Executive Summary

ES.1. BACKGROUND

Planning for revision of the 1995 Elliott State Forest Habitat Conservation Plan (HCP) and Forest Management Plan (FMP) began in early 2000. The primary driver for the revision was the pending expiration of the HCP's marbled murrelet Incidental Take Permit (ITP) in October 2001. The 1995 HCP provided incidental take coverage for 60 years for the northern spotted owl, but only six years for the marbled murrelet, as little was known about the marbled murrelet at that time. Part of the 1995 HCP strategy called for the Oregon Department of Forestry (ODF) to fund research about the marbled murrelet, which would then be used to revise strategies to support a longer-term ITP. New information on the marbled murrelet gathered from this research, as well as from research conducted by other scientists, was used in the HCP revision process.

The revised multi-species HCP includes the northern spotted owl, marbled murrelet, and coastal coho salmon. Other fish and wildlife species at risk for listing and known to inhabit the Elliott State Forest, and for which there was suitable scientific knowledge, were also considered for inclusion in the revised HCP.

ES.2. PURPOSE

The ODF has prepared this multi-species HCP to ensure state forest land management compliance with the federal Endangered Species Act (ESA) (16 United States Code [USC] 1531 et seq.). The HCP is a long-term plan that will support the conservation of threatened and endangered species while allowing the ODF to perform its management responsibilities of maximizing revenue for the Common School Fund (CSF) over the long term. The State Land Board and the Oregon Board of Forestry (BOF) are responsible for reviewing and approving the HCP and any necessary changes in strategies over time.

ODF management responsibilities are set forth in the Oregon Constitution, Oregon statutes and administrative rules, the Oregon Department of State Lands (DSL) Asset Management Plan, and (BOF) policy mandates. These management obligations are met through Forest Management Plans (FMPs) "based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region" (Oregon Revised Statute [ORS] 526.255). In addition to sustained yield, the *Elliott State Forest Management Plan* establishes a landscape management approach that will produce and maintain an array of forest stand structures capable of contributing to the range of habitats needed by native fish and wildlife species in western Oregon.

To support implementation of the current FMP, the ODF is seeking an Incidental Take Permit (ITP) from the U.S. Department of the Interior (USDI) and the U.S. Department of Commerce under Section 10 of the ESA. Section 10 authorizes a landowner to negotiate a HCP with the federal government to minimize and mitigate potential impacts to threatened and endangered species while conducting lawful activities, such as forest management. The HCP defines how the ODF will offset any potential harm caused by forest management activities, while promoting conservation of the species as a whole. Once issued, incidental take is allowed within the limits defined by the ITP. Periodic reviews will assess the adequacy of the conservation strategies in meeting the established objectives. The reviews will be based on monitoring, research, and adaptive management components of the strategies.

The permit area will be the contiguous Elliott State Forest, which consists of approximately 93,000 acres of forest lands. The location of these lands is described in Chapter 3. The map section contains maps of the Elliott State Forest. Ninety-one percent of the lands are Common School Fund Lands (CSFLs); the remaining nine percent are Board of Forestry Lands (BOFLs).

ES.3. THE FOREST

The Elliott State Forest is located in the southern Oregon Coast Range. Coos Bay and North Bend are the nearest cities to the southwest of the Elliott State Forest; Reedsport is the nearest town to the northwest. The forest is a contiguous block of land approximately 18 miles long (north to south) and 16 miles wide (west to east). The Umpqua River approximates the northern boundary of the forest. To the west, the Elliott State Forest extends to within six miles of the ocean. On the east, it extends approximately 21 miles inland. The contiguous Elliott State Forest covers about 93,000 acres in Coos and Douglas Counties.

Conifer forests cover nearly all (98 percent) of the Elliott State Forest. Most of the forest resulted from the 1868 Coos Bay Fire. Today, as a result of harvest and management, about half of the conifer forests on these lands are less than 75 years old, a slightly lesser amount are between 76 and 145 years old, and only a few thousand acres are older than 146 years.

The Elliott State Forest produces high-quality timber, dispersed recreation opportunities, and excellent habitat for many of the region's fish and wildlife species.

ES.4. GOALS

To meet the diverse set of state and federal mandates and laws, and to promote sustainable stewardship of the Elliott State Forest, the following goals have been used to guide the development of the conservation strategies that are fully described in Chapters 5 through 9 of this HCP:

1. Actively manage CSFLs with the objective of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management to maximize revenue for the CSF over the long term.
2. Actively manage BOFLs to secure the greatest permanent value to the citizens of the state of Oregon by providing healthy, productive, and sustainable ecosystems that, over time and across the landscape, provide a full range of social, economic, and environmental benefits to the people of Oregon.
3. Meet the requirements of the federal and state ESAs through an approved HCP, using a forest ecosystem management and multi-species approach.
4. Ensure that the Elliott State Forest contributes to habitats needed by the listed and unlisted species, and fish populations covered by this HCP.
5. Promote the development, maintenance, and enhancement of wildlife habitats through active management approaches that use a variety of silvicultural techniques.
6. Provide for short-term certainty and long-term stability in the management of state forests to meet legal mandates.

ES.5. ALTERNATIVES CONSIDERED

Based on direction from the State Land Board and the BOF, a Steering Committee composed of representatives from the DSL, county commissioners, school districts, the Oregon Department of Fish and Wildlife (ODFW), the Oregon Department of Justice, and the ODF guided the development of the proposed approach and the set of alternatives.

Resource specialists and administrators from the ODF and the ODFW developed the concepts and strategies in the proposed approach and the various alternatives in cooperation with counterparts from the federal agencies. The public also contributed to alternative development through the public involvement process described in Appendix G of the FMP and Appendix D of the draft EIS, "Consultation with Others."

The alternatives are discussed in Chapter 10 of the HCP, and described in greater detail in the EIS. Alternative 1 is the no action alternative; it involves the continued use of the existing (1995) HCP to manage for northern spotted owls and avoid any incidental take of marbled murrelets. Alternative 2 is the preferred alternative, and the basis for the conservation strategy. Alternatives 3 through 7 utilize management strategies with a range of different emphases on reserves and intensive management.

ES.6. PROPOSED APPROACH – ALTERNATIVE 2

The proposed HCP strategies combine two approaches that will protect and provide habitat for the covered species while generating the revenue expected from CSFL and BOFL forests. The first approach is a set of sustainable forest ecosystem management strategies that focus on the development of a diverse forest landscape. The second is a set of specific strategies for northern spotted owls, marbled murrelets, and the other listed and unlisted species identified in Chapter 9, Table 9-1. Chapter 5 describes the broader landscape strategies. Chapters 6 through 9 describe the fine filter strategies for threatened and endangered and other species.

Sustainable forest ecosystem management will emulate many aspects of natural stand development patterns, as well as preserve portions of the forest for biological refugia. The covered lands will be managed to develop a dynamic mosaic of differently developing stands across the landscape. These stands will comprise a relatively stable quantity of early, intermediate, and advanced stand structures. Some stands will be managed for timber production while incorporating habitat structures such as snags and downed wood. Other stands will be managed to develop habitat conditions normally associated with older forests while also producing timber. Finally, a network of stands, referred to as conservation areas, will be maintained or develop into an advanced forest structure condition, and then persist on the landscape in a relatively unmanaged state.

This diversity of stand structures will provide for a broad range of ecosystems and wildlife habitats that will contribute to biological diversity. The structural components associated with the range of stand structures will benefit long-term forest productivity by maintaining the key linkages for nutrient cycling and soil structure. Additionally, the level of diversity should result in a resilient forest that will not be prone to large-scale damage from environmental or human-caused stresses.

Aquatic ecosystems interact closely with the surrounding terrestrial systems, both at the landscape scale and at the scale of stream reaches and riparian zones. Therefore, the health of the aquatic system depends on forest management practices that recognize, maintain, and enhance, at a variety of scales, the functions and processes that constitute these terrestrial-aquatic interactions at a variety of scales. Thus, the strategies apply the concepts of landscape ecology to manage riparian and aquatic habitats at the landscape level and through site-specific prescription.

The landscape level component of the aquatic and riparian strategies consists of the sustainable forest ecosystem management strategies described earlier in this section. Over time, the application of these strategies is intended to create forest conditions on the landscape that will emulate historic conditions and processes relative to aquatic systems.

The HCP also incorporates a set of variable, site-specific riparian strategies to address the range of desired conditions along the stream network. Desired conditions vary depending on the functions provided by streams in different portions of the landscape.

Finally, critical to the evaluation and refinement of both the landscape level and site-specific approaches is watershed analysis. Watershed analysis is a strategy designed to collect and synthesize key watershed information that will be used to further evaluate the landscape and site-specific strategies.

Monitoring and adaptive management provide the essential information sources and approaches that will guide implementation of all strategies in the HCP, and will advise future generations of resource managers as to the successes of the longer-term sustainable forest ecosystem management approach and any changes that may be needed.

ES.7. IMPLEMENTATION

Implementation of this HCP will be governed by an agreement between the ODF and the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's Fisheries Service (NMFS), and will be funded by ODF as a part of ongoing operations. The Implementing Agreement is complimentary to the HCP; together, they fulfill the requirements outlined in the ESA for issuance of an ITP. The Implementing Agreement is included in Appendix K of this document.

State forest management is carried out under an approved forest management plan (FMP) developed in accordance with the Oregon Constitution, and State of Oregon statutes and accompanying administrative rules. The Elliott State Forest's FMP provides for the maximization of revenue to the CSF over the long term, consistent with sound techniques of land management. The ODF anticipates that adjustments to the FMP may be necessary as social, environmental, and economic factors change. Additionally, the ODF will continually improve its knowledge through experience and experimentation during the performance of its management responsibilities, and through research and monitoring activities. The level of change to ODF management approaches will determine whether a modification or amendment to the HCP or ITP would be appropriate. Modifications and amendments to the HCP or ITP are addressed in the Implementing Agreement.

Final decisions on implementing change may be made by various people or institutional bodies, depending on the implications of the change. Where change significantly alters the fundamental strategies that determine the management of the forest, the State Land Board and State Forester will weigh the scientific and operational information in a relatively formal public process and in consultation with appropriate other federal or state agencies. Where change does not significantly alter the fundamental strategies, such as in a practice or silvicultural technique, field personnel may institute changes.

ES.8. ACHIEVEMENTS

The *2003 Forestry Program for Oregon* includes as part of its vision, "healthy forests providing a sustainable flow of environmental, economic, and social outputs and benefits". The designers and contributors of this HCP believe that it is in line with that vision.

The HCP is designed to meet legal mandates and trust obligations for both CSFLs and BOFLs while complying with the federal ESA. The HCP is intended to provide a high level of predictable and dependable products and revenues, along with a high level of management certainty. The HCP is intended to provide social values such as regular employment; abundant plant, fish, and wildlife populations for hunting, viewing, and collecting; and diverse recreational opportunities. Additionally, the HCP is designed to produce positive environmental effects such as clean air, clean water, productive soils, and functional habitats for native fish and wildlife.

The ODF invites the public and owners of these productive forest lands to unite in realizing the important resource goals for the Elliott State Forest. The ODF believes that implementation of this HCP will result in economic, social, and environmental benefits from the forest over time, in accordance with the Forestry Program for Oregon and the legal mandates and trust obligations for these lands.

Chapter 1
Introduction

1.1. PURPOSE

The Oregon Department of Forestry (ODF) has prepared this multi-species Habitat Conservation Plan (HCP) to ensure state forest land management compliance with the federal Endangered Species Act (ESA) (16 United States Code [USC] 1531 et seq.). The HCP is a long-term plan that will support the conservation of threatened and endangered species while allowing the ODF to perform its management responsibilities to maximize revenue for the Common School Fund (CSF) over the long term.

ODF management responsibilities are set forth in the Oregon Constitution, Oregon statutes and administrative rules, the Oregon Department of State Lands (DSL) Asset Management Plan, and Oregon Board of Forestry (BOF) policy mandates. These management obligations are met through Forest Management Plans (FMPs) "based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region" (Oregon Revised Statute [ORS] 526.255). In addition to sustained yield, the *Elliott State Forest Management Plan* establishes a landscape management approach that will produce and maintain an array of forest stand structures capable of contributing to the range of habitats needed by native fish and wildlife species in western Oregon.

To support implementation of the current FMP, the ODF is seeking an Incidental Take Permit (ITP) from the U.S. Department of the Interior (USDI) and the U.S. Department of Commerce under Section 10 of the ESA. Section 10 authorizes a landowner to negotiate a HCP with the federal government to minimize and mitigate any impact to threatened and endangered species while conducting lawful activities, such as forest management. The HCP defines how ODF will offset any harm caused by forest management activities, while promoting conservation of the species as a whole. Once issued, incidental take is allowed within the limits defined by the ITP.

The ODF is applying for an ITP for northern spotted owls, marbled murrelets and coho salmon, with permit coverage for several unlisted native vertebrate species (Table 1-1). These native vertebrate species may inhabit the planning area over the duration of the HCP, and may be listed during the period of the ITP. The ODF does not plan to harm, harass, hunt, or otherwise injure northern spotted owls, marbled murrelets, or any listed or unlisted species; however, the ODF may remove or alter habitat in the course of management activities. The HCP defines how ODF forest management will promote conservation of the species as a whole, and that such management "will not appreciably reduce the likelihood of survival and recovery of the species" (ESA)." Once issued, incidental take is allowed within the limits defined by the ITP.

1.2. GOALS

The following goals have been used to guide the development of the conservation strategies set forth in Chapters 5 through 9 of this HCP.

1. Actively manage Common School Forest Lands (CSFLs) to obtain the greatest benefit for the people of the state of Oregon, consistent with the conservation of this resource under sound techniques of land management to maximize revenue for the CSF over the long term.
2. Actively manage Board of Forestry Forest Lands (BOFLs) to secure the greatest permanent value to the citizens of the state of Oregon by providing healthy, productive, and sustainable ecosystems that, over time and across the landscape, provide a full range of social, economic, and environmental benefits to the people of Oregon.
3. Meet the requirements of the federal and state ESAs through an approved HCP, using a forest ecosystem management and multi-species approach.
4. Ensure that the Elliott State Forest contribute to habitats needed by the listed and unlisted species (including fish populations) covered by this HCP.
5. Promote the development, maintenance, and enhancement of wildlife habitats through active management approaches that use a variety of silvicultural techniques.
6. Provide for short-term certainty and long-term stability in the management of state forests to meet legal mandates.

1.3. COVERED SPECIES

The HCP provides mitigation for incidental take of the listed species identified in Table 1-1. The HCP also seeks unlisted species agreements for certain federal and state candidate species or species that may be proposed for listing in western Oregon. These additional species are identified in Table 1-1 as well. Chapter 4 provides a discussion of the legal status, habitat requirements, and current condition of these species on the Elliott State Forest.

Table 1-1
Species Covered by the HCP

Species	Status[1]	
	Federal	**State**
Birds		
Northern spotted owl, *Strix occidentalis caurina*	T	T
Marbled murrelet, *Brachyramphus marmoratus marmoratus*	T	T
Bald eagle, *Haliaeetus leucocephalus*	Bald and Golden Eagle Protection Act/ MBTA	T
Northern goshawk, *Accipiter gentilis*	MBTA	SC
Olive-sided flycatcher, *Contopus borealis*	MBTA	SV
Western bluebird, *Sialia mexicana*	MBTA	SV
Fish		
Coho salmon, *Oncorhynchus kisutch*	T	SC
Chinook salmon, *Oncorhynchus tshawytscha*	N	N
Chum salmon, *Oncorhynchus keta*	N	SC
Steelhead trout, *Oncorhynchus mykiss*	FSC	SV
Coastal cutthroat trout, *Oncorhynchus clarki clarki*	FSC	SV
Pacific lamprey, *Lampetra tridentatus*	FSC	SV
River lamprey, *Lampetra ayresi*	FSC	N
Western brook lamprey, *Lampetra richardsoni*	N	N

Table 1-1 continued

Species	Status[1]	
	Federal	State
Mammals		
Fisher, *Martes pennanti*	C	SC
Amphibians		
Red-legged frog, *Rana aurora*	N	SU
Southern torrent salamander (HAS)[2] , *Rhyacotriton variegatus*	N	SV
Tailed frog (HAS)[3] , *Ascaphus truei*	N	SV

[1] T = Threatened; C = Candidate; FSC = Federal, species of concern; SC = Sensitive, critical status; SV = Sensitive, vulnerable; SU = Sensitive, undetermined status; N = not listed; MBTA = Migratory Bird Treaty Act.

[2] HAS = Headwater amphibian species.

Table 4-4 provides additional detail.

1.4. SCOPE OF THE INCIDENTAL TAKE PERMIT

1.4.1. Permit Period and Area

The BOF and the DSL are seeking a 50-year ITP from the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration Fisheries Service (NMFS). This HCP provides the measures intended to minimize, and mitigate to the maximum extent practicable, any potential effects of forest management. Periodic reviews will assess the adequacy of the conservation strategies in meeting the established objectives. The reviews will be based on monitoring, research, and adaptive management components of the strategy.

The permit area will be the contiguous Elliott State Forest, which includes approximately 93,000 acres of forest land. The area of these state forest lands is described in Chapter 3. The map section contains maps of the Elliott State Forest.

1.4.2. Type of Take

The ITP will cover potential incidental take of northern spotted owls, marbled murrelets, coho salmon and identified unlisted species in connection with otherwise lawful forest management operations in the permit area.

Northern Spotted Owls—Under the current definition of "harm," the primary form of possible take for northern spotted owls under the HCP is the potential injury or death of northern spotted owls as a direct result of habitat modification from forest management activities. No intentional or direct killing of individuals is anticipated. Measures will be taken to avoid pursuing, hunting, shooting, killing, wounding, trapping, or capturing threatened or endangered species. However, incidental take of northern spotted owls may occur in places when habitat is reduced below levels that would support the reproduction of northern spotted owls.

Marbled Murrelets—As currently stated in the Recovery Plan for threatened marbled murrelets in Washington, Oregon, and California (USDI Fish and Wildlife Service 1997), incidental take of marbled murrelets may occur in the terrestrial environment as a result of any activity that kills or injures birds, impairs essential breeding behavior by adversely affecting occupied or unsurveyed suitable breeding habitat, or causes significant disturbance of breeding birds that leads to reduced reproductive success.

Coho Salmon —The direct take of coho salmon or other aquatic species is not expected under this HCP. Forest management strategies restrict activities in the aquatic and stream bank zone, and will not directly manipulate aquatic species.

A potential for indirect take exists through management-related influences on riparian and landscape processes important for the maintenance of high-quality aquatic habitats. Indirect take of habitat is minimized and mitigated through a series of upland, riparian, and aquatic

strategies, described in Chapter 5. Effects from forest management to aquatic and riparian resources are qualitatively evaluated in Chapter 8 using a set of key aquatic indicators. In general, practices described in the HCP are expected to result in either a reduced effect, no effect, or a minor effect.

Unlisted Species—No incidental take levels or guidelines are currently defined for these species. Unlisted species are native species that may experience population declines resulting in a listing under the federal ESA.

1.4.3. Covered Activities

The ITP will cover the following management activities:

- Mechanized timber management (i.e., felling, bucking, yarding, and loading)
- Forest product transport
- Road and landing construction, use, maintenance, and abandonment
- Harvest site preparation (excluding the use of herbicides)
- Tree planting
- Fertilizer application
- Silvicultural activities
- Fire suppression (excluding chemicals)
- Aquatic habitat restoration
- Rock pit development and use
- Other management activities, including vertebrate control and harvesting of minor forest products
- Research and monitoring

The components of these forest management activities are described below.

Mechanized Timber Management

Mechanized timber management includes the felling, bucking, yarding, loading, and salvage of timber. Felling activities include cutting down trees. Bucking activities include cutting felled trees into logs. Yarding activities include moving the logs from the area they are felled to the landing area using cable systems, ground-based equipment, helicopters, balloons or other means. Loading activities include loading logs from the landing area to a truck. Salvage activities include the removal of snags, downed logs, windthrow, or dead and dying material. Operations involve both regeneration harvest and thinning.

Forest Product Transport

Transport is the removal of timber on established road systems by logging trucks.

Road and Landing Construction, Use, Maintenance, and Abandonment

Road activities are the construction of roads and landings, maintenance of existing road surfaces, and abandonment of unneeded roads. Road and landing construction typically involves excavating and depositing soil or rock to form a road prism; establishing ditches, culverts and waterbars to manage surface water; and installing culverts, bridges across streams. Road construction includes the widening, realignment or modification of existing roads. Road maintenance activities typically include surfacing, grading, erosion control, brush control, ditch clearing and drainage structure repair or replacement.

Abandonment may include removing stream crossing structures and associated fill materials, insuring proper drainage, mulching or seeding exposed soil, and blocking road entrances through the use of gates, excavation, boulders or other means.

Harvest Site Preparation

Site preparation includes any work performed to prepare a harvested area for reforestation. Site preparation activities typically include burning of slash and/or application of herbicides. Although herbicides may be used infrequently for site preparation, their use is not a covered activity under this plan.

Tree Planting

Tree planting typically involves hand planting of young seedlings in harvested areas using shovels or other digging tools.

Fertilizer Application

Fertilization typically includes the aerial broadcast application of urea pellets onto specific tree stands.

Silvicultural Activities

Silvicultural practices include activities designed to control the establishment, composition, growth, health, and quality of stands to achieve forest management objectives. Silvicultural activities include commercial and pre-commercial thinning, vegetation control, seed tree management, and active snag development using blasting, cutting or inoculation methods. Pre-commercial thinning typically is done in stands younger than 15 years old. One or more commercial thinning may be done for older stands. Silvicultural chemicals (e.g., herbicides, insecticides, and soil fumigants) may be used for some activities, and may require drafting water from local streams or ponds to mix with chemicals. Although chemicals may be used for silvicultural activities, their use is not a covered activity under this plan.

Fire Suppression

Fire suppression may include helicopter water drops, handline and bulldozer line construction, the application of water by engines or stationary pumps, snag felling, and manual digging for fire mop-up. Bulldozer lines and handlines are water-barred and mulched after the fire is controlled as needed. In addition, water drafting in local streams or ponds may occur to

support fire suppression activities. Fire suppression may include the application of aerial fire retardant[1] and surfactants but are not a covered activity under this plan.

Aquatic Habitat Restoration

Stream enhancement projects within the action area may include placement of logs or whole trees in streams to create pools and to retain spawning gravels; replacement 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 banks); improvement of road drainage systems; road closure; and/or road abandonment.

Rock Pit Development and Use

Rock pit activities include the development of rock quarries to provide crushed rock for roads in the forest. Quarry development includes the use of drills, explosives, bulldozers, loading equipment, crushing equipment and trucks. Portable rock processing plants may be located at strategic locations to facilitate extraction from small, localized quarries (i.e., approximately 200 feet long, 200 feet wide and 20 feet deep). Quarries would be maintained and active for several years, with crushing activities occurring intermittently.

