Draft Elliott State Forest Habitat Conservation Plan

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Prepared by: Oregon Department of Forestry

Acronyms and Abbreviations

AIP	Aquatics Inventories Project
BGEPA	Bald and Golden Eagle Protection Act
AOP	Annual Operations Plan
BLM	Bureau of Land Management
BMP	Best Management Practice
BOF	Board of Forestry
BOFL	Board of Forestry Land
CA	conservation area
CFR	Code of Federal Regulations
cfs	cubic feet per second
CSA	Conservation Support Area
CSF	Common School Fund
CSFL	Common School Forest Land
DBH	diameter breast height
DEQ	Oregon Department of Environmental Quality
DFC	desired future condition
DO	dissolved oxygen
DSL	Oregon Department of State Lands
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FIA	Forest Inventory and Analysis
FMP	Forest Management Plan
FPA	Forest Practices Act
FPFO	Forestry Program for Oregon
FVS	Forest Vegetation Simulator
GIS	geographic information system
GPS	global positioning system
HAS	headwater amphibian species
HCP	Habitat Conservation Plan
HU	harvest unit
IP	Implementation Plan
ITP	Incidental Take Permit
LC50	50 percent lethal concentration
LWD	large woody debris
MBF	thousand board feet
MBTA	Migratory Bird Treaty Act
MMBF	million board feet
MMMA	Marbled Murrelet Management Area
MOCA	Managed Owl Conservation Area
NEPA	National Environmental Policy Act
n	number of samples
NMFS	National Marine Fisheries Service

Acronyms and Abbreviations – continued

NSO Recovery Plan	Final Draft Recovery Plan for the Northern Spotted Owl
NTP	natural thermal potential
OAR	Oregon Administrative Rule
OCFWRU	Oregon Cooperative Fish and Wildlife Research Unit
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ORS	Oregon Revised Statute
QMD	quadratic mean diameter
RMA	Riparian Management Area
ROOTS	Reforestation Organization Operations Tracking System
SE	standard error
SDI	stand density index
Services	U.S. Fish and Wildlife Service and National Marine Fisheries Service
SLI	Stand Level Inventory
SNC	Swiss needle cast disease
SUV	steep, unique, or visual land
T&E core	threatened and endangered core
TMDL	total maximum daily load
USC	United States Code
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
°C	degrees Celsius
°F	degrees Fahrenheit

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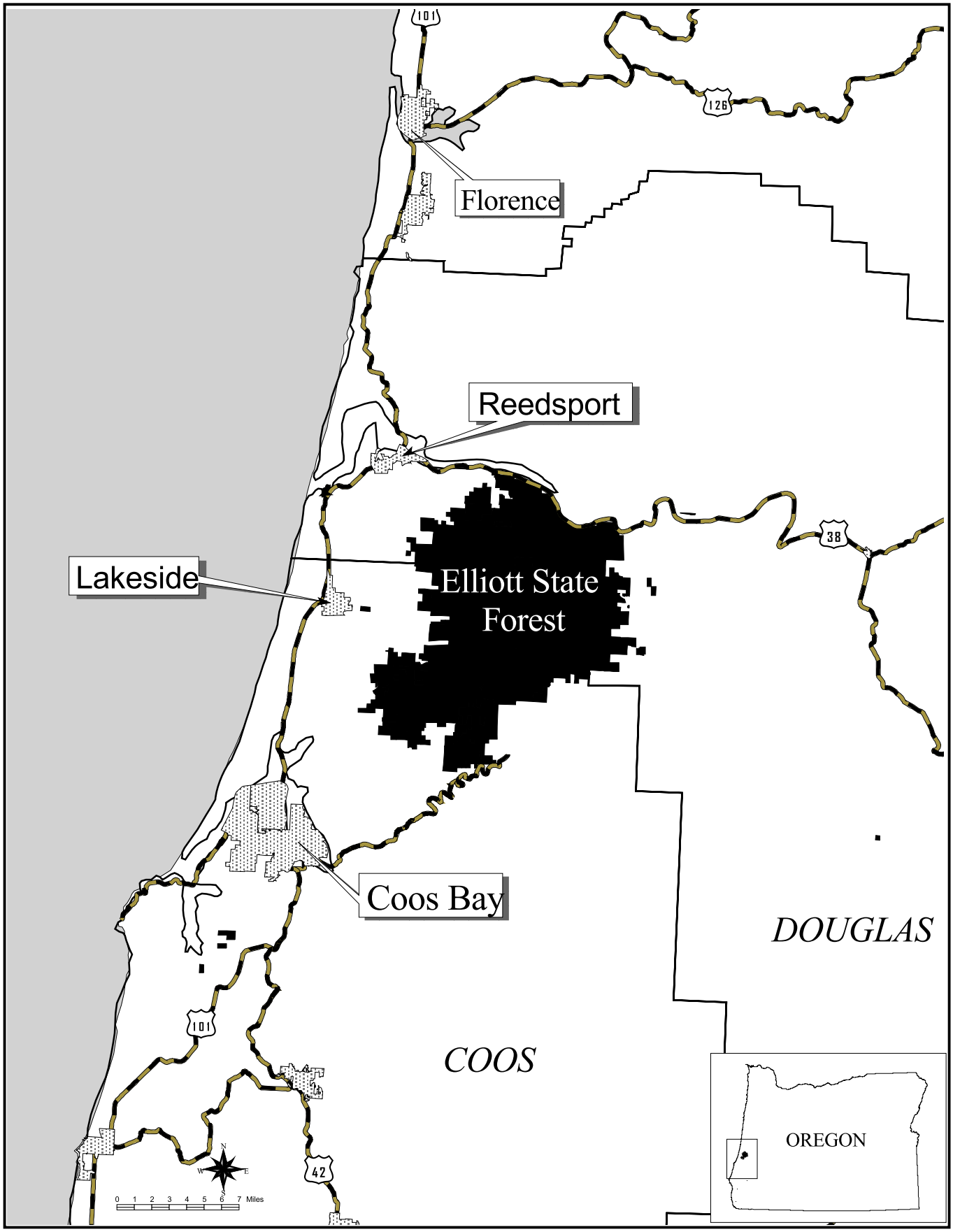
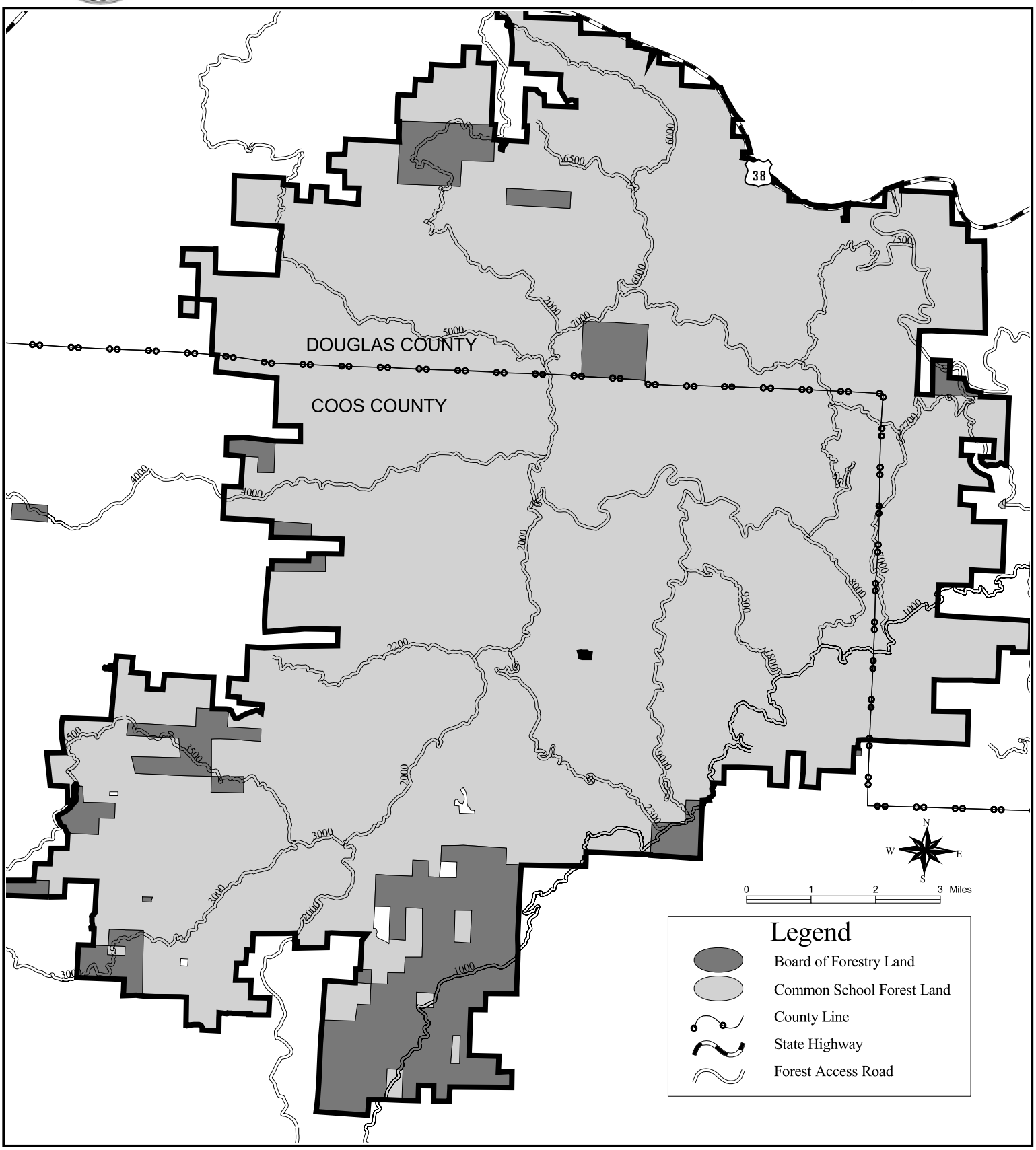
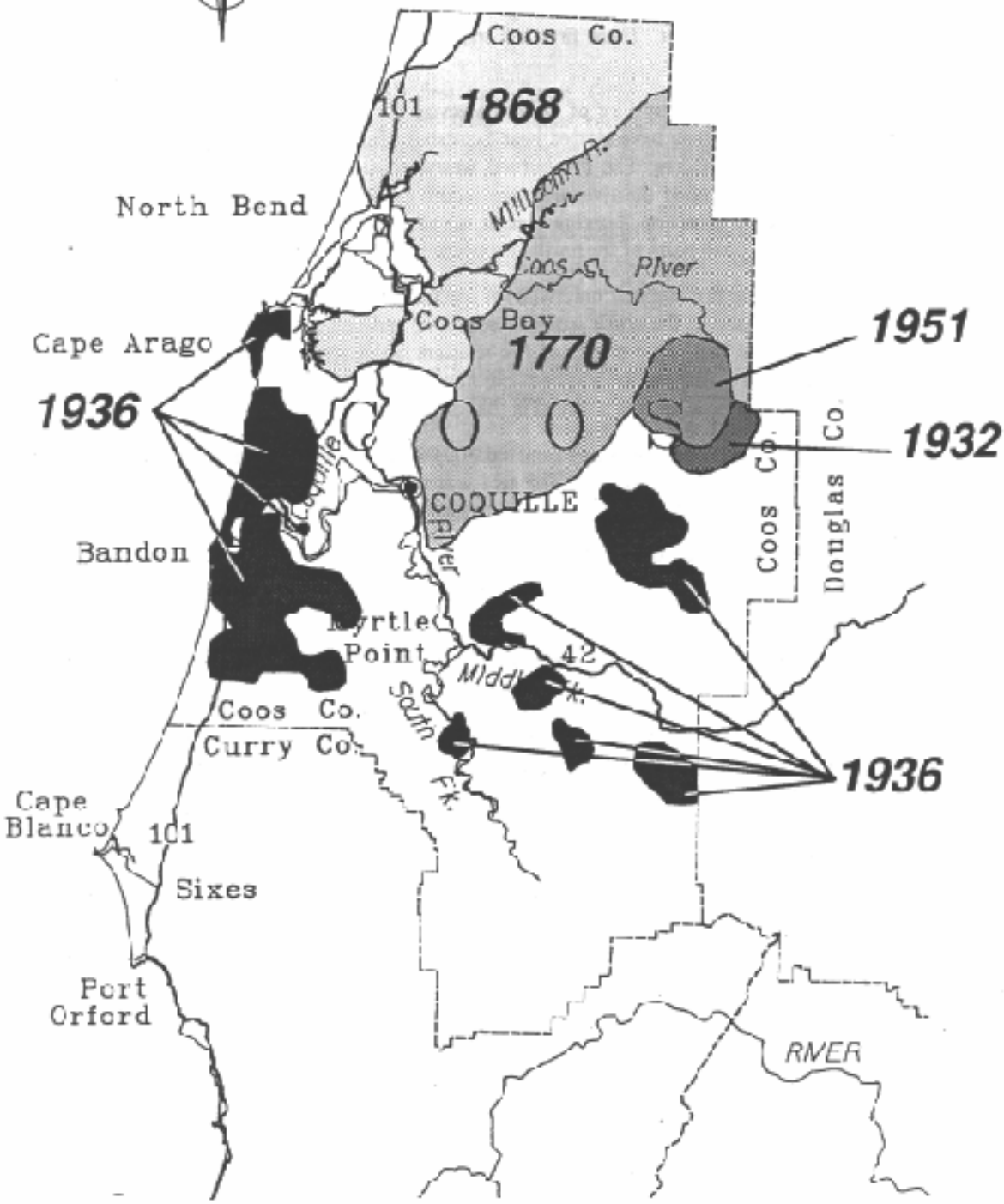
Elliott State Forest Vicinity Map



Elliott State Forest Ownership

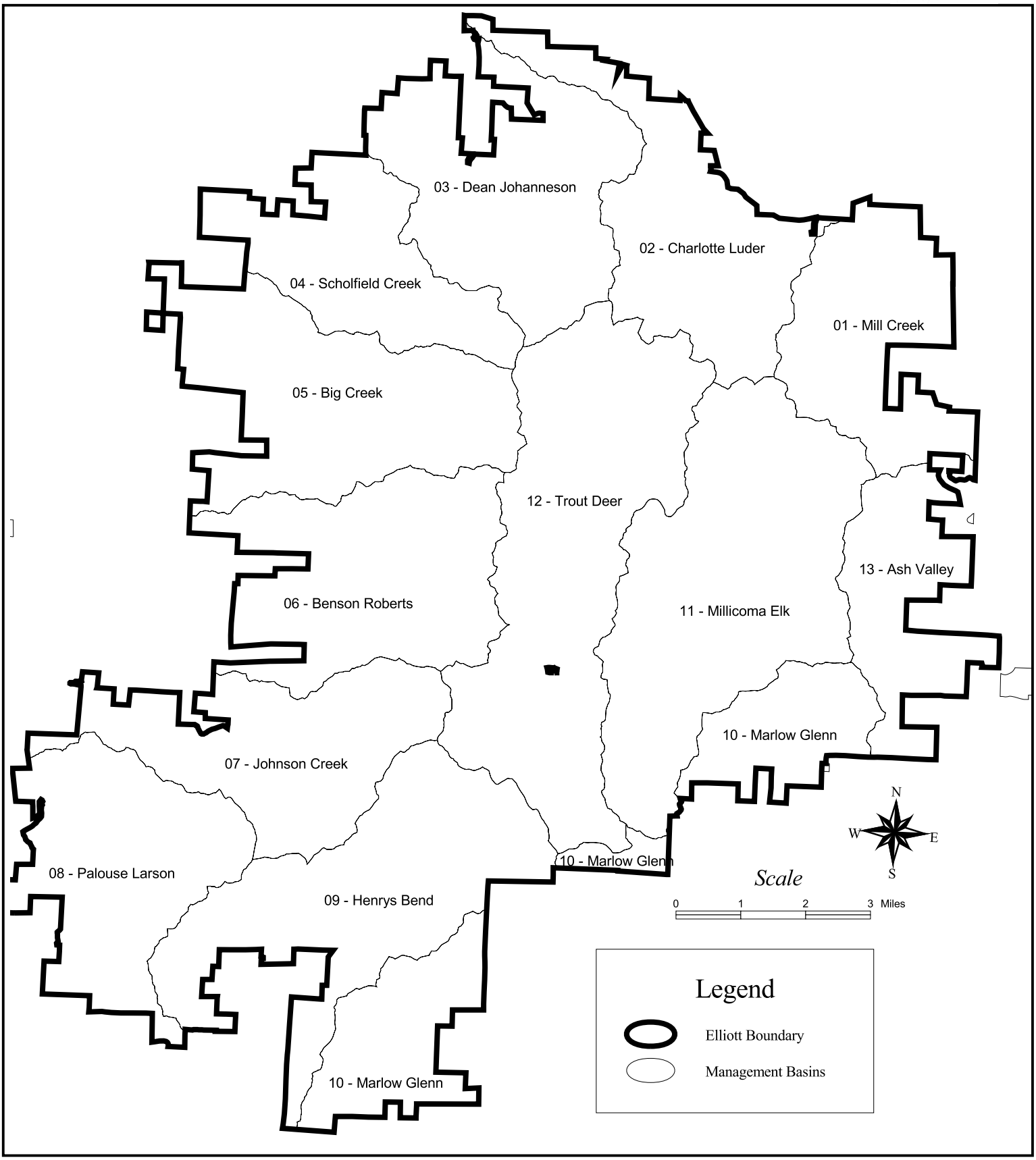


Some of Coos County's Major Forest Fires

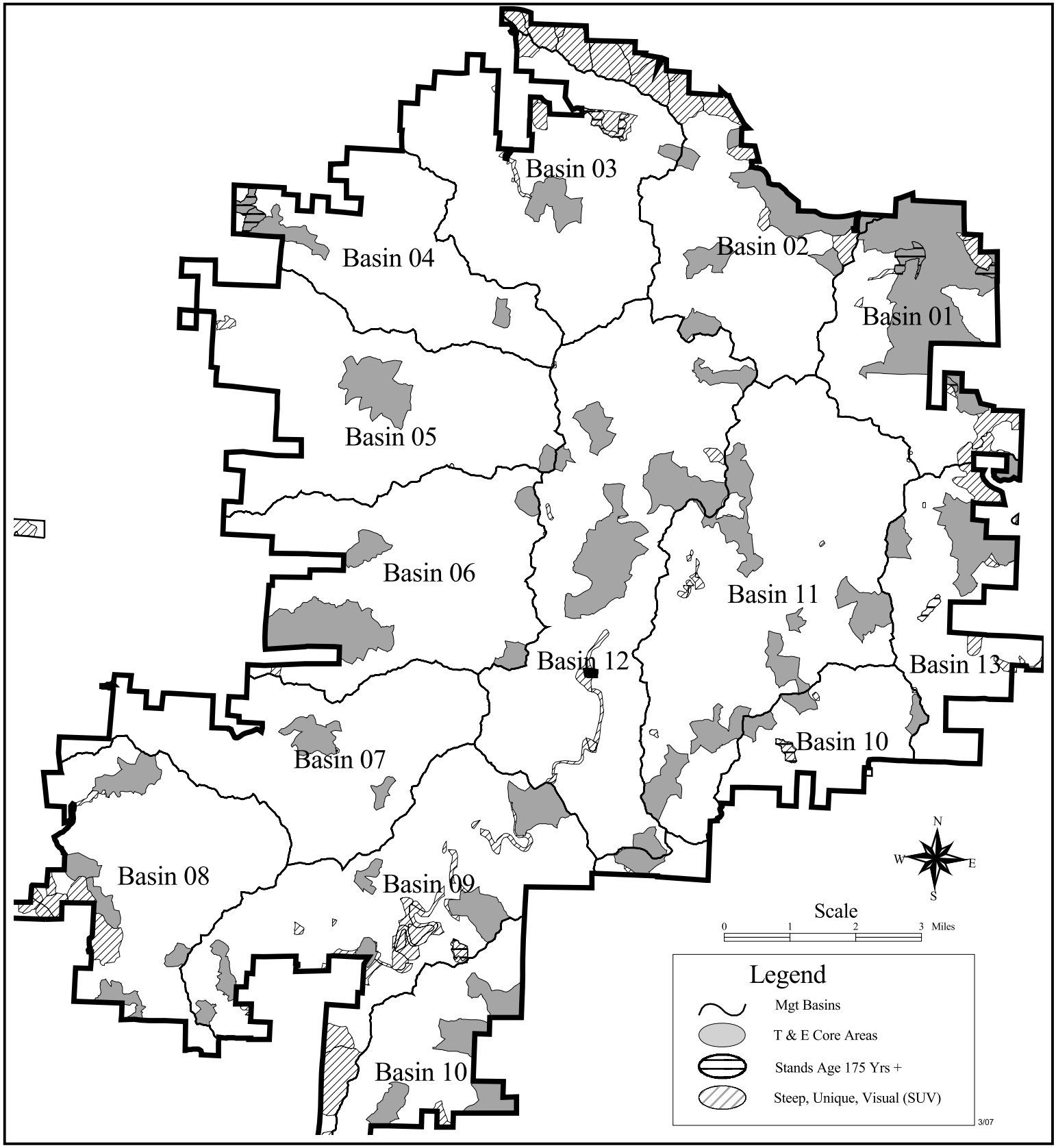


Source: Jerry Phillips

Management Basins on the Elliott State Forest



Elliott State Forest Conservation Areas



Executive Summary

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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

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1.4.1. Permit Period and Area 5
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1.4.3. Covered Activities 6

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

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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

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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.

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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 ≥18" and <32" DBH	13	
Trees/acre ≥ 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°	

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.

Chapter 5
Habitat Conservation Strategies

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5.1. INTRODUCTION

The Habitat Conservation Plan (HCP) combines two approaches to protecting and providing habitat for the covered species. The first approach involves sustainable forest ecosystem management strategies as a coarse filter in managing the forest landscape. The second approach involves specific strategies (a fine filter) for the management of salmonids, northern spotted owls, marbled murrelets, and the other listed and unlisted species (see Tables 1-1, 4-1 or 9-1). Chapters 6 through 9 of the HCP describe the fine filter strategies.

Sustainable forest ecosystem management seeks to 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, including 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 in an advanced forest structure condition, or will develop into such, and then will 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, which 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 be resistant to large-scale damage from environmental or human-caused stresses.

Monitoring and adaptive management provide the essential information and approaches that will guide implementation of all strategies in the HCP, and will advise future generations of resource managers on successful long-term sustainable forest ecosystem management, including any changes that may be needed.

5.2. MANAGE FOR A RANGE OF STAND STRUCTURES ACROSS THE LANDSCAPE

Summary of Conservation Measures

- Maintain the range of 40 to 60 percent advanced structure across the forest.
- Maintain the range of 25 to 55 percent of intermediate structure across the forest.
- Maintain the range of 5 to 15 percent of early structure across the forest.
- 50 percent of the forestwide advanced structure will have at least eight trees per acre at 32 inches diameter breast height (DBH) or larger.
- Meet advanced structure targets ranging from 30 to 60 percent in each management basin.
- Only harvest advanced structure in a basin as long as the basin target for advanced structure will be maintained.
    - For basins below the target amount of advanced structure during initial implementation periods, only harvest advanced structure when the basin has reached it advanced structure target.
    - Once a basin has reached its advanced structure target, maintain advanced structure at or above the target level in a basin.

5.2.1. Stand Structure Definitions

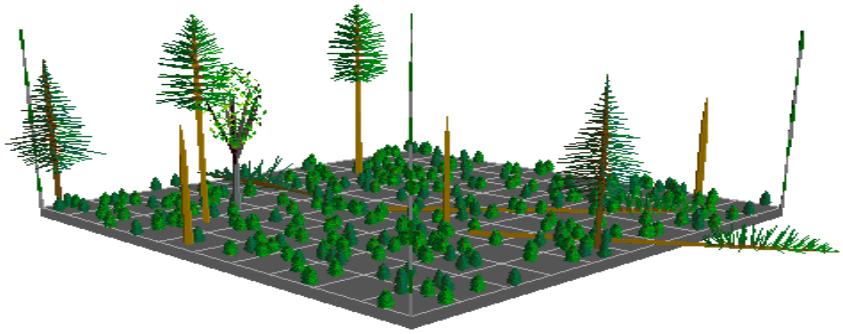
Pacific Northwest forests follow a typical progression of stand establishment and development over time following a major stand-replacement disturbance. Historically, these disturbances resulted from significant windstorm events, large-scale insect and disease outbreaks, and wildfires.

For this HCP, three defined stand structures depict the typical progression of stand development following a natural or human-caused disturbance: early, intermediate, and advanced. This is a simplified model. In reality, a continuum of forest development stages exists, reached by a multitude of pathways. These stand structures apply to all stands regardless of species composition—including pure conifer, mixed conifer/hardwood, and pure hardwood stands.

The processes that develop stand structures are described below. The stand initiation process is represented by the early stand structure. The stem exclusion and early understory re-initiation processes are represented by the intermediate structure. Structural complexity and larger tree size inherent to the advanced understory re-initiation process are characteristic of the advanced stand structure. The term “old growth” is used to describe both a process and a structure. Old-growth stands are included in the advanced stand structure.

The boxes below illustrate how these three representative stand structures might appear following the typical stand disturbance, establishment, and development sequence. In addition, the boxes describe stand characteristics, developmental stages, and the relative structural complexity. At the end of each description, the definition to be used during the first

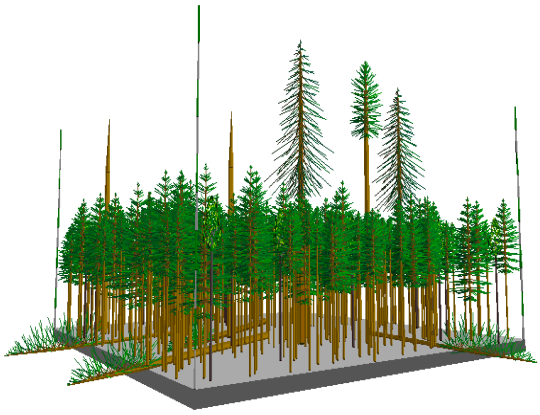
implementation period of this HCP is identified. Currently available data are limited to only a few of the characteristics desired in these structure types. As a result, these surrogate definitions have been developed for use during the first HCP implementation period, and will be re-evaluated thereafter.

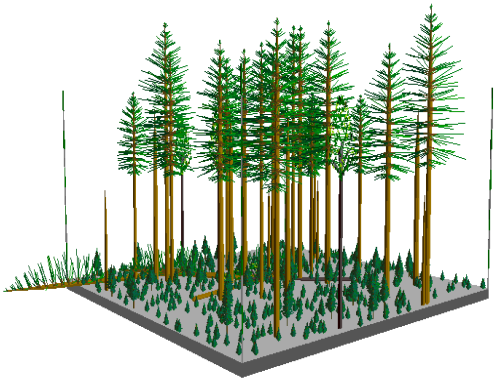


EARLY STRUCTURE
Stand Development Process—Stand Initiation

Following a disturbance, an early structure stand develops through the stand initiation process. In the early years of this stage, new plants (trees, shrubs, and herbs) begin growing from seed, sprouts, artificial regeneration, or other means. The site is occupied primarily by conifer or hardwood tree seedlings or saplings. Herbs, shrubs, and/or grasses are widespread and vigorous, covering 20 to 80 percent of the ground. This stage includes first-year regenerated stands, and continues to the stage when the trees approach crown closure. Snags, downed wood, and residual live trees are carried over or recruited from the previous stand.

In the later years of this stage, increasing crown closure shades the ground, and herbs, shrubs, and grasses begin to die out or lose vigor. At this point in development, the stand transitions from an early initiation stage to an intermediate stem exclusion stage. Early structure stands also include stands thinned and/or pruned until the average stand diameter is six inches, and an understory exists that meets the definition of an intermediate structure stand.





INTERMEDIATE STRUCTURE
Stand Development Processes—Stem Exclusion and Understory Re-initiation

As early structure stands develop and transition into the stem exclusion stage, trees fully occupy the site and form a single main canopy layer. The stem exclusion process begins when new trees, shrubs, and herbs no longer appear and existing ones begin to die due to competition for light, nutrients, and moisture. The shrub and herb layers may be completely absent, or may be short and dominated by one or two shade-tolerant species, such as sword fern, Oregon grape, oxalis, or salal. The trees begin to show decreasing diameter growth rate and crown length. Less competitive trees die and root diseases may kill additional trees. As some trees die, snags and downed wood begin to appear in the stand. The surviving trees grow larger, with more variation in height and diameter.

The understory re-initiation process begins when enough light and nutrients become available to allow forest floor herbs, shrubs, and tree regeneration to again appear in the understory. The amount of brush and herbaceous cover is minimal at the beginning, but increases to a substantial part of the stand by the end of the stage. In all understory re-initiation stands, the shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. Adequate light reaches the ground to allow shade-tolerant and intolerant herb and shrub species (e.g., Oregon grape, sword fern, blackberry, huckleberry, twinflower) to flourish. Tree canopies may range from a single-species, single-layered, main canopy with associated dominant, co-dominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed in the intermediate structure stands. The least developed stands in this category consist of a single-species, single-layered, main tree canopy with a limited understory of shrubs and herbs. Depending on the intensity and timing of density management activities, stands could shift back and forth between the stem exclusion and understory re-initiation stages over time.

ADVANCED STRUCTURE
Stand Development Process—Understory Re-initiation and Old Growth Processes

The understory re-initiation process continues after sufficient light and nutrients are available to allow herbs, shrubs, and trees to grow and develop in the understory. The new understory may grow very slowly at higher stand densities. The vertical structure of advanced structure stands is more developed than that of intermediate structure stands in the understory re-initiation stage. Tree crowns show significant layering from the tallest trees to the forest floor. Shrub and herb layers are diverse, in terms of species and in vertical arrangement. A mixture of shade-tolerant tree species (e.g., western red cedar, western hemlock, bigleaf maple), intolerant tree species (e.g., Douglas-fir), and shrub and herb species (e.g., vine maple, huckleberry, rhododendron, Oregon grape, prince's pine, oxalis) may be present. The plant community provides a wide range of habitat niches from the forest floor through the canopy. Advanced structure stands that are highly diverse may develop structural characteristics typically linked with older forests or old growth. These stands will not necessarily emulate all of the processes and functions of very old forests. However, they provide habitats for many species commonly associated with older forests.

5.2.2. Desired Future Condition

Conservation Measure 5.1
Provide a Range of Stand Structures Across the Landscape

- Maintain the range of 40 to 60 percent advanced structure across the forest.
  - Twenty or more trees per acre of 18 inches or larger DBH and 100 feet or more in height, of which at least ten overstory trees per acre are at least 24 inches DBH. The quadratic mean diameter is 15 inches or more based on trees of at least 8 inches DBH.
  - Understory trees average 30 feet in height.
  - The basal area of these stands will be at least 150 square feet per acre, and no more than 325 square feet per acre.
  - Conservation areas and mapped marbled murrelet habitat are considered advanced structure regardless of silvicultural characteristics.
- Maintain the range of 25 to 55 percent of intermediate structure across the forest.
  - Average tree diameter of dominant and co-dominant trees is 6 to 18 inches DBH, but may be larger. Tree heights generally range from 40 to 100 feet.
  - Trees dominate the site and form a single main canopy layer. There may be little or no understory development, or the development may include understory trees. Generally, herbs, shrubs, and grasses may cover up to 40 percent or more of the forest floor. The stand does not have significant vertical layering of tree crowns.
- Maintain the range of 5 to 15 percent of early structure across the forest.
  - Average diameter of the largest 40 trees per acre of the new cohort is generally less than or equal to six inches DBH.
  - The trees are seedlings or saplings, usually less than 15 years old. Herbs and shrubs are widespread and vigorous, covering 20 to 80 percent of the ground.

Rationale—The stand structure types are designed to emulate the diversity of stands historically associated with conifer forests in the Coast Range. The percent ranges are selected recognizing that the actual quantity and distribution of early, intermediate, and advanced structure stands are, and have been, highly variable through time. Once a desired array of stand structures is achieved, individual stands on the landscape will continue to change. However, the relative abundance of the different stand structures is expected to remain reasonably stable. At some point in the future, a dynamic balance of stand complexity in a desired array will be achieved, and individual stands will move in and out of the various developmental stages at a relatively consistent rate.

