ODFW Fish Passage Program (OAR 629-625-0900(6)(D)(iv)).
- Ongoing stream diversions at stream crossings and areas considered for future stream diversion potential.
- Areas of known hydrologic connectivity.

Ameliorating high conservation value sites may include, but is not limited to, the following actions.

- Remove/upgrade fish passage barriers consistent with the latest NFMS fish passage and ODFW requirements.
- Minimize sediment delivery to waters of the state, stream diversions at water crossings, and hydrologic connectivity between roads and waters of the state.
- Meet other relevant criteria as determined by ODF in consultation ODFW.

Once pre-inventory lists are submitted to ODF in Year 1, ODF and ODFW will meet with each landowner in Year 2 to review the list and ensure that high conservation value sites are prioritized based on habitat values, road conditions, sediment delivery to waters of the state, hydrologic connectivity, and fish passage in alignment with the barrier assessment and inventory prioritization under the ODFW Fish Passage Program. Additionally, ODF and ODFW will coordinate to ensure that

information collected in the pre-inventory process is standardized and is in a format consistent with the Oregon fish passage barrier database standard (OFPBDS). During Years 2–5 landowners will begin to address projects and submit annual reports to ODF to demonstrate pre-inventory projects are being addressed.

Table 4-4. Pre-Inventory Process to Occur Between Years 0 and 5 of the FRIA Process

Period	Pre-Inventory
Years 0–1	Within the first year of the pre-inventory, landowners prepare a list of high conservation value sites as defined above. This list is based on the landowner's evaluation of (1) areas of known chronic sedimentation, (2) fish passage barriers known to be of significant concern, (3) ongoing stream diversions at stream crossings and areas with stream diversion potential, and (4) areas of known hydrologic connectivity. The landowner submits a report at end of Year 1.
Year 2	Landowner meets with ODF and ODFW to discuss the Year 1 list and to solicit feedback on the prioritization of the pre-inventory. ODF and ODFW can propose additional projects to a landowner's pre-inventory list if they believe that a high conservation value site has not been addressed. Landowners that do not identify any high conservation value sites in the pre-inventory are still required to meet with ODF and ODFW to solicit feedback on the process.
Years 2–5	Landowners will begin to address projects no later than the Year 2 after meeting with ODF and ODFW. Landowners will submit annual reports to ODF for Years 2–5 to confirm that pre-inventory projects are being addressed and to provide status updates.

Initial Inventory

The initial inventory occurs concurrently with the pre-inventory during the first 5 years of the FRIA process. The initial inventory differs from the pre-inventory in that it is a complete accounting of road networks for each RMB, which must be submitted to ODF within the initial 5-year period of the FRIA.

During the initial inventory, landowners will identify and prioritize sites that will provide the greatest environmental benefit. Generally, projects will be prioritized in the following order, while also taking into consideration operational constraints.

1. Fish passage barriers identified as high priority by ODFW.
2. Sites with prominent erosion and sediment delivery occurring within the road prism (cutslope, ditch, road surface, fill slope), stream diversion potential, and hydrologic connectivity.
3. Locations with potential slope failures that could deliver to waters of the state.
4. Basins containing road systems that are actively degrading waters that contain covered species or are listed on the current 303(d) water quality impaired list for road-related issues.

ODF, ODFW, and DEQ will coordinate to ensure that information collected in the initial inventory is standardized and consistent with the OFPBDS. Landowners will prioritize addressing the high conservation value site projects identified in the pre-inventory in consultation with ODF and ODFW. Landowners will assess the complete road network within each RMB and submit core documents to ODF by the end of Year 5 (Table 4-5), including maps (OAR 629-625-0900(6)(a)(A)), work matrix (OAR 629-625-0900(6)(a)(B)), and written plan (OAR 629-625-0900(6)(a)(C)) (Table 4-6). Information to be included in core documents is outlined in Table 4-7.

Table 4-5. Initial Inventory Process from Years 0 to 5 of the FRIA Process

Period	Initial Inventory
Year 0–5	Landowners will assess the complete road network within each RMB to develop the core documents required for the initial inventory submission (maps, work matrix, and written plan).
Year 5	Before the close of Year 5, landowners will submit the initial inventory to ODF. ODF will coordinate with ODFW to ensure that data submitted through the initial inventory is consistent with ODFW data standards, specifically for the OFPBDS.

Table 4-6. Documents to Be Submitted as Part of the Initial Inventory Process to ODF

Document Type	Description
Maps	Paper or electronic maps detailing an RMB's road network.
Work Matrix	A document or table showing actions necessary to ensure that all roads are brought into compliance with the OFPA as well as detailing work prioritization.
Plan	A written plan describing how the landowner intends to bring its road network into compliance by the close of the 20-year FRIA period. Will include specific actions and general description of how all work will occur during the FRIA period. The plan will also include a description of how the landowner is prioritizing the work, with the goal of optimizing the environmental benefit of projects and ongoing operations.

Table 4-7. Information to Be Included in the Initial Inventory Submittal Documents (OAR 629-625-0900(8)

Category	Details
Location and Length of Forest Roads	Inventories will show the location and estimated length of active roads, inactive roads, and vacated roads in an RMB.
Locations of Streams	Locations of streams and stream type will be determined based on the regulatory stream layer described in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas*. To the extent known, an inventory will show the location of streams in an RMB consistent with the regulatory layer developed in Section 4.4.1. Streams will be coded as fish, non-fish, SSBT, fish presence unknown, and/or 303(d) listed due to sedimentation, turbidity, or temperature to assist in the prioritization of work.
Status of Roads	Each road segment in an inventory will be identified as meeting OFPA standards, not meeting OFPA standards, vacated, or abandoned. This will include a determination of whether a road segment is complying with the OFPA that are designed to hydrologically disconnect roads. Where a road is determined to not comply with the OFPA, the landowner will identify the work necessary to achieve standards and prioritize the work accordingly (e.g., replace a culvert, disconnect a crossing). Detailed design plans will be submitted as part of the Annual Inventory Report and Plans process.
Abandoned Roads	Abandoned roads known by the landowner should be disclosed in the FRIA. Unknown abandoned roads will be addressed through ODF's inventory process and integrated into the FRIA as described in OAR 629-625-0910.
Fish Passage Barriers	Each known or potential road-related fish passage barrier will be identified and prioritized. The prioritization of road-related fish passage barriers will be described in the initial inventory with the goal of optimizing environmental benefits of projects and ongoing operations. ODF, ODFW, and private

Category	Details
	landowners will coordinate to ensure that assessment and prioritization of fish passage barriers are consistent with ODFW and NMFS fish passage programs and that any data collected is consistent with the OFPBDS. Barriers identified by landowners not included in the OFPBDS will be incorporated into the database.
Locations of Road Crossings	The inventory will show the location of roads crossing streams (culverts) in an RMB.
Status of Culverts	The inventory will show the status of culverts in each RMB. An assessment of the status of a stream crossing culvert will include the following. ● Date of installation (if known) ● Assessment of the culvert material ● Assessment of culvert in relation to stream type and functionality (i.e., fully functional culvert on a Type F or Type SSBT stream)

Annual Inventory Reports and Plans

Annual reports will be submitted by landowners to ODF after the completion of the pre-inventory and initial inventory processes until the FRIA process is completed. Annual reports will expand on the information provided in the initial inventory report submission (Table 4-8 and Table 4-9). Annual reports will also detail progress made towards improving forest roads, aquatic migration barriers, and actions to be taken in the following calendar year (Table 4-10).

Table 4-8. Information to Be Included in Annual Reports Submitted to ODF (OAR 629-625-0900(8)

Category	Description
Total Length of Forest Roads Improved	Detail the total lineal length of forest roads improved over the course of the annual period and the FRIA process.
Total Length of Forest Roads Still Requiring Improvement	Remaining miles of road still requiring improvements.
Total Length of Forest Roads Planned for Improvements in the Upcoming Year	Details of the upcoming year plan to improve forest roads and nature of work.
Total Length of Forest Roads Vacated	Detail the total length of roads vacated over the course of the annual period and the FRIA process.
Number of Fish Barriers Brought into OFPA Compliance	Total number of culverts or other barriers fixed to be compliant with the OFPA, ODFW fish passage criteria, and NMFS fish passage criteria over the course of the annual period and the FRIA process.
Number of Fish Barriers Still Requiring Improvement	Identification of fish barriers within the RMBs still requiring improvements over the course of the FRIA process.
Fish Barriers to be Addressed in the Upcoming Year	Total number and location of fish barriers to be improved over the course of the upcoming year.
Certification that Landowner Remains on Track to Complete FRIA Process	Landowner to certify, after review of inventory, work history, and plans that they believe they will meet FRIA completion deadline. Failure to certify requires landowner to seek immediate extension from ODF.

Pre-Existing Culverts

Culverts existing on roads managed by large landowners will be identified as part of the FRIA process. Fully functioning culverts that present minimal risks to public resources are a lower priority to bring into full compliance with the OFPA than high-risk culverts that are restricting or preventing fish movement, degrading habitat conditions, highly connected hydrologically to aquatic environment, at substantial risk of failure, or otherwise represent a risk to public resources. Each culvert identified during the initial inventory will be addressed by the landowner based on the following requirements.

- If the structure meets ODFW fish passage criteria detailed in OAR 635-412-0035.
- If the structure is fully functioning with minimal risk to public resources (OAR 629-600-0100(60) and the date of installation is known, it will be maintained until the end of its service life. In any case where a culvert has been reused and the first installation date is known, it will be maintained until the end of its service life from the original date of installation.
- If the structure is fully functioning with minimal risk to public resources and the date of installation is NOT known, the culvert must be inspected at least every 5 years as part of the Annual Inventory Report and Plans process under the FRIA.
- If the structure is NOT fully functioning, or there is more than a minimal risk to public resources (e.g., fish passage barrier or high diversion potential), it will be prioritized to be repaired or replaced as part of the FRIA process. These culverts will not be considered "pre-existing culverts."
- If the structure has an imminent risk of failure, it will be repaired to meet the OFPA.
- Culverts identified as fully functional with minimal risk to public resources with or without a known installation date are considered pre-existing; culverts requiring repairs or replacement are not considered pre-existing (Figure 4-12). If structural failure occurs, the landowner or manager must, within 90 days, submit to ODF for review and approval a plan or plans for that culvert to be repaired or replaced within the calendar year of the date of failure.
- ODF, in consultation with ODFW, will identify lower-priority culverts that are partially functional (i.e., providing some passage) but not identified as pre-existing. The culvert may be maintained until the end of its service life, if the cost of repair or replacement is disproportionate to the benefits, or until it fails and poses a threat to covered fish species. Additionally, if ODF in consultation with ODFW determines that the culvert is providing valuable wetland or pond habitat it may remain unchanged until it fails.

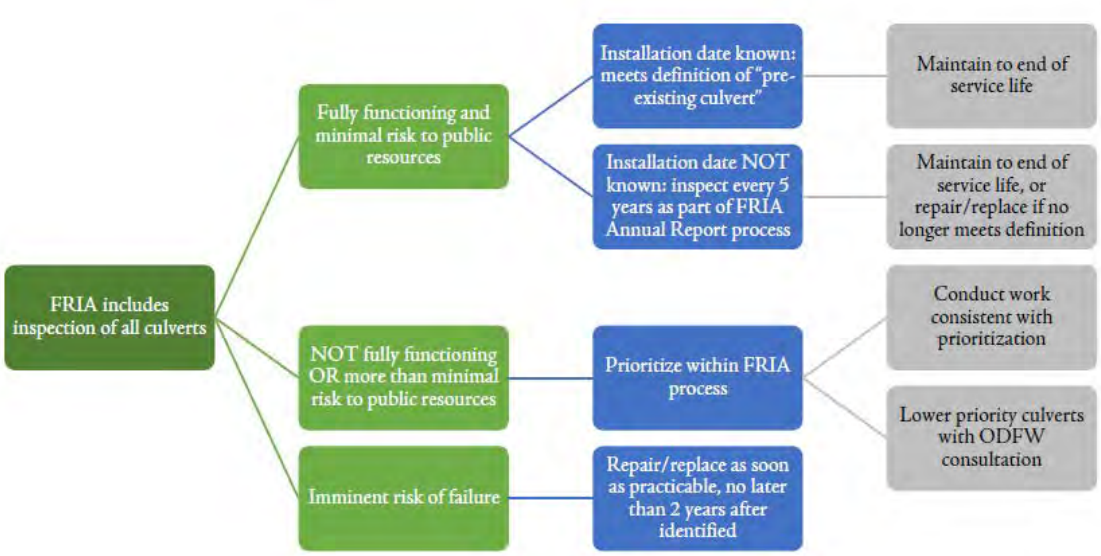


Figure 4-12. Framework for Classifying Pre-Existing Culverts in the FRIA Process

Fish Passage Requirements

Fish passage for native migratory species is regulated under federal and Oregon state law. The State of Oregon requires fish passage in all waters of the state in which native migratory fish are currently or have been present historically (ORS 509.585(1)). Water crossing structures (OAR 629-625-0320) over all typed waters—including lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals—will:

1. Minimize excavation of side slopes near the channel;
2. Minimize the volume of material in the fill;
3. Prevent erosion of the fill and channel;
4. Minimize hydrologic connectivity for adjacent roadways;
5. Avoid or minimize alterations or disturbances to stream channel, bed, bank, or bank vegetation;
6. Have disturbed streambanks replanted with native woody species or stabilized with other natural erosion control techniques;
7. Ensure that streamflow is not likely to be diverted out of its channel if the crossing fails;
8. Preserve water quality and unobstructed flow; and
9. Route and deposit temporarily turbid water from crossing projects to the forest floor in an upland area, or above the 100-year flood level if present.

All water crossings occurring within the HCP covered lands will comply with OAR 629-625-0320 to minimize impacts on covered fish and amphibians and their habitats.

Abandoned Roads Inventory

Abandoned roads are defined as roads that were constructed prior to 1972 and do not meet the criteria of active, inactive, or vacated roads, not including skid trails. Many abandoned roads are

unmapped and may be difficult to inventory, which presents a unique risk to aquatic systems as ongoing and potential problems may go unnoticed for prolonged periods. For example, abandoned roads can cause chronic sedimentation, increase the risk of mass wasting, and create stream diversions. For example, a stream diversion can form when a culvert is undersized and cannot accommodate high flows. This can cause the stream on the upstream side of the culvert to back up and flow over the road either returning to the main channel or creating a new channel, a stream diversion. More damage to the stream channel is likely when the backed-up water is routed down the road and returns to the channel away from the crossing. Stream diversions in the context of the HCP are those that route water away from the stream. Stream diversion may also occur when ice and snow accumulate on the road or if debris flows deposit material across the roadway (Furniss et al. 1997). Furniss et al. (1997) note that "In almost all cases, [a stream] diversion will create a greater erosional consequence of capacity exceedance than stream flows that breach the [road] fill but remain in the channel."

The number and condition of abandoned roads on private timberlands in Oregon has not been quantified, but abandoned or "legacy" roads have been cited by the U.S. Environmental Protection Agency (USEPA) and NMFS as an area of concern and a reason for the agencies' disapproval of Oregon's Coastal Nonpoint Pollution Control Plan. As such, identifying and remediating abandoned roads to minimize effects on the aquatic environment is especially important.

ODF will take the lead in identifying abandoned roads that are not identified or disclosed by landowners during the FRIA process. First, ODF will lead a cooperative effort to identify abandoned roads and assess risk and prioritize remediation efforts. In coordination with USEPA ODF will support landowners in conducting field verifications to determine net benefits to covered species and practicability of remediation. Finally, if conditions are met, the abandoned road will be remediated as part of the FRIA process.