Other Management Activities

Vertebrate Control

Vertebrate control includes trapping and removing mountain beavers (Aplodontia rufa), as needed to prevent damage to seedlings in newly planted areas. It also includes the use of plastic tubing sleeves and big game repellent to prevent browsing damage to young seedlings from deer and elk. The use of repellents is not a covered activity under this plan.

Harvesting of Special or Minor Forest Products

Special or minor forest products within the action area include a variety of plant products other than timber, which are collected or harvested for personal or commercial purposes. These special or minor forest products include but are not limited to sword fern (Polystichum munitum), salal (Gaultheria shallon), red huckleberry (Vaccinium parvifolium), and firewood

Research and Monitoring

Under this HCP, the ODF has identified three research priorities:

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[1] PHOS-CHEK fire retardant grades D-75F and D-75R would be the aerial fire retardant applied to the Action Area in the event of a timberland fire. According to the Material Safety Data Sheet for this product, components of this product include diammonium sulfate, monoammonium phosphate, diammonium phosphate, guar gum hydroxypropyl, and performance additives, which are protected by a trade secret. In addition, PHOS-CHEK WD861 fire suppressant foam concentrate would be used by fire engines for on-the-ground fire suppression. PHOS-CHEK WD861 is a proprietary formulation, so specifics on the components are not available; however, it is not classified as a hazardous material by the U.S. Department of Transportation.

1. Research that is a necessary part of a conservation strategy;
2. Research needed to:
    - assess or improve conservation strategies that are in place; or
    - increase management options and commodity production opportunities for lands managed pursuant to the HCP, including testing of new technologies and experimental application of silvicultural techniques.
3. Research needed to improve general understanding of the wildlife, habitats, and ecosystems addressed by the HCP

Research and monitoring projects will be implemented to better understand the effects of forest management activities on forest resources and provide information for the Adaptive Management process. Experimental study designs that are both more and less operationally restrictive than practices described in the ESF FMP may be conducted that will help researchers and policymakers assess how effectively current management strategies meet established resource objectives. The ODF research and monitoring staff will work with a team of scientists, biologists, and field staff from the ODF and other state and federal agencies to develop experimental study designs.

Because research and monitoring projects will affect a small fraction of lands covered by the HCP (less than one percent), adverse impacts to covered species and their habitats are not expected. Anticipated research and monitoring activities are described in Section 11.3.3 of the HCP. These research and monitoring projects and their associated forest management activities are covered under the ESF HCP.

Key Terms

Many of the definitions below are from the Handbook for Habitat Conservation Planning and Incidental Take Permit Processing (USDI Fish and Wildlife Service 1996b).

Candidate species—"... any species being considered by the Secretary [of the Interior or Commerce] for listing as an endangered or a threatened species, but not yet the subject of a proposed rule" (50 Code of Federal Regulations [CFR] 424.02).

Critical habitat—The specific areas within the general geographic area occupied by a federally listed species, in which physical and biological features occur that have determined to be essential to the conservation of the species. Critical habitat is designated by a federal agency pursuant to the ESA. Not all of the area encompassed by critical habitat contains the necessary habitat characteristics to support a particular species.

Endangered species—"... any species [including subspecies or qualifying population] which is in danger of extinction throughout all or a significant portion of its range" (Section 3(6) of ESA).

Federally listed species—Species, including subspecies and distinct vertebrate populations of fish, wildlife, or plants, listed at 50 CFR 17.11 and 17.12 as either endangered or threatened.

Habitat Conservation Plan—A comprehensive planning document that is a mandatory component of an ITP application pursuant to Section 10(a)(2)(A) of the ESA.

Harass—"... an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, and sheltering" (50 CFR 17.3).

Harm—An act "which actually kills or injures" listed wildlife; may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering ..." (50 CFR 17.3).

Incidental take—Take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities.

Incidental take permit—Federal exemption to take prohibition of Section 9 of the ESA; permit is issued by the USFWS pursuant to Section 10(a)(1)(B) of the ESA. An ITP is also referred to as a Section 10 Permit or Section 10(a)(1)(B) Permit.

Take—"... to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" with regard to federally listed endangered species of wildlife (Section 3(18) of the ESA). Federal regulations provide the same taking prohibitions for threatened wildlife species (50 CFR 17.31(a)).

Threatened species—"... any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (Section 3(19) of the ESA).

Chapter 2
Legal Context

2.1. LEGAL AND POLICY MANDATES FOR WESTERN OREGON STATE FORESTS

The Oregon Department of Forestry (ODF) manages the Elliott State Forest, which consists of approximately 93,000 acres of consolidated land near Coos Bay, Oregon. Of this total acreage, 84,352 acres (91 percent) are Common School Forest Lands (CSFLs), and the remaining 8,930 acres (9 percent) are Board of Forestry Forest Lands (BOFLs). These state forestlands are managed by the ODF according to several legal requirements.

2.1.1. Common School Forest Lands

The CSFLs are owned by the State of Oregon, which, acting through its State Land Board, contracts with the ODF to manage these lands. The State Land Board is composed of the Governor, the Secretary of State, and the Treasurer. The Oregon Constitution (Article VIII, Section 5) authorizes the State Land Board to manage the CSFLs "with the object of obtaining the greatest benefit for the people of this state, consistent with conservation of this resource under sound techniques of land management."

A 1992 Oregon Attorney General opinion (Crookham 1992) established that the "greatest benefit for the people" standard requires the State Land Board to use the lands for schools and the production of income for the Common School Fund (CSF). The CSFL resources are not limited to timber (currently recognized as a revenue generator for the CSF), but include all features of the land that may be of use to the schools. The State Land Board should consider other resources that may offer revenue for the CSF, such as minerals, water, and plant materials. In addition, the State Land Board may take management actions that reduce present income if such actions are intended to maximize income over the long term. In its management role, the State Land Board establishes policy that provides for the stewardship of the CSFL's, including the setting of harvest levels for these lands.

2.1.2. Department of State Lands Asset Management Plan

The Oregon Department of State Lands (DSL) is the administrative agency of the State Land Board and implements State Land Board policy to provide stewardship of lands, wetlands, waterways, unclaimed property, estates, and the CSF. The DSL Asset Management Plan (Oregon Department of State Lands 2006) guides management of CSFLs through overall and resource-specific goals and strategies. A key strategy of the Asset Management Plan is to "manage forest lands to increase timber harvest levels to the extent possible while maintaining a sustainable, even-flow harvest of timber, subject to economic, environmental and regulatory considerations."

2.1.3. Board of Forestry Lands

Oregon Revised Statutes (ORSs) establish that BOFLs can be acquired by the State of Oregon through "purchase, donation, devise or exchange (ORS 530.010)." The majority of the lands currently under Board of Forestry (BOF) management were acquired through the transfer of deeds by counties. The conveyance of county lands was made "in consideration of the payment to such county of the percentage of revenue derived from such lands (ORS 530.030)." ORS 530.050 directs BOFLs to be managed "so as to secure the greatest permanent value of such lands to the state." To this end, the statutes authorize the State Forester to produce timber and other commodities as well as to conserve, protect, and use a variety of natural resources.

Oregon Administrative Rules (OARs) 629-35-0000 to 629-35-0110, "Management of State Forest Lands," provide additional direction to the ODF in the management of BOFLs. These rules state that greatest permanent value means healthy, productive, and sustainable forest ecosystems that, over time and across the landscape, provide a full range of social, economic, and environmental benefits to the people of Oregon. OAR 629-35-0020(2) states that:

> "To secure the greatest permanent value of these lands to the state, the State Forester shall maintain these lands as forest lands and actively manage them in a sound environmental manner to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts. This management focus is not exclusive of other forest resources, but must be pursued within a broader management context that:
>
> - Results in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;
> - Protects, maintains, and enhances native wildlife habitats;
> - Protects soil, air, and water; and
> - Provides outdoor recreation opportunities."

2.1.4. Forest Management Plans

For lands managed by the ODF, Forest Management Plans (FMPs) are developed in accordance with the requirements set forth in the OARs. The OARs require the State Forester to "develop Forest Management Plans, based on the best available science, that establish the general framework for the planning area of forest land (OAR 629-035-0030)." The FMPs are subject to State Land Board and BOF reviews and approvals, which call for FMP activities to produce revenue for the CSF and for BOFLs to secure the greatest permanent value to the state. Implementation and Annual Operation Plans (AOPs) complement FMPs, and are developed to "describe smaller-scale, more specific management activities within the planning area." The FMPs are founded in stewardship principles, and include strategies that:

- Provide for active management
- Contribute to biological diversity of forest stand types and structures at the landscape level and over time

- Manage forest conditions to result in a high likelihood of maintaining and restoring properly functioning aquatic and native wildlife habitats
- Provide for healthy forests
- Maintain or enhance long-term soil productivity
- Comply with all applicable provisions of the law concerning federally listed threatened and endangered species
- Maintain and enhance forest productivity
- Use the best scientific information available to guide forest resource management actions and decisions

2.1.5. Forestry Program for Oregon

Policies for managing state forests are based on the Oregon Constitution and statutory direction, as described above. In addition, the ODF's forest management is guided by BOF policies. The BOF is a seven-member board appointed by the Governor to "supervise all matters of forest policy and management under the jurisdiction of this state and approve claims for expenses incurred under the statutes administered by the board except as otherwise provided by law (ORS 526.016)." The Forestry Program for Oregon (FPFO) is the strategic plan established by the BOF. It sets forth the BOF's mission and vision for Oregon's forests and the values and strategies that guide the BOF's decisions. The FPFO sets forth seven strategies adapted from internationally recognized criteria for measuring progress toward sustainable forest management in Oregon. Sustainable forest management means that forest resources across the landscape are used, developed, and protected at a rate and in a manner that enables people to meet their current environmental, economic, and social needs, and also provides that future generations can meet their own needs (based on ORS 184.421).

The *Elliott State Forest Management Plan* was developed to be consistent with the State Land Board's obligation to maximize revenue over the long term, and with the BOF's strategies and policies for ensuring productive state forestlands to secure the greatest permanent value to the state while protecting resources. The Habitat Conservation Plan (HCP) describes how the ODF will meet federal and state Endangered Species Act (ESA) requirements for all listed species identified in the FMP, including the northern spotted owl, marbled murrelet, and bald eagle. The Incidental Take Permit (ITP) will provide the most efficient and effective way for the State Land Board and the BOF to legally meet both the federal ESA requirements and the constitutional and statutory responsibilities to the state of Oregon. The HCP does not revisit decisions made in either the FPFO or FMPs. Therefore, the HCP should not be seen as an alternative to these documents, but rather as a way of providing more substance and detail to existing policies. The state forestlands to be covered by this ITP are described in detail in Chapter 3.

2.2. REGULATORY FRAMEWORK

2.2.1. Endangered Species Act

The federal ESA was enacted in 1973, and subsequently has undergone several modifications. The stated purposes of the ESA are: 1) "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species" (Section 2(a)(5)(b)); and 2) to act on specified relevant treaties and conventions. The Secretary of the Interior oversees the administration of the ESA, with the U.S. Fish and Wildlife Service (USFWS) acting on the Secretary's behalf. The Secretary of Commerce, through the National Oceanic and Atmospheric Administration's Fisheries Service (NMFS), which is the authority for the listing of marine mammals and anadromous fish.

The federal ESA lists several factors that, individually, may provide the basis for listing a species as endangered or threatened. These factors include "the present or threatened destruction, modification, or curtailment of its habitat or range; …the inadequacy of existing regulatory mechanisms; other natural or man made factors affecting its continued existence" (Section 4(a)(1)(A),(D),(E)).

Once a fish or wildlife species has been listed by either Secretary as endangered, the federal ESA defines several prohibited activities, including the "take [of] any such species" (Section 9(a)(1)(B)). "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (Section 3(18)). The USFWS has further defined "harm" to mean "an act which actually kills or injures wildlife. Such acts may include 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). Under Section 4(d), the listing Secretary may apply, and usually has applied, the same prohibitions of activities to threatened species.

Congress amended the ESA in 1982 to allow taking of listed species "if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (Section 10(a)(1)(B)). A nonfederal landowner may apply for an ITP by submitting an application that contains an HCP to the Secretary. The terms "conserve" and "conservation" means "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary" (Section 3(3)).

Under Section 10(a)(2)(A), the applicant's HCP must describe the impacts that are likely to result from the incidental take and the measures the applicant will carry out to minimize and mitigate such impacts. In addition, the HCP must include a discussion of alternative actions to such taking that the applicant has considered, and the reasons the alternative actions are not being utilized. Finally, the HCP must include "such other measures that the Secretary may require as being necessary or appropriate for the purpose of the plan."

Section 7 of the ESA requires federal agencies to ensure that "any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species" (Section 7(a)(2)). This section also prohibits "the destruction or adverse modification of habitat of such species…determined, after consultation as appropriate with affected States, to be critical" to the recovery of the species. Critical habitat includes areas occupied by the species at the time of listing, essential to the conservation of the species, and that may require special management considerations or protection (Section 3(5)(A). Once designated, critical habitat enters the federal rule making process within 90 days (Section 4(b)(5).

Recovery of listed species is not the primary objective of conservation planning, but an important consideration in the development of an HCP. Criteria established for the approval of an HCP (Appendix E) ensure consistency with critical habitat recovery goals. Where a recovery plan has not been adopted, the HCP should thoroughly consider recovery opportunities and be based on known limiting factors for the species. It should be noted that an HCP is not a surrogate or substitute for a recovery plan, but only one part of a much larger federally supported species recovery effort.

The ITP can be issued following opportunities for public comment and a finding by the Secretary that "the taking will be incidental" and the applicant will, "to the maximum extent practicable, minimize and mitigate the impacts of such taking." The Secretary's finding must also show that "adequate funding for the plan will be provided, the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild, and the measures, if any, required will be met" (Section 10(a)(2)(B)(iii)). Granting an ITP is a federal action, making an HCP subject to a jeopardy analysis and biological assessment, as set forth in Section 7(a)(2) and 7(c). A more thorough discussion of habitat conservation planning may be found in Appendix E.

2.2.2. National Environmental Policy Act

The National Environmental Policy Act (NEPA) was signed into law on January 1, 1970. NEPA establishes environmental policy at the national level, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains "action-forcing" procedures to ensure that federal agency decision-makers take environmental factors into account (42 United States Code [USC] 4321; 40 CFR 1500.1). The four purposes of NEPA are to: 1) declare a national policy that will encourage productive and enjoyable harmony between people and the environment; 2) promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate health and welfare; 3) enrich the understanding of ecological system and natural resources important to the nation; and 4) establish a Council on Environmental Quality.

The USFWS and NMFS must comply with NEPA when evaluating potential impacts related to the issuance of an ITP. NEPA requires every federal agency to prepare an Environmental Impact Statement (EIS) for proposed legislation or other major federal actions significantly affecting the quality of the human environment (USC 4332; 40 CFR 1501). An EIS provides an analysis of environmental impacts related to a proposal and considers all reasonable

alternatives that would avoid or minimize adverse impacts. NEPA provides for public involvement throughout the review process.

It is important to understand the difference between the requirements of an ITP, as set forth in the federal ESA, and those of NEPA. A HCP identifies potential impacts to species listed under the ESA, and describes the planned measures that will minimize (and mitigate to the maximum extent practicable) those impacts, and other measures if necessary. An HCP also describes alternatives to the proposed taking and why those alternatives are not considered feasible. A NEPA analysis, on the other hand, examines additional environmental impacts not necessarily related to a listed species.

2.3. FEDERAL PLANS AND RULES

Section 4 of the ESA requires the U.S. Departments of the Interior (USDI) and Commerce (USDC), collectively referred to as the Secretary, to prepare and implement recovery plans for all listed species, unless the Secretary determines that a recovery plan would not promote the conservation of the species. Recovery Plans generally establish target conditions on federal and non-federal lands that would constitute ecological recovery for that particular species or population. Federal recovery plans are not binding on nonfederal lands, where they serve as recommendations only. The federal government has published a recovery plan for the marbled murrelet; the recovery plan for the northern spotted owl is still in the draft stage. A Pacific Region Recovery Plan for the bald eagle was adopted in 1986 (USDI Fish and Wildlife Service 1986); statewide objectives under this plan were reached in 1999 and the species was delisted in 2007. The NMFS announced intent to develop a recovery plan for coho salmon; a completion date for this plan has not yet been determined.

The federal government has also proposed restoration of viable marbled murrelet and northern spotted owl populations on federal lands through the Northwest Forest Plan. In addition, the Secretary can issue regulations called 4(d) rules regarding the conservation of listed species on nonfederal lands. Such a rule has been proposed but not enacted for the northern spotted owl in Oregon. The relevant plans are briefly discussed because of their potential to affect state forest management.

2.3.1. Northwest Forest Plan

Federal forest land management controversies in the Pacific Northwest led to the convening of the Northwest Forest Conference in April 1993. A team of resources specialists, the Forest Ecosystem Management Assessment Team, was asked to identify management alternatives that would achieve the greatest economic and social contributions from forestlands while meeting the requirements of applicable laws and regulations.

The Forest Ecosystem Management Assessment Team was also asked to develop long-term management alternatives that would maintain or restore:

- Habitat conditions for the northern spotted owl and marbled murrelet that would provide for the viability of each species
- Habitat conditions to support viable populations, well distributed across their current range, of species known to be associated with old-growth forests
- Rearing habitat on U.S. Forest Service (USFS), Bureau of Land Management (BLM), National Park Service, and other federal lands to support the recovery and maintenance of viable populations of anadromous fish species and other fish species considered “sensitive” or “at risk”
- Fully implement all strategies and monitoring plans

The Preferred Alternative (Option 9) was approved by the Secretaries of the Interior and Agriculture, and the Record of Decision issued in 1994 (USDA Forest Service et al. 1994b).

In 2001, changes were made to the survey and manage provisions (USDA Forest Service et al. 2001). In 2004, a decision was made to remove the Survey and Manage Mitigation Measure standards and guidelines, and to rely instead on the USFS and BLM special-status species programs. In a separate decision, the Northwest Forest Plan's aquatic conservation strategy was clarified to apply at the watershed level rather than at the individual project level.

2.3.2. Recovery Plan for the Northern Spotted Owl

The northern spotted owl was listed as a federal threatened species on July 23, 1990 in Oregon, Washington, and California. A *Draft Recovery Plan* for the northern spotted owl was issued in 1992, and was revised after the public comment period (USDI Fish and Wildlife Service 1992a). In 2006, the USFWS began development of a new recovery plan to address what is needed to recover the species throughout its range. The Recovery Plan for the Northern Spotted Owl was finalized in 2008 (U.S. Fish and Wildlife Service 2008).

The Recovery Plan was prepared by a team representing Federal agencies, State governments, and other affected and interested parties, as well as the assistance of a contractor. Federal and state agency scientists and academic researchers provided support to the Recovery Team. The final recovery plan outlines the recovery goal and objectives for the northern spotted owl, and the strategy for attaining these objectives, and presents specific criteria to measure progress towards recovery.

The objectives identified in the recovery plan are to have sufficiently large and well-distributed northern spotted owl populations, adequate suitable habitat available for northern spotted owls to persist, and reduced or eliminated threats. Numerous actions also are presented in the Recovery Plan that address overall recovery through maintenance and restoration of suitable habitat for northern spotted owls, monitoring of avian diseases, development and implementation of a delisting monitoring plan, and management of the barred owl.

The Northwest Forest Plan specifically addresses northern spotted owls and their habitat on federal lands, and was considered in development of the Recovery Plan strategy.

2.3.3. Critical Habitat Rule for the Northern Spotted Owl

The USFWS first proposed the areas to be designated for critical habitat for the northern spotted owl in May 1991. The USFWS announced a revised proposal on August 5, 1991, which recommended that 8.2 million acres of land be designated as critical habitat. The revised proposal included 3.8 million acres in 77 locations in Oregon. The final rule on critical habitat was published in the Federal Register on January 15, 1992 (Volume 57, Number 10, pp. 1796 to 1838). The final rule designates 6,887,000 acres as critical habitat, including 3,257,000 acres in 76 locations in Oregon.

2.3.4. Recovery Plan for the Marbled Murrelet

The marbled murrelet was listed as a federal threatened species in Washington, Oregon, and California on October 1, 1992. A Draft Recovery Plan for the marbled murrelet was issued in August 1995 in response to a requirement in Section 4 of the ESA (16 USC 1533(f)). In 1997, the USFWS completed the *Recovery Plan for Threatened Marbled Murrelet* (USDI Fish and Wildlife Service 1997). This Recovery Plan addresses management needs on both federal and nonfederal lands and in the marine environment. Federal recovery plans are not binding on nonfederal lands unless federal funds or activities are involved, such as the issuance of an ITP.

A scientific team assisted by representatives of affected states and other federal agencies developed the draft and final recovery plans. The final recovery plan includes information on: a) biology of the species, including habitat needs; b) reasons for population decline and current threats; c) current management; and d) recommendations for recovery efforts in Oregon, Washington, and California. The objectives identified in the recovery plan are to stabilize the population at a sustainable level throughout its range; provide future conditions that support viable, self-sustaining populations; and gather the scientific information necessary to develop criteria for de-listing the species.

The Northwest Forest Plan specifically addresses marbled murrelets and their habitat on federal lands. The Northwest Forest Plan was recognized as a cornerstone of the Recovery Plan's strategy. The Northwest Forest Plan identifies and protects large reserve areas where marbled murrelet habitat will increase over 50 to 100 years, and that are known occupied marbled murrelet sites. The recovery plan includes nonfederal lands that were not considered by the Northwest Forest Plan. Actions necessary to achieve the objectives of the recovery plan include: 1) establishing six conservation zones with specific management strategies for each; 2) identifying and protecting habitat in each zone through the designation of critical habitat, or other methods such as HCPs and FMPs for these areas; 3) monitoring populations and habitat, and surveying potential breeding habitat to identify occupied sites; 4) implementing actions to stabilize and increase the population in the immediate future and increase population growth in the long term; and 5) initiating needed research and establishing a regional research coordinating body.

2.3.5. Critical Habitat Rule for the Marbled Murrelet

The USFWS published its first draft rule for marbled murrelet critical habitat in January 1994. After reviewing public comments and additional information, the agency released a revised draft rule in August 1995, the same time at which it published the *Draft Recovery Plan* for the marbled murrelet (USDI Fish and Wildlife Service1995). In the August 1995 revision, the USFWS proposed that 4.5 million acres in Washington, Oregon, and California be designated as critical habitat for the marbled murrelet. On May 15, 1996, a final critical habitat rule for the marbled murrelet was published in the Federal Register (Volume 61, pp. 26255–26320).