The definitions given for each structure type are based on currently available data. These data are limited to only a few of the characteristics desired in these structure types. As a result, these surrogate definitions have been developed for use during the first HCP implementation period, and will be re-evaluated thereafter.

Conservation areas are considered advanced structure regardless of their silvicultural characteristics because they were identified based on their association with use by covered

species or as sensitive areas. Only very limited management activities are allowed in these areas.

Mapped marbled murrelet habitat areas are considered advanced structure regardless of their silvicultural characteristics because they were identified based on the silvicultural characteristics commonly used by marbled murrelets.

Conservation Measure 5.2
Manage 50 percent of Forestwide Advanced Structure for Larger Trees

- Fifty percent of the forestwide advanced structure will have the following characteristics:
  - 20 trees per acre at least 18 inches DBH and 100 feet or more in height
  - At least 10 of these trees at least 24 inches DBH
  - At least 8 of these trees 32 inches DBH or larger

In conservation areas, once a stand attains these characteristics, it is considered to have met these criteria for the remainder of the term of the HCP.

Rationale—Advanced structure stands will exhibit a range of characteristics as they develop beyond the minimum requirements for advanced classification. A significant percentage of advanced structure stands will contain larger trees and considerable amounts of snags and downed wood. These stands are expected to provide high-quality habitat for northern spotted owls and marbled murrelets based on the characteristics of older forest stands in the Coast Range.

Conservation Measure 5.3
Manage Advanced Structure Stands for Snags and Downed Wood

- Manage stands to be developed into advanced structure with the following characteristics:
  - At least six snags per acre, two of which must be at least 24 inches in diameter, with the remaining four at least 12 inches in diameter.
  - A total of 3,000 to 4,500 cubic feet of downed logs in all decay classes 1 to 5; or 600 to 900 cubic feet per acre of sound downed logs in decay classes 1 or 2.
  - Multiple tree species, including shade-tolerant species; some trees with defects or decadence; and diverse understory vegetation.

Rationale— In addition to large trees, functional advanced structure stands are characterized by elements of diversity, including snags, downed wood, and multiple species. Stands identified in implementation planning for development into advanced structure will be managed as needed to maintain or supplement these elements of diversity.

During implementation planning, field foresters will evaluate each stand's potential and determine how many stands are available to produce the array of stand structures in a basin. The foresters will then decide which stands will be managed for the various stand structures,

and these decisions will be based on the current condition of stands as well as placement on the landscape. Stands with more complex structural development may be managed to continue to produce advanced structure through prescriptions that retain and/or supplement biodiversity components and develop multi-canopied structure. Some intermediate structure stands may be chosen for eventual development into advanced structure if they are adjacent to existing advanced structure and/or conservation areas and have the potential to develop the characteristics associated with advanced structure. Prescriptions for these stands would likely include density management for vigorous growth. It is unlikely that early structure stands will achieve the characteristics of advanced structure during the term of this permit; nevertheless, some of these stands will have early silvicultural treatments such as precommercial thinning that will retain options for developing the stands into advanced structure later in stand development.

Conservation Measure 5.4
Meet Basin Targets for Advanced Structure

- Meet advanced structure targets ranging from 30 to 60 percent in each management basin according to Table 5-1. All acres in conservation areas and acres of mapped marbled murrelet habitat contribute to advanced structure targets, regardless of their silvicultural characteristics.
- Only harvest advanced structure in a basin as long as the basin target for advanced structure will be maintained.
  - For basins below the target amount of advanced structure during initial implementation periods, only harvest advanced structure when the basin has exceeded its advanced structure target.
  - Once a basin has reached its advanced structure target, maintain advanced structure at or above the target level in a basin.

Rationale—For implementation planning purposes, each management basin has a target for advanced structure ranging from 30 to 60 percent (see Table 5-1). These targets were developed considering connectivity of advanced structure for late successional species across the forest, and particularly in basins with northern spotted owls. Implementation plans will identify the location of existing advanced structure stands, as well as the location of stands to be developed into advanced structure to meet or maintain this target. These identified stands will be subject only to silvicultural techniques such as thinning that will move the stands toward their desired future condition. In successive Implementation Plans (IPs), the desired future condition of a particular stand may change based on how that stand contributes to the landscape design.

All acres in conservation areas (see Section 5.3) are considered to contribute to the targets for advanced structure regardless of their silvicultural characteristics. These areas were identified based on their association with use by covered species or as sensitive areas, and only very limited management activities are allowed. As HCP implementation begins, approximately 71 percent of the conservation area acres will have the silvicultural characteristics associated with advanced structure. However, by the end of the permit term, 91 percent of the conservation area acres will have those characteristics. By including all acres in conservation

areas, most basins will exceed their respective target for advanced structure at the beginning of plan implementation. For basins that do not meet the target for advanced structure, regeneration harvest of advanced structure is allowed only when the basin has exceeded its advanced structure target. Once a basin has attained its advanced structure target, advanced structure in that basin will be maintained at or above the target.

Regeneration harvest will occur in both intermediate and advanced structure. Regeneration harvest of advanced structure stands may occur in stands not identified as needed to meet the basin target during the implementation period. Harvest of these stands will occur at a rate that will maintain the basin target for advanced structure over the term of the HCP.

Table 5-1
Target Stand Structures to be Maintained Within Individual Basins on the Elliott State Forest over the Term of the Habitat Conservation Plan

Basin Number	Basin Name	Target Percentage Advanced Structure
1	Mill Creek	50
2	Charlotte-Luder	40
3	Dean Johanneson	50
4	Scholfield Creek	60
5	Big Creek	50
6	Benson-Roberts	60
7	Johnson Creek	60
8	Palouse Larson	50
9	Henrys Bend	30
10	Marlow-Glenn	30
11	Millicoma Elk	50
12	Trout Deer	40
13	Ash Valley	50

The result of the above structure targets, combined with the landscape design standards and guidelines in Section 5.4, will improve the functional arrangement of advanced structure across the landscape.

5.3. ESTABLISH CONSERVATION AREAS TO PROTECT SPECIAL RESOURCES

Conservation Measure 5.5
Establish Conservation Areas

- Manage at least 22,598 acres of the Elliott State Forest in conservation areas where little or no active management occurs.
- Maintain or develop advanced structure within conservation areas.

Conservation areas will have little or no active management. Some expected activities related to forest management include vehicle traffic on forest roads, wildfire suppression and control, road maintenance, minimal road construction, harvest unit guylines or tailholds for nearby harvests, stream rehabilitation work, stream survey work, and animal survey work. Additionally, some trees or snags may be removed for safety reasons in some circumstances, such as when a dead tree is leaning over a forest road. Management activities that further the purpose of the conservation area may also be allowed in some areas, such as management to attain mature forest conditions along streams.

Conservation areas vary by type, each serving different functions. The types of conservation areas are described below.

5.3.1. Types of Conservation Areas

5.3.1.1. Threatened and Endangered Species Core Areas

These conservation areas encompass 11,819 acres of the forest. They are designed to protect specific wildlife habitat for species included in the HCP associated with advanced structure conditions (i.e., northern spotted owl, marbled murrelet, and bald eagle). In most cases, the threatened and endangered cores (T&E cores) are known to be used by one or more of these species. In some cases, these T&E cores are part of, or next to, existing steep, unique, or visual lands (SUVs) (see below). T&E cores are designated across the forest, distributed so that there is at least one in each management basin.

Figure 5-1 shows the distribution of T&E cores and SUVs across the forest.

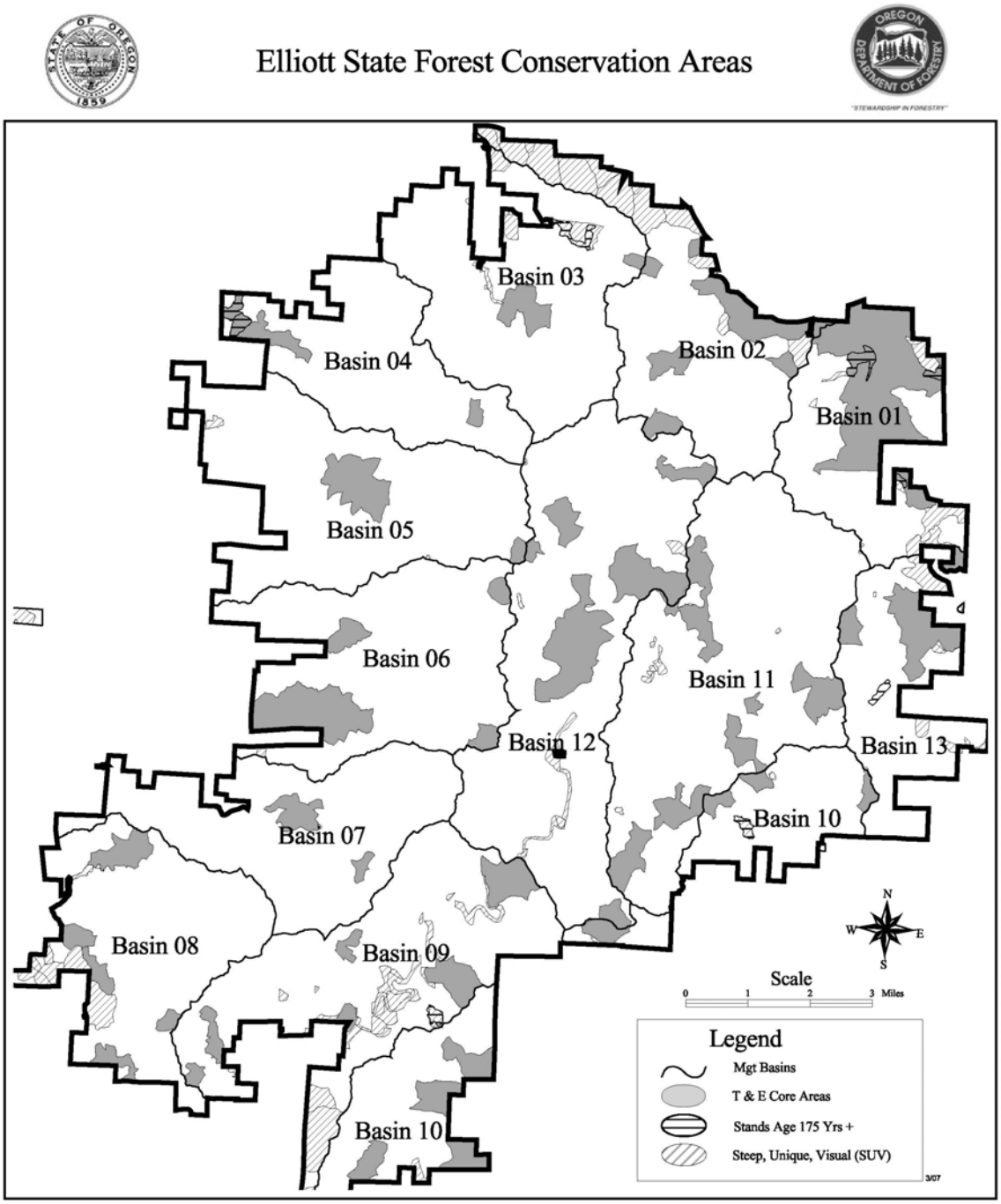


Figure 5-1. Distribution of T&E Cores and SUVs on the Elliott State Forest

Factors considered when determining the location of the T&E core areas include:

- Location of northern spotted owl nest sites or activity centers
- Location of areas receiving concentrated use by northern spotted owls, as measured by telemetry
- Location of stands with documented marbled murrelet occupancy behaviors and/or known nest trees
- Location of bald eagle nest trees
- Location of late successional habitat, including identified marbled murrelet habitat and older, advanced structure stands

Within the Elliott State forest, 48 T&E core areas exist, ranging in size from less than 100 acres to over 2,000 acres, with a median size of 246 acres. Table 5-2 provides specific information about individual T&E core areas. Table 5-3 provides total acreage in the three types of conservation areas and the acreage of overlap between type and the other two.

5.3.1.2. Steep, Unique, or Visual Lands

SUVs will also include lands where little or no management is expected for reasons that may not be associated directly with habitat values. These lands are termed steep, unique, or visual, and they constitute 6,433 acres of the forest. The function of these areas is described in more detail below. Although they are not specific to wildlife habitats, these lands can provide valuable wildlife habitats in addition to their primary function. In 2005, approximately 47 percent of the area within the SUV classification met the criteria for advanced structure.

SUVs include:

- Areas almost exclusively associated with the steep, rocky slopes on either side of major rivers or streams, including the Umpqua River, Mill Creek, and the West Fork Millicoma River. These protected corridors vary in width from 1,000 to 4,000 feet. Slopes affected by public safety considerations fall within this category.
- Areas classified as non-silviculturally capable because they are rocky, boggy or covered by water, or for various other reasons, have little to no commercial value for timber production. Currently, the Elliott State Forest has a few parcels of rocky or swampy lands scattered throughout the forest. Most parcels are less than 5 acres, though a few are as large as 20 acres.
- Areas where scenic values are the primary values to be maintained, including areas buffering recreational areas, highway corridors, river corridors, lakeshores, and other scenic attractions.

Table 5-2
T&E Core Areas—Acres and Presence of Northern Spotted Owl and Marbled Murrelet Sites[1]

Core Area	Basin	Acres	Northern Spotted Owl Activity Centers	Number of Occupied Marbled Murrelet Sites	Mapped Murrelet Habitat (acres)
Barn Gulch	6	146	Benson Creek	0	33
Beaver Headwaters	10 12	211		1	108
Benson Top	6	76		1	8
Big Alder	5	477	Alder Creek	0	194
Big Otter	5 12	97		1	48
Camp Creek	1	120	Upper Mill Creek	0	11
Charlotte Knife	2	116		1	9
Dean Creek	3	263	Dean Creek	1	93
Dry Ridge	6	94		1	28
Elk Forks	11	235		2	130
Elk Pass	10 11	304	West Glenn	5	71
Fish Knife	11 12	831	Panther Creek	4	392
Fourmile Creek	10	174	Fourmile Creek	0	72
Glenn Headwaters	10	67		1	0
Goody Ridge	4	55		1	37
Indian Charlie[2]	2	36		0	25
Joe Buck	12	772		7	285
Johanneson	2 3	89		2	41
Kentuck Ridge	9	55		1	26
Knife Forks	12	139		2	39
Larson Bottom	8	105		2	31
Larson Palouse	8	109		1	43
Larson Point	8	58		1	24

[1] All numbers in this chapter are from District layer maps, unless noted otherwise.
[2] Indian Charlie Core Area contains a bald eagle nest site.

Table 5-2 continued

Core Area	Basin	Acres	Northern Spotted Owl Activity Center	Occupied Murrelet Sites	Mapped Murrelet Habitat
Lockhart Ridge	10	196	Marlow Creek	0	35
Loon Lake East	1	60	Tom Fool	0	0
Lower Johnson	7	214	Johnson Creek	0	59
Lower Mill	1 2	2029	Lower Mill	7	712
Lower Roberts	6	781	Roberts Creek	2	217
Luder Footlog	2	67		1	15
Luder Umpqua	2	454		5	145
Marlow Bottom	10	143		2	41
Marlow Henry	9	257		1	86
Marlow Lockhart	10	206		3	40
Middle Charlotte	2	151		2	61
Middle Deer	12	169		2	70
Millicoma Schumacher	9	56		1	13
Old Maids Cabin	11	275		2	68
Palouse Creek	8	249	Palouse Creek	0	24
Panther Bench	11	38		1	19
Panther Howell	10 11	242		2	103
Right Fork Johnson	7	54		1	13
Salander Creek	13	523	Salander Creek	0	205
Salander Headwaters	13	115		1	41
Schumacher Headwaters	9	71		2	23
Stonehouse Point	9	113		2	55
Sullivan Creek	8	122		2	66
Trout Mouth	9	305		1	126
Wind Ridge	4	300	Wind Creek	0	222
Total Acres		**11,851**			

Table 5-3
Acres in the Three Types of Conservation Areas, and Overlap Among Conservation Area Types

Type of Conservation Area	Total Acres	Acres in Other Types of Conservation Areas		
		T&E Cores	SUVs	Aquatic/Riparian Protection
T&E Cores	11,819	n/a	1,874	1,353
SUVs	6,433	1,874	n/a	753
Aquatic/Riparian Protection	8,578[1]	1,613	912	n/a

[1] Aquatic/ riparian acreage in Conservation Areas is an estimate. This acreage figure will change as additional stream classifications are identified on the ground.

- Areas that the Oregon Department of Forestry (ODF) has determined to be uncommon or unique on the landscape, such as:
  - **Old-growth stands**—This category includes stands over 175 years of age as of 2004. These old-growth stands are rare in the Elliott State Forest because of its fire history. Most of these stands are included in T&E cores; however, a few old-growth stands are not known to have resident northern spotted owls or marbled murrelets, and thus are classified as unique habitat.
  - **Unique forest types**—Two areas contain forest vegetation types that are uncommon on the Elliott State Forest—1) reportedly, a pure stand of myrtle in the Big Creek Basin; and 2) a stand of bottomland hardwoods dominated by big-leaf maple in the Ash Valley Basin.

Timber harvest may take place if compatible with resource values in these areas; however, little active management is expected other than occasional removal of danger trees.

In addition to their primary functions, T&E cores and SUVs may fulfill other functions on the landscape. For example:

- Provide benefits to other species using these habitats, especially those using late-successional habitats
- Provide patches of advanced structure between late-successional reserves on adjacent federal forest lands ("stepping stones")
- Maintain unique or special habitats not necessarily associated with federally listed species
- Contribute to diverse forest conditions on the landscape by providing relatively unmanaged areas across the forest
- Be available as reference areas when testing overall landscape strategies

5.3.1.3. Riparian Management Stream Bank and Inner Zones

This HCP also considers riparian area, stream bank and inner zones (see Section 5.6.2) to be conservation areas. Such linear features constitute 10,419 acres of the forest, and serve several functions: protecting streams and riparian areas from disturbance; filtering sediment from uplands; and supplying food, cover, shade, and large wood. Riparian corridors provide diverse habitats and connectivity throughout the stream network of a watershed. Riparian management areas (RMAs) are embedded in all stand structure types.

No management activities are allowed within 25 feet of either side of fish-bearing and large and medium non-fish-bearing stream channels (stream bank zone). Outside this area to 100 feet (inner zone), the forest will be managed to develop or maintain certain levels of mature forest conditions based on stream classifications. Harvest may only occur within these inner zones, to facilitate the establishment of mature forest conditions. Other activities expected to occur in the stream bank and inner zone include cable yarding corridors, traffic and maintenance on existing roads, wildfire suppression and control, fish and wildlife enhancement projects, and fish and wildlife survey work. See Section 5.6 for more details on RMAs, including activities associated with non-fish-bearing streams. In 2005, approximately 37 percent of the area within riparian management stream bank and inner zones were associated with advanced structure stands.

The conservation area of riparian areas is calculated by measuring from the aquatic zone to 100 feet on all fish-bearing streams and on large and medium-sized non-fish-bearing streams. For small perennial non-fish-bearing streams, the conservation area is measured from the aquatic zone to 50 feet. For small seasonal non-fish-bearing streams, as well as high energy and potential debris flow track streams, the conservation area is measured from the aquatic zone to 25 feet. On all other small seasonal non-fish-bearing streams, there is no conservation area. (See Section 5.6 for stream and zone definitions.)

5.3.2. Stand Structure in Conservation Areas Over Time

All acres in conservation areas are considered advanced structure, even though some stands may not exhibit all of the typical characteristics. This section describes how actual stand structure will likely evolve within the conservation areas over the term of the HCP.

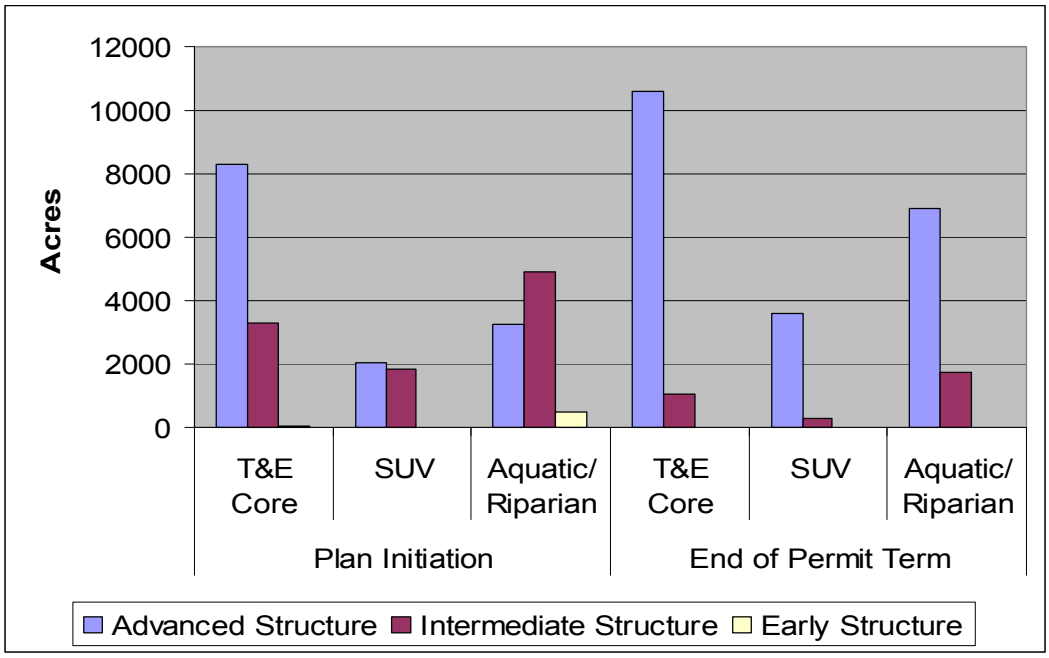
T&E core areas are based on use of these areas by northern spotted owls and marbled murrelets. At the time of selection, approximately 71 percent of the acres within T&E cores have the characteristics associated with advanced structure. Most intermediate structure (with the exception of some younger plantations) within the T&E core areas provides the function of advanced structure by virtue of its juxtaposition with advanced structure and its use by these late seral species. The presence of early structure within T&E core areas is not necessarily a reflection of habitat use, but is the result of a selection process that attempts to create largely circular patches and minimize convoluted edges. In some cases, early structure stands are included within T&E cores because they are surrounded by used habitat. At other times, early structure types are included with other structure types that together compose a

logical harvest setting. In all cases, the presence of early structure is minimized in the designation of T&E core areas. Over time, as early and intermediate structure develop toward more complex stand structure, the T&E core areas will evolve to provide functional patches of advanced structure (91 percent advanced structure).

SUVs contain higher percentages of early structure because these areas were determined by factors other than habitat use (see description of the different types of areas above). At the time of selection, approximately 53 percent of SUVs had the characteristics of advanced structure. However, by the end of the permit term, over 90 percent of SUVs are projected to consist of advanced structure, because of the limited management that will occur in these areas.

At plan implementation, riparian area, stream bank, and inner zones consist of 37 percent advanced structure, 57 percent intermediate structure, and 6 percent early structure. At the end of the permit term, these conservation areas are projected to contain 80 percent advanced structure and 20 percent intermediate structure. However, unlike T&E Cores and SUVs, RMAs are linear features that exist within larger stands rather than larger patches containing a mixture of structure types. The structure classification of these features will be important for species that live in the stream; however, for many other species, these features will functionally have the characteristics of the larger stands in which they are embedded.

Figure 5-2. Acres in Three Structure Types within Conservation Areas at Plan Initiation and as Projected by Modeling at 50 Years



5.3.3. Adaptive Management and Conservation Areas

When large-scale disturbance events such as severe fire or insect and disease outbreaks occur, conservation areas will be evaluated through an adaptive management process to determine if they can still function for their intended purpose. Active management, including salvage, may be applied if the evaluation indicates that it would help restore the conservation area's function faster. Salvage of downed wood in T&E cores would occur only to facilitate the maintenance or development of advanced structure, one of the conservation measures for these areas.

Vegetation will be retained or managed within the stream bank and inner zones of fish-bearing and large and medium non-fish-bearing streams to achieve mature forest condition with the goal of protecting aquatic and riparian resources. Salvage of downed wood in these areas would occur only to facilitate the establishment of mature forest conditions, and only in consultation with the Oregon Department of Fish and Wildlife (ODFW), as well as the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS).

Monitoring data gathered throughout the forest will be evaluated over time, as well as research information from a variety of sources. If the USFWS, NMFS, and ODF agree that such information indicates silvicultural treatments or other management activities in conservation areas would be beneficial for covered species and cost effective to perform, such management activities may occur in conservation areas. However at the time of the preparation of this HCP, only the management activities previously discussed in this subsection or in the introduction to Section 5.3 are anticipated.

5.4. DEVELOP IMPLEMENTATION PLANS TO ACHIEVE A LANDSCAPE DESIGN THAT PROVIDES FUNCTIONAL HABITAT FOR NATIVE SPECIES

The district Implementation Plan (Oregon Department of Forestry. 2007) will include a landscape design that is consistent with the guidelines and standards outlined below, and that strives to achieve the variety of patch types, sizes, and arrangements necessary to provide functional habitat for covered species. The guidelines apply to all habitat types, from early to advanced structure. The application of these principles, guidelines, and standards will be discussed in the landscape design section of the district Implementation Plan.

Implementation—Each basin will have a different amount and placement of conservation areas, advanced habitat patches, riparian corridors, and other unique habitat areas. Each of these areas can maximize its contribution to overall wildlife diversity when considered in relation to other similar habitat within the basin, as well as in relation to similar habitat within adjacent basins. During implementation planning, the following standards and guidelines will be considered in selecting stands for development and maintenance of advanced structure.

5.4.1. Maintain Connectivity Between T&E Core Areas and Advanced Structure in each Management Basin

Conservation Measure 5.6
Manage for Larger Blocks of Advanced Structure

In each management basin, develop and maintain advanced structure so that a minimum of 500 acres of advanced structure is provided that includes at least one T&E core and other advanced structure within 0.7 mile of the outer boundary of the core. Advanced structure patches must be at least 20 acres to count toward this target. These acres may be within one mile of the core's boundary if they are contiguous. Part or all of the 500 acres may reside in an adjacent basin and may include other conservation areas. Intermediate structure within conservation areas counts toward the 500 acres.

Rationale—T&E core areas provide core habitat to support threatened species. However, it is recognized that the species may require, and would likely benefit from, additional habitat in these areas. For example, T&E cores provide a nesting core use area for known northern spotted owl pairs, but northern spotted owls require additional habitat for roosting and foraging. By providing some advanced structure adjacent to core areas, larger patches of interior habitat will be provided to support occupancy by threatened species.

The purpose of this standard is to ensure that, for the most part, T&E core areas do not become isolated from other advanced structure in a basin. Another result of the application of this standard is to provide better connectivity and functional arrangement among T&E core areas.

5.4.2. Apply Other Landscape Design Principles

The following landscape design principles will be used in developing Implementation Plans (these are not requirements, but are guidelines to be followed as practicable):

- Limit the amount of early structure adjacent to T&E core areas. The juxtaposition of early structure with advanced structure produces areas of high edge contrast. Although this edge habitat is valuable to many species, it is detrimental to others—in particular, to the northern spotted owl and marbled murrelet. By limiting the amount of early structure adjacent to T&E cores, and providing advanced and intermediate structure surrounding T&E cores, interior habitat values for these species will be enhanced.
- Locate advanced structure stands in proximity to other advanced structure stands to promote connectivity within this habitat type.
- In general, avoid creating small isolated patches of advanced structure to prevent excessive fragmentation. In this HCP, it is assumed that isolated patches are those with greater than 50 percent of the boundary adjacent to early structure or surrounded by forest land where future patch contributions are not anticipated, such as plantations on other land ownerships. It is assumed that isolated patches of less than 120 acres will provide benefits for only a limited array of species inhabiting advanced structure conditions (Rosenberg and Raphael 1986).
- Maintain riparian inner zones in an advanced structure condition. Stands that are in early structure condition may contain RMAs that are linear strips of advanced structure. Although these features do not provide the same benefits on the landscape as larger patches of interior habitat, they do serve an important function in providing habitat for stream-dwelling species, as well as providing connectivity to other patches of advanced structure on the landscape.
- Provide a variety of patch sizes across the landscape.
- Consider the shape of patches, and provide patches that are circular in shape to provide better interior habitat.
- Ensure that the minimum distance between patches is a function of size and frequency within a management basin. Smaller patches should be placed closer together than larger patches.

Rationale—Forestwide and basin-specific targets for advanced structure stands, coupled with a logical landscape design that incorporates these guidelines and principles developed during implementation planning, will provide for connectivity of advanced structure habitats across the Elliott State Forest. In management basins with relatively high levels of advanced structure, connectivity is likely to be provided for many species by the increased amount of

this habitat type. However, where advanced structure targets are relatively low, the arrangement of advanced structure patches becomes more important.

5.5. MAINTAIN OR INCORPORATE HABITAT COMPONENTS INTO THE FOREST AT A LANDSCAPE LEVEL

Summary of Conservation Measures

In regeneration harvests:

- Retain an average of three (no fewer than two) live trees per acre.
- Retain existing snags and downed wood of all decay classes where operationally feasible.
- Retain at least three hard snags per acre, 15 inches DBH or larger, and at least 20 feet tall; or create one snag per two acres using live trees greater than 20 inches DBH when three snags per acre are not available.
- Retain 300 to 600 cubic feet per acre of hard logs with the minimum volume of 20 cubic feet for any individual piece.
    - At least two logs per acre, 26-inch-diameter large end or larger, when available.
    - 50 percent volume should be conifer logs, when available.

When harvested stands are composed predominately of trees less than 20 inches DBH:

- Snag creation is not required.
- Retain an average of three to six logs per acre (decay class 1 or 2), with the minimum volume of 20 cubic feet for any individual piece.
- 50 percent of volume should be conifer logs.

Structural complexity provides the basis for much of the variety and richness of species, habitats, and processes. The important structural attributes include the size of standing live and dead trees, the condition of those trees, and the size, amount, and condition of downed wood on the forest floor. The canopies and boles of standing trees provide important habitats for a variety of wildlife. Downed wood provides habitat and a long-term source of nutrients. It also fulfills many important roles in stream ecosystems by forming pools and backwaters, providing nutrients, dissipating the energy of flowing water, and trapping sediment.

Active management outside of conservation areas has the potential to provide stand structural complexity while retaining habitat connectivity. If these areas are managed to provide the appropriate vegetation cover or key structures for species across the landscape, the intervening landscape is not a barrier to dispersal (Lindenmayer and Franklin 2002). Managing for connectivity outside conservation areas in this manner may result in increasing the effective size of small- and medium-sized conservation areas, reducing edge effects, and increasing the effectiveness of corridors (Lindenmayer and Franklin 2002).

This strategy presents approaches for managing the following structural components:

- Live trees
- Snags
- Downed wood

Although these approaches were developed specifically for retention in regeneration harvest units, retaining these structures in all stand structure types provides valuable wildlife habitat and other ecological values. Individual stands should meet or exceed these standards. However, sometimes individual harvest units may not meet these standards due to operational constraints. Monitoring efforts will test the viability of these approaches over time.

5.5.1. Structural Component Standards

The following conservation measures address standards for retention of structural components in regeneration harvest units. These standards are to be met outside the streambank and inner zones of Type F (fish-bearing) and large or medium Type N (non-fish-bearing) streams in the harvest unit. Individual stands should meet or exceed these standards. However, sometimes individual harvest units may not meet these standards due to operational constraints. Trees and logs left to meet the legacy wood standard will not be salvaged.

5.5.1.1. Live Tree Retention

Conservation Measure 5.7
Live Tree Retention in Regeneration Harvest Units

Retain an average of three (no fewer than two) live trees per acre

- Retained trees will be larger trees, in general greater than or equal to the stand's average DBH.
- Retain minor species (conifer or hardwood) of any diameter as part of, or in addition to, this target where operationally feasible and practical.
- To address the needs of a broader variety of wildlife species, retain at least 25 percent of the leave trees required to meet the standard in upslope areas or in RMAs that extend well into upslope areas.
- Consider the guidelines for live tree retention.