Process to Address Abandoned Roads

To address the risks that abandoned roads may pose to waters of the state, ODF will implement a five-step process to prioritize and determine remediation steps based on risk to aquatic systems and cost to remedy (Figure 4-13).

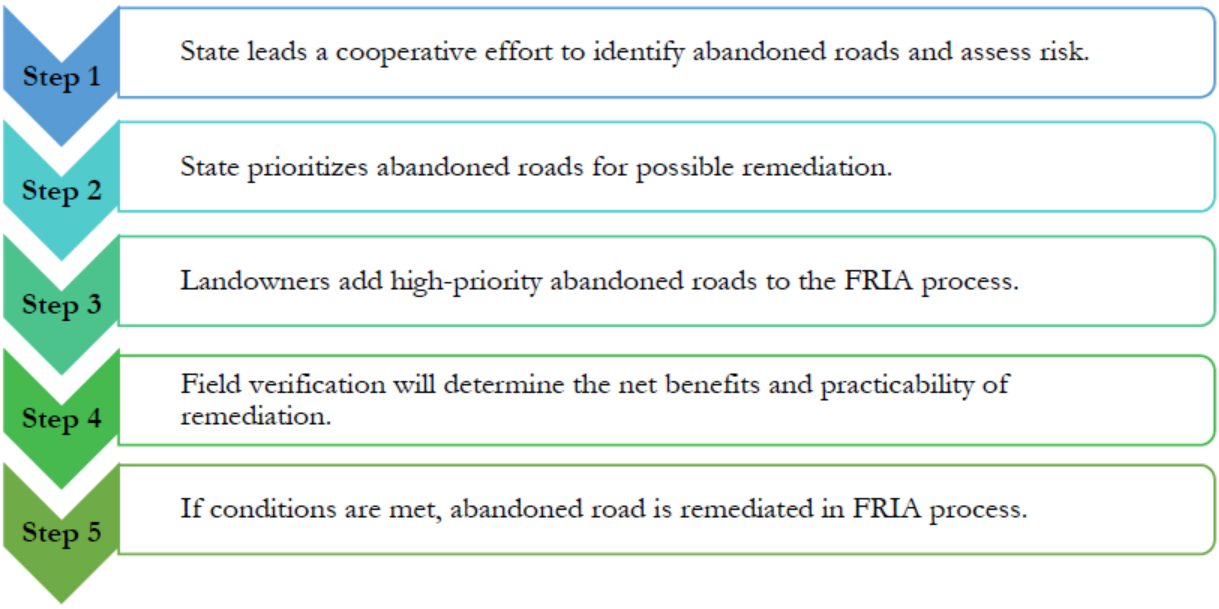


Figure 4-13. Process for ODF-Led Abandoned Roads Inventory

Step 1: Identify Abandoned Roads and Assess Risks

As part of Step 1, ODF will identify abandoned roads using LiDAR, existing geographic information system (GIS) data, aerial images, landowner disclosures, and site visits. ODF will coordinate with the pertinent federal and state agencies as necessary during this step. After abandoned roads have been identified, ODF, with technical support from USEPA will then identify locations that are a high risk to waters of the state or infrastructure. High-risk sites should meet the following criteria.

- Ongoing stream diversions at stream crossings.
- Diversion potential at stream crossings.
- Likelihood of hydrologic connectivity.
- Comparative risk of chronic sediment being produced.
- Risk of contribution to mass wasting.
- High likelihood of beneficial effects on covered species.
- If it contains stream crossings, significant amount of habitat is located upstream.
- Other relevant criteria as determined by ODF in consultation with other state and federal agencies.

Step 2: Prioritize Abandoned Roads for Remediation

Following the identification of abandoned roads and ranking of risk, ODF will work with landowners to develop a list of priority locations for potential remediation. Locations will be prioritized based on the following.

- Importance of the watershed (hydrologic unit code [HUC] 6) to recovering covered fish and amphibian species.

- Number of stream crossings.
- Cost and benefit of work to remediate problems and risks.
- Other relevant criteria as determined by ODF in consultation with other state and federal agencies.

Step 3: Add High-Priority Abandoned Roads to FRIA

Where high-priority abandoned road locations are identified under Step 2, landowners will add them to the initial inventory (Years 0–5) of the FRIA process.

Step 4: Conduct Field Verification

Field verification of all high-priority sites will be completed and documented at the onset of FRIA process. During that time, ODF in consultation with the DEQ and ODFW will review landowner verifications of high-priority sites and remediation plans. Field verification of high-priority sites will include the following (OAR 629-625-0910(4)).

- Confirmation that the high-priority location is on an abandoned road.
- Determination regarding whether the high-priority location is diverting the stream or has diversion potential. ODF and cooperators will develop indicators to determine whether the location is actively diverting the stream or has diversion potential (see Furniss et al. 1997). Landowners should consider potential erosional consequences, the value of downstream resources, the sensitivity of downstream resources to erosion and sedimentation, and costs to repair the road if a stream diversion occurs. See Appendix X, *Title,* for indicators of stream diversion potentials.
- Determination regarding whether the high-priority location is actively contributing sediment or is at a high risk of contributing significant quantities of sediment to waters of the state.
- Indicators developed by the state and cooperators to determine whether the location is actively contributing or has the potential to contribute sediment to waters of the state. These indicators could include the following.
    - A sediment deposit that reaches the high-water line of a defined channel of flood-prone area.
    - A channel that extends from a road drainage systems outlet to the high-water line of a defined channel or a flood-prone area.
    - Evidence of surface flow between the drainage structure outlet and a defined channel or a flood-prone area.
    - Observation of turbid water reaching any typed waters, lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals during runoff events.
    - Evidence of direct sediment entry into a watercourse or a flood-prone area from road surfaces or drainage structures and facilities (e.g., ponded sediment, sediment deposits, delivery of turbid runoff from drainage structures during rainfall events).

  - Gullies or other evidence of erosion on road surfaces or below the outlets of road drainage facilities or structures, including ditch drain (relief) culverts, with transport or a high likelihood of transport to a watercourse.
  - Native-surfaced road exhibiting erosion.
  - Native-surfaced road composed of erodible soil types (e.g., granitic soils).
  - Rilled, gullied, or rutted road approaches to crossings.
  - Presence of stabilizing vegetation that could be removed or damaged during subsequent timber harvest.
  - Existing ditch drain (relief) culverts or other road drainage systems with decreased capacity due to damage or impairment (e.g., crushed or bent inlets, flattened dips due to road grading).
  - Decreased structural integrity of ditch drain (relief) culverts, water breaks, or other road drainage systems (e.g., excessive pipe corrosion, breached water breaks, or rutted road segments).
  - Ditch scour or downcutting resulting from excessively long undrained ditches with infrequent ditch drain (relief) culverts or other outlet structures or facilities. This condition can also result from design inadequacies (e.g., spacing not altered for steep ditch gradient), inadequate erosion prevention practices (e.g., lack of armoring), or ditches located in areas of erodible soils.

- Determination regarding whether the restoration would be a net benefit to water of the state and covered species. To accomplish this, ODF and landowners must weigh the ecological effects of accessing and addressing the high-priority location against the value of vacating the high-priority locations. This analysis will be required as part of the annual reporting process.
- Determination regarding the financial practicability of restoration/remediation and environmental benefit for a range of alternatives. These alternatives could include no action, vacating the high-priority location, and any other reasonable mitigation alternatives to address identified risks, including but not limited to the following.
  - Ongoing stream diversions at stream crossings.
  - Diversion potential at stream crossings.
  - Likelihood of hydrologic connectivity.
  - Comparative risk of chronic sediment produced.
  - Risk of contribution to mass wasting.

Step 5: Remediate Abandoned Roads

If, through consultation with ODF, the landowner determines that all four of the following conditions are met, then the project will be scheduled for remediation during the FRIA period (Years 0–20).

- The high-priority location is an abandoned road.
- The high-priority location is actively contributing or has a high risk of contributing significant quantities of sediment to waters of the state.
- The restoration would be a net benefit to waters of the state and/or covered species.

- Restoration is practicable.

Small Forest Landowners Road Assessment Process

SFOs will be required to complete a Road Condition Assessment (RCA) at the time of notification for harvest of timber. The RCA will include all roads in the SFO's parcel where the harvest will take place and the condition of each road with specific regard to (1) whether the road condition contributes to active or potential delivery of sediment to waters of the state and (2) the status of water crossings. ODF will assist SFOs in completing RCAs, when needed.

An RCA will also indicate potential fish passage barriers on fish streams (Type F and Type SSBT), abandoned roads, and roads with a perched fill that present a significant hazard to fish-bearing streams that may qualify for state funding. Potential fish passage barriers on fish streams (Type F and Type SSBT), abandoned roads, and roads with a perched fill that present a significant hazard to fish-bearing streams, identified in RCAs, that may qualify for state funding grants will be reviewed by ODF in consultation with the ODFW for eligibility.

If a road on land owned by an SFO is used to haul timber, the SFO will ensure that their roads are maintained to the standards of the OFPA. The SFO is not required to undertake the following three types of road improvements to be funded by the state.

- Replacing culverts located on fish-bearing streams.
- Repairing abandoned roads.
- Reconstructing, vacating, or relocating roads with a perched fill that present a significant hazard to fish-bearing streams.

These road improvements will be prioritized and may be eligible for 100 percent funding by the new Small Forestland Investment in Stream Habitat (SFISH) program.

4.4.3.3 Relation to Biological Goals and Objectives

Section under development.

4.4.4 Conservation Measure 4: Beaver Conservation

Conservation Measure 4 pertains to conserving the American beaver's (*Castor canadensis*) role as a landscape architect within the permit area. The American beaver is both the largest native living North American rodent and a keystone species that has played a critical role in shaping landscapes across Oregon and North America. From maintaining wetland and riparian ecosystems to recharging groundwater, beavers can affect multiple biological, physical, chemical, and ecological processes across the landscape. Beavers can be found in virtually all of Oregon's waterways including, rivers, small streams, lakes, marshes, and even roadside ditches that have adequate year-round flow. Beaver dam sites are most often found in small- to medium-sized streams that are less than 23 feet wide and that flow through lower gradient (between 2 percent and 4 percent), unconfined valleys (greater than 100 feet) (Dittbrenner et al. 2018) with *Populus* and *Salix* tree species (e.g., aspen, cottonwood, and willows; Castro et al. 2015; Suzuki and McComb 1998). Beavers feed on the leaves, inner bark, and twigs of aspen, alder, cottonwood, willow, and other deciduous trees. They also eat shrubs, ferns, aquatic plants, grasses, blackberries, and agricultural crops. Beavers prefer deep water for protection from predators and to provide underwater entrances to their den. Potential beaver habitat and areas suitable for dams occur in all portions of the HCP permit area.

Beavers are often referred to as "engineers" because they physically modify stream environments by building dams, lodges, and canals (Naiman et al. 1986). These structures transform hydrologic, geomorphic, and ecological processes (Nash et al. 2021) and significantly influence stream- and riparian-dependent species. The American beaver's role in creating habitat for salmonids is also well documented (e.g., page 3-3 of the *Recovery Plan for Oregon Coastal Coho;* NMFS 2016). In alluvial rivers, dams created by beavers can form wetland or pond complexes that benefit salmonids by creating productive off-channel habitats t for rearing juveniles (Malison et al. 2016). Habitat created by beavers is especially important for juvenile summer rearing and overwintering periods due to its low velocity, variable depths, complexity, and cover (Castro et al. 2015). Studies have demonstrated increased juvenile coho salmon (*Oncorhynchus kisutch*) rearing densities and growth (Bustard and Narver 1975; Murphy et al. 1989; Pollock et al. 2004; Malison et al. 2016), increased survival (Quinn and Peterson 1996), and increased production (Nickelson et al. 1992; Bouwes et al. 2016) associated with beaver ponds. However, at least one study (Stevenson et al. 2022) found some beaver dams may have increased warming and lower dissolved oxygen with negative effects on coho. In coastal Oregon streams, reaches with beaver ponds and alcoves account for 9 percent of all salmonid habitat, but were found to support 88 percent of the coho salmon in the system (Nickelson et al. 1992).

Moreover, in many arid regions in the Pacific Northwest, beaver dams are especially important because they store water, creating wetlands important for plant and tree communities. At the local scale, beavers also reduce hydrologic seasonality (Naiman et al. 1988; Baker and Hill 2003), which may mitigate the effects of climate change on stream ecosystems (Hood and Bayley 2008). Beaver activity has also been shown to cool water temperatures by increasing surface water storage, improving connection of cool surface water flow (Weber et al. 2017), and groundwater recharge and upwelling. For example, in the Skykomish River basin stream reaches downstream of beaver dams exhibited an average decrease of 2.3°C during summer base-flow conditions (Dittbrenner et al. 2021). However, in some cases beaver dams and ponds can cause streams to warm during summer periods (e.g., Stevenson et al. 2022). While beavers can improve habitat for aquatic and riparian species, beaver activity may also result in negative effects on landowners, including damage to trees and shrubs, blocking culverts, and flooding roads and developed areas (Enk et al. 1997; Harbrecht 1991; Jonker et al. 2006). Efforts to identify and mitigate current and potential conflicts between beavers and private landowners are ongoing (Needham and Morzillo 2011).

Under the Oregon Conservation Strategy, beavers were identified as a key component to maintain and restore floodplain functions. Specifically, the Oregon Conservation Strategy includes actions to "support and encourage beaver dam-building activity" (ODFW:67). In many cases, reintroducing or promoting existing beaver populations can often be more cost-effective than other types of restoration projects (e.g., large wood augmentation) (Pollock et al. 2004). Conservation of beavers and their habitats will help sustain and promote the recovery of aquatic species covered by this HCP. For example, increasing the number of beaver dams in key areas is expected to increase juvenile salmonid carrying capacity by creating high-quality rearing habitats and promoting habitat complexity (ODFW 2009).

4.4.4.1 Beaver Management and Conservation

Under current Oregon law, beavers have a dual status. Beavers are classified as a furbearer (ORS 496.004 and OAR 635-050-0050) and on private lands they are classified as predatory animals (ORS 610.002). Trapping of beaver under the furbearer statutes requires a permit, while trapping of beaver as a predatory animal by a landowner on private land does not require a permit.

Specific actions implemented as part of the HCP will support existing beaver populations within the permit area while also providing opportunity for relocation and expansion. These actions are codified in existing statutes and in revised beaver trapping rules (State Bill [SB] 1501 Sections 22–25 amend ORS 498 and OAR 635-050-0045), including the following.

- Annually tracking and reporting of take of beavers on private land led by ODFW (OAR 635-050-0045).
- Submission of annual reports to the Oregon Fish and Wildlife Commission by ODFW that summarizes taking of beaver on private lands.
- Modification of the trapping regulations for beaver for private landowners including a prohibition on trapping beavers for landowners that qualify as large private landowners unless the beaver poses an imminent threat to infrastructure.
- For beavers that pose a threat to infrastructure that is not imminent, new regulations are in place to establish a process for consultation with ODFW regarding nonlethal options to resolve the conflict, including possibly trapping the beaver and reintroducing it to a new location. ODFW has an existing policy in place for assessing feasibility for trapping and reintroducing beavers.