The rule designated 3.88 million acres as critical habitat, a reduction of nearly 600,000 acres from the previous proposal. The designation includes 175,000 acres of land owned by the State of Oregon. The 175,000 acres is mostly state forestland; a small amount is in state parks or other state ownerships. Lands covered by a "legally operative incidental take permit for marbled murrelets issued under section 10(a) of the ESA" will be excluded from this designation according to the 1996 rule. The Elliott State Forest was covered by such a ITP at that time and was not designated as part of the critical habitat.

2.3.6. Recovery Plan for Coho Salmon

In February 2008, NMFS made a final determination to list the Oregon Coast coho salmon (Oncorhynchus kisutch) evolutionarily significant unit (ESU) as a threatened species under the Endangered Species Act (ESA). At this same time, the NMFS announced its intent to work with Oregon to build upon its Oregon coast coho conservation plan, and to develop the necessary elements to meet the requirements of an ESA recovery plan. A date for when the final recovery plan will be available has not yet been projected.

2.3.7. Critical Habitat Rule for Coho Salmon

The NMFS first proposed designations of coho salmon critical habitat for 13 evolutionarily significant units in the Northwest on December 14, 2004. This 2004 proposed designation included critical habitat in 72 of 80 occupied watersheds, contained in 13 subbasins, totaling approximately 6,665 stream miles along the Oregon Coast, south of the Columbia River and north of Cape Blanco (Oregon). Following a determination to not list the species in January 2006 and in response to a court order, NMFS evaluated the comments and new information received on the 2004 proposed rule to ensure that they represented the best scientific data available and made a number of general types of changes to the critical habitat designations.

A final rule designating critical habitat for coho salmon was published in the Federal Register (Volume 73, pp. 2816-7873) on February 11, 2008. This final rule designated as critical habitat approximately 6,568 stream miles (10,570 km) and 15 square miles (38.8 sq km) of lake habitat within the geographical area presently occupied by the Oregon Coast coho ESU. This critical habitat designation excluded five of 80 watersheds within the range of the Oregon Coast coho ESU and approximately 84 stream miles (135 km). The critical habitat comprises percent land ownership as follows: 32.9 federal lands; <0.1 Tribal; 9.1 state lands; 58.0 private lands.

The 2008 final rule also adopted for the coho salmon the same 4(d) rule already adopted to prohibit the "take" of threatened West Coast salmon and steelhead. This 4(d) rule, while prohibiting take, also allows certain activities to continue provided they meet specific conditions to adequately protect yet the listed species. Comprehensive descriptions of these 4(d) regulations are available on the Web: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/Final-4d-Rules.cfm.

2.3.8. Unlisted Species

This HCP addresses the conservation of certain native vertebrate species that may occur in the planning area and become listed during the ITP period. Federal regulation establishes that "in the event an unlisted species addressed in the approved conservation plan is subsequently listed pursuant to the Act, no further mitigation requirements should be imposed if the conservation plan addressed the conservation of the species and its habitat as if the species were listed pursuant to the Act" (H.R. Report No. 97-835, 97th Congress, Second Session, and 50 FR 39681-39691).

2.4. OTHER LEGAL REQUIREMENTS

2.4.1. State Endangered Species Act

For the Elliott State Forest, ODF's responsibility under the state ESA is to coordinate with the Oregon Department of Fish and Wildlife and the Oregon Department of Agriculture in developing plans that comply with the Act, and that are consistent with the constitutional mandate for CSFLs.

The state ESA was adopted in 1987, and included both plant and animal species. Revisions that outline listed species protection requirements were added by legislation in 1995. The bald eagle, northern spotted owl, and marbled murrelet were listed as threatened species under the ESA in the following years: the bald eagle in 1987, the northern spotted owl in 1988, and marbled murrelet in 1995. The American peregrine falcon was listed as an endangered species in 1987.

For threatened or endangered species listed after 1995, the Fish and Wildlife Commission must establish quantifiable and measurable guidelines considered necessary to ensure the survival of individual members of the species. These survival guidelines may include take avoidance and measures to protect resource sites (e.g., nest sites and spawning grounds). Because the bald eagle, northern spotted owl, marbled murrelet, and peregrine falcon were all listed in or prior to 1995, state survival guidelines were not developed for these species. In the absence of survival guidelines, the ODF will rely on measures in this HCP to comply with the federal ESA and as the means of protecting state listed species.

2.4.2. Oregon Forest Practices Act

Activities on forestlands are subject to the Forest Practices Act (FPA), Chapter 527 of the ORSs, and the OARs pursuant to these statutes. The FPA declares it public policy to encourage economically efficient forest practices that ensure the "continuous growing and harvesting of forest tree species and the maintenance of forest land for such purposes as the leading use on privately owned land, consistent with sound management of soil, air, water, fish, and wildlife resources and scenic resources in visually sensitive corridors…" (ORS 527.630(1)). The BOF is granted the exclusive authority to develop and enforce rules protecting forest resources and to coordinate with other agencies concerned with forests. The FPA has developed in an evolutionary manner since the original act was passed in 1971. The original FPA established minimum standards for reforestation, road construction and maintenance, timber harvesting, application of chemicals, and disposal of slash.

2.4.3. Oregon Plan for Salmon and Watersheds

In 1997, the Oregon Legislature adopted The Oregon Plan for Salmon and Watersheds, which focused on coho salmon. In 1998, the Steelhead Supplement of the Oregon Plan was added.

The purposes of the Oregon Plan for Salmon and Watersheds (the "Oregon Plan") are to restore Oregon's wild salmon and trout populations and fisheries to sustainable and productive levels that will provide substantial environmental, cultural, and economic benefits, and to improve water quality. The Oregon Plan 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 is a cooperative effort of state, local, federal, tribal, and private organizations and individuals. Although the plan contains a strong foundation of protective regulations—continuing existing regulatory programs and expediting the implementation of others—an essential principle of the Plan involves moving beyond prohibitions and encouraging efforts to improve conditions for salmon through non-regulatory means.

In relation to the Oregon Plan, Executive Order number EO 99-01 directs that, consistent with administrative rule and statutory and constitutional mandates for the management of state forests, ODF State Forest management plans will include an aquatic conservation strategy that has a high likelihood of protecting and restoring properly functioning aquatic habitat for salmonids on state forest lands.

Chapter 3
Regional Conservation Context

The ideas, objectives, and strategies of this Habitat Conservation Plan (HCP) begin with the forestlands in their current state. This HCP's central strategy is to develop and maintain diverse stand structures across the forest. Therefore, it is important to know the forest as it currently exists on the landscape. This chapter briefly describes Elliott State Forest lands from a regional context and by ownership, including current management approaches of the landowners.

3.1. FOREST LANDS IN THE SOUTH OREGON COAST REGION

The Elliott State Forest is located in the south Oregon coast region, which is defined as the geographic area in the southern one-third of the Oregon Coast Range physiographic province (Franklin and Dyrness 1988). More specifically, this area encompasses the area from Coos Bay and the Oregon Dunes National Recreation Area on the west to near Roseburg on the east, and from Highway 199 on the south to 12 miles north of Highway 38. The region encompasses approximately five million acres.

In the south Oregon coast region centered on Coos and Curry counties, approximately 49 percent of forest land is in public ownership; the Elliott State Forest (93,000 acres) constitutes approximately 10 percent of that total (Sessions et al. 1990). The national forests (Siuslaw with 630,000 acres and Siskiyou with 1,094,250 acres), and lands owned by the Bureau of Land Management (BLM) (324,000 acres) constitute the vast majority of the remaining 39 percent of public ownership.

Private industrial timberlands compose the next largest category of adjacent ownership (550,000 acres). Other private lands with multiple owners and uses are interspersed with industrial timber land and federal holdings.

3.1.1. Federal Lands

Federal forest lands in the region of the Elliott State Forest include lands managed by the BLM, Department of the Interior and national forestlands managed by the U.S. Forest Service, Department of Agriculture. Federal forestlands account for 43 percent of the forestland in the planning area (see Table 3-1), and generally contain a wider range of forest types than either the private or state-managed lands. For example, while much of the federal ownership has been harvested since the late 1940s (Bourhill 1994), large unharvested areas remain in wilderness and other areas that are exempt from timber harvesting.

Although both timber harvesting and fire events have been influential in shaping the current condition of federal forestlands, management of these lands has been heavily influenced by a multitude of laws and policies that guide federal land management. The current management direction for federal forestlands is outlined in the Northwest Forest Plan (USDA Forest Service et al. 1994a). The Northwest Forest Plan uses a system of late successional forest reserves, riparian reserves, adaptive management areas, and matrix lands.

- Late successional forest reserves protect habitat for species dependent on these forests, including northern spotted owls and marbled murrelets.
- Riparian reserves protect habitat for at-risk fish species, other aquatic and riparian species, and all species that use riparian areas.

Table 3-1
Acres of Land Ownership by Ecoregion

Ownership Category	Coast Range: South Region	Coast Range: Coos Region	Klamath Mountains
Oregon Department of Forestry	24,554	95,946	19,109
Federal	369,982	718,966	2,004,801
Other Public	10,491	55,623	71,886
Private Industrial	171,588	872,840	455,662
Private Non-industrial	99,902	554,493	1,318,579
Totals	**676,517**	**2,297,868**	**3,870,037**

Source: Oregon Department of Forestry.

Note: The total number of acres of land in the area of interest is 6,844,422 acres. This table shows total land acres, not just forest ownership. The figures include farmland, urban areas, etc. The ecoregions are based on, but modified from, *Natural Vegetation of Oregon and Washington* (Franklin and Dyrness 1988). Coast Range South Region is the coastal portion of the West Lane District; Coast Range Coos Region is the Coos District down to the Klamath Mountains (see map section).

- Adaptive management areas are used for the development and testing of technical and social approaches to ecosystem management. Resource managers and local communities rely on their experience and creativity to develop innovative prescriptive approaches.
- Matrix lands are used for normal forest management activities. They follow existing forest and area plans, with the addition of some guidelines to provide connectivity to old-growth forests and to assist in the development of diverse landscapes.

The BLM forestlands in the vicinity of the Elliott State Forest are administered by the Eugene, Coos Bay, Medford, and Roseburg Districts. National forestlands in the vicinity of the Elliott State Forest include the Siuslaw and Siskiyou National Forest lands.

Federal lands are present to the north, east, and southeast of the Elliott State Forest. To the north across the Umpqua River is Siuslaw National Forest land. To the east and southeast are BLM lands, most of which are intermixed with private lands in a checkerboard pattern of alternating square-mile sections. Land management on all federal lands near Elliott State Forest lands will follow the management direction given in the Record of Decision for the Final Supplemental Environmental Impact Statement (USDA Forest Service et al. 1994a, 1994b). Management direction pertinent to this HCP is summarized briefly below.

Large amounts of federal lands near the Elliott State Forest are designated as late successional reserves. These reserves are managed to protect and enhance habitat for late successional and old growth-related species, including the northern spotted owl. Limited stand management is permitted, to maintain and protect late successional forest ecosystems.

In 2005, the BLM began revising its Resource Management Plans for western Oregon. The planning area covers approximately 2,557,800 acres of BLM-managed land, and includes BLM lands near the Elliott State Forest. Recent court actions over these lands resulted in a settlement agreement that included a commitment to revise the Resources Management Plans by the end of 2008. Each proposed revision is to include at least one alternative that does not create any reserves on Oregon and California Railroad grant lands, except as required to avoid jeopardy under the federal Endangered Species Act.

Federal lands north and southeast of the Elliott State Forest include several key watersheds. The key watersheds are managed to provide high-quality habitat for at-risk anadromous fish stocks and resident fish species. Key watersheds overlie other land designations. Timber harvest may occur in parts of key watersheds that are also designated as matrix lands, after a watershed analysis is completed.

The remaining federal lands in the south Oregon coast region are designated as matrix lands (approximately 10 percent of federal ownership). These lands are available for regularly scheduled timber harvest. Standards and guidelines require that 100 acres of northern spotted owl habitat be protected around known northern spotted owl activity centers on matrix lands. For BLM lands in the region, a number of 640-acre blocks are managed on a 150-year timber rotation, as connectivity/diversity blocks. For each of these blocks, 25 to 30 percent must be kept in late successional forest at any time. Other matrix lands may be managed on other timber rotations.

All federal lands near the Elliott State Forest are in Marbled Murrelet Conservation Zone 3, and are surveyed for marbled murrelet occupation before any projects take place. All marbled murrelet-occupied sites on federal lands are protected within a 0.5-mile radius where no timber harvest is allowed.

3.1.2. Private Forest Lands

Because of timber harvesting policies, few acres of private land contain forest stands older than 65 years. Shaped by previous timber harvesting, private forestlands are younger than public forest lands. Industrial forest lands are generally younger and better stocked with trees than non-industrial forest lands. Future private timber harvests will be from younger trees with characteristics different from trees harvested in the past. Private final harvest ages in the future are expected to vary from 35 to 65 years (Lettman 1995). The average age of these areas has declined, and the average overall harvest age has declined. The larger private ownerships will likely be in the lower end of the final harvest age range. Future timber supply from private lands will depend on levels and timing of management practices. It is likely that private industrial and non-industrial private lands will continue to be managed for early successional forests.

3.1.3. State Forest Lands

The lands managed by the Oregon Department of Forestry (ODF) included in this HCP constitute approximately 93,282 acres, about four percent of the forestland in the south

Oregon coast Coos region. The majority of Elliott State Forest lands have the potential to produce high-quality timber, dispersed recreation opportunities, and excellent habitat for many of the region's fish and wildlife species. Table 3-2 presents the acreage of the ODF-managed lands, by county.

Table 3-2
Acres of Land Covered in the HCP
in South Oregon Coast Counties
Managed by the Department of Forestry

County	Total Acres
Coos	59,191
Douglas	34,091
Total for all counties	**93,282**

Source: Oregon Department of Forestry, 2000 OSCUR Inventory Summary.

The Elliott State Forest is expected to fill a transitional and progressively graduated niche between the older forests to the north and east and the younger forests to the south and west. The proposed role of the Elliott State Forest lands for northern spotted owl and marbled murrelet habitat protection is described in this HCP. The Elliott State Forest Management Plan has defined the role of the forest for timber production and other forest resources in context with other public and private ownerships in the south Oregon coast region. Timber production and the maintenance or development of habitat for fish and wildlife are emphasized in the management of the Elliott State Forest.

3.2. ELLIOTT STATE FOREST OVERVIEW

The Elliott State Forest is located in the southern Oregon Coast Range. Coos Bay and North Bend are the nearest cities to the southwest of the Elliott State Forest; Reedsport is the nearest town to the northwest. The forest is a contiguous block of land approximately 18 miles long (north to south) and 16 miles wide (west to east). The Umpqua River approximates the north boundary of the forest. To the west, the Elliott State Forest extends to within six miles of the ocean. On the east, it extends approximately 21 miles inland. The contiguous Elliott State Forest covers about 93,000 acres in Coos and Douglas Counties (Table 3-2).

The lands of the Elliott State Forest can be described in various ways. Over the next several pages, these forestlands are described in terms of land ownership, administrative areas, ecoregions, watersheds, current forest condition, and land use classifications. All of these perspectives are used throughout the HCP.

3.2.1. History

Oregon became a state in 1859; at that time, the federal government allotted sections 16 and 36 of every township to be used for schools. Oregon's grant amounted to 3.5 million acres of land. Eventually, much of this land was either sold for the benefit of schools or lost through fraudulent land deals. Some of the sections were exchanged and consolidated into larger blocks. The remaining forest lands, owned by the State Land Board, are known as Common School Forest Lands (CSFLs).

The ODF was created in 1911 for the main purpose of controlling forest fires, and with the authorization to acquire and manage forest lands. The State Land Board authorizes the ODF (through contract) to manage the CSFLs for the purpose of generating income for the Common School Fund.

The ODF did not actually acquire any lands until legislative actions made it more feasible. The 1925 Legislature passed a law allowing the Board of Forestry (BOF) to accept gifts or donations of forest land. The State Forest Lands Acquisition Act of 1939 created procedures for the BOF to acquire tax-delinquent forest lands from the counties, manage those lands, and return most net revenues from the land to the respective counties. In later years, amendments fine-tuned the distribution of revenues and legal direction for forest management on these lands (Fick and Martin 1992). These lands are known as Board of Forestry Lands (BOFLs), and are managed to produce income for counties and local taxing districts.

Additional information on legal and policy mandates for CSFLs and BOFLs can be found in Chapter 2. State forest lands include CSFLs owned by the State Land Board and BOFLs owned by the BOF. Of the 93,282 acres of Elliott State Forest lands managed by ODF under this HCP, 84,352 acres (90.4 percent) are CSFLs that are owned by the State Land Board and 8,930 acres (9.6 percent) are BOFLs. The Ownership map in the Map Section shows the distribution of land ownership.

3.2.2. Administrative Areas

The ODF divides Oregon into three administrative areas—Northwest, Eastern, and Southern—each composed of a number of districts. District foresters and staff conduct all field activities for the ODF in their section of the state. This HCP covers all state forestland in the Elliott State Forest, which is located entirely within the Southern Oregon Area.

3.2.3. Watersheds and Management Basins

The streams draining the Elliott State Forest flow into one of three waterbodies. About 47 percent of the forest drains southwest into Coos Bay, 30 percent drains north to the Umpqua River, and 23 percent drains west to the North and South Tenmile Lakes (Biosystems et al 2003). (See the "Key Terms" box below for definitions.)

The Elliott State Forest is divided into 13 management basins based mainly on major drainage areas. The management basins, which are also used as watershed analysis basins, are primarily based on hydrologic boundaries and can be aggregated up to fifth-field watersheds. (See Figure 5-1 in Chapter 5.)

Key Terms

While the terms "basin" and "watershed" are used in various ways, this HCP assigns particular definitions to the words:

Management basin—An area used for forest planning. Management basins are designated and displayed in the district Implementation Plan, and are shown in Figure 5-1 in Chapter 5. Their boundaries are based primarily on drainage and topographic patterns within the major watersheds. Basin boundaries are generally consistent with 5th and 6th field Hydrologic Unit Codes as developed by the U.S. Geological Survey.

Watershed—In general, a watershed is an area in which water that falls as rain or snow drains to the same stream or river. Watersheds vary in size, from a small stream to a larger waterbody such as the Umpqua River.

3.2.4. Current Forest Condition

Conifer forests cover nearly all (98 percent) of the Elliott State Forest lands. Most of the Elliott State Forest resulted from the 1868 Coos Bay Fire. Today, as a result of harvest and management, about half of the conifer forests on these lands are less than 75 years old, a slightly lesser amount are between 76 and 145 years old, and only a few thousand acres are older than 146 years. Table 3-4 displays stand structure conditions based on January 2005 inventory information applied to stand structure definitions (presented in Chapter 5 of this document).

Other types of vegetation dominate the remaining acreage, including grass, brush, and various species of hardwood trees such as alder and big leaf maple. Non-conifer vegetation is classified by size. Of the total acres dominated by non-conifers, most are in the class of 5- to 10-inch diameter breast height.

Site class is a measure of an area's capacity to produce vegetation as expressed by the height of the tallest trees (see the "Background Information" box below). Most of the Elliott State Forest lands reflect a site class of two or three (see Table 3-3), which indicates a relatively high productive capacity. The Elliott's average 50-year site index for Douglas-fir is 115 feet, or a low site class II, based on the Weyerhaeuser Soil Mapping of the Elliott State Forest completed in 1973 (Duncan and Steinbrenner 1973). A 50-year site index of 115 feet correlates to a 100-year site index of 160 feet (King 1966). Additional information is presented in Appendix C.

Background Information

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). For the site classes described below, an age of 50 years is used.

Site class I — 135 feet and up
Site class II — 115 to 134 feet
Site class III — 95 to 114 feet
Site class IV — 75 to 94 feet
Site class V — Below 75 feet

Table 3-3
Site Class Acres

Site Class		
1 (135 feet and up)	**2 (115–134 feet)**	**3 (95–114 feet)**
5,325 acres	49,712 acres	38,245 acres

Note: Based on Duncan and Steinbrenner 1973, which sampled 88.67 percent of the Elliott State Forest.

Table 3-4

Stand Structure – Current Forest Condition

Basin	Acres in Basin	Acres of CAs	Acres of Advanced Structure Inside CAs	Acres in Advanced Structure Outside CAs	Total Acres of Intermediate Structure	Total Acres of Early Structure	Total Acres of Non-Forest Structure
1. Mill Creek	5,356	2,654	1,427	491	3,281	60	97
2. Charlotte-Luder	6,422	2,514	1,576	2,658	1,936	250	2
3. Dean-Johanneson	7,296	1.044	670	2,897	3,670	24	3
4. Scholfield Creek	4,990	774	320	1,333	3,220	102	15
5. Big Creek	7,823	1,227	832	3,044	3,698	174	75
6. Benson-Roberts	7,417	1,669	1,138	3,106	2,847	326	0
7. Johnson Creek	6,322	745	403	2,884	2,746	223	66
8. Palouse-Larson	6,541	1,561	839	1,858	3,344	450	50
9. Henry's Bend	8,284	2,344	1,284	1,140	4,810	1,020	30
10. Marlow-Glenn	6,512	1,654	678	611	4,315	849	59
11. Millicoma Elk	10,873	2,400	1,600	3,716	4,168	1,267	122
12. Trout Deer	11,314	2,806	1,589	2,190	5,474	2,050	11
13. Ash Valley	4,132	1,206	803	859	2,243	203	24
Forest Wide Total	93,282	22,598	13,159	26,787	45,752	6,998	586

CA = conservation area

Table displays acreages identified using Coos District ArcView shapefiles and does not include mapped habitat crediting.

Chapter 4
Biological Data for Covered Species

The Habitat Conservation Plan (HCP) is based on the best available scientific knowledge about the covered species listed in Table 4-1. Chapter 4 summarizes the current knowledge about these species' basic biology, and their numbers and distribution in the Elliott State Forest.

Table 4-1
Species Covered by the Habitat Conservation Plan

Birds	Mammals	Fish	
Northern spotted owl	Fisher	Coho salmon	River lamprey
Marbled murrelet	**Amphibians**	Chinook salmon	Western brook lamprey
Bald eagle	Red-legged frog	Chum salmon	
Northern goshawk	Southern torrent salamander (HAS[1])	Steelhead trout	
Olive-sided flycatcher	Tailed frog (HAS)	Coastal cutthroat trout	
Western bluebird		Pacific lamprey	

[1]HAS = headwater amphibian species

Sensitive Species Rankings

Oregon Department of Fish and Wildlife Sensitive Species List (1997)

Critical—Species for which listing as threatened or endangered is pending, or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species that are at risk throughout their range and some disjuncta populations.

Vulnerable—Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases, populations are sustainable and protective measures are being implemented; in others, populations may be declining and improved protective measures are needed to maintain sustainable populations over time.