Rationale—Live trees will be retained to meet the short-term habitat needs of species, to serve as a source of future snags and downed wood, and to provide legacy trees in future stands. Legacy trees are living trees that are carried forward into a new stand following disturbance, with the intent that most will persist through future rotations. There may be times when forest conditions preclude achievement of the above averages within a stand. However, in the long term, legacy structures will be present in all stand types across the landscape.

Additional Guidelines for Live Tree Retention

- Consider a variety of types of live trees for retention, including:
  - Larger trees (trees that exceed the average DBH of the stand)
  - Defective trees, such as broken or multiple topped, damaged, diseased, or other deformed live trees
  - Sound, healthy trees with good crowns
  - Minor hardwood or conifer species
- Trees may be retained in a variety of arrangements throughout each harvest unit, including uniform or random distributions as well as dispersed clumps.
- Trees may be retained at greater levels in some units, and lesser levels in others, with the intent of achieving the average for all regeneration harvest units in a given Annual Operations Plan (AOP). Considerations include providing potential recruitment for snags or downed wood where these structural elements fall short of landscape objectives. For example, if insufficient hard snags are available, more live trees should be left.
- Retain a level of scattered native hardwoods as a minor component in stands where such trees occur naturally.

5.5.1.2. Snags

Conservation Measure 5.8
Snag Retention in Regeneration Harvest Units

- Retain existing snags of all decay classes where operationally feasible during harvest activities.
- Retain at least three hard snags per acre (decay class 1 or 2), 15 inches DBH or larger and at least 20 feet tall.
- If fewer than three hard snags per acre exist after harvest, create one snag per two acres, using live trees greater than 20 inches DBH. Created snags should be a minimum of 20 feet tall, and preferably larger.
- When harvested stands are composed predominately of trees less than 20 inches DBH, snag creation is not required.
- Consider the guidelines for snag management.

Rationale—Snags will be provided to meet the habitat needs of cavity-using species, and to serve as a source of future downed wood. Management will be designed to provide snags within all stand types over time, through a combination of existing snag retention, natural mortality in maturing stands, and artificial creation.

Additional Guidelines for Snag Management

- Snags should be retained in a variety of arrangements throughout the landscape. Uniform or random distributions, as well as dispersed clumping, will be used to provide for a variety of habitat and predator/prey conditions.
- Some snags should be left on or near ridgetops when possible and practical.

5.5.1.3. Downed Wood

Conservation Measure 5.9
Downed Wood Retention in Regeneration Harvest Units

- Retain existing downed wood of all decay classes where operationally feasible during harvest activities.
- Retain an average of 300 to 600 cubic feet per acre of hard logs (decay class 1 or 2), with the minimum volume of 20 cubic feet for any individual piece.
    - When available, at least two logs per acre must meet or exceed 26 inches diameter at the large end.
    - 50 percent of volume will be conifer logs when available.

The following exceptions to the standards above apply when harvested stands are composed predominately of trees less than 20 inches DBH:

- Retain an average of three to six logs per acre (decay class 1 or 2), with the minimum volume of 20 cubic feet for any individual piece.
- 50 percent of volume should be conifer logs.
- Consider the guidelines for downed wood management.

Rationale—Downed wood will be provided to meet the habitat needs of wildlife species, to provide for other key ecosystem functions, and to provide the structural legacy necessary for advanced structure development. Achieving the downed wood component will often require a significant amount of time (many decades), especially in areas where existing stands are deficient in this material. Management will be designed to provide downed wood within all stand structures through time, through a combination of existing downed wood retention, natural mortality in maturing stands, and artificial creation. Large-diameter logs (greater than 26 inches) are an important component of advanced structure. In addition, because larger logs decompose more slowly, large logs placed during regeneration harvests will contribute to downed wood needs into the future.

Additional Guidelines for Downed Wood Management

- Retain downed wood in a variety of arrangements within individual harvest units and throughout the landscape. Uniform or random distributions as well as dispersed clumping should be used to provide for a variety of habitat and predator/prey conditions.
- Retain a portion of the downed wood when salvaging windthrow and other dead timber.
- Retain live trees and snags to provide for downed wood contributions through the course of forest development during the life of each stand.
- Retain and, where necessary, provide for the supply of downed wood at the time of partial cut harvests to supplement downed wood in more developed structure stands.

5.5.2. Guidelines for Special Circumstances

It is expected that structural components will be retained at the desired levels during any management activity, unless they create clear safety or fire hazards, or if their retention would result in unacceptable additional operational difficulties, environmental hazards, or threats to public improvements. The following guidelines will govern special circumstances affecting retention of the structural components.

5.5.2.1. Safety Concerns

Where retention would constitute a significant safety hazard or result in a violation of state or federal law, individual trees or snags may be removed.

5.5.2.2. Pest Management Concerns

Where retention would constitute a significant threat to surrounding stands because of the presence of insect or disease agents, individual trees or snags may be removed. The ODF's forest entomologist or forest pathologist will be consulted in making the determination of significant threat.

5.5.2.3. Severe Operational Concerns

Where retention would affect the ability of the ODF to protect other key resources identified in this HCP, trees or snags may be removed.

5.5.2.4. Salvage

In the event of a major fire, windstorm, or other catastrophic disturbance, prompt salvage operations will be conducted to prevent build-up of epidemic insect populations and to minimize economic loss. In the absence of a catastrophic disturbance, it is unlikely that significant amounts of salvage will occur. Salvage refers to the harvest of trees that have died, are dying, have blown down, or are hazardous to public safety. The age and size of salvaged trees may vary. Trees may be salvaged individually or in larger parcels, depending on the cause and extent of the damaging agent. The economic return and the benefits of leaving all or a portion of the dead trees on an area are weighed when considering salvage operations. The same retention guidelines will be used as for other harvest operations.

5.6. APPLY AQUATIC AND RIPARIAN STRATEGIES

Summary of Aquatic and Riparian Conservation Measures

- Implement Watershed Analysis and use results to inform management and restoration decisions, including the Elliott Watershed Analysis (Biosystems et al 2003).
- Establish and maintain RMAs adjacent to all streams in accordance with the standards and guidelines.
- Use results from the Elliott Watershed Analysis to identify, design, and implement projects to restore or improve aquatic and riparian habitat.
- Use basin-level assessments to evaluate the need for alternative vegetation treatments.
- Where appropriate, plan alternative vegetation treatments, in collaboration with ODFW, that will contribute to achieving properly functioning aquatic habitat conditions in a timely manner.
- Monitor and evaluate alternative vegetation treatment projects over time, using results in an adaptive management context.
- Establish and maintain RMAs adjacent to other aquatic habitat areas in accordance with the standards and guidelines described in this HCP.
- Use watershed analysis (initially completed in October 2003) and other information to enhance current understanding of the processes that influence slope stability in the Elliott State Forest.
- Evaluate alternatives and design operations that can minimize, mitigate for, or avoid risk in high and moderate landslide hazard locations during district implementation and project planning.
- Design, construct, improve, and maintain forest roads in accordance with the processes and standards described in the Forest Roads Manual.
- Identify and prioritize roads for closure and/or vacation using information gained from the comprehensive forest roads inventory, and in accordance with the standards described in the Forest Roads Manual.

5.6.1. Riparian and Aquatic Ecosystems

The goals for riparian and aquatic habitat conditions and functions are described in the Elliott State Forest Management Plan (FMP) in Chapter 4 under concept 5. Based on the best available stream data, there are an estimated 771 miles of stream on the Elliott State Forest; these streams are distributed as shown in Table 5-4 among fish-bearing, and seasonal and perennial non-fish-bearing streams. The biological and ecological objectives for these streams are to maintain and enhance the key ecological functions of aquatic, riparian, and upland areas that directly influence the freshwater habitat of aquatic species, within the context of the natural disturbance regimes that created habitat for these species.

Table 5-4
Estimated Stream Miles by Watershed and for the Entire Forest for Fish-Bearing and Non-Fish-Bearing Streams (data source is district stream layer)

Stream Miles	Coos (miles)	TenMile (miles)	Umpqua (miles)	Elliott (miles)	Elliott (%)
Fish-Bearing and Large & Medium Non-Fish-Bearing	113	36	52	200	26%
Perennial Small Type N	173	84	91	348	45%
Seasonal Small Type N	113	47	62	222	29%
Total	**398**	**167**	**205**	**771**	

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 the functions and processes that compose these terrestrial-aquatic interactions at a variety of scales. For this reason, the FMP uses a blended approach that applies the concepts of landscape ecology to manage riparian and aquatic habitats at the landscape level and through site-specific prescription. This type of two-tiered approach was cited by the Independent Multidisciplinary Science Team as necessary to achieve a high likelihood of providing properly functioning aquatic systems (Independent Multidisciplinary Science Team 1999).

In determining what constitutes key functioning aquatic systems, the overall approach is based on the following assumptions:

- Native aquatic species have co-evolved with the forest ecosystems in western Oregon.
- High quality aquatic habitats result from the interaction of many processes, some of which have been influenced by human activity.
- Aquatic habitats are dynamic and variable in quality for specific species, through time and across the landscape.
- No single habitat condition constitutes a “properly functioning” condition. Rather, providing diverse aquatic and riparian conditions over time and space would more closely emulate the natural disturbance regimes under which native species evolved.

The landscape level component of the aquatic and riparian strategies consists of the sustainable forest ecosystem management strategies for upslope stand structure (described earlier in this chapter), road management, and slope stability. 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 approach 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, and are described

in Chapter 4 of the FMP. In summary, the goal of management along fish-bearing streams and larger non-fish-bearing streams is to grow and retain vegetation so that, over time, riparian and aquatic habitat conditions are maintained as, or become similar to, those associated with mature forest stands. Mature forest conditions should support functions and processes associated with properly functioning aquatic habitats.

Along small non-fish-bearing streams, the overall goal of riparian vegetation management is to grow and retain vegetation sufficient to support important functions and processes within the various streams, and to contribute to achieving properly functioning conditions in downstream fish-bearing waters. The functions of these streams will be maintained by the influence and contributions of adjacent stands managed to meet the landscape-level stand structure desired conditions, and by vegetation retained in riparian areas during harvest activities. This FMP recognizes that a variety of small Type N streams exist across the forest landscape, and that these streams may differ in their physical characteristics, dominant functional processes, and contribution to watershed-level processes. As a result, strategies for Type N streams vary according to which functions and processes are dominant within an individual stream.

The site-specific strategies are prescriptive and designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the forest landscape strategies.

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 two components listed above.

5.6.2. Use Watershed Analysis to Inform Management Decisions

Conservation Measure 5.10
Use Watershed Analysis in Making Management Decisions

- Implement watershed analysis and use results to inform management decisions.

A watershed analysis for the Elliott State Forest was completed in October 2003 (Biosystems et al 2003). The Coos Watershed Association served as a sub-contractor in developing the analysis. Both the Tenmile Lakes Basin Partnership and the Lower Umpqua Watershed Council reviewed assessment and analysis documents and provided input. The purpose of the watershed analysis is to measure current resources and assist in improving the understanding of natural processes that influence fish and wildlife habitat, and water resources throughout the Elliott State Forest. Consequences of human activities on these resources were also addressed through the analysis.

The analysis was based on protocols suited to Elliott State Forest management needs utilizing the Oregon Watershed Enhancement Board manual and protocols as a foundation. The

protocols were adjusted to include more rigorous information collection protocols for specific information "modules" based on forest management topics. The watershed analysis used basins based on fifth field scale hydrologic unit codes as developed by the U.S. Geological Survey. In most cases, these fifth field analysis basins are consistent with the Elliott State Forest's 13 management basins.

Information in the watershed analysis has been and will continue to be considered and, as appropriate, applied through the district Implementation Plan (Oregon Department of Forestry 2007). The existing watershed analysis will be supplemented with additional resource information as more data become available on watershed processes and interactions in the Elliott State Forest.

Using current inventories of the forest, or those that could be extrapolated from studies conducted on similar areas, the analysis may be applied, but not limited, to the following:

- **Implementation planning:** Watershed analysis recommendations are incorporated into the current Coos District Implementation Plan (Oregon Department of Forestry 2006a). A summary of watershed analysis findings and related ODF actions is provided in Appendix B of the Coos District Implementation Plan. Examples include identifying small non-fish-bearing streams that can deliver wood to fish-bearing streams, conducting forest management around unstable slopes, working with Watershed councils on basin-scale priorities for wood placement, and developing noxious weed policy.
- **Annual operational planning:** Many recommendations apply to annual operations planning. Examples include, but are not limited to: use of field surveys for determining perennial stream flow and fish distribution, stream protection upstream of domestic water sources, large wood placement to increase gravel retention, road segments in need of improvements, management for conifer stocking in riparian areas, and identifying wood placement locations.
- **Total maximum daily load studies:** Coos district will continue to work with partners on issues of total maximum daily load. Examples include, but are not limited to: exploring opportunities to collaborate with Coos Watershed Council for more stream temperature monitoring. ODF will evaluate potential sediment sources and mitigation using our established road current condition and environmental risk survey and a standardized process for documenting landslides.
- **Restoration activities:** Restoration activities include road and fish passage improvement projects, large wood placement opportunities associated with annual operations plans, and basin-scale prioritization. Prioritization is based on watershed analysis findings, ODF&W input and any other available information. For example High Intrinsic Potential (HIP) maps could be used. The HIP model predicts stream reaches that due to valley and channel morphology have the potential to provide high quality habitat.
- **Public education and outreach:** These activities include domestic water source protection.
- **Long-term resource monitoring:** In addition to those listed above, other examples include: large wood in steep draws and ODFW habitat surveys.

5.6.3. Apply Management Standards for Aquatic and Riparian Areas

Conservation Measure 5.11
Establish Riparian Management Areas

- Establish and maintain RMAs adjacent to all streams, in accordance with the standards and guidelines.

Site-specific prescriptive standards for aquatic and riparian areas constitute a key piece of the second tier of the balanced approach, and will guide forest management activities to achieve properly functioning aquatic and riparian habitat conditions over time. All management actions will be consistent with these standards.

The management standards include specific provisions for establishing RMAs and describe how management is to occur within these areas. The standards will be applied within the context of adaptive management process. As new information and a better understanding of the watershed functions and processes become available, this knowledge will be integrated into the management of riparian and aquatic habitat.

RMAs will be established immediately adjacent to waterways to protect aquatic and riparian resources, and maintain the functions and ecological processes of the waterways. Within these areas, special management considerations and operational restrictions will apply, and the protection of aquatic resources will be a high priority.

The width of RMAs will vary by type and classification of the water body. These widths were developed by considering the functions and processes to be achieved or maintained by management activities. The RMA width is measured horizontally beginning at the average high-water level of the water body, or the edge of stream-associated wetland, side channel, or channel migration zone (whichever is farthest from the waterway), and extending toward the uplands. The width of these areas will be expanded, if necessary, to fully encompass certain sensitive sites such as seeps, waterfalls, or other special sites noted in the management prescriptions.

RMA widths are intended to be averages applied over the length of a management site. The actual extent of a specific RMA can be varied to tailor vegetation retention to site-specific conditions, or to address special resource considerations. For example, an RMA boundary may be expanded where a potentially unstable slope adjacent to a stream could deliver materials to the stream. The intent of this action is to increase the potential for large wood delivery should a disturbance event occur. Variations in RMA design will always be completed in a manner consistent with the management objectives for the specific aquatic or riparian area.

5.6.3.1. Guidelines: The Four Zones of a Stream Riparian Management Area

RMAs established along streams will contain four zones. The purposes and differences between these four zones are discussed below.

Aquatic Zone—The aquatic zone is the area that includes the stream channel(s) and associated aquatic habitat features. This zone includes beaver ponds, stream-associated wetlands, side channels, and the channel migration zone. The other zones of a RMA are established upslope from the outer edge of these features.

Stream Bank Zone—The stream bank zone is the land nearest to the stream, including the stream banks. Most riparian functions are supported to some extent by vegetation in this zone, which provides aquatic shade, delivers downed wood and organic inputs (leaves and tree litter) to the stream and riparian area, stabilizes the stream bank, contributes to floodplain functions, and influences sediment routing processes.

The stream bank zone is defined as the area within 25 feet of the outer edge of the aquatic zone for all streams. This zone exists on both sides of a stream.

Inner RMA Zone—The inner RMA zone exists on both sides of a stream, from 25 feet (the outer edge of the stream bank zone) to 100 feet from the stream. Vegetation within this zone contributes substantially to desired riparian functions, including providing aquatic shade, delivering a high proportion of the potential large wood available, and contributing organic inputs to the stream. Vegetation within this area also provides some protection to certain aspects of riparian micro-climate. Because vegetation in this zone has a relatively greater role in supporting riparian functions and processes, a high priority is being placed on management actions in this area.

Outer RMA Zone—The outer RMA zone is the portion of the RMA farthest away from the stream extending from the edge of the inner zone at 100 feet out to 160 feet on both sides of a stream. Vegetation within this zone may still contribute to certain riparian functions and processes, but to a lesser extent than the two zones nearest the stream. The primary functions provided by vegetation in this area include additional contributions of large wood to the riparian zone and stream channel, and the protection of riparian micro-climate. In some cases, the outer zone may also partially buffer the two inner zones from certain disturbance events such as windthrow.

5.6.3.2. Stream Classification

Determination of the applicable management standards for riparian areas is based on a stream classification system. Streams are grouped into two major categories based on the primary beneficial uses of the stream. Streams are further classified according to size, based on average annual flow. Flow pattern (perennial and seasonal) is also considered for small non-fish-bearing waters. This classification system is generally consistent with the method used for administration of the FPA, as described in the ODF's Forest Practice Technical Note FP1—Water Classification (Oregon Department of Forestry 1994).

Beneficial Use Classifications

Streams and other aquatic habitats are classified into two major groups based on the presence or absence of certain fish species. The following definitions will be applied in classifying streams:

- **Fish-bearing (Type F)—**Waters that are inhabited at any time of the year by anadromous or game fish species, or by fish species that are listed as threatened or endangered under either federal or state ESA, or by fish species (including lamprey) covered for incidental take under this HCP.
- **Non-fish-bearing (Type N)—**Waters that are not fish-bearing (see previous definition).

Stream Size Classifications

Streams are further classified by size, based on estimated average annual flow. The following definitions apply to these size categories.

- **Small—**Average annual flow of two cubic feet per second (cfs) or less.
- **Medium—**Average annual flow greater than two cfs, but less than ten cfs.
- **Large—**Average annual flow of ten cfs or greater.

Flow Pattern Classifications

Small Type N streams are also classified according to the flow pattern exhibited in normal water years. For the purposes of this HCP, the following definitions will be used.

- **Perennial Type N Streams—**Streams that are expected to have summer surface flow after July 15.
- **Seasonal Type N Streams—**Streams that only flow during portions of the year; these streams are not expected to have summer surface flow after July 15.

Some seasonal non-fish-bearing streams are further classified as:

- **Seasonal High-energy Streams—**Seasonal streams with physical conditions that favor the periodic transport of coarse sediments and wood during high-flow events. For the purposes of this HCP, and in the absence of specific geomorphologic identification, stream reaches with an average gradient exceeding 15 percent and an active channel width of five feet or more will be defined as seasonal high energy streams.
- **Potential Debris Flow Track Reaches—**Potential channelized debris flow track reaches exist on seasonal Type N streams, and have been determined to have a high likelihood of delivering wood to a Type F stream.

ODF field staff will determine the likelihood that a reach will deliver wood to a Type F stream via a channelized debris flow, using the following criteria:

- The seasonal stream reach must terminate at or below a high landslide hazard location. High landslide hazard locations are specific sites that are subject to initiation

of shallow, rapidly moving landslides. The specific criteria for determination of these sites is found in Technical Notes 2 and 6 (Oregon Department of Forestry 2003a and b) as:

- The presence, as measured on site, of any slope in western Oregon (excluding competent rock outcrops) steeper than 80 percent, except in the Tyee Core Area, where it is any slope steeper than 75 percent; or

- The presence, as measured on site, of any headwall or draw in western Oregon steeper than 70 percent, except in the Tyee Core Area, where it is any headwall or draw steeper than 65 percent.

- Notwithstanding the slopes specified above, field identification of atypical conditions by a geotechnical specialist may be used to develop site specific slope steepness thresholds for any part of the state where the hazard is equivalent to one of the above.

- The path of a potential channelized debris flow and the likelihood that a debris flow will reach a Type F stream. Determination of such conditions is described in detail in Technical Note 6 (reference). If any one of the following conditions is present along the path from the high landslide hazard location to the Type F stream, a debris flow is likely to stop and the stream reach would be determined to have a low probability of wood delivery to the Type F stream (Benda and Cundy 1990):
  - The presence of a channel junction that is 70 degrees or more, provided the channel downstream of the junction is less than 35 percent gradient;
  - The presence of a stream reach that is less than six percent gradient for at least 300 feet;
  - The stream channel is unconfined; or
  - Other characteristics which, in the judgment of the geotechnical specialist, are likely to cause debris flow deposition

5.6.3.3. Management Standards for RMAs

The following standards will guide management activities so that properly functioning riparian and aquatic conditions will be created over time. These standards will apply until alternative standards are identified through the adaptive management process. As new information and a better understanding of the watershed functions and processes become available, this knowledge will be integrated into the management of riparian and aquatic habitat through the adaptive management process. The management standards are presented in Tables 5-5 and 5-6.

Table 5-5
Management Standards for Type F Stream Riparian Management Areas

All Stream Sizes: Large, Medium, and Small	
Stream bank zone 0 to 25 feet	No harvest. Full suspension required during cable yarding; minimize the number and width of cable yarding corridors through retained RMA zone. No ground-based equipment operation. Leave any trees damaged or felled from yarding activities.
Inner RMA zone 25 to 100 feet	Manage for mature forest condition.[1] No management activity where mature forest condition exists, or where conditions are suitable for development of mature forest condition in a reasonable time frame without further treatment. Allow active management where necessary to achieve the desired future condition in a timely manner. Minimum 15-year interval between harvest entries, and minimum number of entries necessary to achieve the desired future condition. Partial cutting will maintain a conifer SDI of at least 25, and will retain at least 50 trees per acre. Full suspension wherever possible, or one-end suspension on all cable-yarded material. Ground-based equipment operation limited to area more than 50 feet from aquatic zone and slopes less than 35 percent, and allowed on no more than 10 percent of area. Leave any trees damaged or felled from yarding activities and additional felled, girdled, or topped trees to contribute toward downed wood targets.[2] Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Retain at least 10 to 45[3] conifer trees and snags per acre (15 to 70 trees per 1,000 feet of RMA). [4] Retain all snags as safety permits. Less than 10 percent ground disturbance from yarding activities. Retain all dead and downed material that was present prior to the operation.

[1] Desired mature forest condition consists of a stand dominated by large conifer trees or, where hardwood-dominated conditions are expected to be the natural plant community, a mature hardwood/shrub community. For conifer stands, this equates to a basal area of 220 square feet or more per acre, inclusive of all conifers over 11 inches DBH. At a mature age (80 to 100 years or greater), this equals 40 to 45 conifer trees of 32 inches DBH per acre.

[2] Up to ten trees per acre will be retained as felled, girdled, or topped trees during partial cutting, to reach a target of 600 to 900 cubic feet per acre of hard downed wood.

[3] Outer zone tree retention target will be increased when less than the target number of conifers is present in the inner zone. The process for calculating the outer zone retention target is described in the section following the RMA prescription tables.

[4] All trees retained will be dominant or co-dominant conifer trees (if available). To balance the need for short-term and long-term recruitment of large wood to the aquatic zone, preference will be given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel.

SDI = stand density index

Table 5-6
Management Standards for Type N Stream RMAs

Large and Medium Type N Streams	
Stream bank zone 0 to 25 feet	No harvest. Full suspension required; minimize the number and width of cable yarding corridors through retained RMA zone. No ground-based equipment operation. Leave any trees damaged or felled from yarding activities.
Inner RMA zone 25 to 100 feet	Manage for mature forest condition.[1] No management activity where mature forest condition target already exists. Allow active management where beneficial to achieve desired future condition. Minimum 15-year interval between harvest entries, and minimum number of entries necessary to achieve the desired future condition. Partial cutting will maintain a conifer SDI of at least 25, and will retain at least 50 trees per acre. Full suspension wherever possible, or one-end suspension on all cable-yarded material. Ground-based equipment operation limited to area more than 50 feet from aquatic zone and slopes less than 35 percent, and allowed on no more than 10 percent of area. Leave any trees damaged or felled from yarding activities and additional felled, girdled, or topped trees to contribute to downed wood targets.[2] Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Manage to retain at least 10 conifer trees and snags per acre (15 trees per 1,000 feet of RMA).[3] Retain all snags as safety permits.

[1] Desired mature forest condition consists of a stand dominated by large conifer trees or, where hardwood-dominated conditions are expected to be the natural plant community, a mature hardwood/shrub community. For conifer stands, this equates to a basal area of 220 square feet or more per acre, inclusive of all conifers over 11 inches DBH. At a mature age (80 to 100 years or greater), this equals 40 to 45 conifer trees of 32 inches in DBH per acre.

[2] Up to ten trees per acre will be retained as felled, girdled, or topped trees during partial cutting, to reach a target of 600 to 900 cubic feet per acre of hard downed wood.

[3] All trees retained will be dominant or co-dominant conifer trees (if available). To balance the need for short-term and long-term recruitment of large wood to the aquatic zone, preference will be given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel.

SDI = stand density index

Table 5-6 continued

Small Perennial Type N Streams (applied to at least 75 percent of stream reach contained within the Harvest Unit)[1]	
Stream bank zone 0 to 25 feet	No harvest. No ground-based equipment operation.
Inner RMA zone 25 to 100 feet	Manage to retain at least 15 to 25 conifer trees and snags per acre (25 to 40 trees per 1,000 feet of RMA).[2,3] Retain all other snags as safety permits. Within 500 feet of a confluence with a Type F stream, retain all hardwoods, non-merchantable trees, and other conifers as necessary, to achieve 80 percent shade over aquatic zone. Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Manage to retain 0 to 10 conifer trees and snags per acre (0 to 15 trees per 1,000 feet of RMA).[2,3] Retain all snags as safety permits.

1 Prescription to be applied to at least 75 percent of perennial stream reach contained within the harvest unit, including the first 500 feet above the confluence with a Type F stream, and areas that meet the definition of a special emphasis area according to the definitions in the section following these tables. This approach is designed to provide flexibility for operational constraints typically encountered around these small streams.

2 All trees retained will be dominant or co-dominant conifer trees (if available). To balance the need for short-term and long-term recruitment of large wood to the aquatic zone, preference will be given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel. See measure 9.8 in Chapter 9 for a related headwall amphibian conservation measure.

3 In meeting the tree retention target for the inner and outer zones, preference will be given to retaining trees within the inner zone. Where there are sufficient trees within the inner zone to meet the combined target for the two zones (40 trees per 1,000 feet), no additional leave trees are required in the outer zone.

Table 5-6 continued

Small Seasonal Type N Streams: High Energy Reaches (applied to at least 75 percent of stream reach contained within the harvest unit)[1]	
Stream bank zone 0 to 25 feet	No harvest. No ground-based equipment operation.
Inner RMA zone 25 to 100 feet	Manage to retain at least 15 to 25 conifer trees and snags per acre (25 to 40 trees per 1,000 feet of RMA).[2,3] Retain all other snags as safety permits. Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Manage to retain 0 to 10 conifer trees and snags per acre (0 to 15 trees per 1,000 feet of RMA).[2,3] Retain all snags as safety permits.
Small Seasonal Type N Streams: Potential Debris Flow Track Reaches (applied to at least 75 percent of reach)[1]	
Stream bank zone 0 to 25 feet	No harvest. No ground-based equipment operation.
Inner RMA zone 25 to 100 feet	Manage to retain at least 10 conifer trees and snags per acre (15 trees per 1,000 feet of RMA).[2,4] Retain all other snags as safety permits. Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Retain trees and snags sufficient to meet landscape management strategy targets.

1 Prescription to be applied to at least 75 percent of stream reach contained within the harvest unit, including the first 500 feet above the confluence with a Type F stream. This approach is designed to provide flexibility for operational constraints typically encountered around these small streams.

2 All trees retained will be dominant or co-dominant conifer trees (if available). To balance the need for short-term and long-term recruitment of large wood to the aquatic zone, preference will be given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel.

3 In meeting the tree retention target for the inner and outer zones, preference will be given to retaining trees within the inner zone. Where there are sufficient trees within the inner zone to meet the combined target for the two zones (40 trees per 1,000 feet), no additional leave trees will be required in the outer zone.

4 To maximize the influence of retained trees on debris flow processes, preference will be given to retaining these trees as close to the stream channel as operationally feasible, or on adjacent slope features that exhibit a high potential for failure and delivery to the stream.

Table 5-6 continued

Other Small Seasonal Type N Streams (applied to at least 75 percent of reach)	
Stream bank zone 0 to 25 feet	Maintain integrity of stream channel. No ground-based equipment operation.
Inner RMA zone 25 to 100 feet	Manage to retain at least 10 conifer trees and snags per acre where operationally feasible (15 trees per 1,000 feet of RMA).[1] Retain all other snags as safety permits. Retain all dead and downed material that was present prior to the operation.
Outer RMA zone 100 to 160 feet	Retain trees and snags sufficient to meet landscape management strategy targets.

[1] All trees retained will be dominant or co-dominant conifer trees (if available). To balance the need for short-term and long-term recruitment of large wood to the aquatic zone, preference will be given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel.

Outer Zone Conifer Retention on Type F Streams

On Type F streams, in situations where the number of conifers available for retention within the streambank and inner zones is not adequate to achieve the large wood delivery potential of a mature forest condition, additional conifers will be retained in the outer zone to provide additional large wood recruitment potential. This additional outer zone target will apply when the number of conifers of suitable size (11 inches or greater DBH) in the inner zone is less than the mature forest condition target of 45 trees per acre (approximately 100 trees per 1,000 lineal feet of stream for a 25-foot stream bank zone and a 75-foot inner zone).

The number of additional conifers to be retained in the outer zone will be equal to the deficit from the streambank and inner zone target, adjusted to account for the different widths of the zones. The streambank zone and inner zone combine for a width of 100 feet, whereas the outer zone is 60 feet. For example, if the streambank and inner zone have an average of 70 suitable conifers per 1,000 feet of stream, the additional retention level for the outer zone would equal 30 times 0.6, or an additional 18 conifers per 1,000 feet of outer zone.

In no case shall the number of conifers required to be retained in the outer zone exceed the inner zone target for mature forest condition; i.e., no more than 63 conifers per 1,000 feet of outer zone, or 45 trees per acre, are required. In addition, no trees shall be required to be retained in the outer zone in locations where, due to topography, they would have no opportunity to reach the area within the channel migration zone and thus potentially function as large wood in the stream channel. All conifers retained under this strategy shall meet the conifer retention criteria as described in footnotes to Tables 5-5 and 5-6: dominant or co-dominant trees, with preference given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees nearest the channel.

Estimated acreages in stream-associated riparian areas are shown in Table 5-7. There are an estimated total of 10,419 acres of riparian areas, mostly associated with fish-bearing, large and medium non-fish-bearing, and perennial non-fish-bearing streams. This is a conservative estimate, as additional strategies (described above) apply out to 160 feet from the stream on most stream types while the widths used to calculate RMA acres were 100 feet and less.

Table 5-7
Estimated Acres of Riparian Area by Stream Type

Stream Type	Coos (acres)	TenMile (acres)	Umpqua (acres)	Elliott (acres)	Elliott (%)
Fish-Bearing and Large & Medium Non-Fish-Bearing	2736	864	1251	4851	46%
Small Perennial Non-Fish-Bearing	2094	1024	1104	4222	41%
Small Seasonal Non-Fish-Bearing	683	287	377	1346	13%
Total	**5513**	**2174**	**2733**	**10419**	

A width of 100 feet, 50 feet, and 25 feet was assumed for fish-bearing, perennial small non-fish-bearing, and seasonal small non-fish-bearing streams, respectively. Estimates represent RMAs assumed on both sides of the stream.

Perennial Type N Stream Special Emphasis Areas

On small Type N streams, the required RMAs will be located to provide protection to the following special emphasis areas. These special emphasis areas may be especially important to certain species (such as amphibians), or to the functions and processes within a watershed.