SB1501 Section 23 (2(a)) states that an owner of forestland, other than small forestland, may lethally remove a beaver if the beaver apparently poses a threat to infrastructure. The owner should first request that ODFW address the threat, but if ODFW is unable to remove the beaver within 30 days the landowner may complete the removal without ODFW involvement. SB1501 also states in Section 23 that a private landowner, other than of a small forestland, may lethally remove a beaver on the property if that beaver is causing or may cause damage on privately owned forestland without submitting a request to ODFW. All removals will be reported to ODFW as described in their 2017 guidance document.

ODFW's voluntary beaver relocation program for private forestlands will be used to: (a) promote conservation of beavers as an important tool for habitat restoration and recovery of covered fish and amphibians, (b) promote nonlethal beaver management strategies, and (c) develop a list of private forest owners willing to receive relocated beavers. While natural recolonization of beavers may be a slow process, translocation of beavers can also be difficult due to low survival (Petro et al. 2015). The science pertaining to translocation of beavers is evolving with an increased focus on maintaining the integrity of family units during translocation and pair bonding individual translocated beavers in captivity prior to release. With uncertainty in the success of beaver translocation to date, monitoring and adaptive management will be crucial in evaluating management techniques and philosophies applied to forestlands in Oregon covered by the HCP (discussed in more detail in Chapter 6, *Monitoring and Adaptive Management*).

Beaver relocation efforts should be prioritized according to habitat suitability for the species and their dams, including the following considerations (Suzuki and McComb 1998; Petro et al. 2020).

- An active channel width between 10 and 20 feet.
- Valley floor width greater than 82 feet.
- Channel gradient less than 3 percent.

ODFW states that natural colonization of beavers from nearby watersheds typically occurs when (1) other beaver are not present, (2) there is suitable habitat, and (3) landowners are supportive of their presence. Where these conditions exist beaver colonization (natural or via relocation efforts)

have a greater chance of succeeding (ODFW 2017). ODFW provides specific steps in their 2017 guidance document on the process for landowners interested in relocating beavers.

ODF and ODFW will coordinate beaver management with regional partners to ensure actions fit into the larger context of salmonid recovery and statewide beaver management principles. Beaver research is incorporated into the adaptive management framework established in Chapter 6, *Monitoring and Adaptive Management*. This approach will be used to provide science-based recommendations and technical information to ODF in determining when it is necessary or advisable to adjust rules, guidance, and training programs to achieve HCP resource goals and objectives.

4.4.4.2 Relation to Biological Goals and Objectives

Promoting the occurrence of beaver in the covered lands, through both passive and active management will contribute to meeting Objective xx: TBD, by improving floodplain connectivity, stream complexity, slow-moving rearing habitat, water retention, and temperature regulation that would benefit the covered fish and amphibian species.

4.4.5 Conservation Measure 5: Small Forestland Owners

Conservation Measure 5 establishes a program for SFOs designed to ensure that management of small forestlands achieves the biological goals and objectives of the HCP and works to address the potentially disproportional financial constraints that the HCP may impose on SFOs. Small forest landowner rules are codified in OAR 629-607-0000 through 629-607-0800, with specific rules referenced below that are particularly relevant to the HCP and SFO program.

There are multiple definitions and designations of SFOs in Oregon statutes. For the purposes of this HCP and as described in OAR 629-625-0100 and defined in chapter 34, Oregon Laws 2022, an SFO must meet the following three criteria:

1) A person that owns or holds in common ownership less than 5,000 acres of forestland; and
2) Has harvested no more than an average yearly volume of two million board feet of merchantable forest products from the landowner's forestlands in Oregon, when averaged over the 3 years prior to:
    a. The date the department receives a harvest notification from the landowner; or
    b. If applying for a Small Forestland Investment in Stream Habitat Program grant, the date the landowner submits a grant application; and
3) Provides a statement of affirmation that they do not expect to exceed an average yearly volume of two million board feet of merchantable forest products to be harvested from the landowner's forestlands for 10 years after the department receives the harvest notification or grant application.

Any landowner who exceeds the two million board feet average harvest threshold from their land in the 3 years prior to submitting a harvest notification or grant application to ODF, or who expects to exceed the threshold during any of the following 10 years, will still be deemed an SFO if the landowner establishes to ODF's reasonable satisfaction that the harvest limits were, or will be, exceeded to raise funds to pay estate taxes or for a compelling and unexpected obligation, such as for a court-ordered judgment or for extraordinary medical expenses.

Approximately 3.6 million acres of Oregon's forestlands are owned by SFOs, equating to approximately 12 percent of Oregon's total forestlands, and 35 percent of the state's privately owned forestlands (OFRI 2021). Generally, SFOs harvest less frequently than large forestland owners and produce approximately 11 percent of all timber harvested in Oregon. In contrast, forestlands owned by private industry (22 percent) produce 65 percent of all timber harvested in Oregon (OFRI 2021). The spatial footprint of a harvest on an SFO's property is considerably smaller, on average, than the average harvest by large landowners.

The primary goal of the SFO program is to meet all the biological goals and objectives identified in this HCP while acknowledging the inherent differences between SFOs and large landowners. The SFO conservation program included in the HCP includes differences in riparian and slope management requirements, eligibility for incentive programs, requirements for reporting, road measures, and the use of targeted outreach and educational efforts. It also proposes the establishment of the SFO Assistance Office (established under section 19, chapter 33, Oregon Laws 2022), to work with the broader community of both landowners who may be designated SFOs for purposes of this HCP and other landowners of small forestlands. Additional responsibilities of the SFO Assistance Office are described in OAR 629-607-0000 and discussed in Section 4.4.5.7, *SFO Assistance Office*.

The following are the additional goals of the HCP SFO program.

- **Encourage adoption of standard harvest and road management rules:** By implementing the standard harvest and road management rules that apply to large forest owners, SFOs will optimize environmental benefits and mitigate risks to natural resources and most effectively meet the objectives of the HCP.
- **Minimize the conversion of timberlands to other uses:** Socioeconomic factors that result in increased demand for residential, commercial, and industrial development can lead to the conversion of forestlands to developed land uses (Kline and Alig 2005). Small forestlands provide an important suite of economic and ecological benefits to Oregon. These benefits can be diminished if small forestlands are converted to other land uses, such as residential subdivisions. Conversion to other land uses may occur for a wide variety of reasons, including the cost associated with forest ownership. The SFO program seeks to diminish conversion through a system of incentives, education, and regulatory stability for SFOs.

4.4.5.1 Riparian Conservation Measures for SFOs

To conserve riparian areas, the following three management options for SFOs are included in the HCP.

- **Standard Practice:** SFOs may choose to follow the Standard Practice used by large landowners to manage timber harvest around RMAs established in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas*.
- **Minimum Option:** SFOs may choose to manage to alternative minimum rules (SFO Minimum Option) as described later in this section. This practice is limited at the level of the fifth field watershed[7].

[7] The US Geological Survey divides watersheds into distinct units (fields) based on size with first-field watershed covering the larges geographic areas (e.g., Columbia or Mississippi Rivers). Subsequent (e.g., second, third, fourth,

- **Forest Conservation Tax Credit (FCTC) Option:** SFOs may choose to follow the Standard Practice used by large forest owners and claim a tax credit for some of the value committed to conservation.

The following riparian prescriptions apply to SFOs statewide.

1. For timber harvest Types 1, 2, or 3 that include riparian areas, a landowner who qualifies as an SFO is encouraged to follow the Standard Practice. Landowners who qualify as an SFO may also select the SFO Minimum Option or the FCTC Option.
2. SFOs who choose the Minimum Option may harvest using the alternative prescriptions identified for western Oregon defined below. The use of the Minimum Option will be limited to 5 percent of the horizontal lineal feet of SFO owned streams, over a 5-year rolling average, in a defined fifth field watershed. The 5 percent will be tracked by ODF separately for fish and non-fish streams.
3. SFOs who select the FCTC Option must follow the same prescriptions as the Standard Practice but can apply for a tax credit for 100 percent of the calculated stumpage value of merchantable forest products retained under the Standard Practice more than what would be retained under the Minimum Option. The area that may be eligible for the tax credit under the FCTC Option is termed the Forest Conservation Area (FCA). The width of the FCA is the difference between the outermost edge of the Standard Practice width and the outermost edge of the SFO Minimum Option width. The length of the FCA is the length of frontage that follows the same lengths as the Standard Practice. Additional credits may be claimed in accordance with the West Oregon Non-Fish Perennial Stream Rules (4.5.2.2(1)B). A small forestland owner may apply for an FCTC for an amount that is one half of the stumpage value left between the inside edge of the SFO Minimum Option and the edge of dry stream channel areas required to be retained for Small Type Np tributaries to Type F or Type SSBT streams as described in OAR 629-643-0105, 629-643-0125, and 629-643-0130. To be eligible for the tax credit, the SFO will field survey the stream and have 100 feet or more of surveyed dry channel between two flow features downstream of the RH Max (OAR 629-607-0450(2)).
4. Type 4 harvests are not eligible to claim an FCTC. A harvest Type 4 is a commercial thin where enough trees are retained such that regulations pertaining to reforestation or retention of wildlife leave trees are not triggered. There will be no limitations on the use of a harvest Type 4 operation within a fifth field watershed.

4.4.5.2 Riparian Prescriptions for SFOs

Western Oregon

SFOs are expected to utilize the Standard Practice and the FCTC more frequently than the Minimum Option. Table 4-9 establishes the riparian prescriptions for SFOs in western Oregon under the Standard Practice and the SFO Minimum Option. The FCA that may be eligible for a tax credit under the FCTC Option is also indicated. All measurements of RMA widths will be made using slope distance and will be measured from the edge of the active channel or, if present, the CMZ. RMA width will be measured separately on each side of the stream.

etc.) watersheds cover incrementally smaller areas and are typically tributaries or contributing watersheds to larger systems. Fifth field watersheds are commonly used for monitoring or management purposes.

In general, the SFO Minimum Option for western Oregon provides slightly narrower RMA widths compared to the Standard Practice described in Section 4.4.1.3, *Standard Practice Riparian Prescriptions*. The RMA widths indicated in Table 4-9 are no-harvest areas, and all trees and vegetation within those distances will be retained (OAR 629-643-0141(3)).

While the SFO Minimum Option does allow for clearcut harvest closer to streams than the Standard Practice, the HCP anticipates that three factors will result in conservation across SFO properties. First, the SFO Minimum Option can only be utilized at no more than 5 percent of the SFO streams in a fifth field watershed during a 5-year period. Harvests above that rate will require the Standard Practice. The 5 percent cap will ensure that at most the FCA will be harvested on a 100-year rotation at the watershed level. Second, tax credits are made available to compensate landowners who voluntarily use the Standard Prescription. Third, many SFOs are not focused on revenue maximization and voluntarily provide protections even more than the Standard Practice. Taken together the HCP proposes to meet biological goals while also avoiding pressures to convert to other uses.

Generally, SFOs will follow the same RMA rules for small non-fish perennial streams identified in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas,* that apply to larger landowners. Whether and where a stream is defined as perennial will be determined under the methods established in Section 4.4.1.2, *Regulatory Stream Classification Database*. For sections of perennial streams upstream of the above-identified RMAs and for seasonal streams, SFOs will follow the Standard Practice prescriptions identified in Section 4.4.1.3, *Standard Practice Riparian Prescriptions*. The Standard Option for seeps and springs found within RMAs is established under Conservation Measure 1 and applies to SFOs. SFOs may follow different prescriptions for seeps and springs found within RMAs under the SFO Minimum Option. The SFO Minimum Option requires that, if a seep or spring occurs within an RMA, then the RMA will be extended for 15 feet beyond the seep or spring if the RMA is not already 15 feet beyond the seep or spring. ODF will provide a standardized form for SFOs to fill out when they do a harvest notification to inform the use of the SFO Minimum Option around seeps and springs. There is no FCTC Option for additional seep and spring RMAs.

Table 4-9. Western Oregon RMAs for SFOs

Stream Type	Standard Practice Width (feet)	SFO Minimum Option Width (feet)	Forest Conservation Area (feet)
Large SSBT	110	100	100–110
Medium SSBT	110	80	80–110
Small SSBT	100	60	60–100
Large Type F	110	100	100–110t
Medium Type F	110	70	70–110
Small Type F	100	50	50–100
Large Type N	75	70	70–75
Medium Type N	75	50	50–75t

Stream Type	Standard Practice Width (feet)	SFO Minimum Option Width (feet)	Forest Conservation Area (feet)
Small Type Np, Tributary to SSBT	75 feet for 500 feet from confluence with SSBT stream, then 50 feet for next 650 feet, RH Max = 1,150 feet R-ELZ and ELZ as defined in OAR 629-643-0143	35 feet for 500 feet from confluence with SSBT stream, then 35 feet for 650 feet, RH Max = 1,150 feet R-ELZ and ELZ as defined in OAR 629-643-0143	Width: between 35 feet and the outside edge of Standard Practice Option (either 50 or 75 feet) Length: will follow the same lengths as Standard Practice Option
Small Type Np, Tributary to Type F	75 feet for 600 feet from confluence with Type F stream (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	35 feet for 600 feet from confluence with Type F stream (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	Width: between 35 feet and the outside edge of the Standard Practice Option Length: will follow the same lengths as Standard Practice Option
Type Ns	35-foot ELZ	35-foot ELZ	None
Large and Medium Type D	75	75	None
Small Type D	75	35-foot ELZ	None

Eastern Oregon Riparian Prescriptions for SFOs

Table 4-10 establishes the riparian prescriptions for SFOs in eastern Oregon under the Standard Practice and the SFO Minimum Option, and the area that may be eligible for a tax credit under the FCTC Option, that is, the FCA. Eastern Oregon riparian prescriptions establish an inner no-harvest zone and an outer managed harvest zone. Basal area retentions in the outer managed harvest zone for the standard option are established in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas*. The SFO Minimum Option requires the same basal area retentions in the outer managed-harvest zone as the Standard Option.

Generally, SFOs in eastern Oregon will follow the same RMA rules for small non-fish perennial streams identified in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas,* that apply to large landowners. Refer to Appendix XX, *Title,* for complete details on SFO RMA layout methodology for small Type Np streams.

Whether and where a stream is defined as perennial will be determined under the methods established in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas,* and Appendix XX, *Title*. For sections of perennial streams upstream of the above-identified buffers and for seasonal streams, SFOs will follow the Standard Practice prescriptions identified under Conservation Measure 1. Section 4.4.1 also identifies an eastern Oregon prescription for small Type N perennial streams that draws a distinction between laterals and terminals. The SFO Option adopts this approach and uses the same perennial identification rules.

The Standard Option for seeps and springs found within RMAs is established in Section 4.4.1, *Conservation Measure 1: Riparian Management Areas*. SFOs may follow different prescriptions for

seeps and springs[8] found within RMAs under the SFO Minimum Option, which requires that, if a seep or spring occurs within an RMA, then the RMA will be extended for 15 feet beyond the seep or spring if the RMA is not already 15 feet beyond the seep or spring. ODF will provide a standardized form for SFOs when they fill out a harvest notification to inform the use of the SFO Minimum Option around seeps and springs. No tracking of this prescription is required as laid out in Section 4.4.1 related to the RMA SFO Option. There is no FCTC Option for additional seeps and spring buffers.