Peripheral or Naturally Rare—Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those with historically low populations numbers in Oregon because of naturally limiting factors.

Undetermined Status—Species for which status is unclear. They may be susceptible to population decline of sufficient magnitude that they could quality for endangered, threatened, critical, or vulnerable status, but scientific study would be needed before a judgment can be made.

Oregon Natural Heritage Information Center Species State Ranks

List 1—Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with five or fewer occurrences.

List 2—Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6 to 20 occurrences.

List 3—Rare, uncommon, or threatened, but not immediately imperiled, typically with 21 to 100 occurrences.

List 4—Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences.

List 5—Demonstrably widespread, abundant, and secure.

U.S. Fish and Wildlife Service Species of Concern

Taxa for which the USFWS is reviewing for consideration as candidates for listing under the ESA.

4.1. NORTHERN SPOTTED OWL

Information on the ecology of northern spotted owls may be found in the *Scientific evaluation of the status of the Northern Spotted Owl* (Courtney et al. 2004); *Recovery Plan for the Northern Spotted Owl* (U.S. Fish and Wildlife Service 2008); *A Conservation Strategy for the Northern Spotted Owl: A Report of the Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl* (Thomas et al. 1990); and numerous journal articles. Literature published since 1990 is summarized in *A Literature Review on the Northern Spotted Owl* (Hunter 2003), a review conducted for the ODF.

In addition, research was conducted on northern spotted owl populations and habitat in the Elliott State Forest, as well as on state forest lands in the northern Oregon Coast Range, by the Oregon Department of Forestry (ODF) and researchers from the Oregon Cooperative Fish and Wildlife Research Unit, and the Oregon State University College of Forestry. Three separate field studies were established to meet the research objectives (Anthony et al. 2000a; Anthony et al. 2000b; Tappeiner et al. 2000), and the results of those studies are described in the sections below.

4.1.1. Species Ecology and Literature Review

The northern spotted owl (*Strix occidentalis caurina*) is found in conifer forests of northwestern North America, primarily in Washington, Oregon, and Northern California. The northern spotted owl's current range is approximately the same as its historic range, extending from southwest British Columbia to Marin County, California, and from the Pacific Ocean east across the Cascades (U.S. Fish and Wildlife Service 2008).

Northern spotted owls are non-migratory nocturnal predators of medium-sized mammals and occasionally other prey. Prey in the plan area is mainly northern flying squirrel (*Glaucomys sabrinus*), bushy-tailed wood rat (*Neotoma cinerea*), and voles, and also includes mice and species from the rabbit family (Anthony 1996).

Courtship behavior begins in February or March. Pairs tend to stay together for several years. Owls defend a territory, probably smaller than the home range, using vocalizations and visual displays. Northern spotted owls do not construct their own nests. Nesting occurs in cavities or platforms such as abandoned goshawk nests or mistletoe brooms (Buchanan et al. 1993; Forsman et al. 1984; Thomas et al. 1990). Eggs are incubated for approximately 30 days. Juveniles remain in the nest for three to five weeks; they often leave the nest before they can fly, and climb into nearby branches or fall to the ground. Both parents feed the young until they disperse in early fall (late September or early October) (U.S. Fish and Wildlife Service 2008). Juveniles begin to hunt in late summer while they are still dependent on their parents. After dispersal of the young, the adults expand their home ranges and are together less often.

4.1.2. Habitat Requirements

Habitat for northern spotted owls has been studied in depth, and is discussed in the comprehensive reviews listed above. This section will focus on northern spotted owl habitat in the Oregon Coast Range, and specifically in the Elliott State Forest.

In the Oregon Coast Range, northern spotted owl home range sizes have been reported at approximately 4,500 acres (USDI Fish and Wildlife Service 1990c). The size of the home range may be related to availability of prey (Carey et al. 1992; Forsman et al. 1984). Northern spotted owls usually occupy the same general home range from year to year, but they commonly use different nest trees or have alternate activity centers within their home ranges (Oregon Department of Fish and Wildlife 1992). Home ranges may overlap to some degree with other pairs or with single northern spotted owls (Forsman et al. 1984).

The home range and habitat use of 16 northern spotted owls were studied in the Elliott State Forest between 1997 and 1998. The mean home range size in the Elliott State Forest was 2,735 acres, compared to mean home range sizes in other study areas that ranged from 3,620 to 6,057 acres (using a 100 percent minimum convex polygon method). These were found to be smaller than those previously reported for other study areas in the Oregon Coast Range and Cascades. Home ranges in the Elliott State Forest were from 1,425 to 5,555 acres. In comparison, a 1.5-mile circle—the area recommended by the U.S. Fish and Wildlife Service (USFWS) for management for northern spotted owls in the Oregon Coast Range province (USDI Fish and Wildlife Service 1990c)—contains 4,520 acres. A different method for estimating home range size, the 95 percent fixed kernel, estimated home range size in the Elliott State Forest at 2,088 acres, and a mean "core use area" (50 percent fixed kernel) at 214 acres (Anthony et al. 2000b).

Stand structure suitable for nesting is a crucial habitat requirement (Tappeiner et al. 1992). Northern spotted owls generally rely on older forested habitats (Blakesley et al. 1992; U.S. Fish and Wildlife Service 2008). Forest stands used are multi-storied, dominated by large overstory trees with a well-developed understory (Spies and Franklin 1991). The stands often have mixed species, with two or more age classes resulting from disturbances such as fire, windthrow, and root diseases. The stands usually contain large snags and fallen logs. Northern spotted owls may be found in younger forest stands that have the structural characteristics of older forests, such as structural diversity and a high degree of canopy closure, or retained structural elements from the previous forest, such as large-diameter trees. Recent landscape-level analyses in portions of Oregon Coast and California Klamath Provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit northern spotted owls more than large, homogeneous expanses of older forests (U.S. Fish and Wildlife Service 2008).

Northern spotted owls in the Elliott State Forest were found to select mature, old, and "mixed age" coniferous habitats, but also hardwood habitats. Hardwoods appear to provide some of the habitat attributes needed to sustain northern spotted owls in these forests. An analysis of habitat edge types showed that northern spotted owls also select the edge (or ecotone) between hardwood and conifer stands. This includes hardwood trees with relatively complex canopies, such as bigleaf maple and myrtlewood. Northern spotted owls seem to avoid habitat

types with no apparent ecotone (i.e., "edge"), as well as certain edge types that contain pole or open components. These results suggest that hardwood/conifer edge habitat may promote a healthy prey base or enhance access to prey (Anthony et al. 2000b).

In addition, Tappeiner et al. (2000) found that nest and foraging areas of northern spotted owls in the Elliott State Forest tend to have a greater abundance of large trees than do areas receiving little or no use by northern spotted owls. In addition, the number and size of snags is greater in nest areas than in forage and low-use areas in the Elliott State Forest. Within nest areas, nest trees tend to be larger than the mean tree and snag size. The results of this work indicate that initial stocking densities likely were low in some stands in the Elliott State Forest. The investigators also noted that 10 to 15 percent of the plots where foraging occurred had been thinned 15 to 40 years prior to the study.

4.1.3. Management Status in Western Oregon

In 1990, the USFWS listed the northern spotted owl as a threatened species throughout its range in Washington, Oregon, and California (USDI Fish and Wildlife Service 1990). A rule designating critical habitat for the northern spotted owl was published in January 1992; the Elliott State Forest is not included in the critical habitat designation. The Draft *Recovery Plan for the Northern Spotted Owl* (U.S. Fish and Wildlife Service 1992a) was published in 1992.

The USFWS initiated a five-year review of the northern spotted owl in January 2003. A five-year review is required under the Federal Endangered Species Act (ESA) for assessing available information to consider whether the species is listed appropriately. The review was completed in 2004. The review concluded that the northern spotted owl should remain listed under the ESA as "threatened." In summary, for every risk factor that has declined since listing (e.g., the current rate of habitat loss due to timber harvest, the threat of predation), another factor was identified that counterbalanced risks (e.g., habitat removal due to uncharacteristic wildfires, West Nile virus, barred owls). The uncertainty surrounding barred owls, as well as new potential disease, fire, and sudden oak death threats and their effect on northern spotted owls suggest a net increase in risk since 1990. However, the increase in risk was not considered sufficient to suggest reclassification to "endangered" at this time (USDI Fish and Wildlife Service 2004b). Following this review, the Recovery Plan process was reinitiated in 2006, and a Final Recovery Plan for the Northern Spotted Owl was issued in 2008. This Recovery Plan addresses new information since 1992, including potential threats from the barred owl.

Threats to northern spotted owls include predation, competition, and disease. The most frequent cause of death among radio-marked birds is predation (U.S. Fish and Wildlife Service 1992a). The great horned owl (*Bubo virginianus*) is an opportunistic predator on northern spotted owls (Miller 1989). This larger owl shares the same range as the northern spotted owl, but uses more open and fragmented forests, possibly because it is less maneuverable in the dense interior forest preferred by northern spotted owls. Northern goshawks (*Accipiter gentilis*) also prey on northern spotted owls (Forsman et al. 1984). The red-tailed hawk and raven prey on juveniles. There is no research on relative frequency of predation on northern spotted owls in different habitats, or its effects on the population.

Barred owls have been observed within the range of the northern spotted owl only fairly recently (Taylor and Forsman 1976). The barred owl is a closely related owl that can be distinguished because of the barred rather than mottled markings on the body feathers. Barred owls are somewhat larger and more aggressive, and feed on a broader range of prey. Occasional hybridization has been observed in the wild. Based on a preponderance of circumstantial and anecdotal information, scientists believe that the barred owl has a substantial effect on the northern spotted owl in some areas. According to the five-year review, the barred owl currently constitutes a significantly greater threat to the northern spotted owl than originally thought at the time of listing. Although some areas and habitats are not yet occupied by barred owls, this situation may change. Nevertheless, there is substantial uncertainty associated with the effect of barred owls on northern spotted owls (Gutierrez et al. 2004).

4.1.4. Current Status in the Elliott State Forest

Northern spotted owl surveys were conducted in the Elliott State Forest from 1992 to 1998, initially as timber sale surveys, and later as part of a demographic study of northern spotted owls. From 1993 through 1998, a similar survey effort and methodology was in place as part of the demographic study. The methodology of the survey provides estimates of density and demographic parameters (such as survival and rate of population change). In 2003, a survey for northern spotted owls in the Elliott State Forest was conducted (using the same protocol as past surveys) to obtain a density index for northern spotted owls for comparison with previous years. Density estimates conducted for 1993 through 1998 and 2003 are provided in Table 4-2. Northern spotted owl density in the Elliott State Forest declined from 1993 to 1998, but has remained at a relatively stable level through 2003. Because northern spotted owl sites in the Elliott State Forest are not isolated from one another or from adjacent populations, immigration to the area should contribute to population stability. However, the declining trends in density and adult survival over the five-year period of the demographic study are cause for concern in the Elliott State Forest. Advanced structure (see Chapter 5) with sufficient amounts of snags and downed wood is assumed to provide the most likely habitat for northern spotted owls in the Elliott State Forest.

Table 4-2.
Number of Northern Spotted Owls and Owl Activity Centers Observed, and the Crude Density of Northern Spotted Owls and Activity Centers, Elliott State Forest (378 square kilometers), 1993–1998, 2003 (Kingfisher Ecological 2003)

Year	Number Observed[a]		Density (per square kilometer)[b]	
	Activity Centers	Northern Spotted Owls	Activity Centers	Northern Spotted Owls
1993	21	40	0.056	0.106
1994	18	35	0.048	0.093
1995	19	30	0.050	0.079
1996	13	23	0.034	0.061
1997[c]	11	20	0.029	0.053
1998[c]	11	19	0.029	0.050
2003[d]	13	25	0.034	0.066

[a] Number observed includes active pair and resident single sites.

[b] Crude density, i.e., number of northern spotted owls or territories per 378 square kilometers.

[c] Minimum estimates, i.e., only previously known northern spotted owl sites were surveyed.

[d] One-year (six-visit) surveys.

4.2. MARBLED MURRELET

The ecology of the marbled murrelet (*Brachyramphus marmoratus*) is described in several documents, including the *Recovery Plan for the Marbled Murrelet* (USDI Fish and Wildlife Service 1997) and a U.S. Forest Service (USFS) report on the *Ecology and Conservation of the Marbled Murrelet* (Ralph et al. 1995). Weikel (2003) summarizes literature on the marbled murrelet since 1995. The USFWS initiated a five-year review of the marbled murrelet in January 2003. A five-year review is required under the ESA for assessing available information to consider whether the species is listed appropriately. The scientific evaluation of the status of the marbled murrelet is available at the following website: http://pacific.fws.gov/ecoservices/endangered/recovery/5yearcomplete.html).

In addition, since the implementation of the 1995 HCP for the Elliott State Forest, several studies of marbled murrelets and their habitat characteristics have been conducted in the Elliott State Forest. The results of these studies are included in the sections below.

4.2.1. Species Ecology and Literature Review

Marbled murrelets are seabirds that forage at sea, but fly inland to nest on tree limbs in older forests. In Oregon, the breeding season begins in April. Marbled murrelets lay their eggs between late April and the end of July, and young are fledged from June to September (Hamer and Nelson 1995). Marbled murrelets may lay again if the first attempt is unsuccessful (Hamer and Nelson 1995). Marbled murrelets lay a single egg, usually on a wide, moss-covered branch high in the canopy of a mature or old-growth conifer stand (Marshall 1989). Both adults incubate the egg for approximately 27 to 30 days, in 24-hour shifts, and usually change places just before dawn (Nelson and Hamer 1995). The chick is fed with small fish, up to eight feedings a day (Nelson and Hamer 1995) until it fledges, an average of 28 days after hatching. Upon fledging, marbled murrelet chicks fly directly to the ocean. Once juveniles reach the ocean, they are not thought to be attended or fed by adults.

Marbled murrelets exhibit fidelity to nesting areas and are known to return to the same nesting stand in consecutive years (USDI Fish and Wildlife Service 1997). Marbled murrelets have been documented to follow natural features such as rivers and streams during their flights inland (Burger 1997); however, the extent of this behavior is uncertain and may be restricted to geographic regions with tall ridges. Marbled murrelets also typically use a consistent flight path in the vicinity of the nest to access nest stands and trees, usually creeks or other gaps in the forest canopy such as areas of blowdown (Nelson 1997).

Marbled murrelets have been observed inland during both breeding and nonbreeding seasons, although flights below the canopy are rare during the nonbreeding season (O'Donnell et al. 1995; Nelson 1997). Activity levels (measured using audio-visual surveys) are highest during the breeding season, although variation in activity level within the breeding season has differed between studies. Within the breeding season, activity has been reported to increase from May to July, peak in July (Nelson 1997; Jodice and Collopy 2000), and lessens dramatically in August (Cooper et al. 2001). Using radar surveys, Burger (2001) observed low activity levels

in early May and after mid-July; he determined that these low-activity periods represent periods of incubation and post-breeding.

Key Terms

Most of the following definitions are from the Pacific Seabird Group (Ralph et al. 1994).

Diameter breast height—The diameter of a tree, measured 4.5 feet above the ground on the uphill side of the tree.

Detection—Sighting or hearing of one or more birds acting in a similar manner, i.e., a single bird or flock.

Nest stand—A stand with an active nest or a recent nest site as determined from a fecal ring or eggshell fragment, or discovery of a chick or eggshell fragment on the forest floor.

Occupied stand—A stand of potential habitat where marbled murrelets have been observed exhibiting behaviors that have been observed in stands with evidence of nesting, such as subcanopy behaviors or circling.

Potential habitat—Potential marbled murrelet habitat is defined as: 1) mature (with or without an old-growth component) and old-growth coniferous forests; and 2) younger coniferous forests that have deformations or structures suitable for nesting. Potential habitat can be as far as 50 miles from the ocean.

Presence—A stand of potential habitat where marbled murrelets have been detected at the stand, but subcanopy behaviors have not been documented.

Stand—A group of trees that forms contiguous potential marbled murrelet habitat with no gaps wider than 100 meters.

Subcanopy behaviors—Behaviors occurring at or below the forest canopy, and that strongly indicate the site has some importance for breeding, including flying through the canopy, circling below canopy, and landing.

4.2.2. Habitat Requirements

The marbled murrelet is unique among seabirds because it nests inland in mature and older forests, even though its food source is fish and invertebrates from near-shore marine waters. The following discussion of habitat requirements focuses on the nesting habitat of the marbled murrelet.

Marbled murrelets are associated with mature and old-growth coniferous forests throughout their range (Nelson 1997). Recent research has shown this to be a consistent pattern across spatial scales, and that marbled murrelets appear to be sensitive to loss and fragmentation of habitat.

There is striking consistency in characteristics of nest trees selected by marbled murrelets across their range. Although the species of tree most frequently used varies, depending on geographic context, marbled murrelets usually select tall, large-diameter trees (often with

diameter breast height (DBH) larger than 100 centimeters) with many potential nesting platforms (often more than four platforms), and abundant cover of moss or other epiphytes (Manley et al. 1999; Burger 2002; Conroy et al. 2002; Nelson and Wilson 2002). In most regions, nests have been found only in mature or old-growth trees (Nelson 1997); however, marbled murrelets are known to nest in younger trees with platforms created by mistletoe or witches brooms in the northern Oregon Coast Range (Nelson and Wilson 2002), and nests have been found in trees as small as 27 centimeters in diameter. The presence of canopy gaps has also been shown to influence nest site selection (Manley et al. 1999). In his review of existing literature on nest trees used by marbled murrelets across their range, Burger (2002) noted that, given a choice, it appears that marbled murrelets select nest trees with the following characteristics: 1) sufficient height to allow stall-landing and jump-off departures; 2) openings in the canopy for unobstructed flight access; 3) sufficient diameter to provide a nest site and landing platform; 4) some soft substrate to support a nest cup; and 5) overhead foliage cover.

4.2.2.1. Habitat Characteristics of Marbled Murrelet Habitat on the Elliott State Forest

Hamer and Meekins (1996) developed a model for predicting probability of forest stand occupancy by marbled murrelets. They found that the density of five-inch-diameter platforms and percent slope were two variables highly correlated with occupancy of forest stands by marbled murrelets in the Elliott State Forest. The model from this information was used under the 1995 HCP to rate forest stands for probability of occupancy by marbled murrelets.

Between 1995 and 1999, Nelson and Wilson (2002) studied the characteristics of marbled murrelet nesting habitat on state lands in the Elliott State Forest, as well as other state forestlands. This study was conducted in cooperation with the USFWS and the Oregon Department of Fish and Wildlife (ODFW). The study focused on nest, nest tree, and microsite attributes selected for nesting by marbled murrelets. Using four climbing plot sampling methods (intensive, paired-plot, grid-acre, and cluster) and dawn surveys, a total of 37 nests (27 old and 10 active) were located in 33 study sites. Eleven of these nests were located in the Elliott State Forest. The characteristics of nests and nest trees, nest and random platforms, successful and failed nests, and nest and non-nest plots were summarized in 25-meter-radius plots centered on the nest trees or climbing plots.

In the Elliott State Forest, marbled murrelets selected large conifer trees (DBH range 37 to 83 inches) with numerous platforms (average of 35 platforms per tree) for nesting. Nest platforms were larger in diameter, width, and length, with more horizontal cover and closer vertical cover, than other random platforms available in nesting stands. Nest limbs generally were larger and higher than other platforms in the nest plot, with fairly deep (two-inch) moss covering most of the nest platform. Nest trees were most often part of the dominant overstory, larger in diameter than both the plot average and the average tree with platforms. Most of these trees were over 200 years old, although two or three nests were found in 140- to 170-year-old trees. Nest trees also had more, and deeper, moss on the tree overall than the average for all plot trees; however, the substrate (mostly moss) was actually deeper on random platforms than platforms where nests were found. Nest plots can be characterized as

Table 4-3
Marbled Murrelet Habitat Characteristics (mean) at the Limb, Tree, and Plot Level for 11 nests in the Elliott State Forest, 1995-1999 (Nelson and Wilson 2002)

Description	Mean Value	Comments
Limb Characteristics		
Diameter at nest	8.5"	Generally larger than diameter at bole
Height	120'	
Distance from bole	40"	
Horizontal cover	42%	Lower on Elliott State Forest than North Coast—Douglas-fir vs. western hemlock
Vertical cover	74%	Lower on Elliott State Forest than North Coast—Douglas-fir vs. western hemlock
Moss on nest platform	84%	Averaging two inches deep
Tree Characteristics		
DBH	55"	Range 37" to 83"
Height	211'	On mostly site class II ground
Number of platforms	35	No relationship between platform number and DBH
Moss coverage on limbs	68%	8 percent less than North Coast nest trees
Plot Characteristics		
Trees/acre <18" DBH	68	
Trees/acre $\geq$18" and <32" DBH	13	
Trees/acre $\geq$ 32" DBH	16	
DBH	20"	
Tree height	203'	
Midstory tree height	122'	
Trees/acre with platforms	15	Based on 25-meter-radius plot (40-meter-radius plot had 8 trees per acre)
Platforms per acre, ground count	175	Based on 25-meter-radius plot (40-meter-radius plot had 49 trees per acre)
Platform tree DBH	62"	
Percent moss coverage on limbs	86%	Overall in plot
Platform diameter	6.7"	
Platform height	75'	
Slope	38.6^{o}	

having several large, platform-bearing trees per acre (the exact number dependent on whether 25- or 40-meter-radius plots are considered), with both overstory and mid-story trees hosting potential platforms. Overall, moss cover on trees in nest plots was high, and the slope was fairly gentle, possibly because the occupied stands studied in the Elliott State Forest are located along stream and river courses. Higher humidity levels, higher soil site class, local topography, and lower initial stocking in the Elliott State Forest have promoted large trees with deep crowns and lush moss growth, and have protected large, mature, and old-growth trees from catastrophic fires. Good horizontal and vertical cover are essential for turning good platforms into good nesting sites, as they help conceal the nests from depredation. Western hemlock, where present, seems to offer larger limbs and better cover at a younger age than Douglas-fir, even in the absence of dwarf mistletoe.

4.2.3. Management Status in Western Oregon

In 1992, the USFWS listed the marbled murrelet as a threatened species in Washington, Oregon, and California, because of loss of older forest used as nesting habitat, as well as mortality from gill net fishing and oil spills (USDI Fish and Wildlife Service 1992c). The marbled murrelet is also listed as threatened in British Columbia, under the Canadian ESA. Marbled murrelet populations in Alaska are not regarded as threatened.

A draft rule designating critical habitat for the marbled murrelet was published in January 1994, with a supplemental rule adding non-federal lands published in August 1995. In May 1996, the final rule on critical habitat was published. The final rule designated 273,000 acres of state forestland as critical habitat, including all Elliott State Forest lands. In addition, 900 acres of private land comes under this designation. In 2006, the USFWS proposed to revise this critical habitat designation for marbled murrelets. In its proposal, the Elliott State Forest is not included as part of the critical habitat designation (Federal Register Vol. 71, No. 176: 53838-53951). At the time of this writing, this proposal was undergoing public review.