- **Seeps and Springs in Inner RMA Zone, Connected to Aquatic Zone—**The 25-foot stream bank zone of the stream, which is the no-harvest zone, will be extended around the outer perimeter of side slope seeps and springs that are within 100 feet of the aquatic zone and connected to the channel via overland flow. The inner zone will follow that boundary.
- **Source Areas of Perennial Streams—**The 25-foot stream bank zone, which is the no-harvest zone, will be extended for a distance of 100 feet above the initiation point of perennial flow.
- **Stream-associated Wetlands—**The 25-foot stream bank zone, which is the no-harvest zone, will be extended around the outer perimeter of the wetland area.
- **Stream Junctions—**The 25-foot stream bank zone (no harvest) will be extended for a minimum of 100 feet upstream and downstream, on each stream, where two or more small Type N perennial streams intersect.
- **Significant Waterfalls—**A significant waterfall is one that has an identifiable splash zone. The splash zone is the area immediately adjacent to the stream channel that is occupied by vegetation commonly associated with wet areas, i.e., mosses, maidenhair or licorice fern, and other hydric species.

For these sites, the stream bank zone (no harvest) will be extended around the outer perimeter of the splash zone of the waterfall.

Key Terms

Active channel width—The average width of the stream channel at the normal high-water level. The normal high-water level is the stage reached during average annual high flow. This high-water level mark often corresponds with the edge of streamside terraces; a change in vegetation, soil, or litter characteristics; or the uppermost scour limit (bankfull stage) of a channel.

Average high-water level—The stage reached during the average annual high-flow period. This level often corresponds with the edge of streamside terraces, marked changes in vegetation, or changes in soil or litter characteristics.

Bog—A wetland that is characterized by the formation of peat soils and that supports specialized plant communities. A bog is a hydrologically closed system without flowing water. It is usually saturated, relatively acidic, and dominated by ground mosses, especially sphagnum. Bogs are distinguished from other wetlands by the dominance of mosses and the presence of extensive peat deposits.

Channel migration zone—An area adjacent to an unconfined stream channel where channel migration is likely to occur during high-flow events. The presence of side channels or oxbows, stream-associated wetlands, and low terraces are indicators of these zones. The extent of these areas will be determined through site inspections.

Stream-associated wetland—A wetland that is immediately adjacent to a stream. This includes wetlands that are adjacent to beaver ponds, side channels, or oxbows that are hydrologically connected to the stream channel by surface flow at any time of the year.

Wetland—An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The process used to determine the presence of wetlands will be consistent with the method described in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (USDI Fish and Wildlife Service et al. 1989).

5.6.4. Maintain or Improve Aquatic Habitats

Conservation Measure 5.12
Maintain or Improve Aquatic Habitat

- Use results from the Elliott watershed analysis to identify, design, and implement projects to maintain or improve aquatic and riparian habitat.

The aquatic habitat maintenance or improvement strategies are intended to correct human-induced conditions in the forest that may contribute to aquatic habitat deficiencies, or that may limit desired aquatic habitat conditions. These strategies will promote aquatic habitat conditions that support the short- and long-term survival needs of aquatic organisms. Also, these strategies will make it more likely that properly functioning aquatic habitat conditions will be attained in a timely manner. Finally, these strategies will encourage forest conditions that support the ecological processes necessary to naturally create and maintain complex aquatic habitats on a self-sustaining basis.

This approach addresses aquatic habitat maintenance or improvement on a comprehensive basis, and uses both short- and long-term management actions. These strategies will improve levels of aquatic function in the short term (to meet the immediate habitat needs of aquatic species and place aquatic habitats on a pathway toward desired conditions), while at the same time site-specific and landscape actions are carried out to establish and maintain self-sustaining habitats over the long term. The following strategies and actions will be implemented as part of the aquatic habitat maintenance or improvement strategy.

Use the Elliott Watershed Analysis to identify potential factors contributing to undesirable aquatic habitat conditions.

An Elliott Watershed Analysis Implementation Plan was developed by a group composed of the ODF, the ODFW, and area watershed councils. The Watershed Analysis Implementation Plan identifies the significant recommendations from the watershed analysis (Biosystems et al 2003) and describes the ODF's response and proposed actions to address these issues. The Watershed Analysis Implementation Plan has been incorporated into the district Implementation Plan.

Identify, design, and implement projects to correct identified problems in a timely manner.

Aquatic and riparian projects will continue to be implemented at or above current levels, as projects are needed. For the five-year period from 1999 to 2003, the ODF provided an annual average of $34,300 of cash and in-kind contributions toward projects to address fish passage, instream, and riparian improvements. From 1996 through 2003, in cooperation with three watershed associations, ODF's contribution was leveraged into an annual average of $203,546 in cash and in-kind contributions invested in restoration projects. These projects include 56 riparian projects, 38 in-stream projects, 1 upland project, 22 road projects, and 19 fish passage projects. In addition to these cooperative watershed projects, ODF invests about

$200,000 in annual road improvement and maintenance projects that help improve water quality conditions.

The watershed analysis identified 5.9 miles of stream with wood levels less than 250 cubic feet per 100 feet, and 25.3 miles of stream with less than 20 percent pools and wood less than 250 cubic feet per 100 feet of stream.

The watershed analysis identified potential stream restoration sites based on the numbers of pools by reach and the volume of wood per 100 feet of stream. These results were reported for streams less than and greater than 40 feet in width. There are approximately 18.4 miles of streams less than 40 feet wide and 25.3 miles of stream wider than 40 feet that would benefit from wood placement. Specific reaches were identified in the Coos, Umpqua, and Tenmile basins (see Tables 8-14 and 8-15 in Chapter 8 of this HCP) (Biosystems et al 2003). Opportunities to implement restoration in these reaches in collaboration with the Coos Watershed Association will continue to be explored over the life of this HCP.

In addition to the Watershed Analysis Implementation Plan, opportunistic projects associated with harvest operations will be conducted that can take advantage of existing equipment on site. Instream wood placement projects will be conducted on fish-bearing streams within or adjacent to all harvest operations when the stream is below the desired level of wood and the operation contains wood meeting size requirements for the intended stream.

The following guidelines will be considered when planning restoration projects:

- Aquatic habitat improvement projects will be designed with the intent of mimicking natural processes. The use of “engineered” or “constructed habitat” approaches to stream enhancement will be minimized.
- Projects will be designed and implemented using a multidisciplinary approach, in direct consultation with the ODFW and in cooperation with local watershed councils.
- Project planning and design will consider habitat conditions, stream processes, and the disturbance regime at both the watershed and site-specific scale.
- Projects will be designed and implemented consistent with the natural dynamics and geomorphology of the site, and with the recognition that introduction of materials will cause changes to the stream channel.
- A priority will be placed on projects that supplement natural “legacy” elements (large wood) that are lacking due to previous disturbance events, and/or management activities.
- Projects will be designed to create conditions and introduce materials sufficient to enhance or re-establish natural physical and biological processes. An emphasis will be placed on projects that re-introduce large “key” pieces of large wood to stream channels in natural configurations.
- Wood placement activities will utilize materials that are expected to be relatively “stable” yet functional in these dynamic stream systems. The intent is to maximize the functional attributes of large wood, and minimize potential conflicts with public safety in downstream reaches. Reliance on artificial “anchoring” methods (such as cables) will be minimized, and will only be used in cases of significant concern for public safety.

- Projects will be implemented in a manner that minimizes the potential for negative effects to riparian areas.

5.6.5. Apply Alternative Vegetation Treatment to Achieve Habitat Objectives in Riparian Areas

Conservation Measure 5.13
Apply Alternative Vegetation Treatment to Achieve Objectives

- Use basin-level assessments to evaluate the need for alternative vegetation treatments.
- Where appropriate, plan alternative vegetation treatments that will contribute to achieving properly functioning aquatic habitat conditions in a timely manner.
- Monitor and evaluate alternative vegetation treatment projects over time, using results in an adaptive management context.

The term "alternative vegetation treatment" refers to the application of silvicultural tools and management techniques in RMAs, using approaches that differ from the aquatic and riparian management strategies, to change the vegetative community so that the HCP's aquatic and riparian habitat objectives can be more easily achieved. These treatments are primarily designed to address recruitment of large conifers trees to streams for the purpose of improving fish habitat.

Potential projects include silvicultural treatments such as the conversion of hardwood stands to conifer species; selective removal of hardwoods from mixed-species stands and the establishment of shade-tolerant conifer seedlings; the creation of gaps in hardwood stands to establish conifer seedlings (shade-intolerant and shade-tolerant); or other similar practices designed to improve aquatic and riparian conditions.

The alternative vegetation treatment strategies will apply silvicultural approaches in riparian areas where basin-level riparian stand conditions are inconsistent with achieving properly functioning aquatic habitat conditions in a timely manner. These strategies will be implemented in a way that maintains diverse riparian plant communities (heterogeneity) at the landscape and basin scales, and that minimizes the potential for adverse effects to aquatic resources.

Use basin-level assessments to evaluate the need for alternative vegetation treatment projects.

This strategy will be implemented primarily through the watershed analysis strategies described earlier, applied at the basin level.

Plan alternative vegetation treatment projects to achieve properly functioning aquatic habitat conditions in a timely manner.

These projects will be designed to achieve properly functioning aquatic habitat conditions in a timely manner, and involve a variety of resource specialists from the ODF and ODFW. The specialists involved in a given project will vary according to the resources and physical conditions present at the site.

Monitor and evaluate alternative vegetation treatment projects through time using results in an adaptive management context.

The HCP recognizes that these treatments are experimental actions, and that, over time, managers will gain additional knowledge and experience through monitoring and research. These projects will be monitored and evaluated over time to ensure that the objectives are being achieved, and that undesirable effects are being minimized. The knowledge gained will be applied in an adaptive management context so that the multiple resource objectives for riparian and aquatic habitats can be more successfully met.

5.6.6. Apply Specific Strategies to Other Aquatic Habitats

Conservation Measure 5.14
Apply Strategies to Other Aquatic Habitats

- Establish and maintain RMAs adjacent to other aquatic habitat areas in accordance with the standards described in this HCP.

The Elliot State Forest contains aquatic habitats other than streams, such as wetlands, lakes, ponds, bogs, seeps, and springs. The management objectives for these waters are generally similar to the objectives for streams, but the specific prescriptions are sometimes different. RMAs will be established and maintained adjacent to these habitats in accordance with the standards described below.

These waters support diverse plant and animal communities, are connected to other waters in a basin, and play a significant role in the hydrologic patterns and functions of watersheds. Some species have adapted to, or are dependent on, the conditions found in and near these other aquatic habitats. These areas can also be sensitive to land management activities.

The strategies for other aquatic habitats will maintain the productivity of these habitats, protect the integrity of these sites and maintain hydrologic functions, provide suitable habitats for fish and wildlife dependent on these unique habitats, and contribute to habitat conditions needed for maintaining other native wildlife species of concern.

Prescriptions—The prescriptions for other aquatic habitats are presented in Tables 5-8 and 5-9.

Table 5-8
Management Prescriptions for Lakes, Ponds, and Wetlands

Greater Than 1 Acre
Establish a 25-foot no-harvest zone, starting from the high-water line or wetland boundary (whichever is greater). Establish an RMA of 100 feet from the high-water line or wetland boundary (whichever is greater). Manage vegetation to achieve and maintain mature forest conditions. The site-specific prescription will classify the wetland.
From 1/4 Acre to 1 Acre
Establish a 25-foot no harvest zone, starting from the high-water line, or wetland boundary (whichever is greater). Establish a RMA of 50 feet from the high-water line or wetland boundary (whichever is greater). Within the RMA, harvest activities will retain at least 50 percent of the existing live tree basal area, or 110 square feet of basal area per acre (whichever is greater). Retained trees will generally be representative of the existing diameter classes and species distribution, with a preference for retaining trees greater than 20 inches DBH. If the waterway is inhabited by fish, or is identified as an important area for temperature-sensitive amphibian species, at least 80 percent shade will be maintained over the aquatic area. The site-specific prescription will classify the wetland.
Less Than 1/4 Acre
Establish an RMA of 50 feet for Type F waters and 25 feet for Type N waters. These areas will be measured from the high-water line or wetland boundary (whichever is greater). For Type F waters, harvest within the RMA will retain at least 50 percent of the existing live tree basal area or 110 square feet of basal area per acre (whichever is greater). Retained trees will generally be representative of the existing diameter classes and species distribution, with a preference for retaining trees greater than 20 inches DBH. For Type N waters, hardwood trees and brush will be retained to protect the hydrologic functions and wildlife habitat values of the site. If the waterway is inhabited by fish, or is identified as an important area for temperature-sensitive amphibian species, at least 80 percent shade will be maintained over the aquatic area.
Stream-Associated Wetlands
Stream-associated wetlands are considered to be components of the aquatic habitat of streams, and will be managed according to the objectives and prescriptions specified for the associated stream.

Table 5-9
Management Prescriptions for Bogs, Seeps, and Springs

Bogs
Establish a 25-foot no-harvest zone, starting from the high-water line or wetland boundary (whichever is greater). Establish an RMA of 100 feet from the high-water line or wetland boundary (whichever is greater). Manage vegetation within the RMA to achieve and maintain mature forest conditions.
Seeps and Springs
Where possible, these aquatic areas should be incorporated into the RMAs of adjacent streams, and vegetation retention should be provided according to the stream prescription. In practice, this may simply require adjusting the boundary of a stream's RMA to fully encompass the spring or seep. Other management considerations for some of these areas are described in Section 5.6.2.8, "Perennial Type N Stream Special Emphasis Areas."

5.6.7. Employ Slope Stability Management

Conservation Measure 5.15
Employ Slope Stability Management

- Use watershed analysis (initially completed in October 2003) and other information to enhance the current understanding of the processes that influence slope stability in the Elliott State Forest.
- Evaluate alternatives and design operations that can minimize, mitigate for, or avoid risk in high and moderate landslide hazard locations during district implementation and project planning.

Landslides and other geologic processes can have significant effects on watersheds, including aquatic and riparian areas. The objective in relation to landslides and slope stability management is to minimize the occurrence of management-induced slope failures and mitigate potential negative impacts on aquatic and riparian habitats. This will be accomplished through application of risk-based management principles and best management practices. Minimizing road-related landslides and chronic erosion (sedimentation to streams) is fundamental to this objective. Hazard assessment and risk-based management for in-unit slides, and ensuring that large wood is available in the track of potential debris slides and torrents, will promote properly functioning conditions for future aquatic habitat inputs.

A focus of the strategies is on high landslide hazard locations. High landslide hazard locations are specific sites that are subject to initiation of shallow, rapidly moving landslides. A process for screening and identifying high landslide hazard locations is described in detail in Technical Notes 2 and 6 (Oregon Department of Forestry 2003a and b). The initial screen determines if there may be high landslide hazard locations within the operation area. The

initial screen is based on slope steepness and should use USGS 1:24,000 topographic maps, a ten-meter digital elevation model (DEM) based on these maps, or more accurate slope steepness information. Because USGS maps tend to underestimate actual slope steepness, map- or ten-meter DEM-determined slopes steeper than 65 percent for most of western Oregon, and 60 percent in the Tyee Core Area (described later in this Technical Note) are considered likely to have high landslide hazard locations in the field. For operations that meet the initial screen, further investigation is needed to identify High Landslide Hazard Locations.

Upon further investigation, the specific criteria for determination of high landslide hazard locations are described in Technical Note 2 (Oregon Department of Forestry 2003a) as:

(a) The presence, as measured on site, of any slope in western Oregon (excluding competent rock outcrops) steeper than 80 percent, except in the Tyee Core Area, where it is any slope steeper than 75 percent; or

(b) The presence, as measured on site, of any headwall or draw in western Oregon steeper than 70 percent, except in the Tyee Core Area, where it is any headwall or draw steeper than 65 percent.

(c) Notwithstanding the slopes specified in (a) or (b) above, field identification of atypical conditions by a geotechnical specialist may be used to develop site specific slope steepness thresholds for any part of the state where the hazard is equivalent to (a) or (b) above.

Enhance current understanding of the processes that influence slope stability in the Elliott State Forest.

Factors that influence slope stability on the Elliott State Forest include but are not limited to slope steepness, root strength, road construction, stand age, and rainfall intensity. Tools used to assess slope stability when available include, but are not limited to, soil type mapping, slope mapping, geologic history, review of historic slope failures and relevant case studies. In addition, ODF is developing a slope and channel stability modeling tool that, when validated, can be used to further evaluate processes that influence slope stability in the Elliott State Forest. The geotechnical specialist may choose to use other means and methods of evaluating risk.

Information obtained from the watershed analysis (initially completed in October 2003) and other documents will be used to inform management decisions in the Elliott State Forest, including slope stability strategies. Relevant information will be incorporated into Implementation Plans and AOPs.

Evaluate alternatives and design operations that minimize, mitigate for, or avoid risk in high and moderate landslide hazard locations.

During district implementation planning and annual operations planning, alternatives will be evaluated that can minimize, mitigate for, or avoid risk in high and moderate hazard areas. During project planning and design, operations will be designed to minimize, mitigate for, or avoid identified risks.

Geotechnical specialist input will be used as appropriate when alternatives are being considered for proposed operations. The district will coordinate geotechnical specialist review, and will be responsible for subsequent evaluation of alternatives and selection of the course of action.

Timber harvesting and road construction operations will be assessed for hazard and risk by a geotechnical specialist when appropriate. Road alternatives will receive site-specific geotechnical evaluation when the forest engineer must compare risk of road location, design, or construction alternatives.

Steep, unique, or visual (SUV) areas have been established around some of the steepest slopes on the Elliott where little or no management is expected. These lands constitute 6,419 acres of the forest. The function of these areas is described in more detail in section 5.3.1.2. SUVs include areas almost exclusively associated with the steep, rocky slopes on either side of major rivers or streams, including portions of the Umpqua River, Mill Creek, and the West Fork Millicoma River. These protected corridors vary in width from 1,000 to 4,000 feet. Slopes affected by public safety considerations fall within this category. Timber harvest may take place if compatible with resource values in these areas; however, little active management is expected other than occasional removal of danger trees.

Annual Operations Plans—A geotechnical specialist will provide initial hazard and risk assessment for timber harvesting and road construction operations in the AOP, early enough in the process to allow for proper consideration of alternatives (boundary changes, leave tree placement, etc.). Risk management may include ensuring that large wood is available in the track of potential debris slides and torrents, to promote proper conditions for future aquatic habitat inputs. The district is responsible for requesting the initial hazard and risk assessment, and any subsequent site specific review, from the geotechnical specialist. For timber harvesting and road construction operations, the following process will be used:

- Operations will be screened for high-hazard level areas (those areas of probable high slope hazards) by district personnel during operations planning field work. The findings will be reviewed by the geotechnical specialist during the AOP for assessment of risk. If the risk presents unique concerns (e.g. an active, deep-seated failure; debris flow likely to deliver to a fish stream; public safety issue) further review in the field by a geo-technical specialist may be warranted.
- Operations will be screened for moderately high-hazard level areas (those areas of probable moderately-high slope hazards) by district personnel during operations planning field work. The findings will be reviewed by the geotechnical specialist during the AOP for assessment of risk. If the risk presents unique concerns (e.g. an active, deep-seated failure; debris flow likely to deliver to a fish stream; public safety issue) further review in the field by a geo-technical specialist may be warranted.
- Operations in low-hazard level areas (those with a low chance of containing sites with a high probability of failure) will not be expected to undergo further geotechnical review. If high or moderate landslide hazard locations are identified at some other point in the planning process, the geotechnical specialist will be consulted and the site will be evaluated in the same manner as high- or moderate-hazard level areas.

The effect of the forest operation on the landslide potential (potential increase in the probability of failure or landslide rate) will be judged based on slope, landform, underlying rock material, type of operation (road building, regeneration harvest, partial cut, thinning, etc), or other geomorphic or management characteristics.

5.6.7.1. Manage Risk

If the risk is low (minimal or no likelihood of delivery to aquatic system), no management modification will be recommended.

If the risk is moderate or high, management modifications may improve the likelihood of beneficial results.

If the risk is moderate (potential to deliver but likelihood is low), further assessment will be made of the condition and significance of the aquatic resource. If the aquatic resource is already significantly degraded, the geotechnical specialist will develop recommendations for mitigating the harvest operation. Otherwise, no modifications to the operation will be made.

If the risk is high (likely to deliver to the aquatic system), the geotechnical specialist will develop recommendations for avoiding, mitigating, or minimizing the risk. This will include an evaluation of the potential debris chute or run-out channel, consistent with the criteria provided for identification of debris flow track reaches in the RMA strategies.

5.6.8. Use Forest Road Management

Conservation Measure 5.16
Manage Forest Roads

- Design, construct, improve, and maintain forest roads in accordance with the processes and standards described in the Forest Roads Manual.
- Identify and prioritize roads for closure and/or vacation using information gained from the comprehensive forest roads inventory, and in accordance with the standards described in the Forest Roads Manual.

The construction and use of forest roads is an integral part of actively managing state forest lands. Roads provide essential access for forest management activities, fire protection, and a variety of recreational uses. However, roads can be a major source of erosion and sedimentation. Proper road system planning, design, construction, and maintenance will prevent or minimize water quality problems and associated impacts on aquatic resources, and will significantly extend the useful life of a forest road. Quality information on the status and condition of existing roads is also essential to an effective maintenance or improvement program designed to meet the objectives stated above.

For the ODF transportation system, the vision is a road network that will provide effective access for all necessary activities taking place in the forest. The transportation system will be actively managed to protect all forest resources. The road network will be kept to the minimum needed to achieve forest management objectives. Barriers to fish passage created

by road crossings will be corrected. Roads will be constructed in the best locations for carrying out anticipated activities, and the standard for forest roads will be a suitable match for the terrain and type of access needed. The roads will be effectively maintained to prevent degradation to other forest resources. Unnecessary roads will be closed or vacated and, where appropriate, the land they occupied will be returned to active forest management. Adaptive resource management processes will be used to modify future practices as managers gain additional knowledge of resource needs and protection, and to learn more appropriate methods for meeting the objectives of this HCP.

The four primary areas of road system management, addressed in detail in the ODF's *Forest Roads Manual* (Oregon Department of Forestry 2000), are listed below.

- Transportation planning
- Road design, construction, and improvement (including drainage systems)
- Road maintenance
- Road closure

5.6.8.1. Design, Construct, Improve, and Maintain Forest Roads

The *Forest Roads Manual* (Oregon Department of Forestry 2000) contains specific processes, procedures, and standards for road system management. It also describes the roles and responsibilities of the various resource specialists and land managers involved in road system management.

The road system will be managed to prevent water quality problems and associated impacts on aquatic and riparian resources; minimize disruption of natural drainage patterns; provide for adequate fish passage where roads cross fish-bearing streams; and minimize acceleration of natural mass-wasting processes.

Through development and updating of the district Implementation Plan (Oregon Department of Forestry 2007), the processes and standards for transportation planning described in the Forest Roads Manual will be applied. The initial district Implementation Plan will not contain all of the transportation planning elements described in the *Forest Roads Manual* (Oregon Department of Forestry 2000), but will include information obtained from the watershed analysis.

The district has conducted a comprehensive road hazard inventory to a common standard specified through Oregon Plan for Salmon and Watersheds (Oregon Watershed Enhancement Board 1999) protocols. The information from this inventory is being used to identify priority restoration and improvement projects related to the forest roads system. The October 2003 watershed analysis for the Elliott State Forest (Biosystems et al 2003), as described in Section 5.6 of this document, "Apply Aquatic and Riparian Strategies," identified additional information needs relevant to ongoing improvement of the Elliott State Forest road network. These will be addressed through the implementation planning process.

5.6.9. Aquatic and Riparian Monitoring

There is a general need to understand implementation of the aquatic and riparian strategies, including the amount of riparian areas with management in the inner zone. In addition, one of the key aquatic and riparian assumptions that should be tested is that tree retention standards along small perennial non-fish-bearing stream reaches are sufficient to meet management goals related to properly functioning conditions. The following monitoring projects will be conducted to address these needs.

Implementation Monitoring

Comprehensive monitoring will be conducted on a subset of harvest units to determine implementation of riparian and aquatic strategies. The proportion of harvest plans to manage riparian inner zones will be quantified, or alternative vegetation treatments will be applied.

Shade, Riparian Characteristics, and Water Quality on Small Perennial Type N Streams

On a subset of harvest units with small perennial Type N streams, riparian and buffer characteristics, shade, and water quality parameters (e.g., stream temperature, macroinvertebrates, or sediment) will be monitored before and after harvesting. This project will be coordinated with amphibian-related monitoring as described in Chapter 9.

Key Terms

Basal area—The area of the cross-section of a tree stem near the base, generally at breast height (4.5 feet above ground) and including the bark. The basal area per acre is the total basal area of all trees on that acre.

Co-dominant—Trees with crowns that form a general level of crown stratum and are not physically restricted from above, but are more or less crowded by other trees from the sides.

Cohort—A group of trees regenerating after a single disturbance. The age range within a cohort may be as narrow as one year or as wide as several decades, depending on how long trees continue invading after a disturbance.

Connectivity—A measure of how well different areas (patches) of a landscape are connected by linkages, such as habitat patches or corridors. At a landscape level, the connectivity of ecosystem functions and processes is of equal importance to the connectivity of habitats.

Danger tree—A standing tree, alive or dead, that presents a hazard to personnel due to deterioration or physical damage to the root system, trunk (stem), or limbs, and the degree and direction of lean.

Diameter breast height—Diameter of a tree at breast height (4.5 feet above the forest floor on the uphill side of the tree).

Decadence—Process of decay, or condition of being in a decayed state, particularly as related to trees or stands of trees. Typified by the presence of pathogens causing various forms of rot, and often used to refer to the presence of snags and downed wood. A process influential in multiple aspects of ecosystem development from providing cavities for wildlife, to creating gaps in the canopy, to altering forest floor climate and structure.

Disturbance—A force that causes significant change in an ecosystem's structure and/or composition. Disturbance can be caused by natural events such as fire, flood, wind, earthquake, and insect or disease outbreak, or by human activities.

Dominant—Trees with crowns that extend above the general level of crown cover of other trees of the same stratum and are not physically restricted from above, although possibly somewhat crowded by other trees on the sides.

Downed wood—Fallen trees or pieces of trees on the forest floor or in the stream channel that provide many important functions such as mineral cycling, nutrient mobilization, maintenance of site productivity, natural forest regeneration (nurse logs), substrates for mycorrhizal formation, and diverse habitats for fish and wildlife species.

Interior habitat—The portion of the older forest patch that remains effective when the negative effects of high-contrast edge are removed.

Late successional habitat—A forest stand typically characterized by a multi-layered, multi-species canopy dominated by large overstory trees; numerous large snags; and abundant large woody debris (such as fallen trees) on the ground. Other characteristics such as canopy closure may vary by the forest zone (lodgepole, ponderosa, mixed conifer, etc.).

Key Terms (continued)

Legacy structures—Structural components within a forest stand that are retained during harvest operations, and that provide habitat diversity in the future stand. Examples of legacy structure include live trees, snags, and downed wood.

Minor tree species—For a given stand, tree species that occur as a relatively small component of the stand, such as western red cedar or alder in a stand consisting mostly of Douglas-fir trees.

Non-silviculturally capable—Areas that are rocky, swampy, covered by water, or for various other reasons have little to no commercial value for timber production. The Elliott State Forest has a few parcels of rocky or swampy lands scattered throughout the forest. Most are less than 5 acres, although a few are as large as 20 acres.

Old growth—A forest stand typically characterized by a patchy, multi-layered, multi-species canopy dominated by large overstory trees, some with broken tops and decaying wood; numerous large snags; and abundant large woody debris (such as fallen trees) on the ground. In western Oregon, old-growth characteristics begin to appear in unmanaged forests at 175 to 250 years of age. (See "late successional habitat.")

Patch—The landscape patch is an environmental unit between which "quality" differs, such as a habitat patch.

Regeneration harvest—The removal of trees to make regeneration possible or to assist in the development of the established regeneration (young trees). The most common type of regeneration harvest in the Elliott State Forest is a modified clearcut, leaving specified amounts of live trees, snags, and downed wood.

Residual live trees—Live trees that are retained to provide short-term habitat needs of wildlife species, to serve as a source of future snags and downed wood, and to provide legacy trees in future stands. This term also refers to live trees present in a stand that are legacies of a previous cohort of trees.

Salvage—Salvage cutting is the utilization of standing or downed trees that are dead, dying, or deteriorating, for whatever reason, before the timber values are lost.

Snag—The standing portion of a dead tree

Stand—A patch of forest distinct in composition or structure, or both, from adjacent areas.

Suppressed—Trees with crowns entirely below the general level of dominant and co-dominant trees and physically restricted from immediately above.

Telemetry—The process of remotely monitoring an animal and its movements by radio transmissions from a device attached to the animal.

Windthrow—Trees felled by high winds.

Chapter 6
Northern Spotted Owls

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This chapter describes benefits and effects, additional minimization and mitigation measures, and monitoring and adaptive management methods specific to the northern spotted owl.

Other chapters in this Habitat Conservation Plan (HCP) present information essential to understanding this chapter. Chapter 5 details the underlying landscape management context in which northern spotted owl conservation strategies will be implemented, Chapter 4 provides biological information for northern spotted owls on Elliott State Forest lands, and Chapter 11 presents a framework for adaptive management. It is necessary to read all chapters to understand completely the Oregon Department of Forestry's (ODF's) habitat conservation strategies.

6.1. BACKGROUND

6.1.1. Northern Spotted Owl Recovery Plan

The *Recovery Plan for the Northern Spotted Owl* (the NSO Recovery Plan) was finalized in May 2008 (U.S. Fish and Wildlife Service 2008). This Plan describes long-term and interim objectives (for the next ten years) for northern spotted owl recovery and outlines the strategies designed to address the most important range-wide threats to the northern spotted owl. The Recovery strategy has three essential elements: barred owl control, dry-forest landscape management strategy, and Managed Owl Conservation Areas (MOCAs).

The NSO Recovery Plan relies on Federal lands to provide the major contribution for spotted owl recovery. In addition to more recent information on threats to the northern spotted owl posed by the barred owl, the recovery strategy builds on concepts presented in earlier documents such as the Interagency Scientific Committee (ISC) report "A Conservation Strategy for the Northern Spotted Owls, and the 1992 Final Draft Recovery Plan for the Northern Spotted Owl (USFWS 1992). The 1992 draft Recovery Plan remains the most recent northern spotted owl-specific analysis of habitat needed to provide for a sustainable population of northern spotted owls across the species' range. The 2008 NSO Recovery Plan relies on this analysis and is focused on managing large blocks of suitable habitat in designated conservation areas throughout the range of the northern spotted owl, and spacing the blocks and managing the areas between them to permit movement of northern spotted owls between blocks.

6.1.2. Federal Land Commitments to Northern Spotted Owl Conservation

The Forest Ecosystem Management Assessment Team developed a series of alternatives on how best to provide habitat for late-successional and old-growth forest related species, including the northern spotted owl. These alternatives were also designed to meet other management goals on federal lands administered by the U.S. Fish and Wildlife Service and the Bureau of Land Management within the range of the northern spotted owl. Based on the 1992 Draft NSO Recovery Plan and the ISC report (Thomas et al. 1990), the Forest Ecosystem Management Assessment Team proposed a network of habitat conservation areas throughout the range of the northern spotted owl. The management objective for these conservation areas is the development and maintenance of habitat that will support well-distributed population clusters of northern spotted owls. As a result, a network of late successional reserves is now spread across federal lands in western Washington, western Oregon, and northern California (USDA Forest Service et al. 1993). For late successional reserves, the management emphasis is for "restoration and maintenance of late-successional forest habitat" (USDA Forest Service et al. 1994a). These commitments are currently being implemented by the Federal Northwest Forest Plan adopted in 1994 (USDA Forest Service et al. 1994a), which defines the federal land contribution to northern spotted owl recovery. The 2008 NSO Recovery Plan considered these commitments in development of the strategy for MOCAs and Conservation Support Areas (CSAs).