Table 4-10. Eastern Oregon RMAs for SFOs[1]

Stream Type	Standard Option Width (feet)	SFO Minimum Option Width (feet)	Forest Conservation Area[2] (feet)
Large Type F and SSBT	30-foot no-harvest and 70-foot managed area (100 feet total)	30-foot no-harvest and 70-foot managed area (100 feet total)	None
Medium Type F and SSBT	30-foot no-harvest and 70-foot managed area (100 feet total)	30-foot no-harvest and 50-foot managed area (80 feet total)	Difference between 50-foot and 70-foot managed zone
Small Type F and SSBT	30-foot no-harvest and 45-foot managed area (75 feet total)	30-foot no-harvest and 30-foot managed area (60 feet total)	Difference between 30-foot and 45-foot managed zone
Large Type N	30-foot no-harvest and 45-foot managed area (75 feet total)	30-foot no-harvest and 45-foot managed area (75 feet total)	None
Medium Type N	30-foot no-harvest and 45-foot managed area (75 feet total)	30-foot no-harvest and 30-foot managed area (60 feet total)	Difference between 30-foot and 45-foot managed zone
Small Type Np, Terminal[3]	A 30-foot inner no-harvest zone and 30-foot outer managed-harvest zone, for up to first 500-foot length above junction with Type F or SSBT (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	A 20-foot ft inner no-harvest zone and 20-foot outer managed-harvest zone, for up to first 500-foot length above junction with Type F or SSBT (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	None
Small Type Np, Lateral[4]	A 30-foot inner no-harvest zone for up to first 250-foot length above junction with Type F or SSBT (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	A 20-foot inner no-harvest zone for up to first 250-foot length above junction with Type F or SSBT (RH Max) R-ELZ and ELZ as defined in OAR 629-643-0143	None

[8] Some springs in eastern Oregon are considered as "Important Springs in Eastern Oregon" and are protected as significant wetlands under Division 645 of the OAR. These springs are characterized as having established wetland vegetation, flow year-round in most years, and to be used by a concentration of diverse animal species (OAR 629-645-0000).

Stream Type	Standard Option Width (feet)	SFO Minimum Option Width (feet)	Forest Conservation Area[2] (feet)
Small Type Ns	30-foot ELZ retain shrubs and trees under 6 inches DBH, where possible, for up to first 750-foot length from the confluence with Type F or SSBT streams	30-foot ELZ retain shrubs and trees under 6 inches DBH, where possible, for up to first 750-foot length from the confluence with Type F or SSBT streams	None
Large and Medium Type D		30-foot inner no-harvest	
Small Type D		20-foot inner no-harvest	

[1] All measurements of RMA widths will be made using slope distance and will be measured from edge of the active channel or CMZ, if present. RMA width prescriptions established in Table 4-3 refer to width of RMA on one side of stream (from edge of active channel or CMZ, if present, upslope).

[2] Area that may be eligible for tax credit under the FCTC Option is termed the FCA. Width of FCA is the difference between outermost edge of Standard Practice width and outermost edge of SFO Minimum Option width. Length of FCA is length of frontage of harvest unit on that stream type segment.

[3] Terminal Type Np Streams are defined in Section 4.4.1.3, *Standard Practice Riparian Prescriptions*.

[4] Lateral Type Np Streams are defined in the Glossary (Appendix X).

Conservation Measures for Timber Harvest on Steep Slopes

The conservation measures identified in this section cover SFOs harvesting timber on steep slopes as agreed to in the PFA. The two types of steep slopes prescription defined in Section 4.4.2.1, *Timber Harvest Prescriptions,* that apply to SFO are (1) Designated Debris Flow Traversal Area, and (2) Stream-Adjacent Failures. SFOs may choose to not harvest timber on steep slopes under the Standard Practice to optimize environmental benefits and mitigate risks to natural resources. SFOs will have an alternative SFO Minimum Option for each of the steep slopes prescriptions, as detailed below.

Modeling for Steep Slopes Prescriptions

For the purposes of the SFO Minimum Option steep slopes prescriptions, the slopes modeling described in Section 4.4.2, *Conservation Measure 2: Timber Harvest on Steep Slopes,* will be used to determine prescription locations for Designated Debris Flow Traversal Areas. The term "Designated Debris Flow Traversal Area" will be given the same definition and will be in the same fashion as established in Section 4.4.2.1, *Timber Harvest Prescriptions*. SFOs will rely on the same department reporting and notification system maps to identify these features as would any other landowner.

Western Oregon SFO Minimum Option for Designated Debris Flow Traversal Areas

For Type 1, 2, or 3 harvests, the SFO Minimum Option will require buffering 50 percent of the length of the Designated Debris Flow Traversal Area that would be protected under the Standard Practice (OAR 629-0630-0920(1)). The width of the Designated Debris Flow Traversal Area will be the same as the Standard Practice (see Section 4.4.2, *Conservation Measure 2: Timber Harvest on Steep Slopes*). This restriction applies at the harvest unit level.

ODF will determine if an SFO has a Designated Debris Flow Traversal Area in a planned harvest unit and will assist SFOs in determining what areas need to be retained. The SFO Minimum Option is

specific to each individual SFO, meaning that should a single Designated Debris Flow Traversal Area extend to a second SFO's property, each SFO will protect half of the traversal path on their property if they select the SFO Minimum Option.

There will be no FCTC available if an SFO chooses to use the Standard Practice for a Designated Debris Flow Traversal Area**.** There will be no Designated Debris Flow Traversal Area requirements for SFOs who have harvest Type 4 operations.

SFO Designated Sediment Source Areas

SFOs in western Oregon that are managed under the SFO Minimum Option are exempt from the prescriptions identified in Section 4.4.2, *Conservation Measure 2: Timber Harvest on Steep Slopes,* related to Designated Sediment Source Areas and Slope Retention Areas (OAR 629-630-0920(6)). As such, SFOs are entitled to harvest within all Designated Sediment Source Areas on their properties identified by the Slopes Model.

Statewide SFO Minimum Option for Stream-Adjacent Failures

Stream-Adjacent Failures on SFO land will be field identified using the criteria identified in Section 4.4.2.1, *Timber Harvest Prescriptions*. If a Stream-Adjacent Failure is field identified in an RMA, then the SFO will extend the width of the RMA to the lessor of the distance of 30 feet from the outer edge of the SFO Minimum Option or the distance to the slope break, defined as 20 percent or greater reduction in slope gradient. The length of RMA subject to the Stream-Adjacent Failure prescription will be determined under the Standard Practice as established in Section 4.4.2.1. ODF may assist SFOs in determining what areas need to be included in the RMA subject to the Stream-Adjacent Failure prescription. No tracking by fifth field watershed is required for this alternative prescription. There will be no FCTC available if an SFO chooses to use the requirements in the Standard Practice for Stream-Adjacent Failures.

Steep Slope Prescriptions in Eastern Oregon

Steep slope prescriptions for Stream-Adjacent Failures established under *Statewide Minimum SFO Requirements for Stream-Adjacent Failure* described above apply to eastern Oregon. There will be no steep slope prescriptions for Designated Debris Flow Traversal Areas or for Slope Retention Areas located within Designated Sediment Source Areas for SFOs in eastern Oregon.

4.4.5.3 Forest Conservation Tax Credits

SFOs play a critical role in both land conservation and the forest products sector. Small forestland ownership is also culturally important to many Oregonians who take great pride in stewarding their forests. The PFA recognized the high likelihood of conservation commitments detailed in this HCP disproportionately affecting some SFOs, which may influence SFO decisions to convert their lands to non-forest uses resulting in significant environmental effects. Given these threats, the PFA and this HCP recognize the need for durable financial assistance to SFOs to attain improved and durable conservation outcomes. The FCTC envisioned in this HCP is a critical element of the PFA policy package. The FCTC is established to incentivize SFOs to adopt the Standard Practice prescriptions provided for in this HCP for riparian areas. When an SFO adopts the Standard Practice for management in those areas instead of the SFO Minimum Option, the SFO becomes eligible to receive an FCTC equal to the stumpage value, as defined in Appendix XX, *Title*, of the additional timber that is retained in the FCA by adopting the Standard Practice.

Additional details regarding how the tax credit will function are identified in Appendix XX, *Title,* and many of the details are included in the PFA enabling legislation.

4.4.5.4 Duration of the Forest Conservation Tax Credit

The FCTC will be available continuously until the end of the permit term. The FCTC will not have a sunset date. If a future legislature cancels the FCTC and does not replace it with a similar compensation option for SFOs, all existing credits held by taxpayers will be retained by them and may still be used. Similarly, if the FCTC program is canceled, all restrictions on using the Minimum Option within a fifth field watershed will be removed for riparian areas where a credit has not been issued, though the frequency of harvests under the Minimum Option will continue to be tracked.

4.4.5.5 Requirements and Limitations on the Use of the Riparian Minimum Option

Reporting Requirements

ODF will create a standardized form that must be filled out by an SFO whenever the Minimum Option is used for activities near riparian areas. The form will require identification of the horizontal lineal feet of riparian area in the harvest unit and whether the horizontal lineal distance is a two-sided or one-sided harvest. Within 3 months after the completion of the timber harvest, SFOs will report to ODF the actual horizontal lineal feet of riparian area where the Minimum Option was used. Lineal feet will be tracked using each side of a stream such that a one-sided buffer will count as half the lineal feet of a stream segment. ODF will annually track and report the rolling average of fish (Type F and Type SSBT) and non-fish (Type N) streams managed using the SFO Minimum Option for each fifth field watershed. This reporting requirement will allow ODF to monitor the frequency of the practice and to limit it per the watershed cap.

Fifth Field Watershed Cap

The use of the Minimum Option will be limited to 5 percent of the horizontal lineal feet of streams owned by SFOs, over a 5-year rolling average, within a fifth field watershed. The 5 percent will be tracked separately for fish and non-fish streams. ODF will track the actual horizontal lineal feet of riparian area managed using the Minimum Option in any fifth field watershed as described below. By using a rolling average, it is intended that harvests occurring more than 5 years prior will not be used to calculate whether the cap has been reached, but instead harvests of that age will roll off the cap calculation.

Implications of Cap Being Reached

Should the 5 percent threshold for the SFO Minimum Option in a fifth field watershed be reached, two options will exist for SFOs.

- SFOs that want to utilize the Minimum Option may elect to be placed on a waiting list to use the Minimum Option in that fifth field watershed when the rolling 5-year threshold has fallen below 5 percent. This list will be maintained and updated by ODF on a first-come, first-served basis. SFOs will be notified by ODF when the opportunity to use the Minimum Option becomes available. SFOs on the list will have priority to use the Minimum Option before other SFOs, but once an SFO on the list is notified of the availability to use the option, they must elect to harvest or otherwise let other SFOs use the option.

- SFOs can choose the FCTC Option and receive a tax credit for 125 percent of the value that the SFO would have otherwise received using the FCTC Option.

4.4.5.6 Forest Road Conservation Measures

SFOs will comply with the OFPA for forest roads that are required to be established under Section 4.4.3, *Conservation Measure 3: Roads,* with the following exceptions.

- The FRIA program identified in Section 4.4.3 will not apply to SFOs. Instead, SFOs will fill out an RCA specific for SFOs, approved by ODF (see Section 4.4.5, *Conservation Measure 5: Small Forestland Owners*).
- FRIA timelines for replacing or maintaining road infrastructure to the standards established in Section 4.4.3 will not apply to SFOs. However, SFOs will ensure that their roads are maintained to the standards of the OFPA that are required to be established by this HCP for any roads used for harvests. Culverts will be replaced consistent with Oregon law.
- All new construction related to roads on forestland owned by SFOs must satisfy the same standards of the OFPA for forest roads as required to be established under Section 4.4.3.

Road Condition Assessments

The FRIA program described in Section 4.4.3, *Conservation Measure 3: Roads,* does not apply to SFOs (OAR 629-625-0920(2)). In lieu of FRIA, an SFO will fill out an RCA worksheet when they submit a notification to ODF for a timber harvest that will result in the SFO using a road to support harvest activities. The RCA worksheet will be a form that is developed and approved by ODF with stakeholder input. Notifications for activities other than timber harvest will not require an RCA.

The RCA will include all roads in the SFO's parcel where the harvest will take place and the condition of each road with specific regard to the following (OAR 629-625-0920(4)).

- Whether the road condition contributes to active or potential delivery of sediment to waters of the state.
- The status of water crossings.
- Potential fish passage barriers on Type F or Type SSBT streams.
- Abandoned roads.
- Roads with perched fill that present a significant hazard to fish-bearing streams.

An RCA will also denote potential passage barriers on fish-bearing streams, abandoned roads, and roads with a perched fill that present a significant hazard to fish-bearing streams. ODF, in consultation with ODFW, will review RCAs for eligibility for state funding grants that could be used to mitigate these conditions. ODF will assist SFOs in completing RCAs, when needed.

Road Condition Improvements

If a road on land owned by an SFO is used to haul timber, the SFO will ensure that the road is maintained to the standards of the OFPA All new road construction must satisfy the same standards that apply to all landowners under the OFPA that are required to be established under Section 4.4.3, *Conservation Measure 3: Roads*. Culverts will be replaced consistent with Oregon law. The SFO is not

required to undertake the following three types of road improvements to be funded by the state (OAR 629-625-0920(6)).

- Replacing fish stream culverts.
- Repairing abandoned roads.
- Reconstructing, vacating, or relocating roads with a perched fill that present a significant hazard to fish-bearing streams.

These road improvements, when not otherwise required by state law, will be 100 percent funded by the state and will be coordinated through the new SFISH program.

The timing of the above three types of projects will be dependent on the state's ability to fund and prioritize them.

If the state fails to fund eligible and approved projects on an SFO's road under the SFISH program (described in more detail in the following section), the non-implementation of those projects will not preclude the SFO from using the road for any purpose unless:

- The road is actively delivering sediment to waters of the state; or
- The road has one or more culverts with an imminent risk of failure, as defined in Section 4.4.3. *Conservation Measure 3: Roads*.

If an RCA identifies necessary road repairs, there will be no time limit in which the SFO must complete those repairs, though the obligation to improve roads when used for harvest remains.

Small Forestland Investment in Stream Habitat Program

The SFISH program will be managed by ODF's SFO Assistance Office in consultation with ODFW. State funding will be made available to qualified SFOs for the following.

1. Replace culverts on fish-bearing streams (Type F and Type SSBT) that are no longer functioning or still functioning but not designed consistent with the OFPA.
2. Repair abandoned roads.
3. Reconstruct, vacate, or relocate roads with a perched fill that present a significant hazard to fish-bearing streams.

SFISH projects will be 100 percent funded by the state at the rate of $10 million per year. If state funding is not available, SFOs will have no obligation to make such repairs on their forestland until funding is available, unless otherwise required by the OFPA. No more than 10 percent of available SFISH funds may be used for perched fill remediation projects in any year.

An outreach program will be developed by ODF and partner organizations, including the Partnership for Forestry Education to inform SFOs about the SFISH program and to encourage SFOs to voluntarily complete RCAs.

If an SFO submits an RCA, they will be eligible for participation in the SFISH program.

The SFO Assistance Office, in consultation with ODFW, will track projects identified in RCAs related to potential fish passage barriers on fish-bearing streams (Type F and Type SSBT), abandoned roads, and perched fill that present a significant hazard to fish-bearing streams that may qualify for state funding.

To optimize state funding that results in the greatest environmental benefits for covered species and mitigates risks to natural resources, the SFO Assistance Office, in coordination with ODFW, will prioritize funding culvert replacements on fish streams, repair of abandoned roads, and perched fill that present a significant hazard to fish-bearing streams under the SFISH program that are on high conservation value sites. Coordination and data sharing with other state agencies may be necessary to determine project prioritization. SFOs may also work with other partners to coordinate and plan projects funded by SFISH. For purposes of the SFISH program, a site will be designated a high conservation site if, upon evaluation under the SFISH program, the site is identified as one or more of the following.