The *Recovery Plan for the Marbled Murrelet* (USDI Fish and Wildlife Service 1997) divides the range of the marbled murrelet into six conservation zones. The Elliott State Forest is in the far southern end of Conservation Zone 3, which extends from the Columbia River south as far as North Bend, in Coos County, Oregon, and extends inland up to 56 kilometers from the Pacific Ocean shore line. This zone includes the majority of known marbled murrelet-occupied sites in Oregon.

Marbled murrelet nest success seems to be relatively low. In a summary of nest success from 77 nests with known outcome, Manley and Nelson (1999) reported that most (more than 65 percent of) nests failed, and that the leading cause of failure was nest predation (accounting for more than 60 percent of losses). Raphael et al. (2002) note that percent of nests lost due to predation generally increased with decreasing latitude, with predation rates of 33 percent in Alaska, 48 percent in British Columbia, 53 percent in Oregon, and 60 percent in California.

Marbled murrelet nests have been depredated by Steller's jays (*Cyanocitta stelleri*), common ravens (*Corvus corax*), and sharp-shinned hawks (*Accipiter striatus*) (Nelson and Hamer

1995; Long and Ralph 1998). Species implicated, but not documented, as predators include the gray jay (*Perisoreus canadensis*), American crow *(Corvus brachyrhynchos*), great horned owl (*Bubo virginianus*), Cooper's hawk (*Accipiter cooperii*), common raccoon (*Procoyon lotor*), American marten (*Martes americana*), Townsend's chipmunk (*Eutamias townsendii*), northern flying squirrel (*Glaucomys sabrinus*), Douglas squirrel (*Tamiasciurus douglasii*), and fisher (*Martes pennanti*) (USDI Fish and Wildlife Service 1997; Raphael et al. 2002).

Little research has been conducted on the effects of factors other than predation on nest success. Although it has been speculated that marbled murrelets nesting near the coast may have better success because they can make more trips inland to feed young, nest success was not correlated with distance between nest and foraging sites in British Columbia (Hull et al. 2001).

The USFWS initiated a five-year review of the marbled murrelet in January 2003. A five-year review is required under the ESA, for assessing available information to consider whether the species is listed appropriately. This review was completed in 2004 (USDI Fish and Wildlife Service 2004a). The Oregon, Washington, and California population of the marbled murrelet was listed as threatened in 1992, four years prior to publication of the USFWS's 1996 Distinct Population Segment Policy. One of the first steps in the marbled murrelet five-year review was to determine if the original listing was consistent with the Distinct Population Segment Policy. The review has indicated that the marbled murrelet population as currently listed does not satisfy the criteria identified in this policy. The 1992 final listing rule will remain in effect, retaining federal listing status as threatened for the marbled murrelet until the USFWS can complete a rangewide review of the species to determine whether it is in danger of extinction throughout all or a significant portion of its range. Any delisting or reclassification of the marbled murrelet under the ESA will require a separate rulemaking, involving public notice and comment (USDI Fish and Wildlife Service 2004a).

The USFWS Evaluation Report for the Five-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California (USDI Fish and Wildlife Service 2004a) reports the results of demographic modeling of marbled murrelet populations. The models suggest that populations in all zones are in decline, with mean annual rates of decline per decade over four decades ranging from 2.1 to 6.2 percent. In zone 3, mean annual rates of decline per decade range from 2.3 to 3.9 percent.

4.2.4. Current Status in the Elliott State Forest

Marbled murrelet habitat in the Elliott State Forest has been identified through analysis of aerial photos and orthophotos, and subsequently digitized as polygons. The process for this mapping and the methods of a study conducted to test the effectiveness of this method are described in Appendix H. Through this process, 16,680 acres of marbled murrelet habitat have been identified and mapped (Figure H-1). This mapped habitat constitutes approximately 18 percent of the Elliott State Forest.

Marbled murrelet surveys were conducted in the Elliott State Forest from 1992 to 1995, and again from 2000 to the present. These surveys have been conducted primarily for the purpose of surveying proposed timber sales. However, some surveys have been conducted for other

purposes, such as identifying additional occupied sites to aid in characterizing occupied habitat. Not all potential habitat in the Elliott State Forest has been surveyed. The surveys that have been conducted through 2006 have resulted in the identification of 85 occupied sites in the Elliott State Forest.

4.3. BALD EAGLE

4.3.1. Species Ecology and Literature Review

The bald eagle is the only eagle species living strictly in North America. It is a fish eagle that has a presence in every state in the United States except Hawaii. Bald eagles can be found in Canada, northern Mexico, Alaska, and the lower 48 states, and typically inhabit coastal areas, forests, valleys, mountain regions, lakes, rivers, and wetlands.

Some bald eagles are migratory, while others remain in the same area year-round. Bald eagles are resident year-round in Oregon. Bald eagles are most abundant in Oregon in the winter, when additional bald eagles migrate from the north to spend the winter in the state. Both resident and migrant bald eagles over-winter in Oregon, with major concentrations along rivers and lakes or other areas with higher winter prey populations of fish, water birds, or mammalian carrion.

Both resident nesting and wintering populations of bald eagles have been well-studied over the past 28 years (Keister 1981; Isaacs et al. 1983; Frenzel 1984; Anthony and Isaacs 1989; McGarigal et al. 1991; Watson et al. 1991; Garrett et al. 1993; Isaacs et al. 1983; Anthony et al. 1993; Anthony et al. 1994; Marr et al. 1995). Nesting surveys have been performed for 32 years. Currently, several agencies cooperate in conducting annual surveys of nesting and wintering eagles.

The wintering range of bald eagle covers the midwestern United States from the Great Lakes to Oregon, central Texas, including the St. Lawrence River and the Canadian Maritime provinces in the east and Baja California in the west. Some areas are breeding as well as wintering range. The Pacific coast from Oregon to southern Alaska is the largest area.

The bald eagle can have a wing span of up to eight feet and weigh up to 15 pounds. Bald eagles attain sexual maturity, with the adult plumage of white head and tail, at four to five years of age. Sexes are similar in appearance, with females often noticeably larger than males. For their size, bald eagles are extremely agile and can turn quite abruptly.

Bald eagles are opportunistic scavengers that feed primarily on fish and birds, depending on season and location (Frenzel 1984; Marr et al. 1995; Watson et al. 1991). Eagles have been documented taking small mammals, dead sheep, and road-killed deer. Near the coast, they forage year-round on waterfowl and several species of fish.

The breeding season for bald eagles extends from February through August. Egg laying occurs from February through April and hatching occurs in late March to late May. Both adults incubate the eggs, and feed the chicks. Young eagles fledge at approximately three months of age. For several weeks, the young stay near the nest site as they learn how to hunt. During this time, they are fed by their parents. Predators of eaglets include great horned owls, red-tailed hawks, and ravens (Isaacs and Anthony 2003b).

4.3.2. Habitat Requirements

Bald eagles are sea eagles and prefer to live near water, such as lakes, rivers, marshes, and seacoasts. Their nests are built in very large, older trees, and they often use nearby snags as perch sites. During nesting, they will defend a territory up to one-quarter mile around their nests, and alternate nests may be located up to one mile away. Their nests, called eyries, are usually built within one-half mile of water. The same eyries may be used for years, and most pairs have one or more alternate nest sites within their territory. In the Elliott State Forest area, bald eagles are most often found near large inland lakes and marshes, along the Umpqua, Coos, and Coquille Rivers, and along the coast (Csuti et al. 1997).

Bald eagles have different requirements for wintering and nesting habitat. An important element of bald eagle wintering habitat is the use of forested communal night roosts from November through March. The significance of communal roosts is uncertain, but are believed to serve a role in social functions, aid in food location, and help minimize energy loss (Anthony et al. 1982; USDI Fish and Wildlife Service 1986). In western Oregon, tree species used for roosting are usually mature/old-growth conifer. In Eastern Oregon, eagles also use black cottonwood along river systems (Anthony et al. 1982; Keister and Anthony 1983; Watson and Anthony 1986; Isaacs et al. 1996). Roost size varies from a small group of trees used by a few birds to a 635-acre stand in the Klamath Basin used by 200 to 300 birds (Keister and Anthony 1983; DellaSalla et al. 1987; Hunnicutt 1989). Use of roost areas by eagles may vary during winter months and from year to year, depending on prey availability and weather conditions (Keister et al. 1987; DellaSalla et al. 1987).

In the Pacific Northwest, bald eagles nest primarily in multi-layered conifer stands with dominant old-growth trees within the forest canopy. Douglas-fir and Sitka spruce are the tree species most commonly used for nesting along the Oregon coast. However, some nests have been located in western hemlocks and mature black cottonwoods along the Columbia and Willamette Rivers. Nest trees in the Douglas-fir region average 67 inches in diameter and 184 feet tall, according to the primary analysis of nesting habitat in Oregon (Anthony and Isaacs 1989). Nest sites are closely associated with aquatic foraging areas such as estuaries, lakes, and rivers, and are usually within one mile of water (Anthony and Isaacs 1989), with most nests within one-quarter mile (Stalmaster et al. 1985). The nesting period lasts from February to August, but resident pairs sometimes remain in their nest territories all year (Garrett et al. 1993).

Replacement and alternate nest trees are also important. Bald eagles are very strongly attached to their mates and territories, and when a nest tree is lost, they may remain in the same territory even if the lack of replacement nest platforms makes it impossible to nest. Eagle pairs frequently construct more than one nest in a territory, and alternate their use from year to year (Garrett et al. 1993; USDI Fish and Wildlife Service 1986).

Throughout the year, bald eagles spend much of their time perching. They perch for a variety of reasons, including resting, foraging, feeding, defending their territory, and protecting their nest (Stalmaster et al. 1985). On the lower Columbia River, Watson et al. (1991) found that eagles spend 94 percent of their time perching. Perch trees are often prominent snags and live

conifer trees with dead tops or exposed lateral limbs that are usually associated with the nest site and primary foraging areas.

4.3.3. Management Status in Western Oregon

The bald eagle first gained federal protection in 1940 when Congress passed the Bald Eagle Protection Act, later amended to include golden eagles and renamed the Bald and Golden Eagle Protection Act (BGEPA). Bald eagles were listed as an endangered species in 1967 under the Endangered Species Preservation Act and later transferred to the list of threatened and endangered species under the 1973 Endangered Species Act (ESA). In 1978, this action was clarified to list the bald eagle as an endangered species in most of the lower 48 states, with the exception of 5 states, including Oregon, where it was listed as threatened. In 1975, it was listed by the state of Oregon as a state threatened species. The USFWS appointed a recovery team in 1979, and a *Pacific Bald Eagle Recovery Plan* for seven western states was approved in 1986 (USDI Fish and Wildlife Service 1986). The *Pacific Bald Eagle Recovery Plan* (USDI Fish and Wildlife Service 1986) lists criteria that must be met before bald eagles can be considered recovered and then delisted as a federal threatened species.

Most of the criteria in the Bald Eagle Recovery Plan have been met or exceeded in Oregon. The statewide recovery objective for population was reached in 1992, with a total of 206 pairs of eagles across the state. For the coastal recovery zone, the population objective was reached in 1996, with 49 eagle pairs found. The Recovery Plan's statewide objectives for habitat management were reached in 1999. These objectives have now been met throughout Western Oregon (Isaacs and Anthony 2002).The statewide nesting productivity is currently above the recovery objective of 1.0 young eagles per occupied territory. The Elliott State Forest lands recovery zones averaged 1.61 per occupied territory between 1999 and 2003. Two of the three Elliott State Forest sites that are currently active produced three eagles in 2003 (Isaacs and Anthony 2003a). The Recovery Plan called for stable or increasing wintering populations. Wintering populations have remained stable or have grown statewide over the past 10 years, at an average of 684 eagles annually over the past five-year period (Isaacs and Anthony 2003a).

In 1995, the USFWS downgraded the species to threatened status in the remaining lower 48 states. In 2007, the USFWS determined that the bald eagle was no longer in danger of extinction, or likely to become endangered within the foreseeable future because the threats that led to its listing have been reduced or eliminated. As a result, on August 8, 2007, the bald eagle was removed from the list of threatened and endangered species. The bald eagle has not yet been removed from the state list of threatened species. Protections for the bald eagle remain under the BGEPA as well as the Migratory Bird Treaty Act of 1972 (MBTA). In addition, the USFWS has proposed a post-delisting monitoring plan (USDI Fish and Wildlife Service 2007).

There have been many threats to bald eagles. The use of the pesticide DDT (*dichlordiphenyltrichlor*) over the past century has poisoned the food chain, resulting in weakened eggshells (making them too thin to support the weight of brooding parents). A 1972 ban on DDT led to gradual improvements in the population. Mercury, PCBs, lead,

dioxins, and other chemicals that accumulate in fish and wildlife food chains have also had detrimental impacts on eagle survival and reproduction.

Bald eagles have few natural predators. The greatest threat to their survival is human encroachment—through habitat destruction, chemical contamination, degradation of fisheries, illegal shooting, collisions with high-tension wires, collisions with automobiles, and nest disturbance.

A bald eagle working team for Oregon and Washington was established in 1979 to provide a forum for the exchange of information on bald eagles, provide technical assistance, coordinate research, and assist with the development and implementation of the Recovery Plan. The ODF has participated as a member of the working team since its beginning. In 1990, the working team produced an implementation plan for bald eagle recovery in Oregon and Washington to assist agencies and landowners (Washington Department of Wildlife 1990). Implementation tasks currently being carried out in Oregon include annual surveys and monitoring, development of nest and roost site plans, research, and public education.

4.3.4. Current Status in the Elliott State Forest

Bald eagles are considered year-round residents of the Elliott State Forest and vicinity. Since surveys began, four bald eagle pairs have nested in the Elliott State Forest. As of 2005, there are three active nesting pairs in the Elliott State Forest, at Footlog, Indian Charlie, and Loon Lake. The Loon Lake pair has an alternate nesting site on BLM land.

Nesting in the Elliott State Forest was first confirmed in 1985, with the Alder Fork Big Creek nest site. This site was occupied until 1997 when the pair moved to land under private ownership at Willow Point on Tenmile Lakes. The Indian Charlie site was first established in 1999, and has fledged seven juveniles through 2004. In 1998, a pair occupied the West Scottsburg nest site until selecting a new nest site in 2004 at Footlog Creek. This pair has fledged 11 juveniles through 2004. The Loon Lake nest site was established in 2002 when the pair moved from the Camp Mill site on BLM land. From 2002 to 2004, the pair fledged three juveniles. In 2005, the pair moved off the Elliott State Forest and constructed a new nest on BLM land at Sock Creek.

Twenty-seven past and present bald eagle nest sites are located within five miles of the Elliott State Forest, six of which were active in 2004 and one of which produced young (Isaacs and Anthony 2003a).

Bald eagles prefer to nest in dominant old-growth trees in multi-layered conifer stands within the forest canopy. Douglas-fir and Sitka spruce are tree species most commonly used for nesting in the Elliott State Forest. Eagles look for nest sites that are in close proximity to aquatic foraging areas such as estuaries, lakes, and rivers; nest sites are usually within one mile of water. All of the current nest sites in the Elliott State Forest are near large bodies of water, including the Umpqua River, Mill Creek, and Loon Lake, where large nest and replacement trees are present generally near the top of a prominent ridge overlooking the water body.

The portion of the Elliott State Forest to the north and east that borders the Umpqua River, Mill Creek, and Loon Lake has excellent nesting and roosting habitat for bald eagles. The steep ridges overlooking foraging area and abundant large, residual Douglas-fir trees provide nesting opportunities for additional eagle pairs.

Bald eagles in the Elliott State Forest are likely limited by the amount of water sources for foraging and territoriality by neighboring eagles. Fortunately, significant amounts of habitat for bald eagles exist near these large water bodies. A scarcity of large, dominant trees on ridgetops near the lower West Fork and East Fork Millicoma Rivers and east of Tenmile Lakes are likely limiting factors for bald eagles becoming established in these locations.

4.4. NORTHERN GOSHAWK

4.4.1. Species Ecology and Literature Review

The northern goshawk is a large migratory hawk, belonging to the Accipiter family. It is holarctic and nests in forested areas of Eurasia and North America as far south as the Mexican highlands. In Oregon, goshawks are an uncommon to fairly common permanent resident in suitable habitat at elevations between 1,900 feet (480 meters) and 6,100 feet (1,860 meters) in forested portions of the Cascade, Blue, and Klamath mountains. The highest densities are found east of the Cascade crest. Goshawks were found nesting in the Oregon Coast Range in 1995 when one nest each was found in the Yachats River (Lincoln County) and Siuslaw River (Lane County) drainages (Thrailkill and Andrews 1996).

Goshawks are forest hunters and prey on both birds and mammals. The word "goshawk" is a contraction of the original name given to this bird, which was "goose hawk." Goshawks can take prey as large as grouse and rabbits, but also take squirrels, smaller hawks, and insects.

Goshawks return to their nesting territory in March or April. Three to four eggs are laid in a stick nest built 30 to 40 feet up in a mature live tree (Zeiner et al. 1990). The incubation period is 36 to 41 days, and the birds fledge approximately 35 days after hatching. Goshawks are known to be particularly fierce in defending their nests, and will attack humans if approached too closely (Bent 1961).

4.4.2. Habitat Requirements

The northern goshawk nests and forages in a variety of habitats in both coniferous and deciduous forests across its range in North America (Bent 1937; Reynolds et al. 1982; Squires and Reynolds 1997). In Oregon, most studies have been conducted east of the Cascades, and nest sites have been identified primarily in coniferous forests, with a few nests in aspen groves (Reynolds et al. 1982; Bull and Hohmann 1994; Haines 1995; Rissler 1995; Daw 1996; Desimone 1997; McGrath 1997). In one study conducted west of the Cascades, an administrative survey of national forests in western Oregon by the USFS, the biologists reported 35 nests equally divided between mixed conifer and Douglas-fir stands (Schommer and Silovsky 1994).

Goshawks typically build their nests in dense patches of large, old conifer trees, with and without understories. Nest trees are frequently the largest in a stand, and are located near small breaks in the canopy. Frequently, a nesting territory contains more than one suitable nest tree (Oregon Department of Fish and Wildlife 1997). Goshawk nests are built of sticks near the trunks of large trees, 20 to 80 feet up. Goshawk nests are often reused from year to year.

Goshawk nesting territories are large, and their foraging areas extend to 4,900-5,900 acres.. Goshawks prefer to nest on north-facing slopes near fresh water. Because they need sizable territories with large trees for nesting, they prefer expansive patches of late-successional forests with considerable canopy closure (Csuti et al. 1997).

Goshawks can be observed throughout Oregon during migration periods and in winter. The birds are known to nest primarily in coniferous forests statewide (Reynolds et al. 1982; Marshall 1992; DeStefano et al. 1994; DeStefano and McCloskey 1997). Until 1995, when two nests were located west of Eugene (Thrailkill and Andrews 1996), goshawks had not been documented as nesting in the Oregon Coast Range province. The territory of one pair likely included adjacent state lands. Additional nests in the Oregon Coast Range have been located since 1995 (Christine Ross, personal communication, 1999; Nancy Duncan, personal communication, 2004).

4.4.3. Management Status in Western Oregon

Northern goshawks are listed by the ODFW as a sensitive species, critical status (Oregon Department of Fish and Wildlife 1997), primarily because they seem to prefer mature and old-growth forests for nesting, at least in coniferous forests (Reynolds et al. 1982; Marshall 1992; USDI Fish and Wildlife Service 1998c).

At one time, the species was considered a candidate for listing under the federal ESA. In response to a series of petitions to list the species, the USFWS initiated a status review in 1997 throughout all western states. In June 1998, the USFWS determined that federal listing was not warranted at that time (USDI Fish and Wildlife Service 1998b). A lawsuit was filed in the District Court of Oregon to contest that determination, and the decision not to list the species was upheld in July 2003.

Nesting and foraging habitat can be impacted by timber harvests that damage or destroy nest trees, modify or remove nest stands, alter habitat through removal of overstory trees, and remove or decrease the number of snags and the amount of downed wood available to goshawk prey. Other forest management practices, such as the use of controlled fir and selective thinning, have the potential to enhance habitat suitability for goshawks. Other less significant threats include disturbance, predation, interspecific competition, and disease (USDI Fish and Wildlife Service 1998c).

4.4.4. Current Status in the Elliott State Forest

Surveys for northern goshawks have not been conducted in the Elliott State Forest; thus, the status of this species on the forest is not known. Although goshawks have been detected at times during surveys for other species (such as northern spotted owls), no goshawks were detected in the Elliott State Forest during surveys for northern spotted owls conducted from 1992 to 1998, and again in 2003. During surveys conducted on adjacent BLM lands, there have been three sightings of northern goshawks, but no nesting territories have been located. Suitable habitat for northern goshawks likely exists within advanced structure habitats in the forest. However, while northern goshawks are present in Coast Range forests, they are not common in this region, and it is possible that no nesting territories currently exist in the Elliott State Forest.

4.5. OLIVE-SIDED FLYCATCHER

4.5.1. Species Ecology and Literature Review

The olive-sided flycatcher is found from western and central Alaska to Canada's Maritime provinces, through the upper midwestern United States, south through the Rocky Mountain states, and throughout the coastal regions of the Pacific states. This species is found throughout the Pacific Northwest in small, scattered populations. Washington, Oregon, and Northern California contain the densest breeding populations in the continental United States. Its range includes the Elliott State Forest and other state forestlands in the Klamath Mountains ecoregion in Curry, Josephine, and southwestern Douglas counties.

The olive-sided flycatcher is a long-distance migrant that winters in the South American mountains and returns to North America to breed in the summer. Males return to Oregon in May, and females return shortly after the males. Olive-sided flycatchers remain in Oregon through September.

Nest sites, which are most often found in conifers, are chosen by the female after an acrobatic courtship display. Nest building usually occurs from late May to mid-June. Three to four eggs are laid and the female incubates the eggs for the full 14 to 15 days, although the male will sometimes bring her food during early incubation. Fledglings leave the nest between 19 and 22 days after hatching, and may spend some days scrambling around the nest tree branches before their first flight. Nestlings may be present in the nest as late as August. Adults can remain with the young for up to two weeks after fledging (Altman 2003).