6.1.3. Northern Spotted Owl Conservation on Non-Federal Lands

Although the NSO Recovery Plan relies on federal lands to provide the major contribution for northern spotted owl recovery, it also recognizes that non-federal forests are important to the northern spotted owl's conservation needs in some key areas of the species range, in part because federal lands are limited in distribution or in habitat condition. In particular, Conservation Support Areas between or adjacent to MOCAs are identified where habitat contributions by private, State, and Federal lands are expected to support the MOCA network and the dry-forest landscape management approach. In addition, all landowners (federal and non-federal) are encouraged to maintain older, multi-layered forests. The Elliott State Forest is not included in any CSA designation.

Overall, the contribution to recovery by non-federal lands will be to enhance the viability of the local or regional northern spotted owl population beyond that which is possible solely through federal land conditions.

6.1.4. Northern Spotted Owls on the Elliott State Forest

Northern spotted owl surveys were conducted in the Elliott State Forest from 1992 to 1998. In 2003, a survey for northern spotted owls in the Elliott State Forest was conducted to compare the population density of northern spotted owls on the forest with previous years. (Appendix F). This survey covered 48 areas where northern spotted owls had been observed in the past (Appendix F; Table F-4). These 48 areas represented 17 sites that were occupied during the last survey in 1998, two new resident sites, one new status unknown site, 11 areas where owl responses were determined to be non-territorial and 17 sites that once were occupied and that had been vacant for three consecutive years and classified as historic at some point in the past. The 2003 density study estimated 25 northern spotted owls present in 13 activity centers for a density of 0.034 activity centers per square kilometer, which is similar to the densities estimated from 1996 through 1998.

Although only 13 activity centers counted towards the density estimates in 2003, according to the management survey protocol, 20 sites were considered to be occupied in 2003: 16 pairs, three resident singles, and one status unknown (see key terms; Appendix F; Table F-3). The seven sites not included in the density estimates include three sites that were outside of the area covered by the original density study (including two sites on adjacent landowners), and four sites where no owls were located in 2003, but that continue to have resident status according to the management protocol because they have not been surveyed for three consecutive years with no response.

Northern spotted owl density in the Elliott State Forest declined from 1993 to 1998, but it appeared to remain relatively stable level through 2003. The declining trends in density and adult survival over the initial five-year period of the density study are cause for concern in the Elliott State Forest. However, 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.

The home range and habitat use of 16 northern spotted owls were studied in the Elliott State Forest between 1997 and 1998. Home ranges on the Elliott State Forest ranged from 1,425 to 5,555 acres, with the mean home range size of 2,735 acres. The mean core use area was 214 acres (Anthony et al. 2000b).

Northern spotted owl habitat has been described in the literature as follows:

> "…a multilayered, multispecies canopy dominated by large (larger than 30 inches in DBH) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods; a moderate to high (60 to 80 percent) canopy closure; substantial decadence in the form of large, live coniferous trees with deformities—such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags; ground-cover characterized by large accumulations of logs and other woody debris; and a canopy that is open enough to allow owls to fly within and beneath it." Thomas et al. (1990)

Blakesley (2004) summarized literature published since 1990, and concluded that the results of more recent studies characterizing stand structural attributes associated with northern spotted owl foraging, roosting, and nesting are consistent with Thomas et al. (1990), and include vertical canopy layering, tall tree height or diameter diversity, high canopy volume and canopy closure, large tree diameter, and abundant snags and logs. These stand structural attributes were characteristic of habitat whether it occurred in old-growth forest or in managed stands.

Studies conducted on northern spotted owl habitat characteristics in the Elliott State Forest (see Chapter 4) found that nesting habitat was characterized by large trees, moderate relative densities and basal areas, three snags per acre over 20 inches diameter breast height (DBH), and high amounts of downed wood (see Table 6-1). Foraging habitat had similar characteristics. Nest and foraging areas tended to have a greater abundance of large trees than did areas that received little or no use by northern spotted owls. At a landscape level, northern spotted owls selected mature, old, and "mixed age" coniferous habitats, but also selected hardwood habitats. An analysis of habitat edge types showed that northern spotted owls also selected the edge (or ecotone) between hardwood and conifer stands, and avoided certain edge types that contained pole or open components. Analysis of Stand Level Inventory (SLI) information on stands with northern spotted owl nest sites in the Elliott State Forest resulted in similar structural information (Table 6-1).

Stands with large trees, multiple canopy layers, and sufficient amounts of snags and downed wood are the most likely to provide suitable habitat for northern spotted owls in the Elliott State Forest. Advanced structure with at least eight trees per acre at least 32 inches DBH provides the most likely nesting, roosting, and foraging habitat for northern spotted owls on the Elliott State Forest, while advanced structure without the large tree component is likely to provide adequate foraging habitat for northern spotted owls. Some intermediate structure stands in a more mature stage of development may also provide adequate structure for foraging habitat for northern spotted owls, especially those intermediate structure stands at least 70 years of age.

Table 6-1
Selected Structural Characteristics of Northern Spotted Owl Nesting Sites on the Elliott State Forest as determined through Research and Inventory Plots

Characteristic	Elliott State Forest Research [1] (range) n = 9	Inventoried Stands [2] (range) n = 20
Tree diameter (inches)	24.4 (18–37)	28.4 (20.5–43)
Relative density	0.37 (0.20–0.49)	0.54 (0.24–0.94)
Basal area (square feet per acre)	203.3 (90–322)	227 (99–461)
Number of snags/acre (>20-inch DBH)	3 (1–8)	1.8 (0.3–4.7)
Volume of down wood (cubic feet per acre)	2,559 (599–7396)	1,744 (197–3792)

[1] Tappeiner, et al. 2000. Values are mean values from the "Whole Elliott," and represent values measured in fixed radius plots of 1/10 to 1/4 acre around nest sites.

[2] These values are from the inventory of stand polygons within 0.1 mile (528 feet) of known nest trees. Stand polygons varied from 22 acres to 205 acres in size, and were sampled using the ODF's SLI methodology. Therefore, these values represent a stand level compared to the plot level measured in the Elliott State Forest research studies.

6.2. CONSERVATION OBJECTIVE

The Elliott State Forest is located in a region in which northern spotted owl populations are in decline. Adjacent federal lands are being managed to provide future habitat in late successional reserves. The Millicoma Tree Farm, to the south of the Elliott State Forest, is being managed by Weyerhaeuser Corporation under an HCP to provide dispersal habitat and limited nesting, roosting, and foraging habitat for northern spotted owls.

The conservation objective for the Elliott State Forest relative to northern spotted owls is to support the distribution of northern spotted owls on federal lands by providing habitat sufficient to allow the persistence of northern spotted owls on the Elliott State Forest, and habitat sufficient to accommodate the movement and interaction of northern spotted owls across the regional landscape.

6.3. CONSERVATION STRATEGIES

The habitat conservation strategies described in Chapter 5 provide the basis for conservation of northern spotted owls under this HCP. Specifically, the following habitat conservation strategies contribute to the maintenance and development of northern spotted owl habitat and the maintenance of northern spotted owl sites on the Elliott State Forest:

- **Strategy 5.2: Manage for a Range of Stand Structures Across the Landscape**
- **Strategy 5.3: Establish Conservation Areas to Protect Special Resources**
- **Strategy 5.4: Develop Implementation Plans to Achieve a Landscape Design that Provides Functional Habitat for Native Species**

Under the forest management strategies, forestwide and basin-specific targets for advanced structure stands have been established. Threatened and endangered core (T&E core) areas surrounding occupied northern spotted owl sites have also been established. In combination with a logical landscape design, these strategies will contribute to the conservation of northern spotted owls and their habitat in the Elliott State Forest. These conservation strategies will:

- Maintain known northern spotted owl sites
- Maintain nesting, roosting, and foraging habitat across the forest through time
- Maintain habitat connectivity

6.4. KEY INDICATORS

Key indicators for the success of the habitat conservation strategies for northern spotted owls include:

- Persistence of northern spotted owl sites on the Elliott State Forest over time
- Contribution of habitat (nesting, roosting, and foraging) throughout the forest that allows northern spotted owl sites to persist
- Functional arrangement of habitat on the landscape that accommodates movement and interaction of northern spotted owls across the regional landscape

The following sections describe each indicator and the potential effects of activities covered under this HCP on the indicator, followed by the minimization and mitigation provided by the conservation strategies.

6.4.1. Persistence of Northern Spotted Owl Sites

6.4.1.1. Summary of Potential Effects

During the most recent survey of northern spotted owls on the Elliott State Forest in 2003, 13 active northern spotted owl activity centers were identified (Appendix F, p. F-7). An additional seven sites also have resident status that are either not located on state forest land, or were not located in 2003, but retained resident status from previous surveys. Harvest activities have the potential to affect these sites and sites discovered in the future through:

1. Removal or modification of habitat in proximity to nest sites, resulting in temporary or permanent displacement of northern spotted owls from nesting sites or shifts in habitat use
2. Disturbance to nesting northern spotted owls from the use of harvest-related equipment
3. Reduction of habitat within a home range below what is needed to meet the life history needs of individual sites

6.4.1.2. Summary of Minimization and Mitigation

Maintaining northern spotted owl sites involves both protecting their nesting sites and providing sufficient habitat for foraging and other activities within their home ranges.

T&E Core Areas

Conservation areas have been established, which included T&E core areas (Conservation Measure 5.5). The T&E core areas contain the nest area or activity centers for all 13 northern spotted owl sites that were active in 2003 and counted toward the density estimate. In addition, two additional T&E cores that protect sites did not meet the protocol for resident status in 2003, but northern spotted owls had been located there and had nested there in

previous years. Details on each of these activity centers and core areas are provided in Table 6-2.

Table 6-2
Northern Spotted Owl Activity Centers and T&E Core Areas

Northern Spotted Owl Activity Center	Core Area	Acres	Status	Basin	Comments
Alder Creek	Big Alder	477	Pair	5	
Benson Creek	Barn Gulch	146	Pair	6	
Dean Creek	Dean Creek	263	Pair	3	
Fourmile Creek	Fourmile Creek	174	Pair	10	
Johnson Creek	Lower Johnson	214	Pair	7	
Lockhart Road	None (within ¼ mile of Marlow Lockhart)	na	Pair	10	On private land
Lower Mill	Lower Mill	2,029	Pair	1, 2	
Marlow Creek	Lockhart Ridge	196	Pair	10	
Murphy Creek*	None	na	Pair	5	No response in 1997, 1998, 2003
Noble Creek*	None	na	Resident single	5	No response 1998, 2003
Palouse Creek*	Palouse Creek	249	Pair	8	
Panther Creek	Fish Knife	831	Resident single	11	
Roberts Creek	Lower Roberts	781	Pair	6	
Salander Creek	Salander Creek	523	Pair	13	
Sock Creek	None (within 0.15 mile of SUV and 0.5 mile of Loon Lake East)	na	Resident single	13	On BLM
Tom Fool	Loon Lake East	60	Pair	1	
Upper Mill Creek *	Camp Creek	120	Pair	1	
Upper Sock Creek*	None	na	Status unknown	13	
West Glenn	Elk Pass	304	Pair	10 11	
Wind Creek	Wind Ridge	300	Pair	4	
Total Acres		**6,667**			

*Site not meeting resident status in 2003.

The T&E core areas were designated based on specific information about the northern spotted owls on the Elliott State Forest. The median size of these T&E cores is 250 to 300 acres, and is based on the average size of the core use areas that were measured in 1997 and 1998 (approximately 214 acres). The boundaries of these T&E cores were based on telemetry information from northern spotted owls on the Elliott State Forest gathered between 1997 and 1998, where available. In particular, areas where northern spotted owls showed more concentrated use was used as a basis for these T&E core areas. Where telemetry information was not available, the location of individual core areas was based on survey and habitat information as well as on consistency with the average size of measured core use areas. Some T&E core areas do incorporate small areas of non-habitat because boundaries were drawn to maximize interior habitat by minimizing convoluted edges and discontinuous stands.

Because T&E core areas are based on known telemetry and survey information, and the selection of best available habitat adjacent to nest sites, these areas have a high likelihood of providing sufficient protection for nesting sites. In addition, other conservation areas that are at least 150 to 200 acres in size have the potential to provide new nest areas for additional northern spotted owls over time.

Management activities, if they occur at all, will be very infrequent and low intensity within T&E cores. Therefore, the habitat within these T&E cores is expected to be maintained in a suitable condition for northern spotted owls throughout the term of the Incidental Take Permit (ITP).

Two sites that have resident status and are located on the Elliott State Forest are not included in T&E core areas: Murphy Creek and Noble Creek. Although these sites have resident status according to the management protocol, they do not appear to be currently occupied. No owls were located in these areas during six surveys in 2003. No owls were located at either site during three surveys in 1998. Murphy Creek also was vacant in 1997, and in 1998, the Murphy Creek female was found at the Palouse Creek site. In addition, no T&E core areas were established specifically for the Sock Creek (BLM) or Lockhart Road (private) sites because the activity centers are not located on the Elliott State Forest. However, both of these sites are within 0.25 miles of designated conservation areas, either SUV or T&E core. Finally, no T&E core was established for the Upper Sock Creek site where status was not determined.

Seasonal Restrictions

Northern spotted owl sites discovered in the future outside of conservation areas will not be specifically designated as new T&E core areas. However, seasonal restrictions to minimize disturbance will be applied to all active northern spotted owl nest trees on ODF lands or on adjacent ownership during the term of the ITP, according to the following conservation measure. Appropriate disturbance standards will be applied in proximity to known nest sites when management activities are planned. As a result, the potential for disturbance to nest sites during the nesting season will be minimized.

Northern Spotted Owl Conservation Measure 6.1:
Apply Seasonal Restrictions to Known Active Nest Trees Outside of T&E Core Areas

Outside of T&E core areas, seasonal restrictions to minimize disturbance will be applied to known active owl nest trees during the term of the ITP. When management activities are planned, the following disturbance standards will be applied, unless there is a fire emergency in the ITP area (USDI Fish and Wildlife Service 2004b):

- Harvest of advanced structure within ¼ mile of known active nest trees will not be allowed from March 1 to July 7.
- Harvest in a 70-acre core surrounding an active nest tree will not be allowed from March 1 to September 30, unless there is contiguous advanced structure to the core area that is not part of the harvest operation.
- Known nest trees will be retained as part of the live tree retention in harvest units, unless prohibited by safety concerns or operational constraints.
- From March 1 to July 7, the use of explosives will be prohibited as follows: those associated with rock quarries in or within 1.0 mile of an active tree nest, and those associated with road construction in or within 0.25 mile of an active nest tree.
- Aircraft conducting work for the ODF (including Type I helicopters) will be prohibited from flying within 500 feet of an active nest tree from March 1 through July 7.
- The operation of chainsaws will not be allowed within 200 feet of an active nest tree from March 1 through July 7, except as described below.
- The operation of heavy equipment will not be allowed within 100 feet of an active nest tree from March 1 through July 7, except as described below.
- Burning will not be allowed within ¼ mile of an active nest tree from March 1 through September 30.

The following activities are not considered disturbance:

- Ground application of chemicals and fertilizer, trapping, forage seeding, manual brush cutting without chainsaws, planting, surveying, pruning, roadside seeding, harvest of minor forest products, and snag creation by girdling or chemical injection
- The operation of chainsaws between July 7 and March 1, or farther than 200 feet from an active nest tree

Habitat Outside of T&E Cores

Additional protection for northern spotted owls inhabiting these T&E core areas will be provided through maintenance and development of habitat outside of T&E core areas that is needed to meet the basin targets for advanced structure (Conservation Measure 5.4; Table 5-1). Because all conservation areas are counted as advanced structure, Basins 1, 2, and 9 meet the basin targets for advanced structure within the conservation areas (Table 6-3). No additional advanced structure is required to be maintained or developed outside of conservation areas in these basins. For the remaining basins that do not meet the basin targets for advanced structure within the conservation areas, additional advanced structure will be maintained and developed on the landscape outside of conservation areas.

Basins with at least 40 percent advanced structure are likely to provide sufficient amounts of advanced structure habitat for connectivity of habitat for northern spotted owls on the landscape, particularly if they are in a functional arrangement (minimizing fragmentation).

The guidelines for landscape design encourage a functional arrangement of habitats within a basin (5.4.2). Only basins 9 and 10 have advanced structure targets less than 40 percent. There is a higher risk of insufficient habitat to sustain northern spotted owls in these basins over the long term. Basins 2 and 12 have advanced structure targets of 40 percent. Because a portion of this target will be met by riparian areas, which will provide functional habitat only if located adjacent to other habitat, there is also a risk of insufficient habitat in these basins to support resident northern spotted owls. However, these basins are likely to provide for dispersal of northern spotted owls through the landscape. There were no resident northern spotted owls in basins 2, 9, or 12 as of 2003.

The remaining basins—1, 3, 5, 8, 11, and 13 (50 percent target) and 4, 6, and 7 (60 percent target)—currently have or will achieve 40 percent advanced structure or more, not including the riparian areas, and are likely to provide sufficient amounts of habitat for support of resident northern spotted owls. These basins all had resident northern spotted owls as of 2003.

The requirement for 500 acres of advanced structure incorporating a T&E core area in each basin (Conservation Measure 5.6) will ensure that habitat will be provided in proximity to T&E core areas, and that nest sites are not isolated but connected to other advanced structure habitats.

Table 6–3
Advanced Structure in T&E Core and SUV Areas and Outside Conservation Areas

Basin Name	Basin Acres	Acres in T&E Core and SUV	% Basin in T&E Cores and SUV	% Basin in Riparian Outside T&E Cores and SUV	Basin Target for Advanced Structure
1 - Mill Creek	5,354	2,452	46%	4%	50%
2 - Charlotte-Luder	6,422	2,187	34%	5%	40%
3 - Dean Johanneson	7,296	612	8%	6%	50%
4 - Scholfield Creek	4,990	351	7%	8%	60%
5 - Big Creek	7,823	558	7%	9%	50%
6 - Benson-Roberts	7,417	1,171	16%	7%	60%
7 - Johnson Creek	6,322	271	4%	8%	60%
8 - Palouse Larson	6,541	1,082	17%	7%	50%
9 - Henrys Bend	8,284	1,787	22%	7%	30%
10 - Marlow-Glenn	6,512	1,152	18%	8%	30%
11 - Millicoma Elk	10,873	1,395	13%	9%	50%
12 - Trout Deer	11,314	1,840	16%	9%	40%
13 - Ash Valley	4,132	968	24%	6%	50%

6.4.2. Contribution of Nesting, Roosting, and Foraging Habitat Across the Forest Through Time

Foraging habitat for northern spotted owls is assumed to be equivalent to advanced structure under this HCP. Under this assumption, at the initiation of this HCP, approximately 43 percent of the Elliott State Forest consisted of foraging habitat for northern spotted owls (Table 6-4). Nesting and roosting habitat for northern spotted owls in this HCP is assumed to be equivalent to advanced structure that has at least 8 trees per acre greater than 32 inches DBH. Under this assumption, at the initiation of this HCP, approximately 28 percent of the Elliott State Forest consisted of nesting and roosting habitat for northern spotted owls (see Table 6-4). In addition to advanced structure, some intermediate structure stands in later stages of structure development will provide suitable habitat for foraging and roosting.

Table 6-4
Northern Spotted Owl Habitat on the ESF at Initiation of HCP – Acres Within Conservation Areas, by Type, and Outside of Conservation Areas

Habitat Type	Total Habitat in Plan Area at Start of Plan	Habitat within Conservation Areas				Outside Conservation Areas
		Total	T&E Core	SUV	Riparian	
Nesting, roosting, foraging habitat (advanced structure with eight trees per acre at least 32" DBH)	25,698	8,622	5,857	976	1,789	17,076
Foraging habitat (all advanced structure)	41,716	13,159	8,410	2,070	2,679	28,557
Intermediate structure	44,090	8,723	3,219	1,851	3,653	35,367
Early structure & Non forest	7,476	716	180	96	440	6,760

6.4.2.1. Summary of Potential Effects

Harvest activity has the potential to effect nesting, roosting, and foraging habitat through:

1. Removal of advanced structure. An estimated 20,000 acres of advanced structure will be harvested over the 50-year term of this plan (Table 6-5). Included in this number is approximately 12,500 acres of advanced structure with at least eight 32-inch DBH trees per acre (62 percent).
2. Development of advanced structure. It is projected that approximately 13,000 acres of advanced structure ingrowth will have been retained on the landscape by the end of the permit term. Approximately 5,400 of these acres are projected to have at least eight trees per acre greater than or equal to 32 inches DBH (41 percent).
3. Reduction in amount of advanced structure through removal and modification within a home range below what is needed to meet the life history needs of individual sites.

See Table 6-5 for a summary of effects to advanced structure.

Table 6-5
Projected Effects of the Plan on Acres of Advanced Structure According to Harvest Model

Structure Type	Total Time 0[1]	Inside Conservation Areas			Outside Conservation Areas					Total Time 50[6]
		Time 0	Ingrowth[2]	Time 50[3]	Time 0	Harvest[4]	Ingrowth	Maintenance[5]	Time 50	
Advanced structure (foraging habitat)	41,716	13,159	7,767	20,926	28,557	20,081	13,136	11,518	21,612	42,538
Advanced structure with large trees (nesting, roosting, foraging habitat)	25,698	8,622	5,919	14,541	17,076	12,488	5,432	7,534	10,020	24,561

[1] Time "0" acres are from District GIS. Ingrowth, Harvest, and Maintenance acres are from harvest model.

[2] Ingrowth = acres developed into advanced structure during the 50-year period.

[3] Time 50 acres are sum of Time 0 acres plus ingrowth, and subtracting any harvest. This number may differ from the harvest model estimate since it uses District GIS information.

[4] Harvest = total acres of advanced structure regeneration harvested for 50 years

[5] Maintenance = total acres of advanced structure maintained as advanced structure throughout the 50-year period (subject to partial cutting only).

[6] Total Time 50 = total acres of advanced structure present on the forest at year 50. This number may differ from the harvest model estimate since it uses District GIS information.

6.4.2.2. Summary of Minimization and Mitigation

Suitable habitat for northern spotted owls will be provided on the Elliott State Forest through conservation areas, and through the maintenance and development of advanced structure outside of conservation areas to meet basin targets for advanced structure.

Conservation Areas

T&E core areas (approximately 11,800 acres) and SUVs (an additional 4,500 acres outside of T&E cores) have been established within all management basins where little or no active management will occur (Conservation Measure 5.5). These areas provide stands of advanced structure in configurations functional for use by northern spotted owls. T&E core areas comprising over 6,800 acres of conservation areas currently include nesting areas for northern spotted owls. The remaining T&E cores that do not currently contain the activity center for a northern spotted owl are, however, composed primarily of advanced structure stands; nine of these are at least 200 acres in size. Thus, several additional T&E core areas currently provide habitat for northern spotted owls and have the potential to provide core nesting areas for northern spotted owls in the future (see Table 5-2). The majority of area in SUV outside of T&E cores occurs in larger contiguous patches with the potential to provide core nesting areas for northern spotted owls.

Maintenance and Development of Advanced Structure

At the initiation of this HCP, approximately 66 percent of the area within T&E Cores and SUVs was classified as advanced structure, with an estimated 65 percent of this advanced structure having at least eight trees per acre greater than or equal to 32 inches DBH. No advanced structure will be harvested within the conservation areas. In addition, over the permit term, intermediate structure will eventually develop into advanced structure. By the end of the permit term, model projections indicate that 91 percent of the area within T&E cores and SUVs will consist of advanced structure habitats, and that 78 percent of this total will have eight trees per acre at least 32 inches DBH.

Additional nesting, roosting, and foraging habitat will be provided through the maintenance and development of advanced structure outside conservation areas. A range of 40 to 60 percent advanced structure will be maintained across the Elliott State Forest (including conservation areas) through time. Fifty percent of the advanced structure across the forest will have at least eight trees per acre greater than or equal to 32 inches DBH (Conservation Measure 5.2). Basin targets for advanced structure (Conservation Measure 5.4; see Table 5-1) are in place to ensure that the advanced structure is distributed across the forest and is focused in areas where northern spotted owls are resident.

Outside of the conservation areas, development and maintenance of advanced structure will be achieved through stand management activities to increase stand diversity (thinning and partial cuts). According to model projections, an estimated 11,500 acres of current advanced structure will be maintained outside conservation areas over the term of the permit, through these types of management activities and approximately 7,500 acres of this advanced structure will have larger trees. In addition, model projections estimate that approximately 13,000 acres of advanced structure ingrowth would be retained on the forest outside of

conservation areas at the end of the permit term, with approximately 5,400 of these acres having the eight larger trees per acre (see Table 6-5).

Two key assumptions of this HCP are that advanced stand structure[1] provides foraging habitat for northern spotted owls, and that advanced structure with eight trees per acres at least 32 inches DBH provides nesting and roosting habitat for northern spotted owls. These assumptions are based on information from the literature and from research in the Elliott State Forest. To test these assumptions about northern spotted owl habitat, monitoring projects will be established in a sub-sample of stands to determine and track development of stand structure and northern spotted owl habitat suitability (see Section 6.5 and Chapter 11).

6.4.3. Maintaining Habitat Connectivity Through Application of Landscape Design Principles

6.4.3.1. Summary of Potential Effects

Harvest activity has the potential to affect habitat connectivity through:

1. Reduction in amount of advanced structure through removal and modification within a home range below what is needed to meet the life history needs of individual sites
2. Change in arrangement of advanced structure on the landscape that affects the connectivity of suitable habitat

Because spatial locations of advanced structure outside core areas are not spatially explicit, the possibility exists that habitat will not be in a functional arrangement.

6.4.3.2. Summary of Minimization and Mitigation

This HCP includes both forestwide and basin-specific targets for advanced structure stands, establishment of conservation areas, and a logical landscape design developed during implementation planning. Combined, these strategies will provide for landscape connectivity for northern spotted owls across the Elliott State Forest. In management basins with relatively high levels of advanced structure (at least 40 percent), connectivity is likely to be provided for many species by the high amount of this habitat type. However, in basins where advanced structure targets are relatively low, the arrangement of advanced structure patches becomes more important.

There are several approaches to achieving connectivity of habitat on a landscape, including reserves, corridors, riparian habitats, stepping stones, stand structural complexity, and landscape level habitat goals. Approaches used in this HCP are described briefly below.

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[1] Advanced structure is defined as having 20 or more trees per acre of 18 inches or larger DBH and 100 feet or more in height, of which at least 10 overstory trees per acre are at least 24 inches DBH (the quadratic mean diameter is 15 inches or more based on trees of at least 4 inches DBH); understory trees average 30 feet in height; the basal area of these stands will be at least 150 square feet per acre, and no more than 325 square feet per acre.

Conservation Areas

An analysis of the late successional reserves in the Northwest Forest Plan concluded that the reserves on their own do not maintain late seral connectivity for all species, particularly in the Coast Range, or for species with large home ranges (Richards et al. 2002). Midspatial-scale reserves managed primarily for conservation goals (Lindenmayer and Franklin 2002) can provide connectivity between larger scale reserves on the landscape (e.g., late successional reserves on federal lands).

T&E core areas and SUVs function as midspatial-scale reserves by providing patches of primarily advanced structure habitats, which will be maintained throughout the term of the ITP with minimal if any management. T&E core areas provide core habitat to support occupied northern spotted owl sites. Combined with SUVs, they facilitate connectivity between late successional reserves on federal lands (Conservation Measure 5.5).

By developing and maintaining at least one patch of at least 500 acres of advanced structure in each basin (Conservation Measure 5.6), larger patches of interior habitat will be provided to support occupancy by northern spotted owls. In addition, better connectivity between T&E core areas will be ensured by minimizing the distance between patches of advanced structure in a basin. By limiting the amount of early structure that is adjacent to T&E cores, and providing some advanced structure around T&E cores, interior habitat values for northern spotted owls will be enhanced (Conservation Measure 5.6).

Finally, the Riparian Management Areas described in the aquatic and riparian strategies provide connectivity on the landscape. Riparian inner zones are linear reserves along aquatic habitat features that provide connectivity throughout the stream network of a watershed. Riparian reserves may provide connectivity for northern spotted owls and other upland species when they are adjacent to stands with habitat values for northern spotted owls, including advanced structure and some intermediate structure stands.

Maintenance and Development of Advanced Structure

In addition to midspatial-scale reserves, stepping stones patches of late seral habitat can be provided through the management of patches of suitable habitat on a landscape over time that are not necessarily in reserves (Richards et al. 2002). These stepping stones may be the best way of providing connectivity for mobile species that can readily move across the matrix between roosting and foraging locations (Lindenmayer and Franklin 2002). Maintenance and development of advanced stand structure outside the conservation areas provides stepping stones of habitat on the landscape.

Stands that are managed to develop into advanced structure will be managed to include at least six snags per acre and abundant downed logs. When the “matrix” between reserves is managed such that appropriate vegetation cover or key structures for species are provided for across the landscape, the intervening landscape acts as a movement filter rather than a movement barrier (Lindenmayer and Franklin 2002). Rosenburg and Raphael noted that even small forest patches retaining down logs or large snags appeared to support forest-interior species associated with those elements (Rosenburg and Raphael 1986). Stands with these characteristics will support connectivity for northern spotted owl habitats.

Basin Targets for Advanced Structure

Landscape-level goals for structures and habitat conditions are another approach to achieving landscape connectivity. Examples include minimum area-based objectives for northern spotted owl dispersal and nesting, roosting, and foraging habitat, and maximum limits in the amount of recently cutover areas (Lindenmayer and Franklin 2002).

In this HCP, 40 to 60 percent of the forest landscape will be managed for advanced structure, with targets in individual management basins varying from 30 to 60 percent advanced structure. Another 25 to 55 percent of the forest will be in intermediate structure; the later stages of this structure will be likely to provide adequate foraging and dispersal habitat. The targets for advanced structure across the forest and by basin should be sufficient to provide habitat connectivity for northern spotted owls. Basin targets guarantee that distribution of habitat occurs across the forest and is not concentrated in one area.

In a study modeling northern spotted owl habitat in the Coast Range, Richards et al. (2002) found that a threshold of 40 percent habitat within a northern spotted owl home range resulted in a distribution of home ranges throughout the study area similar to known distribution of northern spotted owl habitat. In addition, a range of 30 to 60 percent advanced structure is consistent with the results of modeling efforts examining levels of habitat that may provide connectivity on a landscape (Andrén 1994; Monkkonen and Reunanen 1999; Richards et al. 2002; With and Crist 1995; With et al. 1997). When habitat is below the critical threshold, some of the potential effects include: 1) disrupted ecological processes; 2) increased potential for disturbance; 3) altered interactions between species; 4) altered movement patterns; and 5) destabilized population dynamics (Lindenmayer and Franklin 2002).

Other Stand Structure Types

In addition to advanced structure, intermediate structure will range from 25 to 55 percent of the forest. Many intermediate structure stands also will provide habitat that allows for movement and interaction of northern spotted owls across the regional landscape. In addition, some intermediate structure stands in later stages of structure development will provide suitable habitat for foraging and roosting.

Landscape Design Principles

Section 5.4.2 describes landscape design principles that will be applied during implementation planning. These principles include planning for larger blocks of advanced structure, locating smaller patches closer together than larger patches, and maintaining riparian inner zones in an advanced structure condition. Application of these principles during implementation planning will improve connectivity of the landscape for northern spotted owls.

6.5. MONITORING

Assumptions

The landscape management strategies will provide habitat sufficient for the persistence of northern spotted owl sites in the Elliott State Forest, and sufficient to accommodate movement and interaction of the northern spotted owl across the regional landscape.

- T&E core areas will maintain habitat sufficient to allow northern spotted owl pairs to persist.
- Advanced stand structure provides nesting, roosting, and foraging habitats for northern spotted owls.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow northern spotted owls to persist.
- Active silvicultural management can result in the development of habitat for northern spotted owls.
- Intermediate structure stands provide some foraging habitat and allow for movement and interaction of northern spotted owls across the regional landscape.
- Implementation of landscape design principles results in a landscape that provides connectivity for northern spotted owls.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and northern spotted owl habitat suitability as an objective of activities described in Section 11.3.3.5 at 10-year intervals. This study would determine what proportion of advanced structure stands also have characteristics of northern spotted owl habitat. Northern spotted owl habitat suitability would be determined by similarity to inventoried stands occupied by northern spotted owls (see Table 6-1).
- Conduct periodic density studies to assess the population of northern spotted owls on the Elliott State Forest and where they are located. Studies would use established density protocols for one year and survey all suitable habitat. Studies would occur at approximately eight-year intervals. These studies would address the questions of whether northern spotted owls are persisting on the Elliott State Forest; whether they are continuing to use T&E cores; and whether or not northern spotted owls are using developed habitat.