1. An area of known chronic sedimentation.
2. A fish passage barrier.
3. An ongoing stream diversion at stream crossings or an area with high stream diversion potential.
4. An area of known hydrologic connectivity.
5. A road with a perched fill that presents a significant hazard to fish-bearing streams.

The SFISH program will prioritize a project at a high conservation value site for funding if the project will result in one or more of the following.

1. Remove fish passage barriers consistent with ODFW requirements under ORS 509.585 as implemented through the OFPA.
2. Minimize the potential for sediment delivery to waters of the state.
3. Minimize stream diversions at water crossings.
4. Minimize hydrologic connectivity between roads and waters of the state.
5. Remove perched fill that presents a significant hazard to fish-bearing streams through reconstruction, relocation, or vacating.

When a grant application has been submitted by an SFO and the Assistance Office has identified that project as a priority, the SFO will collaborate with the Assistance Office and other technical service providers to determine the project specifications, timing of the project, hiring of contractors, other project issues, and oversight of the project. The SFO and the Assistance Office may mutually agree on the best and most efficient way to complete the project, under the direction of the Assistance Office. The SFO's involvement in completing the project can vary depending upon the mutual agreement. The actual timing of the project will be determined by contractor availability and other factors. An extension of time may be needed due to factors outside the control of the SFO or ODF.

All completed SFISH projects will be annually reported by ODF with cost and miles of streams improved. Funding for SFISH will not interfere with similar programs at the Oregon Watershed Enhancement Board (OWEB), but OWEB participants, such as Watershed Councils and others, may partner with SFOs to coordinate projects funded by SFISH.

4.4.5.7 SFO Assistance Office

An SFO Assistance Office has been established by statute and will be housed within ODF. A primary focus of the Assistance Office will be to implement the financial incentives and technical assistance programs that support the HCP and to ensure SFOs are compliant with the OFPA. ODF already

supports several programs for owners of small forestlands including the Partnership for Forestry Education, forest management planning, partnership development and program funding, outreach and education through stewardship foresters, and the Committee for Family Forestlands. Existing programs will be housed within the new Assistance Office and will be leveraged to support programs associated with the HCP. The Assistance Office will be responsible for building and maintaining a database of SFOs, their ownerships, roads, streams, and other information as determined to be necessary to support compliance with the HCP.

4.4.5.8 Effectiveness Monitoring

Effectiveness monitoring is more fully described in Chapter 6, *Monitoring and Adaptive Management*. However, in regard to SFOs, access to land for the purpose of conducting studies and monitoring will allow access if implementing SFO-specific provisions (OAR 629-607-0200(4)). If the AMPC or the IRST demonstrate that access to land has been insufficient to achieve the monitoring goals described in Chapter 6 to determine the effectiveness of the conservation measures described for SFOs, BOF will consider rulemaking to address any research and monitoring problems arising from lack of access to land (OAR 629-0603-0100(3)). ODF will work with the Services to develop metrics to be tracked annually to demonstrate effectiveness of the conservation measures specific to SFOs. SFOs that use the Minimum Option or FCTC Option, or receive grants for stream crossing or road work, may be required to allow access to land for effectiveness monitoring, specifically tailored to riparian management or the grants received, as outlined by the AMPC.

4.4.5.9 Highly Disproportionate Impacts

In some rare circumstances, a small forestland ownership may become highly encumbered by Forest Practice Administrative Rules. This high encumbrance is most likely to be true in ownerships with a dense concentration of streams when the encumbrances affect an owner of modest means who is highly dependent on revenue from encumbered locations. For these cases, ODF will work to develop a process prior to July 1, 2023, to address the significantly disproportionate impacts on SFOs of modest means who are highly dependent on revenue from locations with highly dense concentrations of streams by the Forest Practice Administrative Rules.

4.4.5.10 Relation to Biological Goals and Objectives

Section under development.

4.4.6 Conservation Measure 6: Mitigation and Restoration Funding

The purpose of Conservation Measure 6 is to promote and fund implementation of mitigation projects that minimize, reduce over time, provide restorative actions, and compensate for the effects on natural resources from the covered activities. Moreover, the components of this measure provide a funding mechanism for mitigation and restoration projects to mitigate and offset the effects of the covered activities on covered species.

Mitigation will include both Permittee implementation and in-lieu fee mitigation. Under Permittee implementation of mitigation measures, the Permittee, ODF, is responsible for successfully completing the required compensatory mitigation to offset the incidental take (*Habitat Conservation Planning and Incidental Take Permit Processing Handbook* [HCP Handbook], USFWS

2016:9-19). Permittee implementation may include wood augmentation, riparian restoration, road improvements/culvert replacement, and other practices described in more detail below.

As part of the HCP conservation strategy private landowners are not required to complete mitigation projects on their land to offset effects from covered activities; however, they may, but those offsets are not analyzed as part of this HCP. This HCP does account for projects that are funded via the in-lieu fee mitigation application process. Under in-lieu fee mitigation, the Permittee does not complete project-specific mitigation. Rather, the Permittee directs funds to an in-lieu fee mitigation sponsor that channels funding to one or more project. The Permittee supervises the in-lieu fee mitigation project(s) managed by the mitigation sponsor and remains responsible for its mitigation obligations (USFWS 2016:9-22).

For the purposes of the HCP, in-lieu fee mitigation may include all mitigation practices supported by money deposited in the Private Forest Accord Mitigation Subaccount (PFAMS) of the Oregon Conservation and Recreation Fund (OCRF). The OCRF was established by the Oregon Legislature in 2019 and is administered by ODFW. The funds appropriated to ODFW via the OCRF are used to fund activities that protect, maintain, or enhance fish and wildlife resources throughout the state of Oregon. Via sections 28 through 30 of Enrolled State Bill 1501 (SB1501), the Oregon Legislature mandated that a subaccount, the PFAMS, be created in the OCRF to receive and disburse funds for the purposes of PFA mitigation commitments.

The Private Forest Accord Mitigation Advisory Committee (MAC) was also established in SB1501 to make recommendations to the ODFW Commission regarding allocation of PFAMS funds. The purpose of the MAC is to ensure that funds are invested in projects that will generate the greatest degree of mitigation for incidental take that may occur because of covered activities. The MAC will develop criteria for grant applications and awards and will prioritize awards to projects providing the greatest ecological benefits to covered species and that address specific limiting factors (see Appendix X, *Species Accounts,* for discussions around species-limiting factors). Grant funding criteria and applications will be made public. The MAC will be made up of seven voting members appointed by the Governor: three from nongovernmental organizations that promote conservation of freshwater aquatic habitat, three from the timber industry, and one from the Oregon Conservation and Recreation Advisory Committee. The MAC may also include ex officio member representatives from NMFS, USFWS, ODF, OWEB, and ODFW. Refer to Appendix XX, *Title* (SB1501) for more details regarding MAC membership terms, officers, meetings, voting, and duties.

Tracking and reporting of mitigation implementation for both in-lieu fee and Permittee implementation will include details about mitigation and restoration funding in the annual HCP implementation report submitted to the Services. In addition, SB1501 requires ODF and the MAC to submit biennial reports to the Legislative Assembly regarding the expenditure of monies deposited in the PFAMS and the status of the funded projects and activities.

The PFAMS will be used to fund outreach to landowners that own or operate artificial fish passage obstructions (defined in ORS 509.580) as well as the Private Forest Accord Grant Program (PFAGP). Mitigation funding via the PFAGP will be available both to the public and government agencies and will be allocated by the MAC using a competitive grant process described in SB1501 section 28-29 (Appendix XX, *Title*). The PFAGP will provide funding for projects that mitigate effects of forest practices by performing the following (section 32 of SB1501).

- Removing or replacing structures preventing or limiting passage of aquatic species.

- Promoting natural stream functions by placing logs or other wood-based materials within the stream or river channel where wood is currently lacking.
- Conserving, recruiting, or reintroducing beavers to restore aquatic landscapes.
- Developing or sustaining healthy riparian corridors or wet meadow complexes to restore and sustain ecosystem functions including, but not limited to, shade, filtration of fine sediments and nutrients, reduction of burn intensity during fires, etc.
- Applying restoration treatments to densely stocked, single species stands of trees to hasten the return of riparian function after tree harvesting and enhance historic species diversity that benefits riparian function.
- Supporting establishment of conservation easements on land other than forestland to protect critical watershed functions and riparian areas.
- Supporting acquisition of an existing water right for conversion to an instream water right, as described in ORS 537.348, to improve flow conditions.
- Installing fencing or otherwise excluding grazing in riparian areas or around seeps or springs.
- Installing off-stream stock water systems or hardened watering gaps to reduce the effects of grazing on aquatic ecosystems.
- Undertaking other measures that effectively conserve or restore habitat for the covered species.

The aforementioned projects can be further classified under the following mitigation measure categories described in the HCP Handbook.

- Restoration of degraded habitat to natural condition/function, or to a condition more likely to be resilient to projected changes.
- Land preservation.
- Enhancement of habitat.
- Creation of new habitat or new populations.
- Threat reduction or elimination.
- Translocation of affected individuals or family groups to establish new or augment existing populations.
- Repatriation of species to formerly occupied and still suitable or enhanced habitats.

The PFAGP will prioritize funding for projects that restore or enhance habitat, preserve land, and reduce or eliminate threats to covered species or their habitats. For the purposes of this HCP restoration is defined as returning habitat to its natural or historic state. Enhancement, conversely, involves manipulation of the physical, chemical, or biological characteristics of a resource with the goal of increasing or improving specific habitat functions. Restoration or enhancement projects to be funded may include, but are not limited to aquatic organism passage, wood augmentation, beaver conservation and reintroduction, wildfire resiliency, restoration treatments in RMAs, and riparian thinning.

Land preservation is a mechanism for preventing the effects of development threats to covered species and their habitats on a particular property or properties. Mitigation funds may be directed to the creation of conservation easements within and outside of the permit area to mitigate effects

from covered activities. Riparian Conservation Easements are one type of land preservation that could be funded as part of the mitigation effort. Easements or similar mitigation projects outside of the permit area will not be able to take advantage of the ESA protections provided by this HCP but may be counted towards mitigation efforts funded as part of the HCP.

Finally, mitigation funding may be used for projects that will improve instream flow conditions such as water temperature and water availability. Projects may include acquisition and transfer of instream water rights, creating cattle grazing exclusion zones along riparian areas, or installation of off-stream stock water systems or hardened watering gaps. These types of projects may improve instream flow conditions where lack of flow is currently, or is projected to be, a limiting factor in the future or where grazing has degraded riparian conditions leading to unstable banks, increased sediment input, geomorphic changes, and channelization.

Chapter 5
Effects Analysis and Level of Take

5.1 Introduction

This chapter presents the analysis of effects of the covered activities on covered species and their habitats within the permit area. The effects analysis describes sources and types of take[1]; estimates the amount of projected take; describes the impacts of the projected take, and the beneficial and net effects of the conservation measures; and discusses the effects of the covered activities on designated critical habitats. The effects analysis is intended to accurately describe take expected from the covered activities; however, take may only occur from a subset of actions. This chapter also includes a description of the expected cumulative effects—as defined under Section 7 of the federal Endangered Species Act (ESA)—of non-federal projects other than this Oregon Private Forest Accord Habitat Conservation Plan (HCP) in or near the permit area, on covered species and their critical habitat.

This effects analysis includes information necessary for the U.S. Fish and Wildlife (USFWS) and National Marine Fisheries Service (NMFS) (collectively, the Services) to make their findings for issuance of their permits. Sections of the ESA relevant to this effects analysis are as follows: (1) Section 10(a)(2)(A)(i) requires that an HCP specify the impacts on covered species that will likely result from the taking; and (2) Section 10(a)(2)(B)(ii) and (iv) state that the Services may only issue an incidental take permit (ITP) if, among other requirements, the applicant will minimize and mitigate the impact of the taking 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.

The Services will consult independently to comply with Section 7 of the ESA prior to issuance of permits. As a component of this internal consultation, the Services will prepare a written biological opinion describing how each 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) (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016) recommends that an HCP include the information necessary for the Services to complete the internal consultation process under Section 7 of the ESA, including a defined action area and associated effects.

This chapter first defines important terms that will be used throughout the analysis. It then explains the effects mechanisms expected from the covered activities and the methods used in the analysis. This is followed by a description of the effects on covered species and finally the effects on designated critical habitat.

[1] *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is defined as "[a]n act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering." (50 Code of Federal Regulations 222.102)

5.2 Definitions

The terms below are defined for the purposes of the HCP.

Effects are the direct and indirect consequences of a covered activity on the covered species or their habitats in the HCP plan area. Effects can be adverse or beneficial, occurring at the time and place of a covered activity (direct effects), or later and/or beyond the footprint of a covered activity (indirect effects). Effects can also be cumulative. Net effects are the combination of adverse and beneficial effects. As used in this document, effects are synonymous with impacts.

Cumulative effects are defined under Section 7 of the ESA as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 Code of Federal Regulations [CFR] 402.02). HCPs do not require a discussion of cumulative effects. However, cumulative effects on the covered species need to be addressed as part of the Services' intra-agency consultation under ESA Section 7.

Stressors are any agent capable of causing an adverse or beneficial change to a resource upon which an organism depends (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016).

5.3 Approach

Effects are considered in the analysis if they would not occur but for the proposed action, meaning the implementation of activities described in Chapter 3, *Covered Activities,* and if they are reasonably certain to occur. Similarly, the effects analysis assumes that all proposed conservation measures described in Chapter 4, *Conservation Strategy,* will be implemented as described.

5.3.1 Sources and Types of Effects

This analysis focuses on effects that may modify or alter habitat conditions, or directly injure or kill covered species. Effects can be either adverse or beneficial. As described in the HCP Handbook, effects are identified following an "effects pathway" model framework whereby project activities are subdivided into their individual components and effect mechanisms are identified. This approach predicts causation and estimates likelihood of occurrence and magnitude of effects on listed species, their habitats, and the resources on which they rely. Behavioral and physical responses of individuals from covered activities are considered as well as any associated biological effects resulting from impacted habitats. Finally, this approach examines how effects on individuals and habitat features may translate into population-level effects on abundance and distributions across each covered fish species' evolutionarily significant unit (ESU) or distinct population segment (DPS), or on covered amphibian populations. More information is known for certain fish ESUs or DPSs because they are monitored more intensively than others, which may allow for a more detailed discussion of effects of covered activities at the ESU level.

Effects considered in the analysis are reasonably likely to occur, including the projected level of take, over the permit term. The effects analysis considers implementation of the conservation strategy as part of the beneficial and net effects evaluation conducted for each covered species.

The effects analysis for covered fish and amphibian species relies on applying the best available science and information regarding known effects of the covered activities, distribution and extent of

covered species and their habitats, and their natural histories, known behaviors, and habitat requirements (Chapter 2, *Environmental Setting,* and Appendix X, *Species Accounts*. Given the wide geographic area and the 50-year fish/25-year amphibian permit term the effects analysis is programmatic in nature. The analysis describes the effect mechanisms and expected responses of the species and/or habitat. Moreover, direct take of individuals is not possible to calculate in most cases when considering effects of the covered activities on the covered species. Thus, this HCP will primarily rely on surrogates or proxies, generally in the form of habitat features, to describe the impact of the covered activities on individuals and populations of covered fish and amphibian species.