4.5.2. Habitat Requirements

Breeding habitat for olive-sided flycatchers is conifer forest characterized by tall prominent trees and snags that serve as foraging and singing perches. They breed in forest burns where snags and scattered tall, live trees remain, in forested riparian areas adjacent to streams, rivers, and lakes, at the juxtaposition of late and early-successional forest, such as meadows and harvest units, and in open or semi-open forest stands with a low percentage of canopy cover. They are associated with forest openings and forest edges, and are more abundant in landscapes that have high-contrast edges between late seral and early seral forest. They nest on branches of conifer trees. Prey consists of large insects, including bees, wasps, flying ants, moths, and bark beetles, which they pursue from perches on top of snags or live trees in stands with an open or broken canopy. (Altman 2003). Altman (1999) describes optimal habitat as early-seral forest with retained live trees and snags over 40 feet tall. Altman recommends retaining more than three 2.5-acre clumps with four to twelve trees per acre in the interior of a 50-acre harvest unit (HU) and with an additional one to two trees per acre dispersed relatively equally throughout the HU. He also recommends retaining or providing suppressed or plantation trees throughout the HU to provide habitat for olive-sided flycatchers. Nesting territories are relatively large, typically 35 to 45 acres, but may be as large as 100 acres per pair (Altman 2003).

4.5.3. Management Status in Western Oregon

The olive-sided flycatcher is listed by the ODFW as a sensitive species, vulnerable status (Oregon Department of Fish and Wildlife 1997). This species has a state rank of 3 by the Oregon Natural Heritage Information Center. It is also considered by the USFWS as a Bird of Conservation Concern in the Northern Pacific Forest region.

In spite of its very large range, this species occurs in overall low densities. Since 1966, the overall population has declined by 67 percent. Speculation on causes of population declines has focused on habitat alteration and loss on the wintering grounds, because declines are relatively consistent throughout the breeding range of the species (Altman and Sallabanks 2000). Factors potentially contributing to declines on the breeding grounds include habitat loss through logging, alteration of habitat from forest management practices (e.g., clear-cutting, fire suppression), lack of food resources, and reproductive impacts from nest predation or parasitism (Altman 2003).

4.5.4. Current Status in the Elliott State Forest

Olive-sided flycatchers have been detected in nearly all management basins in the Elliott State Forest during bird surveys conducted in 2001 (Weikel and Vesely 2001). Weikel and Vesely mapped the locations of 41 olive-sided flycatchers detected during their surveys. However, these observations cannot be tied to individual territories. Because targeted surveys have not been conducted, it is not known how many territories exist in the Elliott State Forest. Likely habitats for olive-sided flycatchers include riparian areas, and high-contrast edges between early structure and advanced structure, particularly where early structure stands have retained green trees and snags.

4.6. WESTERN BLUEBIRD

4.6.1. Species Ecology and Literature Review

This cavity-nesting thrush breeds throughout much of western North America. It is one of three bluebird species found only in North America. Western bluebirds are known to be present in Southwestern Oregon in both winter and summer; they nest in both the Rogue and Umpqua river valleys and foothills (Marshall and Weeks 1996). This species' range includes state lands in the Elliott State Forest.

Pair bonding occurs as early as February, and the nesting season extends from late March through August. A pair can raise up to three clutches a year, and the female lays four to six eggs each time in a suitable snag or nestbox. Incubation lasts 13 to 15 days. Although the female builds the nest, both parents feed the young and, in at least one instance, a "helper" male western bluebird was seen assisting parent western bluebirds in feeding their young. Fledging occurs in 20 to 21 days (Eltzroth 2003; Baicich and Harrison 1997). They are largely insectivores in the summer, but utilize many winter berries in the colder months. They do not migrate in the fall, but are known to move to lower elevations when winter weather arrives (Eltzroth 2003).

4.6.2. Habitat Requirements

The western bluebird is a secondary cavity-nesting species. Bluebirds use cavities created by other woodpeckers, natural cavities, or nest boxes for nesting. They use both hard and soft snags and a wide range of snag sizes. The western bluebird breeds in open habitats, with low overstory tree densities, including grass-forb, shrub, and early successional clearcuts that have suitable nest cavities and structures. In an Oregon Coast Range study, western bluebirds were found in 10 of 13 clearcuts (less than four years old) with suitable snags (Shreiber and deCalesta 1992). In another western Oregon study, a greater density of western bluebirds was found in areas of four live overstory trees per acre than in areas of eight trees per acre (Hansen et al. 1995). Estimated territory size is 13 acres (Altman 1999). This species appears partial to edge-type habitat, and is most often found nesting in cavities along the edges of open fields (Eltzroth 2003).

4.6.3. Management Status in Western Oregon

In Oregon, the western bluebird breeds throughout the state in favorable habitat. However, the species is no longer found in many of its former sites because of competition for available nesting sites and the widespread removal of snags. The species suffered a precipitous decline in the 1940s because of habitat degradation and avian competition. The western bluebird has been listed as a sensitive species, vulnerable status by the ODFW. This species has a state rank of 4 by the Oregon Natural Heritage Information Center, as a species with cause for long-term concern.

The greatest threat to this species is forest practices—in particular, the widespread removal of snags that ultimately reduces nesting habitat. Avian competition is also a threat. House sparrows and European starlings are two introduced species that not only compete with western bluebirds for nesting cavities, but also may destroy eggs, and kill adults and nestlings (Gabrielson and Jewett 1940; Prescott 1980; Jobanek 1993). Other native species also compete for cavities with the western bluebird (Eltzroth 2003). Western bluebirds are easily affected by cold or inclement weather, which leads to food shortages and brood loss; broods are highly subject to parasitism (Marshall and Weeks 1996).

4.6.4. Current Status in the Elliott State Forest

In summer 2001, a systematic survey of suitable habitat in the Elliott State Forest revealed western bluebirds in 8 of 17 management basins (as delineated for the 1995 HCP) (Weikel and Vesely 2001). These surveys were conducted in forest stands that were 10 years old or younger. These early structure stands provide the most likely suitable habitat for western bluebirds, if suitable snags are available for nesting.

4.7. FISHER

4.7.1. Species Ecology and Literature Review

The fisher is large mustelid occurring in forested areas of Canada, the Pacific Northwest, Maine, and the Upper Midwest. There is limited information about the range of the fisher in Western Oregon. Few Oregon museum records exist for the species. There is one record from the Glendale area in Douglas County and two from the Oakridge area in eastern Lane County (Verts and Carraway 1998). Olterman and Verts (1972), Ingram (1973), Yocum and McCollum (1973), Robart (1982), Powell and Zieliniski (1994), and Marshall et al. (1996) compiled records from trappers, agency personnel, and miscellaneous reports with varying degrees of reliability. Most sightings were reported in the southern Cascades and Klamath Mountains, with small numbers from the Oregon Coast Range. The first study of the fisher in Oregon was initiated in 1995 by the U.S. Forest Service Pacific Northwest Research Station and other cooperators in the upper Rogue River drainage, primarily on the Rogue River National Forest (Aubry and Raley 2002). Fisher have also been reported near Lost Lake Reservoir.

The fisher is considered widely distributed in forested areas of northwest California immediately south of the Oregon border and on the west slope of the southern Sierra Nevada (Gibilisco 1994; Zielinski et al. 1995). In southwestern Washington, few sightings were ever recorded and fishers are considered absent, although systematic surveys have only been conducted in a few locations (Lewis and Stinson 1998).

Fishers are generalized predators and eat anything they can catch. They generally eat small- to medium-sized mammals (rabbits) and birds, but will readily eat carrion (deer and elk) and fruit (Powell and Zienlinski 1994). Porcupines have been documented as a significant prey item in some areas of the eastern United States and Canada.

Female fishers give birth in cavities of live trees or snags (natal dens). After the kits become mobile, the mother moves her young to larger maternal dens in cavities, downed logs, and mistletoe brooms (Buskirk and Powell 1994; Powell and Zielinski 1994; Aubry and Raley 2002). In Idaho, fishers have been documented in the winter using younger stands regenerated after fires that retained some residual trees, snags, and logs (Jones and Garton 1994).

4.7.2. Habitat Requirements

In general, habitats used by the fisher are associated with mature to late-successional conifer-dominated stands with a high percentage of canopy closure, abundant large woody debris,, large snags and trees with cavities, and various amounts of hardwoods (Buck et al. 1994; Jones and Garton 1994; Buskirk and Powell 1994). (Carroll et al. 1999). Although fishers are often associated with unmanaged forests (Aubry and Raley 2006), they also occupy some managed forests landscapes that provide habitat elements such as large trees, snags, large woody debris, and high canopy closure (USDI Fish and Wildlife Service 2004c).

Fishers have large home ranges. Home range sizes for fishers in six study areas in Northern California and the South Oregon Coast Range average 16,140 acres. (Lewis and Hayes 2004)

4.7.3. Management Status in Western Oregon

The fisher is listed by the ODFW as a state sensitive species of critical concern, meaning that it may qualify for listing as threatened or endangered. In 1990, the USFWS was petitioned to list fisher populations in California, Oregon, and Washington as endangered. However, the petition was denied, primarily because of insufficient information (Lewis and Stinson 1998). A subsequent petition, which requested listing populations in the Rocky Mountain and Pacific Northwest states, was received and denied in 1996. However, because available information indicated that the species has declined, the agency stated the need to retain the fisher as a species of concern (USDI Fish and Wildlife Service 1996a). In 2003, the West Coast population of the fisher was petitioned for listing. The finding of the USFWS to this petition was that listing of this population was warranted but precluded because of higher priority actions. Currently, the West Coast population of the fisher is classified as a candidate species for listing (USDI Fish and Wildlife Service 2004c).

Overtrapping and habitat loss by logging are believed to be the main causes of the species' decline throughout much of its historical range in the United States (Powell and Zielinski 1994). Trapping for fishers has been prohibited in Oregon since 1937 (Marshall and Weeks 1996). Strychnine poison baits, used to eliminate wolves and control coyotes in the early 1900s, may also have contributed to the species' decline in Western Oregon (Marshall and Weeks 1996).

Continuing threats to the fisher include loss and fragmentation of mature and late-successional habitats across the landscape (Rosenberg and Raphael 1986), incidental capture and injury in traps set for other species (e.g., bobcat, coyote), and decreases in prey populations on lands of mixed ownership caused by shorter forest rotations and stand structure simplification through intensive forest practices. In a study on habitat use by fishers in the Shasta Trinity Forest, in adjoining heavily and lightly harvested forest, forests that contained seven percent clearcuts and 25 percent selective cuts were found to be too heavily harvested to sustain fisher populations (Buskirk et al. 1994).

4.7.4. Current Status in the Elliott State Forest

Fishers were probably present on the Elliott State Forest at one time. However, fishers are not believed to currently be present on the Elliott State Forest because of their limited distribution in the state.. There is a known population in the upper Rogue River drainage in Southern Oregon, as well as populations known from Northern California. The closest known documented recent observation is over 75 miles from the Elliott State Forest. However, the Elliott State Forest does contain potential habitat for this species. Likely habitat for the fisher is advanced structure, with sufficient snags and downed wood, particularly in conservation areas where there is little or no management. If fisher populations expand in the future, there is the possibility that they will utilize habitat on the Elliott State Forest.

4.8. RED-LEGGED FROG

4.8.1. Species Ecology and Literature Review

This species is found throughout western Washington and Oregon at elevations from sea level to 3,000 feet (Corkran and Thoms 1996). The red-legged frog has short egg and tadpole stages, which allows it to use temporary ponds for breeding. The breeding period is short (one to two weeks) and may begin as early as February. Approximately 2,000 fertilized eggs are attached to underwater vegetation in slow-moving water. Eggs hatch in approximately four weeks and tadpoles are fully metamorphosed approximately four months later. The frogs breed for the first time at three to four years of age (Csuti et al. 1997).

4.8.2. Habitat Requirements

This species occurs in meadows, woodlands, and forests, and can wander as far as 300 yards from water. During the breeding season, it is found in ponds, marshes, and slow-moving streams. It generally favors riparian areas with dense undergrowth. Its range includes state lands in the Klamath Mountains and Oregon Coast Range ecoregions in Coos and western Douglas Counties (Csuti et al. 1997).

In general, breeding sites seem to have three major requirements: They must have little or no water flow, exist long enough for metamorphosis to occur, and contain some sturdy underwater stems to allow egg mass attachment (Nussbaum et al. 1983).

4.8.3. Management Status in Western Oregon

In the Oregon Coast Range, the red-legged frog is considered to be a sensitive species, undetermined status, by the state of Oregon (Oregon Department of Fish and Wildlife 1998). Populations are declining for unknown reasons (Marshall and Weeks 1996). This species is considered a species of conservation concern by the Oregon Natural Heritage Information Center.

Threats to red-legged frogs include habitat alteration as a result of development and overgrazing, and predation from introduced fishes and bullfrogs (Kiesecker and Blaustein 1998; Cook and Jennings 2001). Other potential factors in amphibian declines include global warming, UV radiation (Belden and Blaustein 2002), airborne contaminants (pesticide drift), and disease (Davidson et al. 2001, 2002).

Activities that alter the cool, moist microclimate of the riparian habitat or that remove or disturb riparian cover may cause harm to individuals or populations. Such activities include ground-disturbing activities (e.g., operation of heavy machinery), removal of riparian buffers for activities such as road building, and any activities that could potentially raise water temperatures in breeding areas. Early embryos are tolerant of temperatures only between 4 and 21 degrees Celsius (39.2 and 69.8 degrees Fahrenheit) (Nussbaum et al. 1983).

4.8.4. Current Status in the Elliott State Forest

Two systematic surveys have been conducted for the red-legged frog on Elliott State Forest lands (Allbritten 2002; Bruce Bury, personal communication, January 28, 2002). Red-legged frog eggs, tadpoles, or adults were found at 6 of 13 ponds surveyed in 2001. In addition, there are several records of this species occurring within one mile of state lands in Coos County.

4.9. HEADWATER AMPHIBIAN SPECIES

Amphibians are the most abundant group of vertebrates in terrestrial forest ecosystems. Evidence suggests that they may have an important functional role in these ecosystems: facilitating energy flow, regulating populations of soil invertebrates, and, indirectly, regulating populations of decomposing bacteria and fungi (deMaynadier and Hunter 1995). The Pacific Northwest has a particularly high number of endemic amphibian species.

In Oregon, several species of amphibians are associated with headwater streams. Many of these species are considered sensitive species by the state of Oregon. None are currently listed by the federal government as threatened or endangered. This HCP includes management strategies for headwater amphibian species (HAS) for several reasons: these species are apparently vulnerable; researchers are concerned about the viability of existing populations; and these species may have an important role in forest ecosystems.

The following species are included as HAS and covered by this HCP: tailed frog (*Ascaphus truei*) and southern torrent salamander (*Rhyacotriton variegatus*).

4.10. TAILED FROG

4.10.1. Species Ecology and Literature Review

The range of the tailed frog includes the Cascades and the Pacific Coast from southern British Columbia south to northwestern California (Nielson et al. 2001; Stebbins 2003; NatureServe 2005).

Courtship and mating take place in late September and early October. Males internally fertilize the females' eggs, a practice unlike any other amphibian in Oregon (and considered an adaptation to the swift water environment). Egg-laying does not occur until the following June or July.

Female tailed frogs lay eggs in rosary-like strings, which are deposited on the underside of rocks in cold, fast-moving streams. Females typically lay eggs every other year (Nussbaum et al. 1983). Clutch sizes range from 37 to 82 eggs (Nussbaum et al. 1983; Brown 1975). The embryos take approximately six weeks to develop, and hatch in late August and September (Brown 1975, Nussbaum et al. 1983). Normal embryo development occurs within a range of temperatures from 7.6 to 18 degrees Celsius (45.7 to 64.4 degrees Fahrenheit), with a lower limit of 5 degrees Celsius (41 degrees Fahrenheit) (Brown 1975).

Tadpoles have an adhesive oral-disc that allows them to attach to smooth rocks in riffles of streams. The time that it takes tadpoles to reach metamorphosis varies throughout the range of tailed frogs, but is reported to be two years in the Cascades and Coast Range (Nussbaum et al. 1983, Brown 1975). Metamorphosis occurs in July or August (Nussbaum et al. 1983).

Adult tailed frogs are primarily nocturnal. Adults forage in water, on the surface of emergent rocks and logs, or on the streamside immediately next to the stream. They eat insects and other invertebrates that they capture on these surfaces (Nussbaum et al. 1983). Foraging activity takes place primarily at night. These frogs are quite vulnerable to desiccation and are typically only active during nights of high relative humidity. When it is raining, adult tailed frogs may venture up to 25 meters (82 feet) from the stream (Nussbaum et al. 1983). Studies show that montane species usually stay within a 20 meter (66 foot) radius, but they also may travel up and down stream (Johnson and O'Neil 2001).

4.10.2. Habitat Requirements

Tailed frogs are highly specialized for life in cold, clear, swift, perennially-flowing mountain streams (Nussbaum et al. 1983). They live in streams where water temperature ranges from 0 to 22 degrees Celsius (32 to 72 degrees Fahrenheit), and are typically found in the riffles. Tailed frog larvae show a strong association with coarse substrates, such as cobble (Welsh and Ollivier 1998; Hunter 1998). Tadpoles attach themselves to gravel and cobble in riffles, and adults are found under larger rocks and boulders in riffles. Tailed frogs are generally negatively associated with fine substrates, such as sand and silt. Fine materials can adversely affect tailed frogs by filling interstitial spaces that are the primary microhabitats for tadpoles.

Generally, tadpoles are found in deeper water than adults (Bury et al. 1991). Tailed frogs are most likely to be found in small and medium-sized streams (Hunter 1998), where habitat conditions for cold, swift running water with coarse substrates are met. Tailed frog larvae densities may vary widely under natural conditions, and may primarily be affected by creek width, substrate composition, and the amount of coarse and fine organic material (Dupuis and Steventon 1999).

Tailed frogs are closely associated with streams in mature and old-growth forests (Welsh 1990; Bury 1983), although they have been found in younger stands (Karraker and Beyersdorf 1997). Logging appears to have a detrimental effect on tailed frog populations, primarily by increasing the amount of fine sediments in streams (Corn and Bury 1989; Dupuis and Steventon 1999). There is evidence that buffers on streams can maintain habitat conditions suitable for tailed frogs (Bull and Carter 1996; Dupuis and Steventon 1999).

4.10.3. Management Status in Western Oregon

The tailed frog is listed as a sensitive species in the state of Oregon because of an overall decline in population numbers throughout the state and susceptibility to environmental changes. This species also has a state rank of 3 by the Oregon Natural Heritage Information Center, and is considered a species of concern by the USFWS.

Research has shown that the tailed frog may be severely reduced or eliminated in some areas as a result of timber harvest and road building. Sedimentation of streams and increased stream temperatures are likely causes (Leonard et al. 1993).

4.10.4. Current Status in the Elliott State Forest

In 2001, surveys for stream-dwelling amphibians were conducted in the Elliott State Forest (Vesely and Stamp 2001). Tailed frogs were found in streams throughout the Elliott State Forest, including all three of the major watershed basins: the Umpqua, Tenmile Lakes/Coos, and Millicoma (Vesely and Stamp 2001). No further surveys have been conducted.

4.11. SOUTHERN TORRENT SALAMANDER

Before 1992, torrent salamanders were known as Olympic salamanders (*Rhyacotriton olympicus*) and constituted one species. However, Good and Wake (1992) split the *Rhyacotriton olympicus* into four distinct species. One species occurs in the southern Oregon Coast Range: the southern torrent salamander *(Rhyacotriton variegatus*).

4.11.1. Species Ecology and Literature Review

The range of the southern torrent salamander extends from southern Mendocino County in California, north through the coast range to the Little Nestucca River and the Grande Ronde Valley in Polk, Tillamook, and Yamhill counties in Oregon, where the range abuts that of the related Columbia torrent salamander (*Rhyacotriton kezeri*). An apparently isolated population exists on the western slope of the Cascade Mountains in the vicinity of Steamboat, Douglas County, Oregon (south of the range of *Rhyacotriton cascadae*) (Good and Wake 1992). Distribution is patchy in headwaters and low-order tributaries (Welsh and Lind 1996; NatureServe 2005).

Torrent salamanders are suspected to be communal nesters, and produce an average of eight to ten eggs per year (Nussbaum et al. 1983). Data from torrent salamander nests suggests that oviposition may be restricted to seeps where the unattached and unguarded eggs are safe from scour damage (Hayes 1999). Eggs are laid usually in May (Nussbaum et al. 1983) and take approximately 210 to 290 days to hatch (Nussbaum et al. 1983). Torrent salamanders are known for a slow, extended development. The young remain in the larval stage from two to five years (Nussbaum and Tait 1977; Leonard et al. 1993; Welsh 1990) and are strictly aquatic. Sexual maturity typically occurs at around 4.5 years.

Torrent salamanders feed on aquatic and semi-aquatic invertebrates, including small insects and their larvae, springtails, spiders, and amphipods (Leonard et al. 1993). Pacific giant salamanders and garter snakes are likely predators of this species, but the toxic skin secretions emitted by these salamanders may assist them in avoiding heavy pressure from predators (Nussbaum et al. 1983).

Torrent salamanders move over very small distances—as little as one to two meters (three to six feet) in a year (Welsh and Lind 1992; Hayes 1999). Individual salamanders may move up to 50 meters (164 feet) per year from permanent water, although these larger movements are thought to be rare (Good and Wake 1992).

4.11.2. Habitat Requirements

Torrent salamanders are encountered in seeps, springs, small streams, and the margins of large streams, in water temperatures ranging from 5 to 16 degrees Celsius (41 to 61 degrees Fahrenheit) (Nussbaum and Tait 1977; Diller and Wallace 1996; Welsh and Lind 1996; Blaustein et al. 1995; Hayes 1999). Different species of *Rhyacotriton* may exhibit significant differences in temperature requirements, and the specific temperature requirements of the

different torrent salamanders are not known. Torrent salamanders are associated with high gradient streams (greater than 10 percent), presumably because the flow on these streams does not allow siltation of the gravel and cobble substrates that are preferred hiding and feeding habitat (Diller and Wallace 1996).

Southern torrent salamanders are generally associated with older forests that provide shade to keep streams cold and buffers to reduce sedimentation. They are more likely to be found at sites with older geologic formations, higher stream gradients, and coarse gravel and cobble in the streams (Corn and Bury 1991; Diller and Wallace 1996). They are very dependent on nearly continuous access to cold water, and are not found in areas where timber harvest has resulted in decreases in cover and increases in water temperature and siltation. They can move one to two meters from stream banks during wet weather, but are usually found in very close proximity to streams (Corn and Bury 1991; Diller and Wallace 1996; Csuti et al. 1997).

Typically, torrent salamanders are found under the cover of small boulders, cobble, and gravel in stream riffles, rather than in slow-moving water such as pools (Diller and Wallace 1996; Bury et al. 1991). Although the larval forms are strictly aquatic, the adults may be found under surface objects or in cracks in rocks, within the splash zone of a stream or waterfall. These habitats are typically less than 3 feet from the water (Nussbaum and Tait 1977).