Key Terms

Active nest tree—A tree or snag in which a nest is tended during the breeding season by a pair of northern spotted owls.

Activity center—The nest tree, or the location best describing the focal point of the activity of a northern spotted owl or pair of northern spotted owls when the nest location is not known.

Core area—An area of contiguous suitable habitat surrounding a nest site or activity center.

Core use area—Areas of concentrated use within the home range identified by calculating an average observation density of all locations for an individual northern spotted owl and determining the contour where the observation density is greater than average. This contour does not have a connotation of statistical significance, but it delimits an area of concentrated use. The advantage to this approach is that it avoids arbitrary selection of contours, and each core area is based only on the density of locations for that particular northern spotted owl (Seaman et al. 1998).

Historic status (aka unoccupied) – Established by:

- No responses from an historical site after 3 years of protocol survey

Home range—The area within which an animal conducts its activities during a defined period of time (generally determined through radio-telemetry monitoring).

Non-territorial – Established by:

Responses over the survey period that to not meet resident status. As opposed to the status unknown category, this category is commonly used when the survey protocol (1 year or 2 year) has been completed and 2 or fewer responses were observed.

Northern spotted owl circle—An area defined by the provincial radius circle around a northern spotted owl activity center. On the Elliott State Forest, the provincial radius is 1.5 miles.

Northern spotted owl site—A territory occupied by northern spotted owls.

Pair status—Established by any of the following:

- A male and female are heard and/or observed (either initially or through their movement) in proximity (less than 1/4 mile apart) to each other on the same visit; or
- A male takes a mouse to a female; or
- A female is detected (seen) on a nest; or
- One or both adults are observed with young.

Resident single status—Established by:

- The presence or response of a single northern spotted owl within the same general area on three or more occasions within a breeding season; or
- Multiple responses over several years (e.g., two responses in year 1 and one response in year 2, from the same general area).
- The presence or response of two birds of the opposite sex where pair status cannot be determined and where at least one member meets the other resident single requirements. (Note: This is considered “two birds, pair status unknown” in the survey protocol. This is lumped with the resident single category because management options are the same as for resident singles.)

Key Terms (continued)

Site status—The occupancy status of a surveyed area, as defined by the survey protocol (USFWS 1990).

Status Unknown – Established by:

- The response of a male and/or female which does not meet any other definition (e.g. fewer than three responses during a survey period). This is generally used after the first year of a two year survey.

Chapter 7
Marbled Murrelets

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This chapter describes the benefits and potential effects of the conservation strategies on marbled murrelets outlined in Chapter 5. Additional minimization and mitigation measures specific to the marbled murrelet are also described.

Other chapters present additional information essential to understanding this chapter. Chapter 4 describes the current condition of marbled murrelets on Elliott State Forest lands. Chapter 5 details the underlying landscape management context in which marbled murrelet conservation strategies will be implemented. Chapter 10 provides a framework for adaptive management, within which can be found a discussion of monitoring activities specific to the marbled murrelet. It is important to read all chapters to understand completely the Oregon Department of Forestry's (ODF's) habitat conservation strategies.

7.1. BACKGROUND

7.1.1. Marbled Murrelet Recovery Plan

The federal *Recovery Plan for the Marbled Murrelet* (USDI Fish and Wildlife Service 1997) (hereinafter referred to as the Recovery Plan) details the major threats to marbled murrelet populations in six recovery zones along the coast of Washington, Oregon, and California. Within these recovery zones, the following overall federal recovery objectives for the species are noted (USDI Fish and Wildlife Service 1997):

- To stabilize and then increase population size throughout the listed range
- To provide conditions in the future that allow for a reasonable likelihood of continued existence of viable populations
- To gather necessary information to develop de-listing criteria

Although the marbled murrelet is dependent on ocean habitats for much of its life cycle, the role of forest habitats in supporting nesting and reproduction makes forest management a factor in whether the above objectives ultimately will be achieved. In recognition of this, the Recovery Plan makes a number of recommendations specific to forest management. (After each of these federal recommendations, a citation to the appropriate section of the Recovery Plan is given in parentheses.)

- Maintain currently occupied sites and minimize the loss of suitable unoccupied habitat on non-federal lands, until additional information is obtained and the Recovery Plan objectives can be revised and updated (3.1.1.1 and p.123).
- Maintain potential and suitable habitat in larger blocks, while maintaining north-south and east-west distribution of habitat (3.1.1.2).
- Maintain and enhance buffer habitat surrounding occupied habitat. Buffer habitat will mediate the effects of edge and should be a minimum of 300 to 600 feet and consist of whatever stand age is present (3.1.1.3).
- Minimize nest disturbances to increase reproductive success (3.1.3).
- Increase the amount and quality of suitable nesting habitat (3.2.1).
- Decrease fragmentation by increasing size of suitable stands for interior habitat (3.2.1.1).
- Protect “recruitment” nesting habitat (3.2.1.2).
- Use silvicultural techniques to decrease development time for new habitat (3.2.1.3).
- Improve and develop north-south distribution of nesting habitat (3.2.2.1).
- Improve and develop east-west distribution of habitat (3.2.2.2).
- Initiate research to guide the recovery effort (4).

7.1.2. Federal Land Commitments to Marbled Murrelet Conservation

A network of late successional reserves creates the foundation of the federal conservation strategy (USDA Forest Service et al. 1994a). These reserves and other designated areas (e.g., Congressionally withdrawn lands) encompass approximately 89 percent of the estimated marbled murrelet habitat on lands managed by the U.S. Forest Service and the Bureau of Land Management. Suitable habitat within these designated areas will be protected, and stands that are not currently suitable will be protected or managed to develop characteristics that support nesting marbled murrelets.

Outside of designated withdrawals, suitable habitat on federal lands will be surveyed before forest-modifying activities. If behaviors indicating marbled murrelet occupancy are observed, protections will be placed on the contiguous suitable and recruitment habitat within 0.5 mile of the occupied behavior.

The use of reserves, coupled with the survey and protection of occupied marbled murrelet habitat within matrix lands, attempts a "very low risk" strategy aimed at achieving three primary goals on federal lands. These goals, outlined in the Recovery Plan, are: "(1) the stabilization or improvement of nesting habitat through protection of all occupied habitat (both current and future), (2) the development of future habitat in large blocks (creating more interior habitat and thereby possibly decreasing avian predation), and (3) the improvement of distribution of habitat, thereby improving distribution of marbled murrelet populations."

7.1.3. Marbled Murrelet Conservation on Non-Federal Lands

7.1.3.1. Conservation Recommendations

The Recovery Plan provides the guidance and information necessary to determine whether the Habitat Conservation Plan (HCP) will adequately address conservation of the species. The planning area for this HCP is primarily in the Oregon Coast Range Recovery Zone, designated as Zone 3 in the Recovery Plan. Within this zone, non-federal lands are identified as being critical to the survival and recovery of local and regionwide marbled murrelet populations, and the Elliott State Forest is noted as having large areas of suitable nesting habitat (USDI Fish and Wildlife Service 1997). Some management recommendations noted in the Recovery Plan include:

- Maintain occupied nesting habitat
- Maintain potential and suitable habitat in larger contiguous blocks
- Maintain and enhance buffer habitat surrounding occupied habitat
- Minimize nest disturbances to increase reproductive success

7.1.4. Marbled Murrelets on the Elliott State Forest

Surveys for marbled murrelets from 1992 through 2006 resulted in the discovery of 85 occupied marbled murrelet sites on the Elliott State Forest (see Appendix G for details on each site). In addition, 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. Included in the 37 nests examined in this study were 11 nests 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.

This research confirmed that marbled murrelets select large conifer trees with numerous platforms for nesting (see Chapter 4). A key finding is that nests are predominately found in trees more than 200 years old (two or three were found in 140- to 170-year-old trees). These nest trees are part of the dominant cohort of the stands in which they occur. Stand Level Inventory (SLI) information on stands with occupied marbled murrelet sites in the Elliott State Forest indicates that these stands contain large diameter trees and a range of relative densities and basal areas (Table 7-1).

Marbled murrelets nest on platforms formed on large or deformed branches with moss covering. This type of platform is generally found on large trees, greater than 30 inches in diameter—in Oregon, usually Douglas-fir, western hemlock, or Sitka spruce. Nests are generally found in stands of mature or old trees.

However, not all stands of mature trees maintain the right conditions for formation of platforms. Existing timber inventory information does not include information on availability of large platforms, and stand age or stand diameter are not reliable indicators of the presence of these structural features. The presence of large trees with deep crowns often indicates that platforms may be present. These trees often are apparent on aerial photographs and occur in patches of varying sizes, from small patches within individual stands to larger patches that cross stand boundaries.

Marbled murrelet habitat in the Elliott State Forest has been identified through analysis of aerial photos and orthophotos, and subsequently digitized as polygons. Appendix H describes the process for this mapping, and discusses a study conducted to test the effectiveness of this method. This mapped habitat has a high likelihood of representing occupied habitat in the Elliott State Forest because characteristics of mapped habitat have been demonstrated to be similar to characteristics of occupied habitat (see Appendix H). This mapped habitat constitutes approximately 18 percent of the Elliott State Forest. All mapped marbled murrelet habitat is included as advanced structure, regardless of whether or not the stand polygon within which it was mapped meets the characteristics of advanced structure.

Table 7-1
Selected Structural Characteristics of Marbled Murrelet Nesting Sites on the Elliott State Forest as Determined through Research and Inventory Plots

Characteristic	Elliott State Forest Research [1] (range) n = 10	Elliott State Forest Marbled Murrelet Habitat Mapping [2] n= 53	Inventoried Stands [3] (range) n = 43
Mean tree diameter (inches)	20 (10–37)	38 (0–62)	30 (18–39)
Relative density	47 [4]	42 [4]	53 (33–76)
Basal area (square feet per acre)	212 [4]	260 [4]	233 (145–361)
Number of snags per acre (>20-inch DBH)	Not available	Not available	4.5 (0.5–16.5)
Volume of down wood (cubic feet per acre)	Not available	Not available	1745 (0–5,521)

[1] Nelson and Wilson 2002. Values are mean values from Table 24 of this report, and represent values measured in fixed radius plots of 0.5 acre around nest sites.

[2] Appendix G. Values are mean values from Table 5 and represent values measured in 0.5-acre plots centered on occupied detections.

[3] These values are from the SLI of stand polygons within 0.1 mile (528 feet) of occupied detections. Stand polygons varied from 11 acres to 198 acres in size and were sampled using the ODF's SLI methodology. Therefore, they represent stand levels compared to the plot levels measured in the other studies.

[4] Relative density and basal area are calculated from the mean for trees per acre and the mean for tree diameter. No ranges are available.

DBH = diameter breast height

7.2. CONSERVATION OBJECTIVE

The Elliott State Forest is located in a region in which marbled murrelet populations have been declining. Adjacent federal lands are being managed to protect existing habitat and provide future habitat in late successional reserves. The conservation objective for the Elliott State Forest relative to marbled murrelets is to support regional populations of marbled murrelets by maintaining habitat sufficient for the persistence of marbled murrelet sites in the Elliott State Forest through time.

7.3. CONSERVATION STRATEGIES

The habitat conservation strategies described in Chapter 5 provide the basis for conservation of marbled murrelets under this HCP. Specifically, the following habitat conservation strategies contribute to the maintenance of habitat sufficient for the persistence of marbled murrelet sites in the Elliott State Forest through time:

- Strategy 5.2: Manage for a Range of Stand Structures Across the Landscape
- Strategy 5.3: Establish Conservation Areas to Protect Special Resources
- Strategy 5.4: Develop Implementation Plans to Achieve a Landscape Design that Provides Functional Habitat for Native Species

Under these strategies, threatened and endangered core (T&E core) areas have been established for occupied marbled murrelet sites, and forestwide and basin-specific targets for advanced structure stands have been established. These strategies will contribute to the conservation of marbled murrelets and their habitat in the Elliott State Forest by:

- Maintaining marbled murrelet occupied sites in T&E core areas.
- Maintaining marbled murrelet habitat across the forest through time.

In addition, fine filter strategies have been developed to minimize any potential negative effects of management activities on marbled murrelets. These strategies minimize the likelihood that habitat important to nesting is removed or modified during the nesting season in occupied marbled murrelet sites, and establish limits on and criteria for the harvest of marbled murrelet habitat.

7.4. KEY INDICATORS

Key indicators for the success of the habitat conservation strategies for marbled murrelets include:

- Maintaining occupied marbled murrelet sites on the Elliott State Forest over time
- Maintaining marbled murrelet habitat across the forest through time

The following sections describe each indicator and the potential effects of activities covered under this HCP on the indicator, followed by the minimization and mitigation provided by the conservation strategies.

7.4.1. Maintaining Occupied Marbled Murrelet Sites

7.4.1.1. Summary of Potential Effects

Surveys of marbled murrelets conducted from 1992 through 2006 have resulted in the discovery of 85 occupied marbled murrelet sites on the Elliott State Forest (see Appendix G for details on each site). Harvest activities have the potential to affect these sites and sites discovered in the future through:

1. Removal or modification of habitat in nesting areas that affects occupancy or nesting success. Ten of 85 occupied sites are not located within T&E core areas. One of the ten is located within a steep, unique, or visual area (SUV), leaving nine known occupied sites without specific protection within conservation areas. In addition, occupied sites located after 2006 will not be included in new T&E core areas.
2. Removal or modification of habitat in proximity to nesting areas that affects the suitability of the nesting stand or increases the susceptibility of nests to predation.
3. Disturbance to nesting marbled murrelets from the use of harvest-related equipment.

7.4.1.2. Summary of Minimization and Mitigation

The establishment of T&E core areas, the maintenance and development of advanced structure, and the application of appropriate seasonal disturbance standards will minimize the potential that habitat is removed or modified in or in proximity to marbled murrelet nesting areas, and the potential that nesting marbled murrelets are disturbed by harvest-related activities in proximity to nesting stands.

T&E Core Areas

Seventy-five of the 85 occupied sites are included within the boundaries of T&E core areas. Details on each core area are provided in Table 7-2. The boundaries of these T&E cores were based on survey information, selection of the best available habitat adjacent to observations of sub-canopy behavior, and the presence of a forested or topographic buffer designed to protect the integrity of that occupied site. The median size of the 34 marbled murrelet T&E cores is 122 acres, and these T&E cores contain over 9,300 total acres. The T&E core areas have a high likelihood of providing sufficient protection for these occupied sites, because

they are based on site specific information and include features that buffer the occupied stands.

The remaining T&E cores that do not currently contain known marbled murrelet-occupied sites have not been surveyed. These T&E cores do contain mapped marbled murrelet habitat (see Table 5-2), and may contain occupied sites currently or may provide habitat for nesting marbled murrelets in the future. Thus, the remaining T&E core areas (over 2,400 acres) have the potential to protect occupied marbled murrelet sites that have not yet been discovered.

In addition, there are approximately 4,500 acres of SUV conservation areas outside of T&E cores. These areas contain an additional 1,000 acres of mapped marbled murrelet habitat (Table 7-3). One of the occupied sites not located within a T&E core area is located within an SUV. Many other SUV areas have not been surveyed, and may contain occupied sites currently or may provide habitat for nesting marbled murrelets in the future.

Management activities within T&E cores and other conservation areas will be infrequent and of low intensity. Therefore, the habitat within these T&E cores is expected to be maintained in a suitable condition for marbled murrelets throughout the term of the Incidental Take Permit (ITP).

Table 7-2
Marbled Murrelet Occupied Sites Located in T&E Core Areas

Core Area	Acres	Number of Occupied Sites	Mapped Marbled Murrelet Habitat (acres)	Basin
Beaver Headwaters	211	1	108	10 12
Benson Top	76	1	8	6
Big Otter	97	1	48	5 12
Charlotte Knife	116	1	9	2
Dean Creek	263	1	93	3
Dry Ridge	94	1	28	6
Elk Forks	235	2	130	11
Elk Pass	304	5	71	10 11
Fish Knife	831	4	392	11 12
Glenn Headwaters	67	1	0	10
Goody Ridge	55	1	37	4
Joe Buck	772	7	285	12

Table 7-2 continued

Core Area	Acres	Occupied Sites	Mapped Marbled Murrelet Habitat (acres)	Basin
Johanneson	89	2	41	2 3
Kentuck Ridge	55	1	26	9
Knife Forks	139	2	39	12
Larson Bottom	105	2	31	8
Larson Palouse	109	1	43	8
Larson Point	58	1	24	8
Lower Mill	2029	7	712	1 2
Lower Roberts	781	2	217	6
Luder Footlog	67	1	15	2
Luder Umpqua	454	5	145	2
Marlow Bottom	143	2	41	10
Marlow Henry	257	1	86	9
Marlow Lockhart	206	3	40	10
Middle Charlotte	151	2	61	2
Middle Deer	169	2	70	12
Millicoma Schumacher	56	1	13	9
Old Maids Cabin	275	2	68	11
Panther Bench	38	1	19	11
Panther Howell	242	2	103	10 11
Right Fork Johnson	54	1	13	7
Salander Headwaters	115	1	41	13
Schumacher Headwaters	71	2	23	9
Stonehouse Point	113	2	55	9
Sullivan Creek	122	2	66	8
Trout Mouth	305	1	122	9
TOTAL	9,324	75	3,323	

Table 7-3
Mapped Marbled Murrelet Habitat by Basin
Amount and Percentage of Mapped Habitat in Different Types of Conservation Areas

Basin	Acres in Basin	Mapped Habitat in Basin (acres)	% of Basin in Mapped Habitat	Mapped Habitat in T&E Core (acres)	% of Mapped Habitat in T&E Core	Mapped Habitat in Steep, Unique, Visual Lands (acres)	% of Mapped Habitat in Steep, Unique, Visual Lands not T&E Core	Mapped Habitat in Riparian Special 1 (acres)	% of Mapped Habitat in Riparian not T&E Core or Steep, Unique, Visual Lands
1 – Mill	5,356	939	18%	715	75%	37	4%	22	2%
2 – Charlotte-Luder	6,422	1,609	25%	288	18%	425	26%	92	6%
3 – Dean-Johanneson	7,296	1,766	24%	110	6%	125	7%	144	8%
4 – Scholfield	4,990	1,182	24%	259	22%	2	0%	128	11%
5 – Big Creek	7,823	2,420	31%	221	9%	0	0%	232	10%
6 – Benson-Roberts	7,417	1,726	23%	285	17%	0	0%	108	6%
7 – Johnson	6,322	1,119	18%	71	6%	0	0%	77	7%
8 – Palouse-Larson	6,541	841	13%	187	22%	91	11%	40	5%
9 – Henry's Bend	8,284	828	10%	325	39%	141	17%	29	3%
10 – Marlow-Glenn	6,512	462	7%	294	63%	42	9%	18	4%
11 – Millicoma Elk	10,873	1,846	17%	589	30%	35	2%	253	13%
12 – Trout Deer	11,314	1,466	13%	612	40%	43	3%	132	9%
13 – Ash Valley	4,132	473	11%	246	51%	61	13%	10	2%
Total	93,282	16,680	18%	4,202	25%	1,002	6%	1,285	8%

[1] Riparian Special = Inner Zone extending 100 feet on either side of perennial stream

Outside of T&E Core Areas

Of the ten occupied sites not included within a core area, one is located in a conservation area designated as SUV. The remaining nine sites are not included in any specific conservation area. These sites represent either areas that are small and isolated from other T&E cores, or areas where there is little or questionable information on the murrelet occupancy. To minimize potential negative effects to these sites, five of the nine sites will be deferred from harvest for at least ten years, as described in Conservation Measure 7.1. The remaining four sites (1, 73, 74, and 77), totaling approximately 200 acres, will be available for harvest activities, subject to application of seasonal restrictions as described in Conservation Measure 7.2 and consideration of the retention priorities for murrelet habitat described below.

Marbled Murrelet Conservation Measure 7.1:
Defer Harvest of Selected Occupied Sites for Ten Years

The following five occupied murrelet sites are located outside of T&E cores and SUVs: Sites 32, 38, 76, 78, and 79 (see Appendix G). Harvest of these areas will not occur during the first ten years of plan implementation. After the first ten years of plan implementation, these areas will be available for harvest activities. To avoid disturbance to nesting adults and chicks, the ODF will apply seasonal restrictions during the murrelet nesting season (April 1 to September 15), as described in Conservation Measure 7.2

Additional information on marbled murrelets in the Elliott State Forest may be found in Chapter 4 and Appendix G.

Maintenance and Development of Advanced Structure

Most T&E core areas should provide adequate buffering of occupied habitat within the core area. The basin requirements for advanced structure (Conservation Measure 5.4), combined with the requirement for 500 acres of advanced structure that incorporates a T&E core area in each basin (Conservation Measure 5.6), will increase the likelihood that marbled murrelet nest sites are buffered sufficiently. Between 40 and 60 percent of the forest will be in advanced structure at any given point in time, with 25 to 55 percent of the forest in intermediate structure. These stand structure targets will increase the likelihood that potential and suitable habitat is maintained in larger contiguous blocks, and that buffer habitat surrounding occupied habitat is maintained and enhanced.

Marbled Murrelet Conservation Measure 7.2:
Apply Seasonal Disturbance Restrictions to Known Occupied Sites

To avoid disturbance to nesting adults and chicks, the ODF will apply management standards during the murrelet nesting season (April 1 to September 15) for conservation areas with murrelet-occupied sites, and for other occupied sites located on ODF forest lands or adjacent ownerships in the future. With the exception of those sites covered by Conservation Measure 7.1, sites not located in conservation areas will be available for management activities outside the nesting season. Site-specific topographic features will be considered when seasonal restrictions are applied. The following restrictions apply between April 1 and September 15, unless a fire emergency occurs in the ITP area:

- Prohibit aircraft conducting work for the ODF (including Type I helicopters) from flying within 1,320 feet (0.25 mile) and small aircraft conducting work for the ODF, including single-engine airplanes and Type II and III helicopters, from flying within 330 feet of the likely nesting habitat. Over flights must be greater than 500 feet above the likely nesting habitat.
- Prohibit the use of explosives associated with rock quarries in or within 1.0 mile, and the use of explosives associated with road construction in or within 0.25 mile of the likely nesting habitat.
- Prohibit timber harvest activities—including the use of chainsaws, yarding, and loading, and the hauling of logs, rock, and heavy equipment—or the use of heavy equipment (includes vibratory rollers) on roads that are not commonly used within 330 feet of the likely nesting habitat from April 1 through August 5. Allow these activities from August 6 to September 15 only after consultation with the Area Biologist.
- The following activities are not considered disturbance, and may proceed without restrictions during the nesting season:
  - Hauling of logs, rock, or heavy equipment involving the use of unmuffled compression brakes on commonly used roads
  - Ground application of chemicals and fertilizer, trapping, forage seeding, manual brush cutting without chainsaws, planting, surveying, pruning, roadside seeding, harvest of minor forest products, and snag creation by girdling or chemical injection

Seasonal Restrictions

Seasonal restrictions to minimize disturbance will be applied to all active marbled murrelet nest stands on ODF lands or on adjacent ownership during the term of the ITP, as described in Conservation Measure 7.2. Appropriate disturbance standards will be applied in proximity to known nest stands when management activities are planned. As a result, the potential for disturbance to nest stands during the nesting season will be minimized.

In addition, seasonal restrictions will be applied to mapped marbled murrelet habitat where occupancy is unknown, in order to minimize the potential for removal and modification of nesting habitat and disturbance during the breeding season (Conservation Measure 7.3).

Marbled Murrelet Conservation Measure 7.3:
Apply Seasonal Restrictions to Mapped Murrelet Habitat

To minimize the risk of modifying habitat or causing murrelets to abandon nesting during the breeding season in mapped habitat in which murrelets may be nesting, the ODF will choose from several options designed to limit the likelihood of disrupting nesting during critical nesting periods. This approach applies to felling and yarding activities in and around mapped murrelet habitat during the murrelet nesting season. Other harvest-related activities, including loading, hauling, and use of tailholds, will not be restricted. Any of the options listed below are acceptable. Option 1 is the most conservative approach to limiting disturbance, with somewhat more risk associated with each following option.

The ODF may choose to implement the option that effectively and efficiently reconciles the numerous timing and cost constraints to which operations are subject, such as restrictions for winter hauling and fire season restrictions. Various other constraints—such as, but not limited to, contract duration, numerous operations on a road system, right-of-way limitations, etc.—may limit ODF's ability to apply the most conservative option. Site-specific topographic features will be considered when seasonal restrictions are applied.

1. Between April 1 and September 15, prohibit felling and yarding in and within 330 feet of mapped habitat.
2. Between April 1 and September 15, prohibit felling and yarding in mapped habitat. During this period, felling and yarding are allowed within 330 feet of mapped habitat from 2 hours after sunrise to 2 hours before sunset.
3. Between May 1 and September 15, prohibit felling in mapped habitat. During this period, allow yarding adjacent to and through mapped habitat without restrictions.

If the mapped habitat has been felled prior to April 1, seasonal restrictions do not apply.

7.4.2. Maintaining Marbled Murrelet Habitat Across the Forest Through Time

Marbled murrelet habitat in the Elliott State Forest has been identified through analysis of aerial photos and orthophotos, and subsequently digitized as polygons (Appendix H). This mapped habitat constitutes approximately 18 percent of the Elliott State Forest. All mapped marbled murrelet habitat is included as advanced structure, regardless of whether or not the stand polygon within which it was mapped meets the characteristics of advanced structure.

7.4.2.1. Summary of Potential Effects

Harvest activity has the potential to affect marbled murrelet habitat through:

1. Removal or modification of mapped marbled murrelet habitat to the point that it no longer provides suitable habitat for marbled murrelets. Between 4,000 and 6,800 acres of mapped marbled murrelet habitat may be harvested during the permit term.
2. Development of additional marbled murrelet habitat.

7.4.2.2. Summary of Minimization and Mitigation

Conservation Areas

Approximately 39 percent of mapped marbled murrelet habitat (6,489 acres) is located in conservation areas, including T&E core areas (Table 7-3). Because little if any management will occur in these areas, this habitat is expected to be maintained in these areas. Because these conservation areas are distributed throughout the Elliott State Forest, the east-west and north-south distribution of marbled murrelet habitat in the Coast Range will be facilitated.

A Harvest Scheduling and Economic Analysis Model generated for the Elliott State Forest used the strategies associated with the HCP, and projected an increase of approximately 7,700 acres of advanced structure stands in conservation areas (see Table 6-5). The net result is that approximately 21,000 acres (93 percent) of the conservation areas will meet the advanced structure definition at the end of the HCP term.

Limiting Harvest of Unsurveyed Mapped Marbled Murrelet Habitat

The remaining 61 percent of mapped marbled murrelet habitat (10,191 acres) is located outside conservation areas. A limited amount of mapped habitat, 4,000 to 6,800 acres, will be available for management activities over the term of the permit, as described in Conservation Measure 7.4. As a result, 3,400 to 6,200 acres of mapped habitat will be retained on the landscape outside Conservation Areas.

Additional marbled murrelet habitat is expected to develop on the forest at a level that will offset the loss of habitat to harvesting operations over time. In addition to the increase in advanced structure within conservation areas (see above), the model also projected that approximately 11,500 acres of conifer stands outside conservation areas and that currently meet the advanced structure definition will persist on the landscape over the term of the HCP (Table 6-5). Some of these stands of advanced structure may have the structures needed for marbled murrelet nesting.

Because of the uncertainty associated with the modeled-predicted, future development of marbled murrelet habitat, the harvest of the initial 4,000 acres of mapped marbled murrelet habitat will be limited by decade. The harvest of an additional 2,800 acres will be contingent on demonstrating the development of marbled murrelet habitat (Figure 7-1).

When harvest units are selected, those containing mapped marbled murrelet habitat polygons will be selected using criteria that delay the harvest of large habitat polygons. Units that contain all or a portion of mapped marbled murrelet habitat polygons that are less than 50 acres would be selected for harvest before units containing larger polygons. The largest patches (90 acres or larger), and presumably the most functional patches of marbled murrelet habitat, will persist on the landscape as a component of the advanced structure. These Conservation Guidelines are described below.

Marbled Murrelet Conservation Measure 7.4:
Maintain Habitat Through Limiting
Harvest of Unsurveyed Mapped Habitat

Over the term of the ITP, ODF will limit harvest of mapped murrelet habitat. The initial 4,000 acres of mapped murrelet habitat outside of conservation areas subject to regeneration harvest activities will occur according to the following schedule:

- Decade 1 – 1,200 acres
- Decade 2 – 1,000 acres
- Decade 3 – 1,000 acres
- Decade 4 – 800 acres
- Decade 5 – 0 acres

An additional 2,800 acres (for a maximum of 6,800 acres) of mapped murrelet habitat may be harvested over the term of the permit, contingent upon demonstrating ingrowth of marbled murrelet habitat. Additional acres of murrelet habitat may be harvested if the ODF demonstrates that an equivalent amount of new marbled murrelet habitat has developed on the forest. Figure 7-1 illustrates the allowable harvest of mapped murrelet habitat by decade during the permit term. During the first three decades, no more than 1,200 acres of marbled murrelet habitat will be harvested in any one decade. In the last two decades, no more than 1,600 acres of marbled murrelet habitat will be harvested in any one decade.

When operationally feasible, patches or groups of trees in these mapped murrelet habitat polygons within harvest unit boundaries will be retained as live trees to meet live tree retention targets.

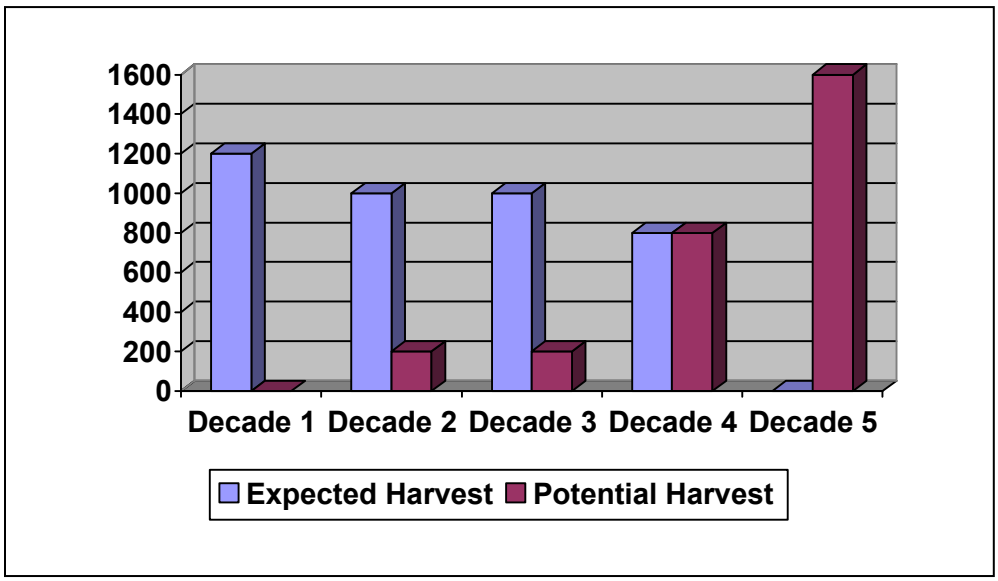

Figure 7-1. Expected Harvest of Murrelet Habitat (acres) and Potential Harvest Based on Projected Ingrowth by Decade

Conservation Guidelines:
Retention Priorities for Marbled Murrelet Habitat

Within a management basin, harvest units with mapped murrelet habitat polygons will be selected in the following priority order, when operationally feasible:

1. Units that contain all or a portion of mapped murrelet habitat polygons that are less than 50 acres, except when other constraints prevent their selection.
2. Units that contain all or a portion of mapped murrelet habitat polygons 50 acres or larger, but less than 90 acres, except when other constraints prevent their selection.
3. Units that contain all or a portion of mapped murrelet habitat polygons 90 acres or larger, except when other constraints prevent their selection.
4. Any units that contain known occupied murrelet sites that are located outside of conservation areas (including sites 1, 73, 74, and 77) will have a low priority for selection, regardless of the amount of mapped murrelet habitat in the unit.