Effects can be considered adverse, beneficial, insignificant, or discountable. Adverse effects are those that reduce the number, range, reproductive success, or survival of the covered species. Similarly, adverse effects on habitat are those that reduce the ability of the habitat to sustain the species by degrading the quality of habitat, reducing habitat quantity, or impairing habitat function. Beneficial effects have a positive impact on the species and/or their habitat; however, some actions deemed beneficial may have short-term adverse effects on species and their habitats. For example, replacing an impassable culvert can result in take when relocating fish from the construction site or sedimentation. Following construction, the new culvert will allow previously inaccessible habitat to be utilized by covered species resulting in a long-term benefit that outweighs the short-term construction effects. Insignificant effects relate to the size of the impact and are undetectable, immeasurable, or cannot be evaluated due to their limited size or extent. Discountable effects are those extremely unlikely to occur (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998).

5.3.2 Methods and Metrics for Calculating Take

To be drafted during Phase 2 based on working groups with the Steering Committee

5.3.2.1 Estimating Take of Covered Fish Species

Take of covered fish species is estimated by examining areas affected by the covered activities within the permit area that overlaps the ESU or DPS of the covered fish species. Effects are described and grouped by temporary or permanent indirect or direct effects.

5.3.2.2 Estimating Take of Covered Amphibian Species

Similar to the approach for covered fish species, impact assessment of the covered activities and ultimately the estimation of take for the covered amphibians will rely on a habitat surrogacy approach.

5.3.3 Evaluating the Impacts of Take

The impacts of take for each covered species is based on guidance provided in the HCP Handbook. Per the HCP Handbook, determining impacts of the covered activities requires identifying and defining the context and intensity of take. Context is the setting in which the impacts of the take analysis occur as well as the location within or proximity to listed species. Context also includes the likelihood or probability of the take occurring, based on the best available information pertaining to the species, the action, and the effect of the action on those species. Evaluation of the impact of take on covered species also requires an understanding of the intensity of the actions on the species.

Intensity is defined here as the percentage of the ESU/DPS or species range affected as well as degree or magnitude of the effect (degraded or improved) on habitat.

5.3.4 Evaluating Beneficial and Net Effects

Chapter 4, *Conservation Strategy,* describes the actions to be implemented to minimize and offset the impacts of take caused by the covered activities. Minimization measures included as part of the covered activities, conservation strategy, and Oregon Forest Protection Act (OFPA) rules are accounted for in the effects analysis. Mitigation included in the conservation strategy is not considered in the effects analysis because the take occurs regardless of the additional mitigation efforts.

5.3.5 Evaluating Effects on Critical Habitat

The *Effects on Critical Habitat* section for each species provides an analysis of the impacts on critical habitat, if it has been formally designated by the Services 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 and passage to and from those sites in stream reaches within designated critical habitat.

5.3.6 Evaluating Cumulative Effects of the HCP

Cumulative effects are those non-federal actions that are reasonably certain to occur within the permit area, during the permit term, and could affect the covered species. Cumulative impacts/effects are limited to known or reasonably foreseeable future actions (e.g., state, private, county, municipal) 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 on non-federal lands are not considered when evaluating cumulative effects.

5.4 Description of Effects

To be drafted during Phase 2 based on working groups with the Steering Committee

5.5 Effects Analysis for Covered Salmon Evolutionary Significant Units

Insert text

5.5.1 Impact Mechanisms and Covered Activities

Insert text

5.5.2 Effects on Species

Insert text

5.5.3 Effects on Critical Habitat

Insert text

5.5.4 Cumulative Effects on Species

Insert text

5.6 Effects Analysis for Covered Steelhead Distinct Population Segments

5.6.1 Impact Mechanisms and Covered Activities

Insert text

5.6.2 Effects on Species

Insert text

5.6.3 Effects on Critical Habitat

Insert text

5.6.4 Cumulative Effects on Species

Insert text

5.7 Effects Analysis for Covered Bull Trout Recovery Units

5.7.1 Impact Mechanisms and Covered Activities

Insert text

5.7.2 Effects on Species

Insert text

5.7.3 Effects on Critical Habitat

Insert text

5.7.4 Cumulative Effects on Species

Insert text

5.8 Effects Analysis for Whitefish

5.8.1 Impact Mechanisms and Covered Activities

Insert text

5.8.2 Effects on Species

Insert text

5.8.3 Effects on Critical Habitat

Insert text

5.8.4 Cumulative Effects on Species

Insert text

5.9 Effects Analysis for Eulachon

Insert text

5.9.1 Impact Mechanisms and Covered Activities

Insert text

5.9.2 Effects on Species

Insert text

5.9.3 Effects on Critical Habitat

Insert text

5.9.4 Cumulative Effects on Species

Insert text

5.10 Effects Analysis for Southern and North Distinct Population Segment Green Sturgeon

5.10.1 Impact Mechanisms and Covered Activities

Insert text

5.10.2 Effects on Species

Insert text

5.10.3 Effects on Critical Habitat

Insert text

5.10.4 Cumulative Effects on Species

Insert text

5.11 Effects Analysis for Amphibians

5.11.1 Impact Mechanisms and Covered Activities

Insert text

5.11.2 Effects on Species

Insert text

5.11.3 Effects on Critical Habitat

Insert text

5.11.4 Cumulative Effects on Species

Insert text

This page intentionally left blank.

Chapter 6
Monitoring and Adaptive Management

6.1 Compliance Monitoring and Adaptive Management Programs

This chapter describes the compliance monitoring and adaptive management frameworks for the Oregon Private Forests Accord Habitat Conservation Plan (HCP). The frameworks include guidelines and recommendations that will help the Oregon Department of Forestry (ODF) develop a detailed program during the initial years of implementation. The purpose of these two frameworks is to inform the development of the following:

- A Compliance Monitoring Program (CMP) designed to measure compliance with the Oregon Forest Practices Act (OFPA) administrative rules and the HCP.
- An Adaptive Management Program (AMP) designed to assess the effectiveness of conservation measures in the HCP through research and validation.

There are three distinct components of monitoring within these two frameworks that will underpin this HCP. The first is a robust inspection and enforcement program that ensures the rules are being implemented, including a system of fines and other disciplinary actions. While this enforcement is an important tool to promote compliance with the HCP and OFPA rules, it is discussed within Chapter 8, *Plan Implementation*, as it is not part of the CMP, which seeks to estimate compliance rates on private forestlands. The CMP is the second monitoring component, and it will be based on statistically valid surveys across the permit area. This is distinct in practice from enforcement, with the goal of continuous improvement through a variety of mechanisms, including, but not limited to, rule clarification, training, and guidance. The third component is the AMP, which establishes a process for conducting both effectiveness monitoring and research inquiry and validation monitoring.

The goal of this chapter is to provide sufficient guidance to ensure that the frameworks designed during implementation will meet Endangered Species Act (ESA) requirements and the State of Oregon's regulatory standards as discussed in Section 6.1.2, *Regulatory Context.* The CMP and AMP program frameworks originate from the agreements within the 2022 Private Forest Accord Report (PFA Report) as codified in Senate Bill (SB) 1501, and the resultant revised OFPA rules.

The compliance monitoring framework provided in this chapter will be implemented by ODF and the results reported out annually and within 8-year cumulative reporting cycles.

The AMP will be implemented by the Board of Forestry (BOF), the Adaptive Management Program Committee (AMPC), and the Independent Research and Science Team (IRST), described in detail below, to ensure that the latest accepted techniques and technologies are used, and that monitoring provides information necessary to determine whether the HCP is being effective at meeting the biological goals and objectives through time.

6.1.1 Overview of Adaptive Management Strategy for the HCP

This section describes how ODF will use adaptive management to both gather and respond to new information. As per the PFA Report, the intent of the AMP is to determine when change is needed to rules, guidance, and training programs to achieve the resource goals and objectives identified in the HCP. In contrast, Chapter 7, *Assurances*, describes how ODF will respond to changed and unforeseen circumstances.

As defined by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), hereafter the Services, *adaptive management* is a decision-making process used to assess the effectiveness of 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 PFA Report notes that careful monitoring of outcomes from management actions requires scientific evaluation that will both advance scientific understanding and help adjust policies or operations as part of an iterative learning process.

SB 1501 and the PFA Report outline the purpose and desired outcomes for the AMP of this HCP.

- Ensure timely and effective change as needed to meet resource objectives.
- Increase the predictability and stability of the process of changing regulations so that landowners, regulators, and interested members of the public can understand and anticipate change.
- Apply the best available science to decision-making.
- Effectively meet biological goals and objectives with less operationally expensive prescriptions when feasible.

6.1.2 Regulatory Context

6.1.2.1 Federal Regulations

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) (U.S. Fish and Wildlife Service and National Marine Fisheries Service 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 objectives. As mentioned above, research and validation are a major element of ODF's AMP.

6.1.2.2 State of Oregon Regulations

The development of an AMP and CMP for this HCP is consistent with the intent of the PFA Report as enacted into law by SB 1501 and 1502, House Bill 4055, the Oregon Administrative Rules (OAR) 629-603-0000 through 629-603-0600, known as the Adaptive Management Rules, and OAR 629-678-0000 through 629-678-0200, known as the Compliance Monitoring Rules.

As stated in the Adaptive Management rules: "It is the policy of the State of Oregon that regulation of forest practices for the protection of aquatic species shall, in addition to other statutory requirements, be subject to a process of adaptive management, whereby forest practice rules are: (a) monitored for effectiveness relative to the biological goals and objectives; and (b) modified if necessary to achieve the biological goals and objectives" (OAR 629-603-0000(3)_). These rules are also intended to implement the agreements made in the PFA Report (SB 1501: 34(2)).

6.1.3 Types of Monitoring

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). ODF will conduct compliance monitoring to ensure adherence to HCP implementation and management standards defined in the OFPA rules, and effectiveness monitoring and research through the AMP to determine if conservation measures are having the intended effect on habitat conditions for covered species in the permit area. Habitat metrics will be used to determine if ODF rules are meeting the biological goals and objectives of the HCP. Monitoring will focus primarily on habitat condition over time. A description of these monitoring types is provided below. Reporting requirements are described in Chapter 8, Section 8.4, *Data Tracking and Reporting.*

6.1.3.1 Compliance Monitoring

Compliance monitoring (also known as implementation monitoring) tracks the status of HCP implementation and documents that the requirements of the HCP and OFPA rules are being met. Compliance monitoring verifies that ODF is carrying out the terms of the HCP and incidental take permits. Compliance monitoring may be conducted by ODF staff, through department contractors, or a combination of both throughout the permit area. ODF will track compliance internally, through the CMP framework, to ensure operators are abiding by the applicable OFPA rules and will provide these and other compliance results to the Services, who will verify the HCP remains in compliance.

As defined by Chapter 8 of the PFA Report, the OFPA rule division 678, and this HCP, compliance monitoring provides feedback to ODF, the Services, and stakeholders to aid in targeting specific areas for guidance, training, clarification, and/or enforcement. The CMP should provide an objective and statistically sound assessment of rule compliance with sufficient precision to be representative of forest practice activities. The CMP does not report on the effectiveness of the OFPA rules. A successful CMP provides foundational information necessary to improve training protocols, enhance public trust in forest practices implementation, and ensure forest operators are following the OFPA rules.

Further details related to compliance monitoring are described in Section 6.2, *Compliance Monitoring Program Objectives*.

6.1.3.2 Effectiveness Monitoring

Effectiveness monitoring assesses the biological success of the HCP and evaluates whether the effects of implementing the conservation strategy described in Chapter 4 are consistent with the assumptions and predictions made during its development (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016).

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 habitats 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. The ultimate measure of success for the HCP is achievement of the HCP's biological goals and objectives. Therefore, effectiveness monitoring should be designed to address each objective and allow ODF to determine whether progress is being made towards achieving those objectives.

Further details related to effectiveness monitoring in an adaptive management framework are described in Section 6.3, *Effectiveness Monitoring and the Adaptive Management Program Objectives*.

6.1.4 Reporting

The CMP will report the following information in annual, biennial, and 8-year cumulative reports (OAR 629-678-0200).

- Information to support any required reporting to the Services in support of the HCP.
- Information to support an annual report to the public on the overall HCP performance.
- A statistically sound report to the BOF every 2 years that summarizes the results of completed compliance audits and provide a progress reports of ongoing compliance monitoring efforts as described in OAR 629-678-0100(6)(a) through (d).
- An aggregate cumulative report every 8 years that includes compliance trends since beginning the CMP.
- Other information, as directed by the BOF.

The AMP will report the following information.

- Monitoring results and associated lessons learned will be compiled and documented in annual reports.
- Reports from the IRST will be submitted to the BOF and the AMPC for consideration, and then the AMPC will recommend to the BOF alternative options for possible rule changes from the AMPC. Summary Reports[1] contain the elements listed in Section (6)(g)(A–C) of OAR 629-603-0200, which requires evaluation of the following.
    - **Effectiveness**: In studies examining alternative prescriptions, the likely effectiveness of each prescription will be reported.

[1] Summary Reports may be provided by the IRST or by an AMPC-approved, third-party servicer contracted through an open, competitive process for research projects in the AMPC-approved research agenda per OAR 629-603-0100(7).

- **Causal links**: An assessment of how the results of relevant new research findings developed by the IRST or through outside research clarify or support causal links between forest practices and aquatic resources, and implications regarding how well forest practices rules or rule sets are likely to address these linkages.
- **Magnitude of impact**: An assessment of the magnitude of impact on covered species or biological goals and objectives on a sliding scale (e.g., Very High, High, Modest, Low, Very Low).
- **Timescale of effects** observed, and the immediacy of likely changes in the environment.
- **Scope of inference**: Refers to the population the study was trying to describe from their sample design. This could be an area, ecoregion, or landscape-level population for which study results can be assumed to apply with acceptable levels of statistical confidence.
- **Scientific uncertainty versus confidence**: An assessment of the scientific uncertainty and statistical confidence in the results.

- A performance audit report will be submitted every 6 years that evaluates the programs progress and performance.
- Other information, as directed by the BOF, will be presented.
- Both the AMPC and the IRST may each prepare a report to the BOF describing instances where access to land has been insufficient to achieve research purposes.

6.2 Compliance Monitoring Program Goals

A CMP is fundamental to understanding whether forest practice rules identified in the HCP are correctly implemented. As described in OAR 629-678-0000, the purpose of the CMP is as follows.

1. To monitor forest practices rule implementation and analyze compliance rates.
2. To assess the OFPA and rule compliance and report findings to the BOF, Oregon legislature, and Services under the terms of an approved HCP.
3. To provide information that will allow for improvement in compliance of the forest practice rules through training, guidance, clarification, and targeted enforcement and to increase the public's trust in the implementation of the OFPA rules.

6.2.1 Process for Compliance Monitoring Program

The CMP will assess OFPA rule compliance, and report appropriate findings to the BOF, Oregon legislature, and Services under the terms of this HCP.

In order to develop a CMP aligned with the goals described above, the following CMP process intent was established in the PFA Report. ODF has discretion to identify additional rule groups for review according to this process.

- Be informed by the recommendations of the *Oregon Forest Practices Act Implementation Study: History, Issues, and Potential Solutions* final report prepared by Mount Hood Environmental and submitted to the BOF on June 15, 2021, and similar reviews of other CMPs in nearby states (e.g., Washington and Idaho).