4.11.3. Management Status in Western Oregon

The southern torrent salamander is listed as a sensitive species in the state of Oregon because of the conversion of mature and old-growth forests to young stands. This species is also considered a species of concern by the USFWS, and has a state rank of 3 by the Oregon Natural Heritage Information Center. Headwater stream and spring habitats are not adequately protected, and local extirpations resulting in population fragmentation and restrictions in gene flow may be increasing throughout the range of this species (Marshall and Weeks 1996).

Potential threats to the southern torrent salamander include the threatened destruction or modification of its habitat. Available information on the southern torrent salamander suggests that habitat can be degraded or lost by the siltation and warming of streams. Clearcutting next to streams may lead to local extirpation of southern torrent salamander populations, because of the combined effects of habitat degradation caused by sedimentation and warmer stream temperatures (Corn and Bury 1989). Recolonization may take decades because these salamanders have small home ranges and limited dispersal abilities. In addition, fragmentation of habitats may lead to the further isolation of populations, which makes populations more vulnerable to local extirpations. These factors are compounded by the relatively long time it takes these salamanders to reach sexual maturity (approximately 4.5 years), and the low number of eggs produced per female (Applegarth 1994).

4.11.4. Current Status in the Elliott State Forest

In 2001, surveys for stream-dwelling amphibians were conducted in the Elliott State Forest (Vesely and Stamp 2001). Southern torrent salamanders were found in streams throughout the

Elliott /State Forest, including all three of the major watershed basins: the Umpqua, Tenmile Lakes/Coos, and Millicoma (Vesely and Stamp 2001). No further surveys have been conducted.

4.12. FISH SPECIES

This HCP covers nine fish species. Seven of these are designated as federal species of concern or state sensitive species (see Table 4-4). In other parts of the state, the federal government has listed some populations of coho salmon, Chinook salmon, chum salmon, and steelhead trout as threatened or endangered species.

The federal government has identified evolutionarily significant units (ESUs) for each species. Only some ESUs, or certain groups of populations, are listed or proposed. None of the populations of the nine species on the Elliott State Forest are federally listed as threatened and endangered at this time.

Following Table 4-4 is a discussion of the ecology of these nine species, their habitat requirements, current status in the Pacific Northwest and Western Oregon, and their status and distribution within the Elliott State Forest.

Key Terms

Anadromous fish—Species of fish that mature in the ocean and migrate into freshwater rivers and streams to spawn; an example is salmon.

Fry—For salmonids, young fish that have just emerged from the gravel and are actively feeding.

Jacks—Sexually mature male salmon that reached maturity earlier than usual for their species.

Non-salmonid fish—Any fish species outside the family *Salmonidae*; may be resident or anadromous; examples are Pacific lamprey and sculpins.

Redd—Location selected by a female salmon or trout for laying eggs; female digs a "nest" in the stream gravels with her tail.

Resident fish—Fish species that complete their entire life cycle in freshwater; non-anadromous fish; an example is a resident population of cutthroat trout.

Salmonid—Fish species belonging to the family *Salmonidae*; includes trout, salmon, and whitefish species.

Smolts—Juvenile salmon that are leaving freshwater and migrating to the ocean.

Table 4-4
Listed, Proposed, or Sensitive Fish Species on Elliott State Forest Lands [1]

Species	Status [2]	Evolutionarily Significant Units/Comments
Coho salmon *Oncorhynchus kisutch*	T, SSC	Oregon Coast ESU
Chinook salmon *Oncorhynchus tshawytscha*		
Chum salmon *Oncorhynchus keta*	SSC	
Steelhead trout *Oncorhynchus mykiss irideus* (anadromous)	FSC, SSV	Oregon Coast ESU
Coastal cutthroat trout *Oncorhynchus clarki clarki*	FSC, SSV	Oregon Coast ESU
Pacific lamprey *Lampetra tridentata*	FSC, SSV	Entire State
River lamprey *Lampetra ayresi*	FSC	
Western Brook lamprey *Lampetra richardsoni*		

[1] This list includes indigenous fish species currently known or likely to exist within waters in the Elliott State Forest, and species that are found in downstream reaches of streams near these state forest lands.

[2] T= Federal threatened species
FSC = Federal species of concern;
SSC = State sensitive species, critical status;
SSV = State sensitive species, vulnerable status; SSR = state sensitive species: peripheral or naturally rare.

4.13. COHO SALMON (*ONCORHYNCHUS KISUTCH*)

4.13.1. Species Ecology and Literature Review

Adult coho salmon return to freshwater and spawn between November and February. Adult coho salmon are typically three years of age and weigh 6 to 12 pounds, although larger coho have been reported (Steelquist 1992). Spawning populations also include two-year-old jacks. Coho salmon typically spawn in smaller, low-gradient (generally less than three percent) streams, although they have been observed spawning in larger streams and rivers (Emmett et al. 1991). Each female coho deposits about 2,500 eggs into a redd formed in the stream bottom. These eggs hatch, and the young coho fry emerge and begin to feed the following spring.

Juvenile coho typically spend one year in freshwater. After emergence, the fry inhabit shallow stream margins and backwater pools. During the summer, they move to deeper pools as a preferred habitat. In the winter, they inhabit side channels, alcoves, beaver ponds, dam pools with complex cover, and other areas sheltered from the strongest currents. Because coho prefer smaller streams, winter floods and summer droughts can cause significant mortality. The young fish survive best in structurally complex streams that offer cover during floods, and maintain their water flow during summer droughts (Groot and Margolis 1991).

Approximately one year after emergence, young coho begin their transformation to the smolt stage as they prepare to move to the ocean. Most smolts migrate downstream to the ocean between February and June, often traveling during a spring freshet. Coho rear within the ocean environment for approximately one and a half years (except jacks, which only rear one summer), where growth is rapid. After the second summer of ocean growth, coho salmon mature and return to freshwater to spawn and begin the cycle again (Wydoski et al. 2003).

4.13.2. Management Status in Western Oregon

In North America, coho salmon originally ranged from the Sacramento River in California to Point Hope in Alaska (Groot and Margolis 1991). It is estimated that coho have been extirpated from approximately 46 percent of their historic range in North America and 3.5 percent of their original range in Western Oregon and Northern California (Botkin et al. 1995). In Western Oregon and Northern California, extinctions have mostly occurred in stocks that spawned in areas inland from the coast and coastal mountain range (Botkin et al. 1995).

Elliott State Forest coho salmon are part of the Oregon Coast ESU. This ESU was originally listed as threatened by the National Marine Fisheries Service (NMFS) in 1998. In September 2001, a federal court invalidated the Oregon Coast ESA listing as part of its ruling in the Alsea Valley Alliance v. Evans decision. As part of an appeals process, this ESU was reclassified as threatened while a final decision could be made by the Ninth Circuit Court of

Appeals. In 2004, the Court of Appeals upheld the 2001 decision, removing the threatened status of this ESU. Later in 2004, NMFS had proposed this ESU for listing as threatened. In January 2006, NMFS formally concluded that this ESU was not likely to become endangered in the foreseeable future, and therefore a listing under the ESA was not warranted. In October 2007, the U.S. District Court in Oregon invalidated the January 2006 NMFS decision not to list Oregon coast coho. In February 2008, NMFS made a final determination to list the Oregon Coast coho salmon (Oncorhynchus kisutch) evolutionarily significant unit (ESU) as a threatened species under the Endangered Species Act (ESA). At this same time, final protective regulations and a final critical habitat designation for the Oregon Coast coho ESU also were issued.

4.13.3. Status in Elliott State Forest Lands

The abundance of wild coho salmon spawners in Oregon coastal streams has been estimated annually since 1990, using a stratified random survey methodology. Spawner abundance estimates for the Tenmile basin are based on extrapolation of estimates in standard index areas.

An assessment of coho salmon conducted by the ODFW in 2001 (Nickelson 2001) identified 12 population complexes within the Oregon Coast ESU. The Elliott State Forest includes portions of three coho population complexes: Lakes, Umpqua, and Coos.

- The Lakes complex consists of coho salmon inhabiting Siltcoos, Tahkenitch, and Tenmile Lakes basins. An estimated 100 miles of spawning habitat is available to coho in this complex, with approximately 38 miles in the Elliott State Forest in the Tenmile basin. The lake systems provide a unique winter rearing habitat, and are one of the most productive complexes on the Oregon coast. From 1990 to 2000, abundance of coho salmon in this complex averaged approximately 9,000 spawners, with a range of approximately 2,000 to 13,500.
- The Umpqua complex is a large basin with an estimated 1,230 miles of spawning habitat available to coho salmon. Only 25 miles of this complex is located within the Elliott State Forest. From 1990 to 2000, spawner abundance for the entire complex averaged 7,519, with a range of approximately 3,000 to 12,800.
- The Coos complex has an estimated 220 miles of spawning habitat available to coho salmon. Approximately 50 miles of this habitat is within the Elliott State Forest. From 1990 to 2000, this complex averaged approximately 8,100 wild spawners with a range of approximately 1,100 to 16,500.

An overall ranking of relative health was calculated for all 12 population complexes within the Oregon Coast ESU. Each complex was reviewed based on viability, abundance, and productivity. For the 12 complexes reviewed, the top three basins in this ESU were Lakes, Coos, and Umpqua.

4.14. CHINOOK SALMON (ONCHORHYNCHUS TSHAWYTSCHA

4.14.1. Species Ecology and Literature Review

Chinook salmon, also known as king salmon, is the largest of the Pacific salmon species. Adult Chinook usually weigh 12 to 50 pounds; historically, some Chinook stocks produced fish as large as 100 pounds. Chinook salmon exhibit very diverse life history patterns, including variations in return and spawning timing, average age at maturity, age and timing of juvenile ocean entry, and ocean migration patterns, among others (Wydoski et al. 2003).

There are two major races of Chinook in Oregon—spring and fall; these races are broadly distinguished by the season in which they return to freshwater streams to spawn. Adult spring Chinook return to freshwater in the spring or early summer, and hold for several months in deep pools in rivers before spawning. Spring Chinook generally spawn from September through November. Fall Chinook return to freshwater during late summer through fall months, and generally spawn from October through December. In both races, the typical age of maturity is three to six years, though some males mature at two years. Fall Chinook salmon tend to spawn in larger streams and rivers (Wydoski et al. 2003), although some fish use smaller tributaries. They may also use deeper water and larger substrate than other salmonids during spawning (Emmett et al. 1991). Each female generally deposits 3,000 to 6,000 eggs depending on age and body size (Wydoski et al.2003). The eggs hatch in about two months, with the alevins remaining in the gravel another two to three weeks after hatching (Wydoski et al. 2003).

The juvenile life stage of Chinook may best be described as highly diverse. This species exhibits significant variation in its spatial and temporal use of rearing habitats and migration timing. This variation exists both within and between populations. In coastal systems, Chinook fry may rear in riverine reaches for periods of three to six months, and may rear in estuarine reaches for up to five months. Some juvenile Chinook have been observed to spend the winter in freshwater. However, most coastal Chinook enter the ocean during their first year of life (Wydoski et al. 2003).

Chinook salmon generally rear in the ocean environment from one to five years before maturing. During this time, growth is relatively rapid. Because of the extended ocean rearing time before reaching maturity, older fish (five to six years old) can reach very large sizes before returning to their natal streams to spawn.

4.14.2. Management Status in Western Oregon

In North America, Chinook salmon range from as far north as the Coppermine River in the Canadian Arctic to central California (Emmett et al. 1991; Groot and Margolis 1991). It is estimated that spring Chinook are extinct from 45 percent of their historic range in the Pacific Northwest, and from 24 percent of their original range in Western Oregon and Northern

California. Fall Chinook are estimated to be extinct from 17.5 percent of their historic range in the Pacific Northwest, and from 17 percent of their range in Western Oregon and Northern California (Botkin et al. 1995). In Western Oregon and Northern California, the majority of Chinook salmon extinction appears to have occurred in the Klamath and Willamette River basins (Botkin et al. 1995).

Chinook salmon in the Elliott State Forest are part of the Oregon Coast ESU. This ESU was reviewed and found to not warrant a listing by NMFS in 1998. The overall spawning escapement of fall Chinook, based on average peak count densities, has increased throughout the Oregon Coast ESU since 1950.

4.14.3. Status in Elliott State Forest Lands

Spawning fish surveys have been conducted on standard index streams to asses coastal stocks of fall Chinook since 1950 (Jacobs and Cooney 1997). No standard index surveys are located on Elliott State Forest lands. One standard survey is located on the West Fork Millicoma a few miles downstream from the Elliott State Forest. This survey was established in the early 1960s and has been repeated every year since.

Standard index surveys are not used to estimate population size as they are not randomly selected. These surveys are useful to track trends over time. Table 4-5 displays the peak number of adult Chinook observed on the West Fork Millicoma standard index survey in five-year increments and the previous five years.

Table 4-5
West Fork Millicoma Standard
Chinook Survey (0.5-mile reach)

Year	Peak Adults
2004	40
2003	209
2002	51
2001	30
2000	5
1995	43
1990	12
1985	11
1980	30
1975	22
1970	12
1965	2

4.15. CHUM SALMON (ONCORHYNCHUS KETA)

4.15.1. Species Ecology and Literature Review

Chum salmon return to freshwater and typically spawn in October and November (Groot and Margolis 1991). This species primarily matures at three to five years (Emmett et al. 1991) and typically weighs 8 to 12 pounds (Steelquist 1992). Chum salmon usually spawn near the head of tidewater in small coastal streams. Each female deposits an average of 2,400 to 3,000 eggs, although large females may release up to 4,000 eggs (Emmett et al. 1991). Chum salmon fry emerge from the spawning gravels the following spring.

Chum salmon juveniles migrate seaward immediately after emerging, and rear in estuarine waters (Emmett et al. 1991). The juveniles may rear in the estuary reaches for up to several months while they feed and grow (Emmett et al. 1991). During this time, they also complete the physiological transition necessary for survival in salt water, and migrate to oceanic waters.

Chum salmon generally rear in the ocean for one to five years while they grow to maturity. Once mature, they return to their natal streams to spawn.

4.15.2. Management Status in Western Oregon

Of all the Pacific salmon species, chum salmon have the widest natural range in North America. The species ranges from the Sacramento River in California to the Arctic coast of Alaska, and as far east as the Mackenzie River in northern Canada (Emmett et al. 1991; Groot and Margolis 1991). However, it is estimated that chum salmon are now extinct in 37 percent of their historic range in the Pacific Northwest, and 34 percent of their range in Western Oregon and Northern California (Botkin et al. 1995).

Chum salmon in the HCP area are part of the Pacific Coast ESU. A review of the status of the Pacific Coast ESU of chum salmon was completed in March 1998, and NMFS determined that listing was not warranted.

4.15.3. Status in Elliott State Forest Lands

A small population continues to spawn annually in Marlow Creek in the Elliott State Forest. Chum salmon have also been observed spawning in the West Fork Millicoma. The Coos Bay chum population is thought to be the southernmost viable chum population on the Oregon Coast (Jacobs et al. 2000).

4.16. STEELHEAD TROUT (ONCORHYNCHUS MYKISS SPP.)

4.16.1. Species Ecology and Literature Review

There are two main races of steelhead —winter and summer—which are broadly distinguished by the season that they return to freshwater to spawn. Summer steelhead typically return to freshwater from late spring through summer, but do not mature and spawn until the following winter or spring, January through May (Emmett et al. 1991). Winter steelhead typically return to freshwater between November and March, and spawn from January through May. Unlike Pacific salmon, which die after spawning, adult steelhead may migrate back to the ocean and return to freshwater to spawn again (Steelquist 1992). The proportion of steelhead that successfully spawn multiple times is low, however, and is often restricted to the females of the population (Emmett et al. 1991).

The age of sexual maturity is variable in steelhead. As juveniles, steelhead may rear in freshwater for one to four years before entering the ocean. The fish then rear for one to three years in the ocean before returning to freshwater to spawn. With so much variation in the years spent reaching maturity, the age of spawning steelhead varies considerably. Steelhead that exhibit extended ocean rearing tend to return as larger adults (Emmett et al. 1991). The average steelhead often weighs from 5 to 10 pounds, but some fish can grow as large as 40 pounds (Steelquist 1992).

Most juvenile steelhead rear in freshwater from two to three years (Emmett et al. 1991). After emergence in late spring, steelhead fry move to the shallow margins along streams where they actively feed. By summer, they are larger and move into the faster portions of pools, or into glides and riffles. Winter rearing occurs within a range of both fast and slower freshwater habitats, but juvenile steelhead (like many other salmonids) prefer complex winter habitat formed by accumulations of LWD.

After reaching the smolt stage, steelhead migrate downstream toward the ocean in the spring. Smolts spend little time in estuaries before entering the ocean environment (Emmett et al. 1991). Smolts grow rapidly in the ocean, and may reach a size of 16 to 20 inches by fall.

4.16.2. Management Status in Western Oregon

The historic range of steelhead in North America extended from Alaska to the Baja Peninsula of northern Mexico (Emmett et al. 1991). It is estimated that winter steelhead are extinct in 25 percent of their historic range in the Pacific Northwest and 14 percent of their original range in Western Oregon and Northern California (Botkin et al. 1995). Overall, winter steelhead remain abundantly distributed throughout much of Western Oregon and Northern California, especially in the coastal region (Botkin et al. 1995). Summer steelhead are believed to be extinct in 35 percent of their historic range in the Pacific Northwest, and 41 percent of their original range in Western Oregon and Northern California (Botkin et al. 1995).

Steelhead in the Elliott State Forest are part of the Oregon Coast ESU. A review of this ESU was completed in March 1998, and NMFS determined that the listing was not warranted at that time. However, the Oregon Coast ESU remains designated as a species of concern due to specific risk factors, and its status will continue to be monitored.

4.16.3. Status in Elliott State Forest Lands

The ODFW implemented a coastwide steelhead survey methodology with the 2003 spawning season. Tables 4-6 and 4-7 display the average number of steelhead redds per mile for sites in the Elliott State Forest and other basins in the vicinity.

Table 4-6
2003 Steelhead Redd Density

Watershed (number of sites)	Steelhead Redds/Mile
Elliott Sites (9)	9
Siuslaw (33)	8.2
Umpqua (137)	8.8
Coos (18)	12
Coquille (22)	16.1

Table 4-7
2004 Steelhead Redd Density

Watershed (number of sites)	Steelhead Redds/Mile
Elliott Sites (13)	25.7
Siuslaw (37)	6.3
Umpqua (90)	11.3
Coos (32)	21.2
Coquille (29)	9

4.17. COASTAL CUTTHROAT TROUT (ONCHORHYNCHUS CLARKI CLARKI)

4.17.1. Species Ecology and Literature Review

Coastal cutthroat trout exhibits both resident and anadromous (sea-run) life forms. The anadromous form is often referred to as "sea-run" cutthroat trout. The resident form may actually have several varieties: one that rears entirely in small streams, and varieties that migrate between small streams and lakes or between small streams and large rivers (Emmett et al. 1991). The following description of life history characteristics focuses on the anadromous life form, although freshwater habitat requirements and life history characteristics are similar among all cutthroat trout life forms.

Anadromous cutthroat trout adults generally enter coastal estuaries on their spawning migration from late June through October. These fish then spend varying times within the estuarine and tidal portions of their natal river system before migrating upstream to spawn. In Oregon, it is believed that spawning occurs from December to May. Spawning tends to occur in small (first- and second-order) tributaries (Wydoski et al. 2003). Like steelhead, anadromous cutthroat trout do not always die after spawning, and may return to spawn multiple times.

Cutthroat trout fry emerge from the stream gravels from March through June, and move to shallow channel margins or backwater areas during this early life stage (Trotter 1997). As they grow larger, the young parr gradually move to deeper pools and low-gradient riffles. During the winter months, cutthroat juveniles use low-velocity pools, beaver dams, and side channels with complex habitat formed by large wood accumulations (Trotter 1997).

After they reach approximately one year of age, cutthroat juveniles may leave their small natal streams and move into larger tributaries and rivers to rear. During winters, they may move back into these smaller streams to escape the winter freshets (Trotter 1997). Juvenile cutthroat trout generally rear in freshwater until they reach an age of two, three, or four years before they begin the downstream migration to the saltwater environment (Trotter 1997). Some juveniles remain up to nine years in freshwater before migrating downstream (Emmett et al. 1991). The seaward migration of cutthroat in Oregon generally occurs from January to mid-June, with the peak in April or May (Emmett et al. 1991).

After reaching the estuary, a portion of the downstream migrants enter the ocean, while others stay and rear in the estuary for additional periods; a small portion of coastal cutthroat may never migrate to the ocean (Trotter 1997). Most cutthroat will rear in the ocean for only one summer (several months) before migrating back to freshwater to spawn (Emmett et al. 1991). At maturity, most sea-run cutthroat in Oregon are less than 20 inches in length, and weigh less than four pounds (Wydoski et al. 2003).

4.17.2. Management Status in Western Oregon

Coastal cutthroat trout populations range from the Eel River in Northern California to Prince William Sound in Alaska (Steelquist 1992; Emmett et al. 1991). While anadromous (sea-run) populations of cutthroat trout are estimated to be extinct in only five percent of their historic range, some evidence suggests that their numbers may be greatly reduced in portions of their range (Botkin et al. 1995). However, because juveniles of both resident and anadromous forms exist in the same rivers, it is very difficult to determine the status of anadromous cutthroat trout.

The Umpqua River ESU was listed as endangered by NMFS in August 1996. However, as a result of the status review of all populations of coastal cutthroat trout in Washington, Oregon, and California, it was determined that this population is part of the larger Oregon Coast ESU. The Oregon Coast ESU was declared a candidate species; therefore, cutthroat trout in the Umpqua basin have been removed from the ESA list.

4.17.3. Status in Elliott State Forest Lands

Resident cutthroat trout are widespread and considered the dominant trout in most headwater tributaries and small streams along the Oregon coast that enter the ocean, including those in the HCP area. Multiple age classes of cutthroat are consistently observed when sampling tributary streams. Numerous independent cutthroat populations exist upstream from impassable barriers to migration. The wide distribution and consistent presence is an indication that resident cutthroat trout have relatively healthy populations in Oregon coastal streams (Oregon Department of Fish and Wildlife 1997), including in the Elliott State Forest.

Adfluvial populations of cutthroat trout exist above Loon Lake in the Umpqua basin and the Tenmile Lakes basins (Oregon Department of Fish and Wildlife 1995). Adfluvial populations migrate between spawning tributaries and lake environments.

Anadromous (sea-run) cutthroat trout are believed to be present in most coastal streams that do not have a barrier to migration in the lower reaches of the stream. A lack of inventory data generally precludes quantitative assessment of the status of most anadromous, adfluvial, and resident cutthroat trout populations along the Oregon coast. Anecdotal information, creel surveys, and fish counts at dams have led to concerns that anadromous populations in Oregon are experiencing a widespread decline.