Maintenance and Development of Advanced Structure

Through the term of the permit, additional advanced structure will be developed on the landscape. The advanced structure that develops will provide some additional nesting habitat, because at least 50 percent of it will have eight or more live trees per acre at least 32 inches in diameter. The presence of these large dominant trees in the overstory may be a good indicator of the presence of platform trees, and ultimately of marbled murrelet nesting habitat.

A key assumption of this HCP is that advanced stand structure provides nesting habitats for marbled murrelets. The ODF will assess and identify the quantity of marbled murrelet habitat ingrowth that is generated on the forest landscape over the term of this HCP. To test the assumption that marbled murrelet habitat will be developed over the permit term, a monitoring strategy will be implemented that utilizes field data to compare polygons in stands believed to have the characteristics of occupied marbled murrelet habitat with known occupied stands already measured. Polygons will be considered to qualify as mapped marbled murrelet habitat if they are similar to occupied polygons already measured on the Elliott State Forest (see Section 7.5, Monitoring).

7.5. MONITORING

7.5.1. Assumptions

The landscape management strategies will maintain habitat sufficient for the persistence of marbled murrelet sites in the Elliott State Forest through time.

- T&E core areas provide sufficient protection to maintain occupied marbled murrelet sites.
- Advanced stand structure provides nesting habitats for marbled murrelets.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow marbled murrelets to persist.
- Active silvicultural management can result in the development of habitat for marbled murrelets.

7.5.2. Activities

Periodic surveys of marbled murrelet T&E core areas will be conducted to determine the proportion that remains in occupied status. Surveys will be discontinued when marbled murrelet occupancy is confirmed, or after a period of five consecutive years of surveying. Surveys will use established protocols and occur at ten-year intervals.

Marbled Murrelet Conservation Measure 7.5:
Monitoring the Development of Marbled Murrelet Habitat

At approximately 10-year intervals, the ODF will digitize areas (polygons) in advanced structure stands believed to have the characteristics of occupied murrelet habitat. Field data will be collected on all or a sample of these polygons and will be used to compare these polygons with known occupied stands already measured. Polygons currently mapped as Marbled Murrelet Habitat would not be part of these samples.

Polygons will be considered to qualify as mapped murrelet habitat if they are similar to occupied polygons already measured in the Elliott State Forest (see Appendix G). The following table lists variables that varied significantly between occupied habitat and unmapped polygons, but not between occupied habitat polygons and mapped habitat polygons. Values in the following table represent the lower 95 percent confidence interval on the mean values in occupied habitat polygons. These characteristics and associated values would provide the basis for determining when a polygon is considered murrelet habitat.

Variable	Value (lower 95% confidence interval on the mean value in occupied habitat polygons)
Mean DBH[1] (conifers >24" DBH) - inches	≥ 35.2 inches
Mean percent moss cover	≥ 52 percent
Conifer Trees per acre with platforms (see key terms)	≥ 6.0

1 DBH = diameter breast height

Surveys for marbled murrelets may be used to demonstrate suitability of habitat; however, marbled murrelet surveys are not required.

Key Terms

Buffer habitat—Stands surrounding occupied stands that do not have the characteristics of suitable habitat, but that buffer the occupied stand from wind and other environmental factors as well as from other potential deleterious effects of edge, such as increased predation.

Commonly used road—A road that receives frequent traffic during the marbled murrelet breeding season, including, but not limited to, a mainline road and roads connecting mainline roads.

Confirmed occupancy—Occupied behaviors observed on more than one visit.

Disturbance—The disruption of marbled murrelet reproductive activities.

Likely nesting habitat—Occupied marbled murrelet habitat that is considered to be the most likely location for nesting sites, based on information from surveys, aerial photos, stand information, and the judgment of biologists or others familiar with the area. Stand type breaks or topography may be used to delineate the boundaries of likely nesting habitat.

Mapped marbled murrelet habitat—Polygons of suitable marbled murrelet habitat digitized from aerial photos, and validated, as described in Appendix G.

Not commonly used road—Roads not commonly used may include, but are not limited to, spur roads, and blocked or decommissioned roads.

Occupied habitat—Suitable habitat that has been surveyed and determined to be occupied by marbled murrelets.

Occupied sites—Sites determined to be occupied by marbled murrelets based on the observation of subcanopy behaviors during protocol surveys, or the observation of nest trees, eggshell fragments, or other evidence of marbled murrelet reproductive activities.

Platform—A relatively flat surface at least 5 inches in diameter and at least 50 feet high in the live crown of a coniferous tree. A platform includes the limb and any deformities of, or epiphyte cover growing on, the limb. For instance, a four-inch-diameter limb with moss cover that increases the overall diameter to five inches is a platform.

Platform tree—Any tree having a single platform capable of hosting a nest for a marbled murrelet.

Potential habitat—Stands with the characteristics of occupied marbled murrelet habitat, but that have not been surveyed for the presence of this species.

Recruitment nesting habitat—Stands that do not exhibit the characteristics of occupied habitat, but that could be managed to develop such characteristics in the future.

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

Suitable habitat—Stands with the characteristics suitable for marbled murrelet nesting (including both occupied habitat and potential habitat).

Chapter 8
Aquatic and Riparian Habitat

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8.1. BACKGROUND

8.1.1. Federal Land Commitments to Aquatic and Riparian Functions

In a recently published report on watershed condition under the Northwest Forest Plan, (Gallo et al. 2005) describe federal conservation strategies as follows. "The aquatic conservation strategy is a comprehensive, region-wide strategy designed to maintain, restore, and protect those processes and landforms that create good ecological conditions in watersheds, such as providing high quality habitat for aquatic and riparian organisms and good water quality (USDA Forest Service et al 1993). The strategy contains nine objectives that describe general characteristics of functional aquatic and riparian ecosystems that are intended to maintain and restore good habitat in the context of ecological disturbance. This approach was intended to prevent further degradation and restore habitat over broad landscapes, as opposed to focusing on individual projects or species (USDA Forest Service and USDI Bureau of Land Management 1994 a and b). Aquatic and riparian organisms evolved in a dynamic environment influenced by natural disturbance. The strategy used four components intended to work in concert to maintain and restore the health of aquatic and riparian ecosystems:

1. Watershed analysis—used to characterize watersheds and provide a basis (context) for making management decisions.
2. Riparian reserves—used to enhance habitat for riparian-dependent organisms, to provide good water quality, to provide dispersal corridors for terrestrial species, and to provide connectivity within watersheds.
3. Key watersheds—provide high-quality habitat or refugia for aquatic- and riparian-dependent species or would be able to after restoration.
4. Watershed restoration—designed to recover degraded habitat and maintain existing good conditions. "

Bureau of Land Management (BLM) lands are managed in accordance with the Western Oregon Resource Management Plans, which are currently being revised in response to the American Forest Resource Council lawsuit settlement agreement. The Northwest Forest Plan for Federal Forests currently provides guidelines for management of aquatic and riparian resources on BLM lands.

8.1.2. Aquatic and Riparian Function Conservation on Non-Federal Lands

Long-term viability of aquatic species covered by this Habitat Conservation Plan (HCP) will require non-federal forest landowners to contribute to conservation. The specific contributions necessary from any given non-federal landscape will vary depending on many factors. In general, the contributions to aquatic and riparian conservation from state forest

lands will be to enhance the viability of the local or regional aquatic species by emulating the historical conditions maintained by the natural disturbance regimes under which native species evolved.

In general, the state contributions to conservation will fall into three very broad categories:

1. Manage for proper functioning aquatic systems by providing diverse aquatic and riparian conditions over time and space.
2. Manage for riparian and aquatic conservation at both the landscape and site-specific levels.
3. Use watershed analysis to inform restoration and management decisions.

8.2. CONSERVATION OBJECTIVE

The biological and ecological objectives of the Elliott State Forest Management Plan are to maintain and or restore the ecological functions of aquatic and riparian areas as well as upland areas that directly influence aquatic and riparian areas. Over time, the application of riparian and aquatic landscape strategies is intended to create forest conditions on the landscape that will emulate historic conditions and processes relative to aquatic systems. Landscape strategies are related to stand structure (see Section 5.2), slope stability, and forest road management. Advanced structure will be maintained on 40 to 60 percent of the landscape, intermediate structure on 25 to 55 percent, and early structure on 5 to 15 percent. The site-specific or prescriptive strategies are designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the forest landscape strategies. This blended approach is intended to more closely emulate the historical conditions maintained by the natural disturbance regimes under which native species evolved. Critical to the evaluation and refinement of both the landscape level and site-specific approaches is watershed analysis. The objectives of these components are described below.

- The overall objective of the slope stability strategies are to minimize management-related landslides and chronic erosion, and to manage uplands to ensure that large wood is available in the track of potential debris flows.
- The objective for each watershed analysis is to identify if proper functioning conditions exist in streams and riparian areas. If the aquatic system is not in proper functioning condition, the analysis will evaluate if existing Oregon Department of Forestry (ODF) strategies are likely to remedy the limiting factors, and, if not, if the ODF can take other measures to address the limiting factors.
- The objectives for managing the forest road systems are to keep as much forest land in a natural productive condition as possible, prevent water quality problems and associated impacts on aquatic and riparian resources, minimize disruption of natural drainage patterns, provide adequate fish passage, and minimize exacerbation of natural mass-wasting processes.
- The objective for riparian areas along fish-bearing streams is to achieve conditions associated with mature forests. Once a riparian area has met the desired condition, it will have limited or no management activity within 100 feet of the stream. For riparian areas that do not meet the desired conditions, management strategies will be designed to move the stand toward these conditions in a timely manner.
- The objectives of stream restoration projects vary; in general, however, the objectives involve improvement or restoration of aquatic habitat and functions in stream reaches that otherwise do not meet desired conditions.

8.3. CONSERVATION STRATEGIES

The conservation strategies described in Chapter 5 provide the basis for conservation of aquatic and riparian habitats under this HCP through the following conservation measures:

8.3.1. Aquatic and Riparian Conservation Measures

- Implement Watershed Analysis and use results to inform management and restoration decisions, including the Elliott Watershed Analysis (Biosystems et al. 2003).
- Establish and maintain Riparian Management Areas (RMAs) adjacent to all streams in accordance with the standards and guidelines.
- Use results from the Elliott Watershed Analysis to identify, design, and implement projects to maintain or improve aquatic and riparian habitat.
- Use basin-level assessments to evaluate the need for alternative vegetation treatments
- Where appropriate, plan alternative vegetation treatments, in collaboration with the Oregon Department of Fish and Wildlife (ODFW), that will contribute to achieving properly functioning aquatic habitat conditions in a timely manner.
- Monitor and evaluate alternative vegetation treatment projects over time, using results in an adaptive management context.
- Establish and maintain RMAs adjacent to other aquatic habitat areas in accordance with the standards and guidelines described in this HCP.
- Use watershed analysis (initially completed in October 2003) and other information to enhance current understanding of the processes that influence slope stability in the Elliott State Forest.
- Evaluate alternatives and design operations that can minimize, mitigate for, or avoid risk in high and moderate landslide hazard locations during district implementation and project planning.
- Design, construct, improve, and maintain forest roads in accordance with the processes and standards described in the Forest Roads Manual.
- Identify and prioritize roads for closure and/or vacation using information gained from the comprehensive forest roads inventory, and in accordance with the standards described in the Forest Roads Manual.

Implementation of these measures is anticipated to conserve aquatic species by minimizing effects, protecting conditions, or improving water quality and physical habitat as described in the next Sections 8.3 through 8.5. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have developed a matrix that lists habitat indicators used for evaluating HCPs. Sections 8.3 through 8.5 provide a qualitative discussion of potential forest management effects on those aquatic and riparian habitat indicators. HCP strategies and programs designed to minimize and mitigate these effects are briefly described. Refer to Section 5.6 in Chapter 5 for a precise description of the strategies. For a description of the current conditions using the matrix indicators, see Appendix C.

In general, the strategies and practices described in the HCP are expected to result either in reduced impact, no impact, or minor effect. These conclusions assume that the strategies will:

- Improve functions over time, improve habitat conditions, and result in "reduced effect over time"
- Prevent impacts to aquatic and riparian areas through restrictive best management practices (BMPs), resulting in "no effect"
- Result in sufficiently small impacts (e.g., likely to be immeasurable , short-lived, or off-set by beneficial outcomes), resulting in a "minor effect"

The qualitative assessment is provided in the following text (and is summarized in Table 8-5, at the end of the chapter).

8.4. WATER QUALITY: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.4.1. Stream Temperature

8.4.1.1. Effects

Stream temperature is a function of multiple factors that can be expressed in terms of a "heat budget." In general, sources of heat input include direct solar radiation and convection. Heat is lost through long wave radiation, conduction, and evaporation. However, of all these factors, direct solar radiation is the primary contributor to increases in daily maximum stream temperature (Brown and Krygier 1970; Johnson 2004). Therefore, managing riparian vegetation to maintain shade is an effective tool for reducing stream temperature heat flux (Johnson 2004). Historic forest management that did not require leave trees along streams resulted in dramatic reductions in shade and associated increases in stream temperature (Brown and Krygier 1970; Levno and Rothacher 1967).

Contemporary forest management practices, as described in the Elliott State Forest HCP, are designed to maintain shade along streams to prevent impacts to stream temperature. Studies have evaluated the effects of current forest management as regulated under the Forest Practices Act (FPA). Given that increases in stream temperature are primarily influenced by reductions in shade, Dent (2001) evaluated cover as a surrogate for shade, before and after regeneration harvesting at sites throughout Oregon that are managed under the FPA. The average reductions in cover were 12 percent, 7 percent, and 1 percent for small, medium, and large fish-bearing streams, respectively. The only statistically significant change in average cover was associated with small streams (p-value equals 0.03). In a separate study, Allen and Dent (2001) evaluated stream shade using hemispherical photography on small, medium, and large streams. They compared harvested sites managed under the FPA to unharvested sites. Average shade was approximately 10 percent lower for harvested sites (73 percent, ranging from 51 to 89 percent) than for unharvested sites (84 percent, ranging from 72 to 95 percent). Sample size issues precluded comparisons of differences by stream sizes. HCP strategies are generally more restrictive than FPA requirements; thus, these findings are not directly applicable, but do provide, an index of possible effects.

Channel substrate also has an important influence on spatial and temporal stream temperature trends. Johnson (2004) concluded that bedrock reaches had wide daily summer stream temperate fluctuations, with relatively high maximum and low minimum temperatures. In contrast, stream reaches with gravel bottoms and belowground flows had a much narrower range of daily fluctuations, with higher minimums and lower maximums. Many of the streams in the region managed under the HCP are bedrock dominated, which possibly explains the elevated stream temperatures observed lower down in these basins (see current conditions discussion in Appendix C). A portion of the channel network is expected to have bedrock characteristics with or without management. However, the greater percentage of

bedrock channels in the management area may reflect historic practices such as stream cleaning and splash damming.

The Elliott State Forest contains approximately 771 miles of stream and 10,419 acres of RMAs (Figure 8-1 and 8-2). The majority of stream miles are classified as small perennial non-fish-bearing streams. However there is a greater proportion of riparian acreage associated with fish-bearing streams and large and medium non-fish-bearing streams.

Forest management under the HCP has the potential to decrease shade to streams, thus potentially increasing stream temperature. The potential for stream temperature effects is low for fish-bearing streams, as well as for medium and large non-fish-bearing streams. This is because HCP strategies establish 160-foot RMAs along these streams. No management occurs within the first 25 feet of the stream (stream bank zone). The inner zone (25 to 100 feet) and outer zone (100 to 160 feet) are established with varying management depending on how adjacent uplands are being managed. The inner zones on fish-bearing and medium and large non-fish-bearing streams are managed to meet mature forest condition.

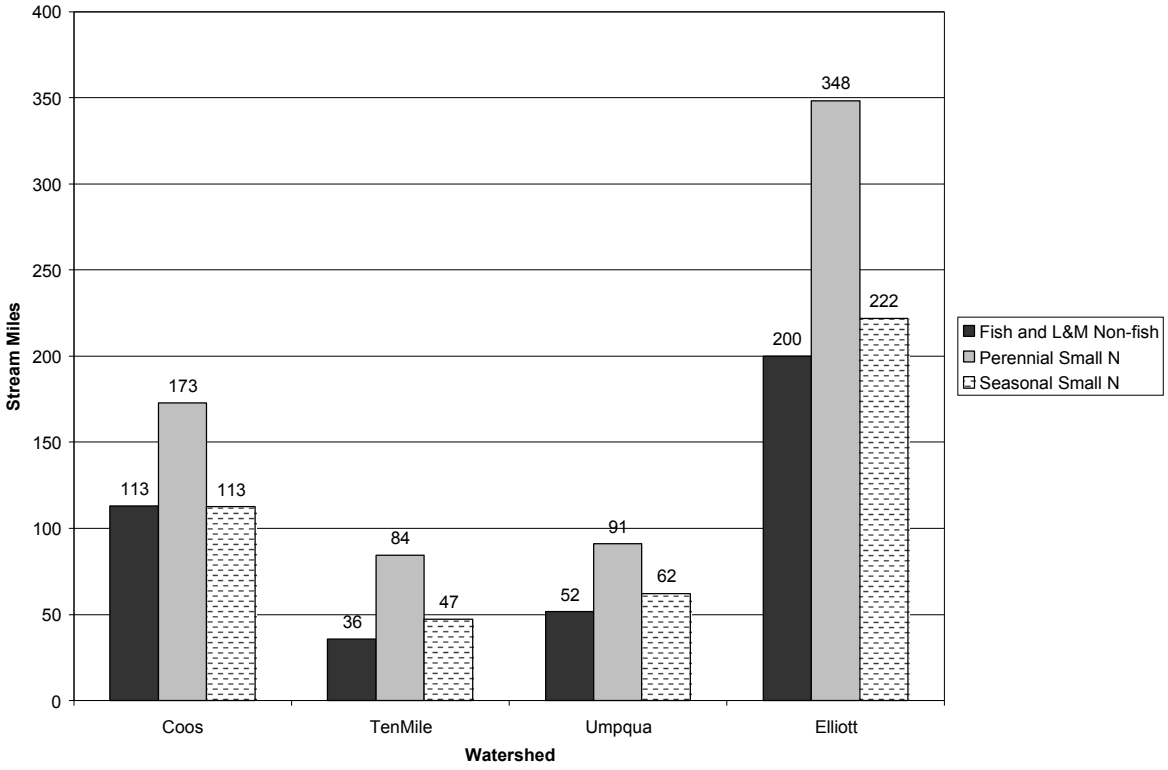

Figure 8-1. Estimated Miles of Stream by Region and for the Elliott State Forest.

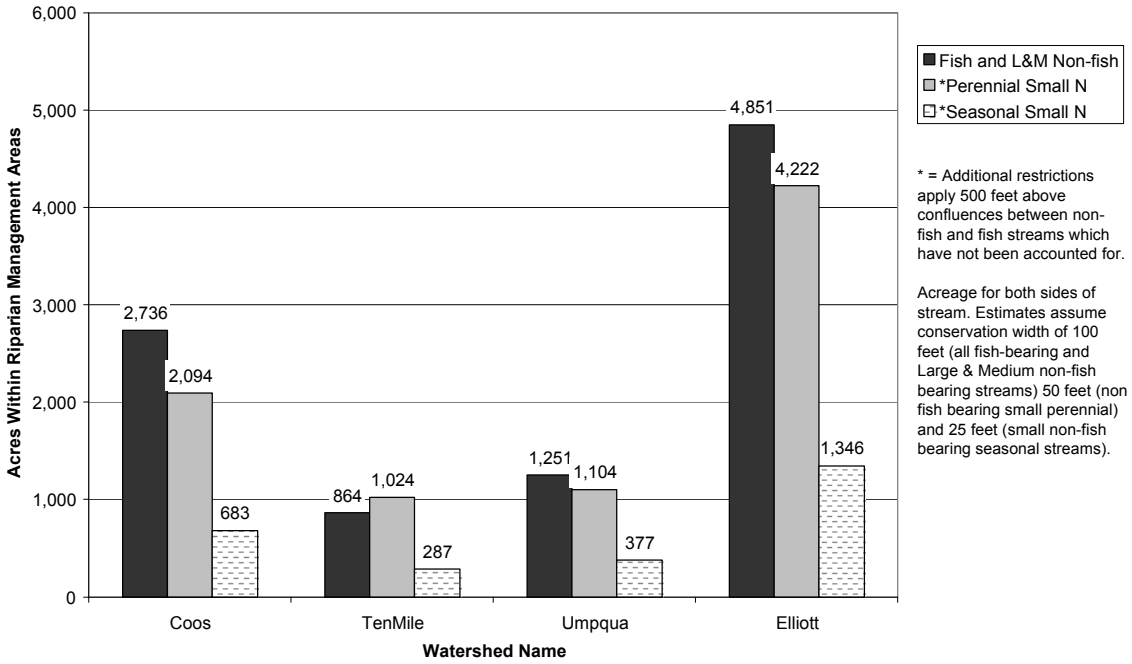

Figure 8-2. Estimated Acres of Riparian Management Area by Region and for the Elliott State Forest

When the adjacent upland is being regeneration harvested, the inner zone is commonly retained as a no-cut buffer along the fish-bearing streams and large/medium non-fish-bearing streams. At least ten conifer trees and snags per acre are retained in the outer zone (100 to 160 feet). If insufficient trees exist in the combined stream bank and inner zone (0 to 100 feet) to meet basal area targets, the outer zone (100 to 160 feet) then serves as an additional search zone to meet the retention requirements (45 conifer trees and snags per acre) of the other two zones. Additional conifer trees and snags are retained in the outer zone regardless of basal area targets.

Management in the inner zone of the riparian area of fish-bearing streams and large/medium non-fish-bearing streams is more common when the adjacent uplands are being thinned. The inner zone (25 to 100 feet) is managed for mature forest condition with basal area targets considered typical for mature forests.

Currently, the acres of mature riparian forests (older than 99 years as defined in the Biosystems 2003 report) range by region, distance from stream, and stream size (Table 8-1). Areas farthest from the stream tend to have an increasing percent of area with mature forest condition (Biosystems 2003). The Umpqua has the greatest percent of riparian forests in mature forest condition, followed by Coos, then Tenmile. On average, forestwide, 31 percent of streams have mature forest condition within 150 feet of the stream. The range is 14 to 36 percent depending on zone, region, and stream size. Within the Umpqua and Coos Region, the average is 25 percent and 36 percent within 50 and 100 feet of the stream, respectively.

Table 8-1
Percent of Riparian Areas with Mature Forest Conditions for Fish-Bearing Streams, by Region [a]

Region	Distance From Stream (feet)	Percent of Riparian Area >99 years old			
		Large Streams (%)	Medium Streams (%)	Small Streams (%)	Average (%)
Coos	0-50	32	24	26	27
	50-100	44	31	32	36
	100-150	51	32	23	35
Umpqua	0-50	21	23	24	23
	50-100	40	40	30	37
	100-150	50	52	34	45
Tenmile	0-50	15	15	13	14
	50-100	25	29	23	26
	100-150	34	40	32	35
Average		**35**	**32**	**26**	**31**

[a] Data from the Elliott Watershed Analysis, Graph 7-3

Within the Tenmile, the average is 14 percent and 26 percent within 50 and 100 feet of the stream, respectively.

If the RMA is hardwood dominated, the inner zone will be left unharvested. The outer zone will be harvested except for conifers needed to meet retention requirements. The exception occurs in reaches, identified through watershed analysis as a priority for conversion to conifer stands. Once RMAs meet mature forest conditions, the HCP does not allow for harvesting within 100 feet of these fish-bearing streams and large/medium non-fish-bearing streams.

Under the Elliott State Forest HCP, trees can be felled in RMAs to create corridors for yarding trees across streams. BMPs require measures to protect channels and RMAs, including minimizing the number and widths of corridors. In 2002, the ODF completed a BMP compliance study that included an evaluation of this practice (Robben and Dent 2002). Sites were randomly selected. The sample was designed to represent compliance on private forest ownership at a state level with a small number of sites selected on state forest ownership. Therefore, findings are not directly applicable to management on the Elliott State Forest. However, study results are the best available information, and are presented here to provide estimates regarding the potential effects of yarding corridors on aquatic and riparian habitat.

The overall occurrence of yarding corridors was low (19 corridors of 93 sites surveyed). Most of the corridors (84 percent) resulted in zero to less than 10 percent overstory disturbance. Of the remaining corridors, two had reductions in overstory cover of 10 to 30 percent and one had reductions in overstory cover greater than 30 percent. Trees were felled in riparian areas in 4 out of 19 corridors (21 percent). Felled trees were left in the RMA in each case. Corridor widths on these four sites were 25, 50, 50, and 123 feet. The remainder of the corridors had no trees felled and an effective corridor width of zero. Similar patterns were observed with regard to understory vegetation. Most of the corridors (89 percent) had no understory vegetation disturbance. In one case, full suspension was not achieved, resulting in potential sediment delivery to waters of the state.

Given the low occurrence of yarding corridors, high rate of compliance with BMPs, and low impacts on riparian and understory vegetation, it is unlikely that felling in riparian corridors presents a substantial risk to riparian and aquatic resources. Anecdotal information from foresters of the Elliott State Forest suggests that yarding corridors may be even less common on the Elliott State Forest, and that, when used, will rarely involve felling trees. Therefore, it is likely that yarding corridor practices on the Elliott State Forest would have similar or fewer effects on riparian and aquatic habitat than demonstrated in the 2002 BMP study. On the Elliott State Forest, when trees are felled within the inner or stream bank zone of streams that have achieved mature forest condition, they will be left in the RMA or stream.

The greatest uncertainties with regard to shade retention under the HCP are associated with small non-fish-bearing streams that have narrower RMAs and fewer leave tree requirements than fish-bearing streams and larger non-fish-bearing streams. The magnitude of reduction, the effects of the shade reduction on stream temperature at the site and watershed scale, and the potential influence on aquatic biota have had little research attention until recently. Preliminary findings from recent studies observed decreases in shade and site-scale increases in stream temperature on very small headwater streams when no trees were retained near the stream (Robison 2006; Skaugset 2006). When temperature increases were observed, Skaugset (2006) did not observe increases in stream temperature in downstream reaches. Furthermore, recent studies also suggest that upslope thinning rather than regeneration harvest may prevent increases in stream temperature and minimize or eliminate changes to microclimate characteristics that can cause stream temperature changes (Chan 2006; Anderson 2006). Biological responses to management around headwater streams suggest that these streams are less sensitive and more resilient that previously thought (Jackson et al. 2006; Olson 2006).

Management under the current HCP is not likely to have negative effects on stream temperature because shade retention will be high from practices such as wide RMAs, managing for mature forest condition within 100 feet of Type F streams and some Type N streams, more types of streams receiving protection (applied to 75 percent of stream reach within the harvest unit), and maintenance of a range of upslope stand structures. These measures will likely maintain shade and stream temperature along Type F streams and some Type N streams. Minor effects are possible on small Type N streams with narrower RMAs and fewer leave tree requirements; however, if increases in temperature occur, they are not likely to be translated downstream.

8.4.1.2. Summary of Minimization Programs

Practices described in Section 5.6 will minimize potential effects on shade, and thus on stream temperature. The aquatic and inner zones contribute substantially to desired stream temperature-related functions, including providing aquatic shade and maintaining riparian microclimate. The outer zone may still contribute to certain riparian functions and processes, but to a lesser extent than the inner zone, particularly in terms of stream temperature. The primary stream temperature-related functions provided by vegetation in this area include additional protection of riparian microclimate. In some cases, the outer zone may also partially buffer the inner zone from disturbance events such as windthrow, further minimizing risks to stream temperature.

Implementation of the HCP riparian and aquatic strategies are expected to shift riparian forest structure more towards advanced structure. On average, forest structure in the near-stream zone of fish-bearing streams is estimated to be predominately intermediate (average of 28 to 36 percent) or advanced stand structure (64 to 72 percent) for the next 50 years across the three watersheds. Similar trends in riparian forest structure are expected for non-fish-bearing streams (Table 8-2). Maintaining adjacent riparian forests (inner zones) in intermediate or advanced structure minimizes potential negative effects of forest management on aquatic and riparian resources by maintaining functions such as shade over streams, riparian microclimates, and large wood recruitment in the near-stream area.

Table 8-2
Forest Structure: Estimated Percent of Riparian Areas in Stand Structure Types by Watershed for Fish-Bearing and Non-Fish-Bearing Streams, Inner Zone (Within 100 Feet and 25 Feet of Fish-Bearing and Small Non-Fish-Bearing Streams)

Forest Structure	Umpqua		Ten Mile		Coos	
	Range (%)	Average (%)	Range (%)	Average (%)	Range (%)	Average (%)
Fish and Large and Medium Non-Fish Within 100 Feet of Stream (Inner)						
Early	0-1%	0%	0-1%	0%	0-1%	0%
Intermediate	18-47%	36%	13-42%	28%	12-53%	35%
Advanced	52-82%	64%	58-87%	72%	46-88%	65%
Small Non-Fish Within 25 feet of stream (Inner)						
Early	0-2%	0%	0-4%	0%	0-12%	2%
Intermediate	21-60%	47%	21-51%	39%	20-66%	50%
Advanced	39-79%	53%	48-79%	61%	30-80%	48%

Note: The range (minimum and maximum) and average as a percent of total inner zone riparian area acres (within 100 feet for fish streams and 25 feet for non-fish streams) were estimated for the plan period. Data were summarized from model outputs prepared for the Oregon Department of Forestry. Source: Model 9u2 outputs (August 3, 2006).

On average, forest structure in the adjacent uplands (100 to 160 feet from streams) of fish-bearing streams is estimated to be in intermediate stand structure (34 to 39 percent) about one-third of the time, and in advanced stand structure (50 to 52 percent) about one-half of the time (Table 8-3). Similar trends are expected for small non-fish-bearing streams with more intermediate and less advanced structure. Maintaining adjacent upland forests (outer zones) in an intermediate or advanced structure further minimizes potential negative effects of forest management by providing additional shade retention to streams and preventing changes in riparian microclimate. These upland landscapes may also contribute to large wood recruitment in the event of a landslide that delivers to the stream system. This is particularly true for small non-fish-bearing streams that otherwise have narrower buffers and fewer leave tree requirements. These benefits of adjacent upland forests to aquatic resources are also important when management takes place within 100 feet of fish-bearing streams.

Table 8-3
Forest Structure: Estimated Percent of Riparian Areas in Stand Structure Types by Watershed for Fish-Bearing and Non-Fish-Bearing Streams, in the Outer Zone (100 to 160 Feet from Stream)

Forest Structure	Umpqua		Ten Mile		Coos	
	Range (%)	Average (%)	Range (%)	Average (%)	Range (%)	Average (%)
Fish and Large and Medium Non-Fish Within 100 to 160 Feet from Stream (Outer)						
Early	2-20%	13%	2-22%	14%	5-17%	13%
Intermediate	3145%	37%	27-42%	34%	32-51%	39%
Advanced	48-53%	50%	49-59%	52%	43-52%	47%
Small Non-Fish Within 100 to 160 feet from stream (Outer)						
Early	3-21%	13%	3-19%	11%	12-20%	16%
Intermediate	35-60%	48%	30-50%	39%	44-61%	53%
Advanced	36-45%	39%	47-54%	49%	27-37%	31%

Note: The range (minimum and maximum) and average as a percent of total inner zone riparian area acres (within 100 feet for fish streams and 25 feet for non-fish streams) were estimated for the plan period. Data were summarized from model outputs prepared for the Oregon Department of Forestry. Source: Model 9u2 outputs (August 3, 2006).

In summary, the riparian and aquatic strategies are likely to be effective at reducing the risks to shade, and thus effects on stream temperature, because:

- No management within the first 25 feet (aquatic zone) ensures retention of the trees most critical to maintaining shade.
- The wide RMAs (160 feet on all fish-bearing streams and medium and large non-fish-bearing streams) and standard management targets designed to mimic mature forest conditions out to 100 feet are expected to maintain shade at comparable levels to the

range of historic conditions. With this approach, stream temperature is likely to be maintained in a distribution consistent with the historic range of conditions.

- The number and widths of yarding corridors are minimized. If riparian trees are felled in stream bank or inner zones of streams with mature forest riparian conditions, they will be left in the RMA or stream.
- Upland strategies maintain 74 to 90 percent of upland conditions in intermediate or advanced structure.