- Explicitly define sampling elements.
- Analyze compliance rates at the appropriate temporal and spatial scale to reduce autocorrelation, variance, and systematic bias that has impacted monitoring programs across the Pacific Northwest.
- Continue to pursue ODF's Key Performance Metrics, however defined, with an initial target of 95 percent compliance at the 8-year roll-up report. The BOF can direct the CMP to conduct analyses at the rule and unit level as appropriate to determine levels of compliance.
- Utilize remote sensing or modifications to the department reporting and notification system to identify completed activities.
- Accommodate ODF or contractor access to land for purposes of assessing compliance with OFPA rules.
- When identified, examine areas of noncompliance to determine if they represent a specific set of circumstances or if they are a systemic response that might warrant new training, guidance, rule clarification, or other appropriate action.
- Produce a roll-up report every 8 years that includes compliance trends since the beginning of the CMP.

6.2.2 Compliance Monitoring of Covered Activities

Administrative reporting is associated with all forestry activities. The OFPA requires forest landowners and operators to notify ODF at least 15 days before they begin forest operations on any non-federal, non-tribal forestland in Oregon using ODF's reporting and notification system in the form of a Notification of Operation. The Notification of Operation is not a permit application, and ODF does not issue a permit following review of the planned operations. A local ODF Stewardship Forester reviews the Notification of Operation for resource protection concerns and to assess if a Statutory Written Plan is justified based on resource concerns. If needed, Statutory Written Plans are reviewed (not approved) following a required 14-day public comment period. Subscribers to geographic areas or activity types can review the plans and comment during the 14-day public comment period. ODF then has 7 days to comment on the plan. If a Statutory Written Plan is determined to be required and the operator does not provide one, this could result in an enforcement action.

The Stewardship Foresters may conduct OFPA compliance inspections before, during, and after selected forest operations to provide recommendations to ensure that they are compliant with the OFPA rules, which form the basis for the covered activities and conservation measures of the HCP.

The list of items in the following section is a sample of types of information that will be tracked for each type of covered activity. During implementation, additional items may need to be tracked in order to report more accurately on compliance. This list is meant to be an example of the types of information that will need to be monitored and included in annual and cumulative reports.

6.2.2.1 Compliance Monitoring Rule Group Priorities

The CMP will prioritize monitoring OFPA rules related to biological and aquatic resources, including the following rule groups.

- Riparian area rules (OAR rule divisions 643 and 655, *Water Protection Rules*).

- Timber harvesting on steep slope rules (OAR rule division 630, *Harvesting*).
- Road rules (OAR rule division 625, *Forest Road Construction and Maintenance*).

The CMP may monitor additional rules as directed by the BOF and through the process detailed in Section 6.2.1, *Process for Compliance Monitoring Program*.

6.2.2.2 Other Plan Implementation Activities

Plan implementation activities will be tracked in the annual and 8-year roll-up reports. Items to be reported may include the following.

- Confirmation that beaver management, if needed, was implemented consistent with Conservation Measure 4: *Beaver Conservation*, through review of take reports or relocation program reports made to the Oregon Department of Fish and Wildlife (ODFW) by any person that takes a beaver on privately owned forestland.
- Confirmation that small forestland owner operations were implemented consistent with Conservation Measure 5: *Small Forestland Owners*.
- Location and type of restoration projects undertaken in consultation with ODFW as part of the PFA Mitigation Advisory Committee (MAC) described under Conservation Measure 6, *Mitigation and Restoration Funding*.

6.2.3 Administration of the Compliance Monitoring Program

Consistent with OAR 629-678-0000, *Compliance Monitoring*, the following process for administration of the CMP is established.

1. The CMP will be led and administered by ODF; however, monitoring can be conducted by ODF staff, contractors, or both. ODF will determine the status of the completion of forest activities through landowner notification of the completion of notified forest activities, as described in OAR 629-605-0150(10).[2] The BOF may direct ODF to conduct compliance monitoring analysis for specific rules for multiple operations, multiple rules implemented at the operation unit level, or both, as appropriate to determine levels of compliance.
2. The CMP will include sampling designs, sample selection, and evaluation criteria to ensure a high level of confidence in the statistical estimates of compliance and their interpretation, by doing the following.
    - Hire or consult with an external, qualified statistician to aid in developing sample selection and evaluation criteria to ensure a high level of confidence in reported results.
    - Be informed by past BOF and third-party CMP assessments and by similar reviews of other CMPs in nearby states.
    - Explicitly define all sampling elements.
    - Analyze rates of compliance at the appropriate temporal and spatial scale to reduce autocorrelation, variance, and statistical bias.

[2] OAR 629-605-0150(1) requires the operator who filed a notification to inform the State Forester of the completion of each activity by (a) the end of the calendar year of the notification; or (b) If the original notification is continued into the following calendar year, the end of the calendar year of the continued notification.

6.2.3.1 Access for Compliance Monitoring

Forest landowners will accommodate the State Forester or State Forester's representative by allowing access to operation sites, for activities that they have informed the State Forester of completion, as described in OAR 629-605-0150(10). Notice will be given to forest landowners in advance of onsite compliance monitoring to provide the landowner's representative an opportunity to be present with the State Forester or State Forester's representative. If necessary, ODF may petition the circuit court with jurisdiction over the forestland for a warrant authorizing the State Forester property access to conduct compliance monitoring. When compliance monitoring identifies rule sets that have low levels of compliance, the BOF will determine the need for training, guidance, OFPA rule clarification, or other appropriate actions.

6.3 Effectiveness Monitoring and the Adaptive Management Program Objectives

[This section to be further developed upon completion of the biological goals and objectives]

The purpose of effectiveness monitoring conducted through the AMP is to determine whether the conservation measures are "effectively" achieving the biological goals and objectives. As such they are primarily focused on monitoring changes in habitat quality and quantity over time, including long-term trends in ecosystem processes. The purpose of the AMP rules (OAR 629-603-0000 through 629-603-0600) is to provide science-based recommendations and technical information to assist the BOF in determining when it is necessary or advisable to adjust rules, guidance, and training programs to achieve the biological goals and objectives described in this HCP.

As described in the AMP rule set (Division 603), the AMP will be driven by two primary questions to evaluate the OFPA rules.

1. **Effectiveness monitoring:** Assessment of the degree to which the OFPA rules facilitating particular forest conditions and ecological processes achieve the biological goals and objectives. This assessment may include cumulative effects.
2. **Research inquiry and validation monitoring**: Should the rules be modified to achieve the overall program goals? What additional scientific inquiry is needed to fill in knowledge gaps that can prioritize biological goals and objectives that will aid in achieving overall HCP goals? What models and methodologies require further testing to implement OFPA rules?

The conservation strategy of this HCP is based on the best scientific information currently available, and it is expected that the conservation measures will effectively achieve the biological goals and objectives as stated in Chapter 4, *Conservation Strategy*. However, there are varying degrees of uncertainty associated with the management techniques and conditions within the permit area. Studies to determine effectiveness will be most readily accomplishable when the causal link or links between a certain forest practice and its impact on the biological resource is well-documented. Future improvements in forest inventory methods, increased accuracy or precision of monitoring important aquatic 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 through rule change, 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 as specific policies are implemented and monitored. Monitoring strategies themselves may change, as they are improved to better quantify or describe specific habitat metrics

To address these uncertainties, the AMP allows ODF to learn from experience and research to reevaluate and revise the type, extent, and location of conservation actions when necessary to meet the biological goals and objectives of the HCP. Results from studies will need time to be verified and for implications to be understood through the AMP process. The feedback loop for research inquiry and validation monitoring is anticipated to evolve more deliberately as new findings build on one another. Changes to OFPA rule or technical guidance that result from the AMP will provide clear documentation and rigor.

6.3.1 Adaptive Management Priority Topics

The following topics will be prioritized in the initial phase of the AMP (OAR 629-603-0100[8]):

1. Literature review for eastern Oregon steep slopes.
2. Requirements of baseline and trend monitoring of road rules.
3. Amphibians.

The AMPC may determine when Section (8) of OAR 629-603-0100 is satisfied and, therefore, when those topics would no longer be priorities. In the event the AMPC makes these findings, ODF will present the AMPC findings to the BOF (OAR 629-603-0100[9]).

6.3.2 Adaptive Management Program Structure

The BOF's AMP will rely on an AMPC, an IRST, and an AMP Coordinator described below.

6.3.2.1 Adaptive Management Program Committee

The AMPC is established as an advisory committee to the BOF whose purpose is to complete work described in Division 630 of OAR 629 and Section 36(7) of SB 1501. The AMPC will fulfill the following primary roles:

- Guide the adaptive management process.
- Set the multi-year research agenda, including setting research priorities, milestones, timelines, and budgets of research projects. These will be provided to the IRST annually in order to guide the overall adaptive management process.
- Work with the IRST through the Adaptive Management Program Coordinator to assure that the AMPC's original research intent is maintained in the final research question(s).
- Assess the scientific findings reported by the IRST and prepare a report for the BOF that identifies alternatives (including no action) that could address identified problems to address resource issues identified in the IRST report, including rule adjustment, guidance, or training.
- Refine the multi-year research agenda, timelines, and comprehensive IRST budgets for each research project.
- Evaluate research proposals and submit a research agenda to the BOF.

- Assist the BOF in the ongoing process of preparing identifying and modifying rule changes, following evaluation of research findings identified in IRST research reports.

The AMPC will set the scientific agenda but will play no part in designing actual research projects, carrying out the inquiry, or the IRST's report of summary findings to the BOF and AMPC. The AMPC sets the research agenda for the IRST, assesses scientific outcomes reported by the IRST, and prepares reports for the BOF regarding rule adjustment, guidance, or training. As directed by the AMPC, the IRST conducts scientific inquiry, including, but not limited to, literature reviews and original research, and also prepares summary reports detailing the research findings to the BOF, as described above in Section 6.1.4, *Reporting*.

As set forth in Section 36 of SB 1501, the AMPC will consist of 10 voting members and up to 3 non-voting members. The BOF will select as a voting member one representative from each of the following.

- The Oregon Forest Industries Council.
- The Associated Oregon Loggers.
- The Oregon Small Woodlands Association.
- The Coalition of Oregon Land Trusts.
- Tribal representative nominated by the Legislative Commission on Indian Services.
- A conservation organization representative collectively selected by Beyond Toxics, Cascadia Wildlands, Klamath Siskiyou Wildlands Center, Oregon League of Conservation Voters, Oregon Stream Protection Coalition, Oregon Wild, Portland Audubon, and Umpqua Watersheds, which were parties to the PFA Report.[3]
- A commercial or recreational angling organization, collectively selected by Northwest Guides and Anglers Association, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited, and Wild Salmon Center, which were parties to the PFA Report.
- The Association of Oregon Counties.
- Oregon Department of Fish and Wildlife.
- Oregon Department of Environmental Quality.
- A BOF-selected representative of ODF (non-voting).

Additionally, the BOF will invite representation from the following.

- A member of NMFS (non-voting).
- A member of USFWS (non-voting).

Committee members will serve 4-year terms and may serve an unlimited number of terms. The BOF will appoint the first voting members of the AMPC. Of those appointed, two will serve for terms ending 1 year after the date of appointment, two will serve for 2 years after date of appointment, and three will serve for terms ending 3 years after date of appointment. The remaining three appointees will serve full 4-year terms.

[3] If an entity described here ceases to exist, BOF will determine a successor entity that represents the same interest.

6.3.2.2 Independent Research and Science Team

The IRST is established as an advisory committee to the BOF whose purpose is to complete work described in Division 603 of OAR Chapter 629 and Section 38(8) in SB 1501. The IRST will be tasked with, and adequately funded to oversee, the research projects that the AMPC prioritizes and delineates, and that are approved by the BOF.

The IRST may conduct their inquiry through literature review, field monitoring, original research, commissioned studies, and other means of scientific inquiry. The AMPC will send preliminary research questions to the IRST annually. The IRST will then draft final research questions. These research questions will be communicated to the AMPC via the Adaptive Management Program Coordinator (described in Section 6.3.2.3) to allow the AMPC an opportunity to provide input to ensure that the AMPC's original intent is maintained in the final research question. The IRST will develop multiple research proposals for each finalized research question that will include the following.

- A literature review that specifies the need for or the type of monitoring, research, commissioned studies, or other means of scientific inquiry necessary to answer the finalized research question.
- A preliminary estimate of the budget for each year of the research, and a timeline to complete the research project with specific deliverables.
- A preliminary description of project requirements, scope of work including an estimate of the timeline and key milestones, and an estimate of the degree to which knowledge may be improved if the research proposal is implemented.

These research proposals will be sent to the AMPC for potential inclusion in the biennial research agenda that is sent to the BOF for approval. The IRST will develop requests for proposals (RFPs) in an open, competitive process for research projects in BOF-approved research agenda (OAR 629-603-0200(6)). The IRST will report to the BOF and the committee on the findings of the research, including findings concerning the magnitude of impacts on species of concern, the urgency of needed action and the degree of scientific confidence or uncertainty behind the findings.

Membership

The composition and housing agency of the IRST is described in Section 38 of SB 1501 and OAR 629-603-0450, respectively. IRST members will serve 4-year terms that can be extended as described below. After the initial selection of IRST members by the AMPC and BOF, all new members and the approval of extended terms for existing members will be voted on by the existing IRST members and ratified by the BOF. IRST members can be removed before the end of a term by a super majority (two-thirds vote) of IRST peers or by a vote of the BOF. New IRST members (either to fill a vacancy or to add a new scientific or technical discipline) will be appointed by the BOF from a list of candidates submitted by the team.

At least five members, but always an odd number, will comprise the IRST. IRST members must have adequate qualifications to serve on the IRST. These qualifications include demonstrated subject matter expertise in a relevant field and a graduate-level degree in a relevant natural resources–related field such as forestry, silviculture, ecology, hydrology, wildlife, fisheries, and geology (SB 1501, Section 38).

The IRST, and any subcommittees it forms, will include a representative employed or contracted by one of each of the following.

- A public institution.
- A public interest non-governmental organization that promotes conservation of freshwater aquatic habitat.
- The timber industry.

6.3.2.3 Adaptive Management Program Coordinator

The AMPC will be led by a program coordinator appointed by the State Forester (OAR 629-603-0500). This position will be a neutral facilitator whose primary function is to assist the program in the following manner.

1. Facilitate communication between, and coordinate the work of, AMP participants listed in OAR 629-603-0100(2).
2. Report to the BOF on annual progress of adaptive management program pursuant to OAR 629-603-0100(4), in addition to appearances as needed to present AMPC reports and other adaptive management program work.
3. Manage budgets for participation grants described in OAR 629-603-0160 for the AMPC and the IRST.
4. Coordinate agreements for regular performance audits of the AMP per OAR 629-603-0100(5).
5. Perform other duties as needed.

6.3.3 Adaptive Management Administrative Process

OAR 629-603-0200 specifies communications between the BOF, AMPC, and IRST to implement the adaptive management program. To the extent there needs to be communications not identified in this rule for AMP success, the Adaptive Management Program Coordinator will facilitate these communications. The State Forester will report to the BOF annually about the status of AMP efforts. A flow diagram of the Adaptive Management Administrative Process is shown in Figure 6-1.