4.18. PACIFIC LAMPREY (LAMPETRA TRIDENTATA

4.18.1. Species Ecology and Literature Review

The Pacific lamprey is an anadromous (sea-run) parasitic species. Juvenile lamprey, called ammocoetes, rear in fresh water for four to seven years and may reach 17 centimeters in length. A two- to four-month metamorphosis period is followed by a movement into saltwater. Pacific lamprey is parasitic in the ocean, feeding on a wide variety of fish and marine mammals (Kostow 2002). Lengths of Pacific lamprey collected in the ocean have ranged in length from 13 to 72 centimeters (Beamish 1980). Adult lampreys have been observed returning to fresh water to begin their spawning migration from February through August. Lampreys overwinter in fresh water before spawning the following spring. Spawning habitat is similar to salmonids, consisting of cool, flowing water and clean gravel; rearing areas are slow-moving backwater habitats (Oregon Department of Fish and Wildlife 1995). Spawning of Pacific lamprey on the Oregon Coast generally occurs from February through May (Kostow 2002).

4.18.2. Management Status in Western Oregon

Pacific lamprey has the widest distribution of any lamprey species in Oregon. They are found on the Pacific coast from the Aleutian Islands south to Baja California and the coast of Asia. They inhabit the entire coast of Oregon and the Columbia River drainage, but the extent of their distribution is poorly understood because of a lack of survey information (Oregon Department of Fish and Wildlife 1995).

This species was designated as "sensitive-vulnerable" by the ODFW following annual stock status review meetings in 1993. The basis for this designation was a widespread perception that abundance had decreased markedly over several decades. Likely threats or causes for decline include habitat destruction in spawning and rearing areas.

4.18.3. Status in Elliott State Forest Lands

The status of lampreys in Oregon, and specifically in the Elliott State Forest, is difficult to assess for a number of reasons. Little effort has been targeted at lamprey monitoring; most data have been collected incidental to other salmonid monitoring projects, and the monitoring activities, locations, and timing were not necessarily appropriate for lamprey. In addition, field identification of lampreys can be difficult, particularly with ammocoetes. This has resulted in data that reference "lamprey," but provides no specific species information (Kostow 2002).

Pacific lamprey are present in most Oregon coastal streams, including those in the Elliott State Forest. Lamprey redds are included with the steelhead surveys initiated by the ODFW in 2003. Tables 4-8 and 4-9 display the number of lamprey redds observed during steelhead surveys in the Elliott State Forest and other basins in the vicinity.

Table 4-8
2003 Lamprey Redd Density

Watershed (number of sites)	Lamprey Redds/Mile
Elliott Sites (9)	0
Siuslaw (33)	9.5
Umpqua (137)	2
Coos (18)	4.6
Coquille (22)	16.3

Table 4-9
2004 Lamprey Redd Density

Watershed (number of sites)	Lamprey Redds/Mile
Elliott Sites (13)	11.2
Siuslaw (37)	16.1
Umpqua (90)	4.9
Coos (32)	13
Coquille (29)	49.3

4.19. WESTERN BROOK LAMPREY (LAMPETRA RICHARDSONI)

4.19.1. Species Ecology and Literature Review

Western brook lamprey is a small non-parasitic fish that is not well understood. Spawning occurs in the spring, with redds created in small gravels upstream of riffles. Eggs generally hatch in 15 to 20 days, with the larva remaining in the redd for an additional 30 days. After emerging from the redd, lamprey promptly burrow into silty areas for further development. Metamorphism likely occurs after four to six years when a lamprey develops eyes and other physical changes to reach adulthood. After metamorphism, brook lamprey are sexually mature and range in size from 8 to 17 centimeters (Pletcher 1963).

4.19.2. Management Status in Western Oregon

The distribution of western brook lamprey ranges from California to British Columbia (Lee et al. 1980), and is reported in the Columbia basin inland as far as the Yakima River. This species is recognized as the second most common and widely distributed lamprey in Oregon (Kostow 2002).

4.19.3. Status in Elliott State Forest Lands

The status of western brook lamprey in the Elliott State Forest is currently unknown. Their presence has been confirmed, but studies to document their distribution and abundance have not been conducted for streams in the HCP area.

4.20. RIVER LAMPREY (LAMPETRA AYRESI)

4.20.1. Species Ecology and Literature Review

River lamprey is a small parasitic anadromous (sea-run) fish that is not well understood. Confirmed observations of this species are rare. The lack of observations may be partly caused by the difficulty in finding this fish in fresh water. Although river lampreys spend most of their life in fresh water, they are indistinguishable from the more common western brook lamprey until the final stages of their life cycle.

The distinctive oral disc of the river lamprey is the last feature to develop during metamorphosis. By this time, the lampreys have apparently entered the main river channels and are just upstream of saltwater influence (Beamish 1980). River lampreys enter salt water between May and July and promptly begin feeding. Their diet mainly consists of smelt and herring. River lampreys remain in the ocean for approximately ten weeks, at which time they are reported to be 25 centimeters long (Beamish and Youson 1987). It is assumed that they spawn the following spring, although adults are rarely observed in fresh water. River lampreys seem to prefer larger rivers, but they have also been observed in smaller streams on the Oregon coast.

4.20.2. Management Status in Western Oregon

The river lamprey is distributed in coastal drainages from southeast Alaska to California. This species is thought to prefer larger rivers, but samples have also been taken from smaller Oregon coastal streams. ODFW staff has not confirmed the presence of river lamprey in a number of years, and have little information on its distribution.

4.20.3. Status in Elliott State Forest Lands

The status of river lamprey in the Elliott State Forest is currently unknown. Its presence has been confirmed on other Oregon coast streams. Studies to document the presence and distribution of river lamprey have not been conducted for streams in the HCP area.

4.21. HABITAT REQUIREMENTS

Freshwater habitat needs are generally similar for all salmonid species found within the Elliott State Forest lands planning area. The discussion of habitat requirements applies to all salmonid species included in this HCP. The information presented here is intended only to be a synopsis of the current knowledge of salmonid and other aquatic species habitats and influences of forest management. More detailed information can be found in a variety of other sources—including Spence et al. (1996), Murphy (1995), Naiman (1992), Meehan (1991), and Salo and Cundy (1987).

4.21.1. Aquatic Habitat

The function and productivity of aquatic habitat are influenced by a variety of physical, chemical, and biological factors. The condition of these factors can have a substantial influence on the health and sustainability of salmonids. Although the relative importance of a factor can vary according to the life stage of these species, the lack of suitable conditions in any one stage can be critical to the status of the entire population. These same factors also affect other aquatic species. Important elements of aquatic habitat are discussed below.

Substrate Character/Embeddedness—Stream habitats that are productive for salmonids and other aquatic life commonly contain substrates that are relatively low in fine sediments. Salmonids depend on suitable stream substrates for spawning, egg incubation, and early rearing, hiding, and resting cover; they also depend on these areas for the production of aquatic invertebrates, an important food source.

During spawning, the process of redd construction displaces fine sediments and prepares the streambed gravel for successful embryo development. These favorable conditions can be affected during egg incubation if fine sediment materials become re-introduced to the redd. Increases in the proportion of fine sediment have been documented to result in decreased egg and fry survival (Bjornn and Reiser 1991; Reiser and White 1988).

Water Quality—In forested streams, water quality parameters that can influence salmonid productivity include water temperature, dissolved oxygen (DO), turbidity, nutrients, pH, and the presence of naturally occurring organic and inorganic chemicals (Spence et al. 1996; Murphy 1995). These parameters can exhibit daily, seasonal, and annual fluctuations. Variability can also occur spatially across a watershed. Most aquatic life forms have adapted to tolerate these natural variations, but can be negatively affected when the magnitude or duration of the variations exceed natural levels.

Water Temperature—Salmonids generally prefer cool water temperatures, although they have been shown to survive extremes in water temperature if acclimation is adequate or exposure to the extreme is of short duration. Based on laboratory studies, the preferred rearing temperature range for most species of juvenile salmonids is approximately 50 to 58 degrees Fahrenheit (Beschta et al. 1987). Exposure to temperature extremes, if not lethal, can

have undesirable effects on growth, behavior, disease resistance, migration timing, or competition from other species, and these factors can affect survival or local abundance.

Dissolved Oxygen—DO is important to the survival of salmonids. Incubating eggs and alevins require a constant source of well-oxygenated water to survive and develop properly. Juvenile and adult salmonids are also affected by the amount of DO in the water column. Decreases in DO can adversely affect swimming and migration ability, growth rates, food conversion ability, and survival (Bjornn and Reiser 1991). DO is not a concern for most streams running through forests. Relatively cool temperatures and high turbulence in these streams normally maintains DO near saturation (Murphy 1995; Bjornn and Reiser 1991). DO can be reduced in streams when flows are low, and water temperatures are high. High amounts of decomposing fine organic matter can also reduce DO concentrations through biochemical oxygen demand.

Chemical Contamination—A variety of chemicals used in forest management can have adverse effects on salmonids and other aquatic life. The major categories of these chemicals include pesticides (herbicides, insecticides, fungicides, etc.), fertilizers, and fire retardants (Norris et al. 1991). Other potentially hazardous chemicals, such as petroleum products, are also present and can be introduced into aquatic habitat through accidental spills. Each chemical compound has a different interaction with the environment, and thus imposes a distinctive risk to salmonids and the aquatic ecosystem. A detailed description of forest chemicals and their potential risks can be found in Norris et al. (1991).

Organic Matter, Nutrients, and Food Production—In streams, the energy available to support aquatic life comes from two sources: photosynthesis by aquatic plants and organic matter imported from areas outside the stream (Murphy and Meehan 1991). Inorganic nutrients and riparian vegetation conditions within a watershed influence these energy sources. In turn, the productivity of the stream ecosystem for salmonids is also influenced by these factors.

In small streams, the amount of energy derived from photosynthesis is affected by the amount of light reaching streams and the availability of nutrients. In closed canopy forests, primary production by algae, diatoms, and macrophytes is usually limited. Where more sunlight reaches the stream due to a more open canopy, primary production will increase if the necessary nutrients (nitrogen and phosphorus) are available. The materials created by primary production provide an important food source for invertebrates (Murphy and Meehan 1991).

If canopy closure is reduced and more sunlight reaches a stream, increased primary production can increase the production of invertebrates and fish through the greater availability of high-quality detritus. The larger quantity of detritus supports greater production of invertebrates, which in turn provides an increased food supply for salmonids. Excessive canopy reductions can also increase water temperature and reduce complex habitat, which can nullify any potential benefits to salmonids. The other important source of materials for stream productivity is organic matter originating from outside the stream. The primary sources include input from riparian vegetation, dissolved materials in groundwater seepage, soil erosion, and input from animals, e.g., terrestrial insects, salmon carcasses, and materials deposited by beavers (Murphy and Meehan 1991).

Habitat Diversity and Large Woody Debris—The physical structure of streams can have a direct influence on the production of salmonids and other aquatic life. Structural features include habitat units such as pools, riffles, rapids, glides (Bisson et al. 1987), and off-channel habitats such as alcoves and side channels.

The relative importance of individual habitat features to aquatic species can vary by species, life history stage, season, and presence of other species.

Given the range of habitat needs and the variability among different species at different seasons, a stream must have diverse habitats to support productive salmonid populations. Recent information indicates that streams with greater habitat diversity tend to support more diverse assemblages of salmonid species (Spence et al. 1996; Reeves et al. 1993; Bisson et al. 1992). Conversely, simplified streams dominated by one type of habitat often support a less diverse assemblage of salmonids (Reeves et al. 1993; Bisson et al. 1992). LWD plays an essential role in the formation of diverse and complex habitats (Spence et al. 1996; Reeves et al. 1993; Bisson et al. 1992; Hicks et al. 1991). The wood's interaction with channel features and flowing water can create pools, side channels, undercut banks, alcoves, and braided channels; these interactions also increase hydraulic complexity (Spence et al. 1996; Bisson et al. 1987; Sullivan et al. 1987). Off-channel habitats, which are important to salmonids for winter survival, are often formed when streams re-route around LWD obstructions and form new channels. LWD also creates microhabitats and increases the functionality of habitats for salmonids. For example, the presence of woody debris in pools provides cover from predators, creates low-velocity refuge areas, and provides complexity that allows multiple salmonid species to coexist (Spence et al. 1996).

LWD also plays an important role in the regulation of sediment and nutrient routing processes within stream systems. The large pieces of wood trap and store coarse sediment, which in turn maintains gravel for spawning areas, creates plunge pools and stepped profiles in steeper gradient reaches, and stabilizes channels (Murphy 1995). Large logjams and debris dams store fine sediments, reducing the rate at which these sediments are transported downstream (Spence et al. 1996; Bisson et al. 1992). Woody debris also traps and retains organic matter for subsequent processing by aquatic invertebrates. All of these processes and functions can influence the productivity of streams for salmonids and other aquatic life.

Habitat Access—Fish passage barriers can prevent or delay returning adults from reaching spawning areas; prevent juveniles and adults from reaching upstream tributaries in search of cool water, food, or shelter (Furniss et al. 1991); and reduce the overall amount of habitat available to aquatic species.

Passage barriers can isolate resident populations and result in genetic differentiation over the long term. These barriers can also result in the local extirpation of isolated populations, if environmental or human-caused factors eliminate fish from the reach. For example, a drought that dewaters a reach above a barrier, or a chemical spill that kills all of the fish, will result in local extirpation of the population because the barrier prevents re-colonization.

In forests, the most common human-made barriers to fish passage are culverts and other road-related structures, although water storage dams and other obstacles are found occasionally.

Stream crossings are required to provide fish passage if located in waters in which migratory fish are currently or were historically present (ORS 509.585).

4.21.2. Riparian Vegetation Influences

The composition and condition of riparian vegetation directly influence the characteristics, functions, and general productivity of aquatic habitat. This section briefly describes these influences.

Stream Bank Condition—Riparian vegetation increases the resistance of stream banks to erosion. The roots of trees and shrubs adjacent to streams can bind soil particles together, helping to maintain bank integrity (Spence et al. 1996) and reducing the release of sediments stored in stream banks. An exposed coarse root network can also physically deflect erosive flows. Complex stream margin habitats, such as undercut banks, are also created when water erodes soil from beneath the roots while the root mass maintains soil materials at the ground surface. These habitats provide important hiding and rearing cover for salmonids.

Vegetation immediately next to a water body is the most important for maintaining stream bank integrity (USDA Forest Service et al. 1993). The root systems of most Pacific coast conifers commonly extend from the bole to approximately the outer edge of the tree canopy (Arney, personal communication, 1999; Arney 1973). Beyond this point, the contribution of root strength to stream bank integrity declines (USDA Forest Service et al. 1993). The contribution of root strength in maintaining streambanks has been found to operate within a distance of one-half site-potential tree height (Murphy 1995; Spence et al. 1996).

Sediment Interception and Storage—Riparian vegetation can influence the routing and storage of sediments within and near stream channels. Vegetation in a high-water zone provides obstructions that can reduce water velocities, allowing the deposition and storage of suspended sediments (Spence et al. 1996). Riparian vegetation and downed logs on the forest floor can intercept and store sediment originating from upland sources. However, this function is primarily limited to sediment moved during small-scale events.

For the interception of sediment from upslope, the zone of vegetation influence is much more difficult to define because a variety of mechanisms can deliver sediments (Spence et al. 1996). A literature review completed by Knutson and Naef (1997) identified a number of forest land studies that recommended buffer widths of 100 to 125 feet, in order to filter 75 to 90 percent of sediments. The review cites one study (Belt et al. 1992) that recommends buffers of up to 200 to 300 feet to control non-channelized sediment below forest roads. The Forest Ecosystem Management Assessment Team report (USDA Forest Service et al. 1993) suggested that buffers of approximately 200 feet (or approximately one site-potential tree height) would be effective in removing sediment.

While riparian vegetation does play a role in sediment interception and storage, a more effective management strategy is to minimize sediment delivery to streams by controlling the upslope sources that generate sediment.

Aquatic Shade and Water Temperature—Riparian vegetation shades the water surface from solar radiation and helps prevent the associated increase in water temperature. The amount of shade provided by vegetation and its importance in preventing water temperature increases can vary with topography, channel orientation, latitude, and vegetation composition (Spence et al. 1996; USDA Forest Service et al. 1993). Vegetation near stream channels and other waters generally provides most of the aquatic shade (Spence et al. 1996). Brazier and Brown (1973) and Murphy (1995) reported that a buffer of 100 feet would provide aquatic shade comparable to old-growth conifer stands in the Oregon Coast Range and southern Cascades (80 to 90 percent angular canopy density). The actual aquatic shade provided by these buffer widths will vary according to the composition and characteristics of the vegetation within these zones.

Leaf Litter and Organic Matter Input—Riparian vegetation provides a significant source of small organic materials (leaf litter, needles, branches, etc.) to forested streams (Gregory et al. 1987). As already discussed, this material is an important part of the aquatic food chain, and contributes to the overall productivity of aquatic systems. Small organic material primarily enters streams through direct delivery (by falling or being blown into the channel), although other mechanisms such as overland flow, floods, or freshets can also move this material into streams (Spence et al. 1996; Richardson 1992). After entering a stream channel, most of this material is eventually transported downstream (Richardson 1992) and can therefore influence productivity throughout the stream system.

There is limited information on determining the relationship between the input of small organic materials to streams and the distance of source materials from streams (Spence et al. 1996; USDA Forest Service et al. 1993). The Forest Ecosystem Management Assessment Team report (USDA Forest Service et al. 1993) inferred that riparian vegetation buffers of at least 100 feet would deliver a supply of small organic material sufficient to maintain the biotic community structure of a stream.

Large Wood—An important function of riparian vegetation is the delivery of trees to streams. This LWD is a critical component of the functions and processes of aquatic ecosystems, and is important to the freshwater survival and production of salmonids, as discussed in Section 4.27.1, "Aquatic Habitat." Trees are recruited to aquatic habitats through stream bank erosion, windthrow, tree mortality, beaver activity, and mass movements of soils (Swanston 1991; Bisson et al. 1987).

Substantial research has been conducted on the potential of trees at various distances from a stream channel to enter streams. As with other ecological functions, trees nearest to a stream channel have the highest potential to interact with the stream, and the likelihood of a tree falling into a channel decreases rapidly as the distance from the stream increases (Robison and Beschta 1990). McDade et al. (1990) found that approximately 92 percent of potential LWD would be delivered from a riparian buffer of 100 feet in mature forests of Western Oregon and Washington. For old-growth forests, a buffer of 120 feet would be required to achieve 90 percent potential wood recruitment, because of greater tree heights in these stands. The maximum zone of potential LWD input is often identified as the distance equal to one site-potential tree height. The likelihood is low that trees farther away will reach aquatic habitats (USDA Forest Service et al. 1993).

4.21.3. Upland Influences

Human activities and ecological processes in the upland portions of watersheds can influence aquatic habitat conditions. These influences are briefly described in this section.

Sediment Delivery—Both coarse and fine sediments are naturally transported to aquatic habitats through processes such as surface erosion, mass movement, and debris torrents (Swanston 1991). Mass movement and debris torrents can also potentially deliver large quantities of woody debris in addition to the sediment. These types of infrequent, catastrophic disturbance events rapidly deliver materials (sediments and woody debris) that can be important to the formation and long-term productivity of aquatic habitats (Murphy 1995; Reeves et al. 1995). Concerns may arise, however, if land management activities increase the frequency, extent, or severity of these events, or if sediment delivery becomes chronic rather than episodic. The potential benefits to aquatic habitat from these events can also be eliminated if management activities fail to retain some of the legacy materials, such as LWD, associated with stream habitat formation after natural disturbances (Reeves et al. 1995; Murphy 1995).

Careful forest management is required in upland areas to minimize the potential negative effects of more extensive, frequent, or chronic delivery of sediments. As discussed previously, riparian buffers have a limited ability to minimize sediment input to streams. Land management strategies must focus on the potential sediment source areas to minimize the negative effects of sediment. A full description of the management activities, resource protection strategies, and objectives related to controlling sediment delivery are presented in other sections of this HCP.

Large Wood Delivery—LWD can be delivered to aquatic habitats from sources outside riparian vegetation zones, primarily through slope failure in the vicinity of stream channels. Mass movement that occurs on slopes adjacent to streams can transport trees and downed logs to the stream channel. High flows or debris torrent events can then potentially transport this wood downstream. Debris torrents often recruit additional woody material as riparian vegetation becomes entrained in the moving wedge of sediment and organic materials.

The amount of wood recruitment from upland sources is still relatively unknown and variable across the landscape, but studies have identified the need to consider this potential source of large wood in the management of aquatic habitats.

Stream Flow and Basin Hydrology—Various land management activities and the use of water can potentially alter the quantity and timing of stream flows within a basin. Forest management activities most commonly associated with effects on stream flow include the removal of vegetation and construction of roads. These activities have the potential to alter the water balance and affect the timing of water delivery within basins (Murphy 1995; Chamberlin et al. 1991). The effects have been observed mainly in studies of small basins, and the results of these studies cannot be accurately extrapolated to large basins (Zeimer and Lisle 1998).

The removal of vegetation from small watersheds can result in increased water yield and increased base flows during late-summer months (Zeimer and Lisle 1998; Chamberlin et al.

1991). The changes in flow occur because less water in the soil is transpired by vegetation, and the amount of precipitation intercepted by foliage (and then evaporated) is reduced. The net effect is greater soil moisture, possibly higher groundwater levels, and increased water delivery to stream channels during late summer (Chamberlin et al. 1991). Hydrologic changes associated with the removal of forest vegetation are temporary. As forest vegetation becomes re-established, water yield and summer base flow declines and returns to pre-logging levels. The length of time for flows to return to pre-activity levels can vary based on the time in which vegetation is reestablished. In Pacific coast forests, recovery usually occurs in less than 10 or 20 years, and occasionally within less than 5 years (Zeimer and Lisle 1998; Murphy 1995).

Other aspects of forest management can have more lasting effects on the hydrology of small basins. The construction of roads and landings creates impermeable surfaces that can divert precipitation to streams faster than would occur through natural soil infiltration and groundwater delivery mechanisms. These changes can result in faster delivery of water to stream channels and earlier peak flows during storm events. Roads and ditches can also intercept subsurface flow and convey it to the surface for more rapid delivery to streams. Soil infiltration rates and groundwater transport capacity may change, because of excessive soil compaction during timber harvest or site preparation, or as a result of excessively hot prescribed fires. The general hydrologic response to these changes can be similar to the response associated with increased impermeable surfaces: more rapid delivery of stormwater to streams (Murphy 1995; Zeimer and Lisle 1998). Current forest practices minimize the effects from road and other impermeable surfaces. Slash management practices minimize the amount of broadcast prescribed fires, and timing these fires in the spring prevents them from becoming excessively hot.