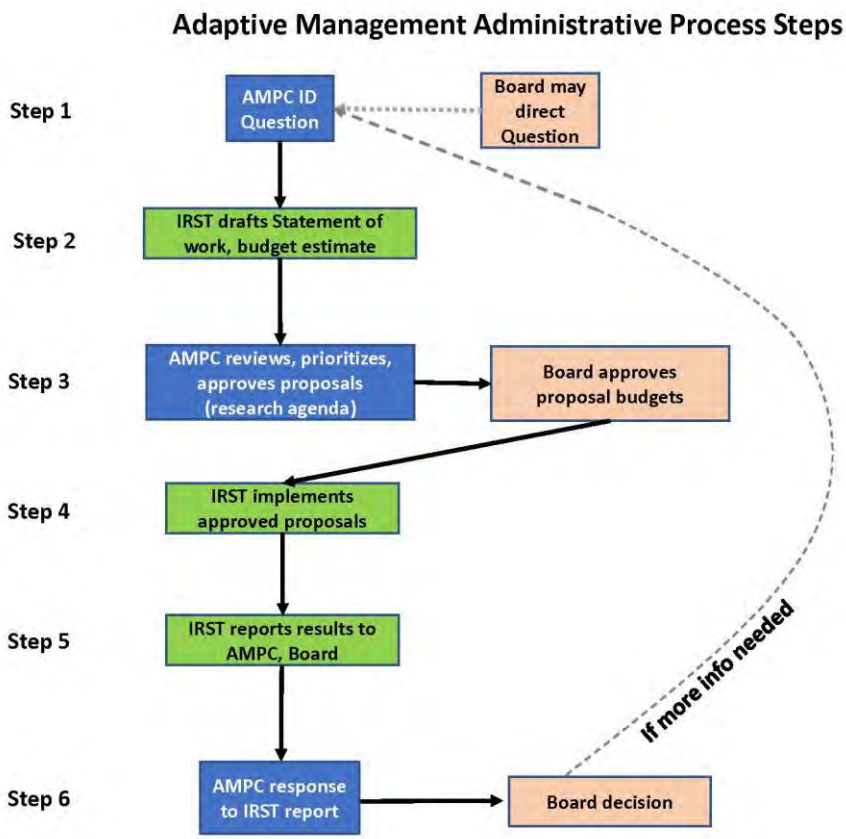


Figure 6-1 Adaptive Management Administrative Process Steps

The BOF intends that the process of continuous improvement be applied to the AMP. The department will conduct performance audits once every 6 years per Generally Accepted Government Auditing Standards. The performance audits will evaluate whether the AMP achieved the goals and objectives outlined in OAR 629-603-0000(5) (SB 1501: 34(1)).

This page intentionally left blank.

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 Marine Fisheries Service (NMFS) 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,

7.2 Federal No Surprises

The federal No Surprises Regulation was established on March 25, 1998. The No Surprises policy (herein referred to as No Surprises assurances) "provides regulatory assurances to the holder of an Habitat Conservation Plan (HCP) incidental take permit issued under section 10(a) of the [Endangered Species Act] ESA that no additional land use restrictions or financial compensation will be required of the permit holder with respect to species covered by the permit, even if unforeseen circumstances arise after the permit is issued indicating that additional mitigation is needed for given species covered by a permit." (50 Code of Federal Regulations [CFR] Part 17). The No Surprises Regulation states that if a Permittee is fully implementing an HCP that has been approved by USFWS and/or NMFS, no additional commitment of resources or limitations on land uses, beyond that already specified in the plan, will be required unless the plan is amended.

In accordance with No Surprises assurances, 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 NMFS to address them within the funding and other constraints of this Oregon Private Forest Accord HCP should they occur.

No Surprises assurances are contingent on the full implementation of the HCP and permits. USFWS or NMFS may suspend or revoke the federal permit, in whole or in part, in accordance with federal regulations (50 CFR Sections 13.27, 13.28, and 222.306 and other applicable laws and regulations) in force at the time of such suspension. See Chapter 8 Section 8.1.2.2, *Permit Suspension or Revocation,* in this HCP for details 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 circumstances describe what changes can be anticipated over the permit term and thus bind the Permittee's commitments to address those changed circumstances, as described above.

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 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." By definition, any circumstance not described in this HCP or as a changed circumstance in this chapter is considered an unforeseen circumstance.

7.3.3 Changed and Unforeseen Circumstances Addressed by this HCP

Changed and unforeseen circumstances are to be anticipated over the life of this HCP. Under ESA Section 10, an HCP is required to identify anticipated and possible changed circumstances that could arise during its implementation and plan for addressing those changes in an affirmative manner. Identifying strategies and protocols for addressing such anticipated changes allows for appropriate program adjustments and is part of the Permittee's obligations.

7.3.3.1 Climate Change

Changed Circumstance

Climate change poses the most uncertainty, and therefore poses considerable risk. Warmer, drier summers with more extreme heat events, and more extreme precipitation events in winter are expected in Western Oregon (Spies et al. 2018), while drier forest types and limited water supply in Eastern Oregon are expected to be exacerbated (State of Oregon 2010). Climate change will likely be a driver for many of the changed circumstances described below, increasing the potential for these events to occur and their possible severity. For example, weather 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 drought, fire, invasive species outbreaks, or other disturbances. These more frequent and intense disturbances may quickly change habitat conditions for covered species in the plan area.

[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.

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 is expected to 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 more and larger wildfires and additional outbreaks of insects and disease, reduce growth and survival for certain species, and ultimately change forest structure and composition at the landscape scale. Species ranges are expected to shift northward and upward in elevation.

Additionally, warming of streams and rivers across the northwest United States is expected in this century, which may have biological implications for both the quality and quantity of habitats available to aquatic species. Ongoing temperature increases will likely have a profound influence on the ecology of salmonids. 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, may expand their range under warmer water conditions, impacting the survival and recovery of salmonids.

Response

Under development

7.3.3.2 Other Changed Circumstances

Under development

This page intentionally left blank.

Chapter 8
Plan Implementation

8.1 Implementation Roles and Responsibilities

This chapter describes how the Oregon Private Forest Accord 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.

8.1.1 Permittee

The Forest Practices Act authorizes the Oregon Department of Forestry (ODF) to ensure forest activities on non-federal, non-tribal forest lands comply with applicable laws and rules. 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 coordination with and reporting to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) (collectively, the Services), including annual reporting. To implement the HCP, ODF will assign HCP implementation responsibilities to the Forest Resources Division of ODF or its equivalent. Chapter 9, *Cost and Funding,* summarizes assumptions about staff time and time allocation across the HCP program.

8.1.1 Oregon Department of Fish and Wildlife

The 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*). 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 change.

8.1.2 Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality (DEQ) will have a member on the Adaptive Management Planning Committee (AMPC) and provide consulting and technical support to ODF for the identification and risk assessment of abandoned roads that pose a risk to waters of the state or infrastructure, including consulting on the development of technical guidance.

8.1.2 National Marine Fisheries Service and U.S. Fish and Wildlife Service

The Services will be responsible for assessing and ensuring that implementation of the HCP by ODF is consistent with the provisions and outcomes that informed the federal agencies' issuance of the incidental take permit. The following summarizes activities the federal agencies will perform in support of HCP implementation.

- Review reports submitted by ODF.

- Meet annually with 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.
- Work with ODF to address 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.

8.1.2.1 Permit Suspension or Revocation

The Services 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 incidental take permits (ITPs). NMFS and USFWS each can suspend or revoke all or a portion of the Section 10(a)(1)(B) permit it issues if: (1) continuation of covered activities would appreciably reduce the likelihood of the survival and recovery of a covered species in the wild (50 Code of Federal Regulations [CFR] 17.22(b)(8), 17.32(b)(8)), or I2) 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.

8.2 Implementation Overview

As described in this chapter, ODF is responsible for ensuring landowner compliance with this HCP. ODF will coordinate regularly with the Services on HCP implementation to ensure that any issues that arise are addressed quickly and with the input of the Services. In those rare instances where an agreement cannot be reached, a formal *dispute resolution process* is available, as described in Section 8.1.2.1.

8.3 Inspections and Enforcement

When the State Forester determines that an unsatisfactory condition or a violation exists, enforcement action will be initiated by the State Forester (OAR 629-670-0100). Assessment of civil penalties, in addition to any other remedy for noncompliance, will be uniformly assessed by a civil penalty administrator appointed by the State Forester (OAR 629-670-0200) and the dollar amount of civil penalties per violation calculated using the formula described in OAR 629-670-0210 (1) through (6). Further, a civil penalty administrator will have the discretion to combine or revoke violations according to the conditions described in OAR 629-670-0214 (1) through (6). Additional penalties are reserved for significant violations committed by repeat violators (OAR 629-670-0225 and 629-670-0228).

8.4 Data Tracking and Annual Reporting

ODF will prepare and submit an annual report for the duration of the permit term to the Services. The report will address compliance, habitat loss, conservation actions, and monitoring activities. An annual meeting reviewing the above submitted information and addressing any other issues will be held with USFWS, NMFS, and ODFW no more than 90 days following submittal of the annual report.

The goals of the annual reports are to demonstrate to the Board of Forestry, USFWS, NMFS, 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 under development.

8.5 Stay-Ahead Provision

The Endangered Species Act (ESA) requires that HCPs minimize and mitigate the impacts of the taking to the maximum extent practicable (ESA Section 10(a)(2)(B)(ii)). As described in the *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (HCP Handbook) (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016), "Stay-Ahead" provisions are often (but not always) included in HCPs to minimize the risk of impacts from covered activities occurring before the benefits of mitigation are realized. Stay-ahead provisions, where conservation occurs or where fees are collected (like through an in-lieu fee program) before impacts, are useful to ensure minimization and mitigation measures occur as planned.

8.6 Modifications to the Plan

The HCP and associated ITP may be modified in accordance with the ESA, NMFS, and USFWS 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 NMFS. The Services 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 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.

8.6.1 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 NMFS or USFWS. Requests from the Services will include an explanation of the reason for the change as well as any supporting documentation.

Administrative changes to the HCP should 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 suggested by ODF or NMFS or USFWS. Minor administrative changes made by ODF will not require pre-approval from NMFS and USFWS, but ODF will report minor administrative changes in the annual report. More substantial administrative changes will require review and approval by the Services through a written exchange.

Examples of administrative changes to the HCP are as follows.

- Minor administrative changes (exempt from approval by the Services):
  - 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 to the HCP or ITP.
- Administrative changes that require written approval from the Services:
  - 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, which will be memorialized in writing and retained in the administrative record.

8.6.2 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, the Services will decide the level of review needed to satisfy ESA, NEPA, and other regulatory requirements. HCP amendments require written approval by the Services.

Depending on their scope and effects, amendments to the HCP can be approved by the Services 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 may 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.
- Change 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 affect levels of authorized take, effects of the covered activities, or the nature or scope of the conservation strategy.

Chapter 9
Costs and Funding

9.1 Introduction

This chapter describes and estimates the costs and funding associated with the Oregon Private Forest Accord Habitat Conservation Plan (HCP). Costs and funding estimates will be based on the most recent and detailed available data. These data inform will be used to project estimates for the project term. Costs and funding will be estimated for the Oregon Department of Forestry (ODF) and will not account for all costs associated with plan implementation.

9.2 Costs

Costs are grouped into five categories: plan administration and staffing program administration, conservation strategy and mitigation program, monitoring and adaptive management, small landowner actions, and remedial measures for changed circumstances.

Each cost item includes a short description as well as relevant assumptions for calculating the identified cost. References to sources utilized for the cost descriptions and estimations are also provided. Inflation will increase costs of services and materials, as well as tax revenue. ODF does recognize that biennial budget planning and requests will need to include an inflation adjustment for administration of the HCP. This will account for increased costs of goods, services, and staffing requirements.

Specific summary costs by category are still to be determined.

9.2.1 Plan Administration

Section under development.

9.2.2 Conservation Strategy and Mitigation Program

This category includes costs associated with activities described in Chapter 4, *Conservation Strategy,* of this HCP. Mitigation costs will be addressed in part through the Private Forest Accord Grant Program administered by the Mitigation Advisory Committee (MAC).

9.2.3 Monitoring and Adaptive Management

Monitoring compliance and the long-term effects of the conservation strategy are key to the HCP. The HCP establishes a monitoring program to ensure it is being implemented and that its objectives are being met, and to identify potential changes to the plan. *Adaptive management* is a process for understanding and addressing inherent uncertainties with the conservation strategy and ensuring actions are meeting the HCPs conservation goals and objectives. What these uncertainties are and how they will be addressed must be documented ahead of time so ODF can address them as needed.

Costs explicitly described in Chapter 6, *Monitoring and Adaptive Management,* will be included in this estimate. These costs include funds for the Independent Research Science Team (IRST) to carry out research tasks, and the Adaptive Management Program Committee (AMPC) to provide direction and oversight.

Total anticipated funding for the adaptive management program will be $6 million per biennium. Funding will mostly cover research conducted by IRST, and will also include participation grants for AMPC and IRST.

9.2.4 Small Landowner Actions

The Small Forestland Investment in Stream Habitat (SFISH) program, administered through the Small Forestland Owner Assistance Office, will provide grant funding to assist small forestland owners to take specific conservation actions described in Chapter 4, *Conservation Strategy*.

9.2.5 Remedial Measures for Changed Circumstances

Section under development.

9.3 Funding

This section will summarize the funding that will be used to carry out the HCP. In Oregon, state agencies operate on a biennial budget cycle; that is, one budget cycle covers two fiscal years. State fiscal years extend from July 1 to June 30. For example, the 2021–2023 biennium started on July 1, 2021, and will end on June 30, 2023. State agencies, with guidance from the State Chief Financial Officer, begin budget development in the year prior to the budget biennium. For example, for the biennium starting in 2027, agency budget development begins in 2026. Biennial budgets and appropriations are determined in the long legislative session in odd-numbered years and are adjusted as needed in the even-numbered year's short session.

9.3.1 Funding Sources

Section under development.

Chapter 10
Alternatives to Take

10.1 Introduction

The federal Endangered Species Act (ESA) requires that applicants for an incidental take permit (ITP) specify what alternative actions to the take of federally listed species were considered and why those alternatives were not selected (see Chapter 1, Section 1.1, *Overview,* for more on *take*). The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016) identifies two alternatives commonly used in habitat conservation plans (HCP).

- Any specific alternative that would reduce take below levels anticipated for the proposed project.
- An alternative that would avoid take and, therefore, not require a permit from the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS).

The preferred and proposed approach is described in the previous chapters of this Oregon Private Forest Accord HCP. This proposed approach represents the Permittee's best attempt to minimize take of the covered species while allowing implementation of the covered activities. In accordance with the ESA, this chapter discusses alternatives that were considered but not selected and the reasons those alternatives were not selected for inclusion in the HCP.

10.2 Alternatives to Take

Under development.

10.2.1 Description of Alternatives

Under development.

This page intentionally left blank.

Chapter 11
References

11.1 Printed References

Under development.

11.2 Personal Communications

Under development.

This page intentionally left blank.

Appendix A

2022 Private Forest Accord

This page intentionally left blank.

Appendix B
Species Accounts

This page intentionally left blank.

Timeline for Private Forest Accord Habitat Conservation Plan Project

	2023				2024				2025				2026				2027			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Management and Advisory Meetings																				
Administration and Internal Meetings																				
Steering and Agency Meetings																				
Board and Advisory Meetings																				
Complete 1st Administrative Draft HCP																				
1st Admin Draft Complete																				
Complete Public Draft HCP																				
Revise all HCP Chapters																				
Submit ITPs ahd Public Draft HCP to Services																				
Complete Final HCP																				
Completed Final HCP																				
ITP Issued to ODF																				X
NEPA																				
Early NEPA Planning and Scoping																				
Administrative Draft EIS through Public Draft EIS and 60-day review period (with HCP)								NOI												
Response to Public Comments, Final EIS, and ROD																				

Key review periods

ICF, ODF, & Author co-authoring and integrated review

Major milestone delivery

X Date tied to legislative mandates