The Elliott State Forest HCP reduces potential impacts on stream temperature of small headwaters streams with the following conservation measures:

- Leave tree requirements 75 percent of the length on perennial and some seasonal non-fish-bearing streams are likely to minimize risk of stream temperature increases locally and prevent potential downstream effects on stream temperature.
- 74 to 90 percent of upland stands adjacent to non-fish-bearing streams will be managed for advanced or intermediate structure, further decreasing potential effects of management on stream temperature.

Monitoring

Given that the greatest uncertainties are associated with small non-fish-bearing streams, the ODF will implement a study focused on these streams to evaluate shade, riparian characteristics, and water quality on small perennial Type N streams. On a subset of harvest units with small perennial Type N streams, the following will be monitored before and after harvesting: riparian and buffer characteristics, shade, and water quality parameters (e.g., stream temperature, macroinvertebrates, sediment). This project will be coordinated with amphibian-related monitoring described in Chapter 9, Section 9.4.12.3.

8.4.2. Suspended Sediment

8.4.2.1. Effects

Sediment can be delivered to streams chronically from erosion of the road surface or episodically from debris flows and road-related landslides. In general road-related, chronic sediment delivery to streams results from moderate-intensity storm events, while landslides and debris flows occur during larger storm events. Both mechanisms can deliver sediment to the stream that, in turn, can be suspended in the water column. However, suspended sediment is most commonly associated with forest roads rather than landslides. This is because road-related sediment, derived from surface erosion, is predominantly composed of small particle sizes that are more easily suspended in moving water. Conversely, landslides in the Elliott State Forest typically are composed of a range of particle sizes, and movement is often by debris flows rather than fluvial mechanisms. However, both mechanisms (surface erosion and landslides) are addressed here to provide comprehensive information on sediment sources and management practices.

Road-associated changes in sediment delivery have no correlation to a natural process; therefore, sediment from roads represents an increase over background. The effects of

increased sediment delivery from roads depend on numerous factors. The nature and timing of sediment delivery, the type of material delivered, and the prior condition of the stream influence the extent to which additional sediment delivery to streams will have a negative effect. Excessive fine sediment deposited in stream channels can cause decreased survival of salmonid eggs and alevin by reducing water flow through streambed gravel, thereby suffocating the eggs or preventing the eggs from hatching. Massive increases in fine sediment delivery and channel deposition can reduce pool frequency, depth, and volume. Alternatively, habitat potentially is enhanced if erosion delivers coarse material to streams where coarse sediment is limiting (Coats et al. 1985; Megahan et al. 1980; Botkin et al. 1995; Everest et al. 1987; Hicks et al. 1991).

Construction, use and maintenance (or lack thereof) of forest roads is the primary source of sediment from forest lands in the western United States. This is especially true during wet season use when they can be a major source of fine sediment and associated stream turbidity (Megahan and Ketcheson 1996; Reid and Dunne 1984; Mills et al. 2003). A number of research and monitoring studies have investigated this issue. In general, lower quality rock results in greater sediment production and delivery of very fine particles (Bilby 1985a; Duncan and Ward 1985; Folz 1996; Bilby et al 1989). Research and monitoring has also shown that use of durable surfacing, road drainage practices, vegetated ditches, and traffic control (wet-weather hauling restrictions) such as required under current BMPs can minimize sediment delivery to streams (Bilby et al. 1989; Bilby 1985a; Sullivan 1985; Mills et al. 2003).

In general, stream crossings present a risk for chronic sediment delivery to streams. There are approximately 475 culvert stream crossings on the Elliott Forest, and an additional 18 bridge crossings. Of the stream crossings, 85 percent are on non-fish-bearing streams, and 12 percent are on fish-bearing streams. Ridgetop roads tend to have fewer stream crossings. Approximately 57 percent of the Elliott roads are located on ridgetops, 33 percent mid-slope, and 10 percent in the valley bottoms or streamside. Among other practices, All-Weather surfacing can reduce road-related sediment delivery to streams. Of the active and restricted access roads in the forest, 52 percent are surfaced to an All-Weather standard. A large portion of the remaining roads have had surfacing applied in the past, but will not support All-Weather traffic at present.

Debris flows are the most common type of landslide in the HCP area, and are of primary focus to aquatic resources. Debris flows are defined as shallow, translational, rapidly-moving landslides commonly transported via stream channels. Debris flows are common throughout most of the Elliott State Forest, as is the case for most of the Oregon Coast Range during infrequent storm events. Where they occur, debris flows overwhelm the sediment budget of both managed and unmanaged watersheds (Dietrich and Dunne 1978; Swanson et al 1987), and have the greatest potential effect on channel morphology. Compared with other types of landslides, debris flows are more prone to the effects of forest management activities because of their shallow and channelized nature.

The effects of debris flows on aquatic species and habitat vary through space and time. Debris flows can dramatically alter aquatic habitat through scour and fill processes, and through transport of wood. Erosion may be accelerated, and decreases in cover may occur (Lyons and Beschta 1983; Kaufmann 1987; Lamberti et al. 1991). However, debris flow

deposits can also provide increased cover and habitat complexity from structure such as boulders and wood. Short-term effects such as scoured tributary channels may be balanced with longer-term benefits such as debris flow deposits at tributary junctions that are associated with high-quality aquatic habitat (Benda and Cundy 1990). Reeves et al. (1995) have suggested a long-term perspective that embraces the dynamic nature of aquatic habitat. For example, in some aquatic environments (e.g., coastal) debris flows represent an important source of coarse sediment and large wood to streams that, in turn, provide high quality habitat for fish. Thus, the goal could be to manage debris flow-prone streams differently to support this unique function.

Multiple studies have examined the differences in landslide rates between forested and recently harvested sites. Several studies in the Oregon coast range have documented that erosion rates are 1.2 to 3.7 times higher in young clearcuts than in unmanaged stands (Swanson et al. 1977; Ketcheson and Froehlich 1978; Robison et al. 1999). Robison et al. (1999) documented higher erosion rates in stands less than ten years old as compared with older forest stands.

Robison et al. (1999) studied road-related landslides following the 1996 storm events in Oregon. These findings include the most current information addressing the adequacy of the forest practice rules in reducing the threats associated with landslides and forest roads. They found that road-related landslides resulting from large storm events (50- to 100-year return interval) constituted a smaller percentage of the total landslides than found in previous studies. While road-related landslides were clearly larger than other landslides, those identified in the Robison et al. (1999) study were smaller than in past studies.

The effect of forest roads on suspended sediment is expected to be minor due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather.

As stand structure shifts across the landscape, there may be periods of increased landslide risks due to harvesting. This is most likely to occur when a greater percentage of the forest is less than ten years old coincident with large storm events. As the percentage of the forest composed of this age class decreases, management influenced landslides rates are also likely to decrease. Additional restrictions around debris flow-prone channels may provide large wood recruitment potential during landslides, reduce run out distances associated with debris flows, and in turn decrease sediment delivery to downstream reaches. However, there will likely be some increases in landslide frequency associated with failures from fills on existing roads.

8.4.2.2. Minimization

The HCP proposes very little new road construction (1.5 miles per year over the life of the HCP). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. For example, the strategies will:

- Use road design and construction BMPs that minimize the occurrence of road-related landslides

- Prevent net increases in road mileage next to streams
- Confine the few miles of road construction to ridgetops away from high landslide hazard locations to the maximum extent feasible
- Keep to a minimum areas of non-forested condition due to road-related disturbance
- Decrease hydrologic connectivity to streams
- Require the use of high-quality rock surface on roads that are hydrologically connected to streams and that are used during wet periods
- Control traffic during wet periods if hauling is contributing to erosion and delivery of sediment to streams
- Require maintenance or proper vacating practices for roads not currently in use

These road practices will minimize negative effects of new roads on water quality and fish habitat by reducing the amount of chronic and episodic erosion sediment that is delivered to streams. Studies conducted to evaluate the effectiveness of road construction and maintenance practices suggest that such BMP regulatory programs for road construction, management, and restoration are effective at minimizing sediment delivery to streams and reducing the size and occurrence of road-related landslides (Bilby et al. 1989; Bilby 1985a; Sullivan 1985; Robison et al. 1999; Mills et al. 2003).

The greatest potential road effects are associated with existing roads. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of existing roads. Older roads may have greater connectivity with streams than newly constructed roads, which increases the potential for sediment to be delivered to streams. Although the greatest concerns are with existing roads, the Watershed Analysis (Biosystems et al. 2003) suggests that a relatively low percentage (4.4 percent near streams and 5.4 percent along valley bottoms) of the road network is located in near-stream areas. Zero to eight percent of the road network is located near streams or on valley bottoms in fifth field watersheds. These relatively low percentages minimize the risk of sediment being delivered to streams.

In managing landslides and slope stability, the objective is to minimize the occurrence of management-induced slope failures and mitigate potential negative effects on aquatic and riparian habitats. This will be accomplished through the application of risk-based management principles and BMPs. In summary, landslide-related conservation measures designed to minimize negative effects of landslides on aquatic habitat include:

- Road practices that reduce the number and size of road-related landslides as well as chronic sources of sediment (described above).
- Leave tree requirements along at least75 percent of debris flow prone, small Type N streams that can deliver to fish-bearing streams (as described below). This will promote delivery of wood with a debris flow to fish-bearing streams and improve aquatic habitat diversity.
- Hazard assessment and risk-based management to reduce the potential for in-unit landslides (described below).

The aquatic/riparian strategies require retention of trees around debris flow-prone channel segments (at least 75 percent of the reach length within the harvest unit) that can deliver

debris flows to fish-bearing streams (Section 5.6.2 and Table 5-3). Potential channelized debris flow track reaches are reaches on seasonal Type N streams that have been determined to have a high likelihood of delivering wood to a Type F stream. ODF field staff will make the determination of the probability that a reach will deliver wood to a Type F stream via a channelized debris flow as described in Section 5.6.2, and will apply standards as shown in Table 5-3. A 160-foot RMA will be established along 75 percent of the debris flow-prone channel. There will be no harvest or ground-based equipment within 25 feet of the stream, and at least ten conifer trees and snags per acre will be retained within 100 feet (inner zone) of the stream. In the outer zone (100 to 160 feet), snags and trees will be retained to meet landscape-scale strategy targets. Leaving trees along these channels is likely to contribute to large wood recruitment during debris flow events and minimize the effects of debris torrents on downstream fish-bearing streams.

The process for identifying high landslide hazard locations is described in detail in Technical Reports Number 2 (Oregon Department of Forestry 2003a) and Number 6 (Oregon Department of Forestry 2003b). High landslide hazard locations are specific sites that are subject to initiation of shallow, rapidly moving landslides because of steepness, shape, and geology of the site. High landslide hazard locations identification is based on physical slope characteristics, and is independent of proposed harvesting or road building practices. The specific criteria for determination of these sites are:

1. The presence, as measured on site, of any slope (excluding competent rock outcrops) that is steeper than 80 percent (75 percent for slopes in the Tyee Core Area); or
2. The presence, as measured on site, of any headwall or draw in western Oregon steeper than 70 percent (65 percent for headwalls or draws in the Tyee Core Area).

Notwithstanding the slopes specified in criterion 1) or 2), field identification of atypical conditions by a geotechnical specialist may be used to develop site-specific slope steepness thresholds for any part of the state in which the hazard is equivalent to 1) or 2), as listed above.

8.4.3. Dissolved Oxygen

8.4.3.1. Effects

Forest management activities that can affect dissolved oxygen (DO) include road construction, road management, and management around landslide initiation sites and debris-flow-prone channels. Fine sediment inputs from road surfaces can reduce DO in gravels if fines deposit in gravel substrates, and can reduce the exchange between subsurface and surface flow.

Landslides are important sources of gravel to streams. In the Elliott State Forest, landslides occur predominantly in the form of debris flows. If debris flows have sources of wood, debris-flow deposits will include both wood and sediment—a condition considered more beneficial to aquatic resources and more likely to result in gravel retention and the development of complex habitat.

Other activities that can affect DO are primarily associated with large wood recruitment. Once in the stream channel, large wood can capture gravels and contribute to gravel-dominated substrates. Depending on the orientation of the wood, it can contribute to velocity profiles that increase DO.

We expect only minor negative effects on DO with this HCP. There should be no effects on DO as it relates to large wood recruitment because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These measures will protect large wood recruitment potential, improve condition of channel substrates, and in turn prevent decreases in intergravel DO. Minor effects are unlikely, but may occur if sediment delivery from roads is higher than expected.

8.4.3.2. Minimization and Mitigation Programs

Management strategies that reduce effects on DO are primarily linked with potential sources of sediment delivery (described in Section 8.3.2) and relationships with large wood (described in Section 8.4.2). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. By minimizing hydrologic connectivity to streams through mitigation projects and new road construction standards, the HCP road management strategies minimize sediment delivery to streams, which in turn minimizes risks to DO. Managing riparian areas and upslope sources for large wood recruitment and mitigation projects such as large wood placement in streams is likely to contribute, maintain, or improve large wood recruitment, which in turn may improve channel substrate characteristics and associated DO levels in a distribution consistent with the historic range of conditions.

8.5. HABITAT: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.5.1. Habitat Access

8.5.1.1. Effects

All new stream crossings must be installed to pass juvenile and adult fish. Therefore, barriers to habitat access on forest land are associated with existing stream crossings. As part of the Oregon Plan, state forest land owners made a commitment to repair existing crossings to the level of the new standards. The best available information on effectiveness of HCP strategies is from conditions across state and private forest ownership throughout Oregon, and from research in Washington.

An ODF compliance study found that 72 to 77 percent of stream crossings were successfully implemented to meet state guidelines in 2000 and 2001 (Oregon Department of Forestry 2002d). Based on the conditions assumed to provide fish passage (Oregon Watershed Enhancement Board 1999), 71 to 74 percent of crossings installed on forest roads from 1996 to 1998 had a high likelihood of passing juvenile fish. Bridges and open arches had the highest success rate (100 percent), followed by those that created a simulated streambed within the culvert (76 to 93 percent). The use of bare culverts at very low gradients (less than 0.5 percent) and baffled culverts had the lowest success rate for fish passage, at 55 and 25 percent, respectively.

Kahler and Quinn (1998) reported that fish were able to exceed both the theoretical limitations and laboratory performances, and pointed to a need for field studies. Based on the results of a small number of studies, the authors reported that simulated natural streambed crossings should not create a barrier to fish passage. They reported that countersunk culverts (embedded) have proved to be better for fish passage than culverts with or without other modifications for fish passage. They tempered this conclusion with the concern that the steepest culverts had not experienced high-flow events (greater than a 10-year flood event), and thus long-term effectiveness was uncertain (Kahler and Quinn 1998). Baffled culverts were found to improve passage of coho and resident trout.

Negative effects of forest management on habitat access will be reduced over time under this HCP because existing roads will be brought up to current standards through restoration activities, which will reduce impacts of current conditions over time. New road construction will have no negative effects on habitat access because all new roads require fish passage. There are approximately 475 culvert stream crossings on the Elliott State Forest, and an additional 18 bridge crossings. Of the stream crossings, 85 percent are on non-fish-bearing streams, and 12 percent are on fish-bearing streams.

8.5.1.2. Minimization Programs

The HCP (Oregon Department of Forestry 1995) and the FPA (Oregon Administrative Rule [OAR] 629-625-0320 (2a) and (2b) and OAR 629-625-600 (8)) both require passage of

juvenile fish at all new stream crossings and existing crossings when replaced. When new roads are built or existing roads are upgraded, they will meet the current fish passage standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000). As with other road-related effects, the greatest risks are posed by existing roads rather than new roads. However, HCP road management strategies include approaches for replacing existing stream crossings that do not pass fish. The strategies are supported by state of the art technical guidance on how to achieve this goal for juvenile fish passage. (Oregon Watershed Enhancement Board 1999; Oregon Department of Forestry 2002b, 2002c)

8.5.1.3. Mitigation Programs

As part of the Oregon Plan, state forestland owners made a commitment to repair existing crossings to meet current fish passage standards. A Memorandum of Understanding between state agencies was signed in 1997 with the goal to achieve these upgrades by 2012. Agencies agreed to use the same criteria and guidelines when designing or consulting on projects that may affect juvenile and adult fish passage. State forestland owners intended to complete upgrades on 100 percent of their crossings with the understanding that it is an ongoing process to maintain passage. The Elliott Watershed Analysis (Biosystems et al. 2003) showed that 14 older culverts likely impede fish passage for at least one life stage. Based on miles of fish habitat upstream, the analysis identified three as a priority for improvement. Most of the stream crossings that had barriers to fish passage have been upgraded with fish passage pipes in the last few years. There are three remaining stream crossing sites to improve; one will be replaced with a bridge, and the other two will be replaced with larger fish passage pipes.

8.5.2. Substrate Character/Embeddedness

8.5.2.1. Effects

Forest management activities that can affect substrate character and embeddedness include road construction and management, riparian management, management around high landslide hazard locations, and management around debris flow-prone channels.

For example, fine sediment inputs from road surfaces can increase embeddedness (see Section 8.3.2). Landslides are important sources of gravel to streams. In the HCP area, landslides occur predominantly in the form of debris flows, which can have a dramatic influence on channel substrate (see Section 8.3.2). If debris flows have sources of wood, debris-flow deposits will include both wood and sediment—a condition considered more beneficial to aquatic resources. Harvesting can increase landslide rates, potentially changing channel substrate character over time and space.

Other activities that can influence substrate character and embeddedness are primarily associated with large wood recruitment (see Section 8.4.2). Once in the stream channel, large wood can capture gravels and contribute to gravel dominated substrates. Harvesting can reduce the amount of large wood recruitment to streams, thus reducing this function.

We expect a range of effects on substrate character and embeddedness with practices described in this HCP. Over time, as riparian and aquatic strategies return riparian areas to desired function (including recruitment of large-diameter wood to streams) and wood is placed in streams, substrate character will improve (e.g., more stream reaches with coarse gravel substrate and fewer bedrock dominated reaches). Minimization programs will prevent degradation from potential sediment input from forest operation with practices such as wide RMAs, managing for mature forest condition within 100 feet of F streams and some N streams, and more types of streams receiving protection, including debris flow-prone channels.

These additional restrictions are likely to maintain large wood recruitment potential, and in turn maintain or improve condition of channel substrates. However, minor effects on substrate may occur from forest roads that can contribute fine sediment to streams. The effect is expected to be low due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels may increase large wood recruitment potential during landslides and reduce run out distances associated with debris flows, thus decreasing sediment delivery to downstream reaches. Landslide frequency can be increased due to harvesting, but BMPs to minimize this impact are described under suspended sediment.

8.5.2.2. Minimization Programs

Minimization programs that might influence substrate character and embeddedness are primarily linked with potential increases in sediment associated with roads (described in Section 8.3.2) and relationships between upland and riparian management, large wood recruitment (described in Section 8.4.2), and channel-forming hydrologic events. When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects to aquatic and riparian resources. By minimizing road-related sediment delivery to streams, the HCP minimizes fine sediment delivery to streams, fine sediment deposition in stream channels, and associated substrate embeddeness. Managing riparian areas and upslope sources for large wood recruitment is likely to maintain or improve substrate characteristics in a distribution consistent with the historic range of conditions. Debris flow-prone channels will have additional leave tree requirements, creating the potential for both additional large wood recruitment and the establishment of debris-flow deposits (wood and sediment, both of which would improve substrate character).

8.5.3. Large Wood

8.5.3.1. Effects

Forest management has the potential to reduce inputs of large wood to streams, through harvesting of riparian areas and trees from upslope and upstream locations. For the sake of clarity, the following terminology, as described in the joint sufficiency analysis by the ODF and the Oregon Department of Environmental Quality (2002) sufficiency analysis, is used to define large wood sources for this discussion.

- **Near-stream Riparian—**Areas directly adjacent to the stream. Large wood is delivered by the tree falling directly into the stream from the adjacent streambank or hillslope.
- **Upstream Riparian—**Near-stream riparian sources upstream of the reach of concern. High water and/or a debris flow transport large wood to its current location after initially falling into the stream from the riparian area.
- **Upslope—**Zero-order channels (zero-order channels are small unbranched draws), hollows, or hillslopes. Areas outside the riparian area. Large wood is delivered by a landslide or landslide-debris flow combination that moves the wood into the stream channel from these areas.

The bulk of the potential *near-stream riparian area* inputs of large wood come from vegetation in close proximity to the channel, with diminishing amounts from distances farther from the stream. The majority of larger pieces of wood, which create key pieces, originate from within a distance of less than 100 feet from the stream (Robison and Beschta 1990). For example, 70 to 99 percent of potential large wood input from adjacent riparian stands originates from within the first 50 to 100 feet of the stream (Van Sickle and Gregory 1990; McDade et al. 1990; Bilby and Bisson 1998; Murphy and Koski 1989). It should be emphasized that these studies did not intend to examine upslope source areas; they analyzed total large wood potential from riparian areas only.

Source areas for potential inputs of large wood are not limited to stream-adjacent locations. Upstream or upslope areas are also important sources of large wood for fish-bearing streams (Keller and Swanson 1979; McGarry 1994; Benda and Sias 1998; May and Gresswell 2003; Reeves et al. 2003). In steep landscapes, such as those included in this HCP, where the occurrence of debris flows is a normal part of the disturbance regime, relatively large pieces of wood in small streams can play an important role in maintaining downstream salmonid habitat (Swanson et al. 1987). High stream flows and debris flows are both mechanisms by which large wood can be transported from relatively small stream channels downstream to larger channels. Debris flows can periodically move very large pieces of wood from a hillslope or hollow downslope to fish-bearing streams where the large wood can interact with the channel and form fish habitat. In these cases, small stream channels can play a significant role in contributing key pieces of large wood to downstream riparian functions. These sources of large wood have been referred to as both “upslope” and “upstream” sources. Available scientific information suggests the relative inputs from upslope and upstream sources can range from 10 to 60 percent (McGarry 1994; McDade et al. 1990; Benda and Sias 1998).

As distance from debris flow source increases, stream flow is the dominant mechanism for transporting large wood downstream. For this population of streams, the hydrologic regime determines the sizes of large wood that will be stable and hydrologically functional in the channel (Bilby 1985b; Bilby and Bisson 1998; Sedell et al. 1982).

Forest management under the HCP has the potential for decreasing *near stream and upstream sources* of large wood recruitment. The potential for decreased large wood recruitment is low for all fish-bearing streams, and for large and medium non-fish-bearing streams. HCP strategies establish 160-foot RMAs along these streams, each with three zones:

stream bank zone, inner zone, and outer zone. The stream bank zone is a no-harvest zone. Management within the inner zone can only occur to move the stand toward a mature forest condition in a more timely manner. Once the mature forest condition is reached, the inner zone is left as a no-cut buffer.

Potential effects are associated with removal of trees in the inner zone that otherwise had the potential to fall into the stream. Beechie et al. (2000) modeled potential wood recruitment of pool-forming wood to streams under various management scenarios. They found that: "thinning of the riparian forest does not increase recruitment of pool-forming LWD where the trees are already large enough to form pools in the adjacent channel and that thinning reduces the availability of adequately sized wood. Thinning increases LWD recruitment where trees are too small to form pools and, because of reduced competition, trees more rapidly attain pool-forming size." The risk associated with thinning in stands where trees are large enough to form pools eliminates suppression mortality, reducing the amount of large woody debris (LWD) recruited to the stream for decades to centuries while the remaining trees grow. However, if the riparian area does not contain large enough conifers to form pools, the recruitment of pool-forming wood to streams occurs more quickly and in greater numbers than if the stands are not managed (Beechie et al. 2000). Therefore, the effect associated with potential management within 100 feet of the stream is assessed as "minor" given the short-term nature of the risk, combined with the long-term benefit of having mature forest conditions in riparian areas, and the policy to only manage in riparian areas when to do so would meet goals faster than no management.

Management near potential landslide locations and debris flow-prone channels influences *upslope* sources of large wood recruitment. The removal of trees in high landslide hazard locations that are located in areas likely to deliver to a stream will reduce this source of large wood recruitment to streams. The HCP will establish leave trees around at least 75 percent of debris flow-prone streams reaches within harvest units. Estimates of RMA acres for the plan area are provided in Table 8-4 as an index of how many near stream acres may be managed along non-fish-bearing streams under this practice. The Elliott State Forest will have a total of 10,419 acres of riparian areas, of which approximately 5,568 acres are along non-fish-bearing streams. Under this HCP, management would be permissible for as many as 1,392 acres of those non-fish-bearing streams. This represents approximately 13 percent of all riparian management acres (for all stream types) in the Elliott State Forest.

Table 8-4
Potential Acres of Small Type N Stream that could be Managed under the Aquatic and Riparian Strategies

Stream Type	Acres of RMA 100% on Fish and Large & Medium Non-Fish-Bearing At least 75% on Small Non-Fish-Bearing				Total Acres in RMAs
	Coos	Ten Mile	Umpqua	Elliott	
Fish-Bearing and Large and Medium Non-Fish-Bearing	2736	864	1251	4851	4851
Small Perennial Type N	1571	768	828	3166	4222
Small Seasonal Type N	512	215	283	1010	1346
Total				**9027**	**10,419**

In summary, we expect a range of effects on large wood recruitment and loading in streams from the HCP. As riparian and aquatic strategies return riparian areas to desired function, including recruitment of large-diameter wood to streams and large wood placement, there should be an improvement of large wood recruitment and eventually wood loading in the stream (which will take much longer). At worst, the aquatic strategies may simply maintain (no effect) current conditions, as research indicates that 70 to 99 percent of streamside sources of wood are provided within RMA widths. Minor negative effects on potential large wood recruitment are expected from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large wood) on some streams. Removal of trees from some high landslide hazard locations initiation sites may reduce large wood recruitment to some Type F streams. HCP strategies minimize this effect by leaving trees along the debris flow-prone reaches (at least 75 percent of reach length in harvest unit) and managing upslope areas for intermediate and advanced forest structure.

8.5.3.2. Minimization Programs

The high landslide hazard locations, debris flow-prone channel, and riparian and aquatic strategies described in Chapter 5 are likely to minimize forest management-related effects on large wood recruitment. The goal to attain mature forest condition in riparian areas within 100 feet of Type F and small and medium Type N streams is likely to meet aquatic and riparian habitat needs by managing for and maintaining large-diameter trees in riparian areas that will be available for recruitment to streams.

In managing landslides and slope stability, the objective is to minimize the occurrence of management-induced slope failures and minimize the potential negative effects on aquatic and riparian habitats. This will be accomplished through application of risk-based management principles and BMPs. Minimization of road-related landslides is fundamental to

this objective. Hazard assessment and risk-based management for in-unit slides, and assurance that large wood is available in the track of potential debris slides and torrents, will promote large wood recruitment for future aquatic habitat inputs. Retaining wood around debris flow-prone channels that are likely to deliver to a fish-bearing stream is likely to reduce effects otherwise associated with debris flows that lack large wood. For example, debris flows may entrain more wood as they move through the channel, which may result in shorter travel distances and increased channel complexity at tributary junctions or other terminal locations. Monitoring and hazard assessment, combined with adaptive management, will ensure that this objective is realized.

Managing approximately 85 percent of upland forests for intermediate or advanced structure further minimizes potential negative effects of forest management on large wood recruitment by maintaining significant levels of mature forest condition over the landscape, including areas that may provide wood during debris flows. This is particularly true for small non-fish-bearing streams that otherwise have narrower buffers and fewer leave tree requirements.

8.5.3.3. Mitigation Programs

Restoration is an important component of the HCP, and will help to mitigate the historic practices that degraded channel conditions. Stream restoration projects will continue to be implemented at or above current levels, as needed, consistent with watershed analysis. For the five-year period from 1999 to 2003, ODF contributed an annual average of $8,400 in cash and $25,900 in-kind toward projects to address fish passage, instream, and riparian improvements. In addition to instream projects, road improvement projects are conducted annually that help improve water quality conditions.

In addition to implementing recommendations from watershed analysis, opportunistic projects associated with harvest operations will be conducted that can take advantage of existing equipment on site. Instream wood placement projects will be conducted on fish-bearing streams within or adjacent to harvest operations when the stream is below the desired level of wood and the operation contains wood meeting the size requirements for the intended stream.

Methods and approaches for restoration activities are described in Section 5.6.3, and include:

1. Watershed assessment to identify potential factors that could be contributing to undesirable aquatic conditions or limiting the recovery of aquatic habitats
2. Identifying, designing, and implementing projects to remedy identified problems in a timely manner

Section 5.6.3 describes restoration strategies designed to improve aquatic habitat through the placement of large wood in streams as well as a summary of watershed analysis recommendations and planned ODF actions. Restoration goals are to promote aquatic habitat conditions that support the short-term survival needs of aquatic organisms, and are intended to correct human-induced conditions in the forest that may contribute to aquatic habitat deficiencies or that may limit desired aquatic habitat conditions.

Using available information such as watershed analysis, the ODF will identify, design, and implement restoration projects in direct consultation with the ODFW and in collaboration

with watershed councils. Aquatic habitat improvement projects will be designed with the intent of resembling natural processes. Project planning and design will consider habitat conditions, stream processes, and the disturbance regime at both the watershed and site-specific scale. Projects will be designed to create conditions and introduce materials sufficient to enhance or re-establish natural physical and biological processes. An emphasis will be placed on projects that re-introduce large "key" pieces of large wood to stream channels in natural configurations. Wood placement activities will utilize materials that are expected to be relatively "stable" yet functional in these dynamic stream systems. The intent is to maximize the functional attributes of large wood, and minimize potential conflicts with public safety in downstream reaches. Reliance on artificial "anchoring" methods (such as cables) will be minimized, and will only be used in cases of significant concern for public safety.

The use of alternative riparian vegetation treatments is another form of restoration designed to address large wood recruitment, and is described in Section 5.6.4, in Chapter 5, page 40. Alternative riparian vegetation treatment refers to the application of silvicultural tools that can be applied in RMAs for the purpose of changing the vegetative community to better achieve the HCP's aquatic and riparian habitat objectives, such as mature riparian forest conditions. The strategy includes three components:

1. Watershed assessment to evaluate whether alternative vegetation treatments are needed to achieve properly functioning aquatic habitat conditions in a timely manner. Where appropriate, this information will be used to plan alternative vegetation treatments.
2. Planning for restoration projects that use a multi-disciplinary approach involving a variety of resource specialists.
3. Monitoring and evaluating projects over time to ensure that objectives are being achieved, and that undesirable affects are minimized. Results will be incorporated in an adaptive management context.

Potential projects include silvicultural treatments such as the conversion of hardwood stands to conifer species; selective removal of hardwoods from mixed-species stands and the establishment of shade-tolerant conifer seedlings; the creation of gaps in hardwood stands to establish conifer seedlings (shade-intolerant and shade-tolerant); and other similar practices not specifically described in the management standards for riparian areas. These beneficial practices establish sources of large coniferous wood recruitment in riparian areas that otherwise do not provide that function.

8.5.4. Pool Frequency and Quality

8.5.4.1. Effects

Pool formation and associated attributes (pool frequency, quality, depth, width-to-depth ratios) are mostly influenced by large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, forest management has the greatest potential to influence inputs of large wood (see Section 8.4.2). The sediment regime can also be influenced by forest management, which in turn can influence pool formation and

associated attributes. Increased frequency and magnitude of landslides and poorly managed forest roads can increase sediment delivery to streams, and in turn influence sediment routing and deposition (see Section 8.3.2).

8.5.4.2. Minimization Programs

Strategies that address pool frequency and quality are primarily linked with reducing or preventing increases in sediment associated with roads and landslides (see Section 8.3.2). Relationships between upland and riparian management to large wood recruitment are also important (see Section 8.4.2). HCP forest management strategies are not likely to influence pool-forming hydrologic events (see Section 8.5.3). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. By minimizing road-related sediment delivery to streams, the HCP strategies minimize degradation of pool quality and depth. Managing riparian areas and upslope sources for large wood recruitment is likely to maintain pool frequency and quality in a distribution consistent with the historic range of conditions. Management strategies around high landslide hazard locations and debris flow-prone channels further minimize impacts on pool frequency and quality (see Sections 8.3.2 and 8.4.2).

8.5.5. Off-Channel Habitat/Refugia

8.5.5.1. Effects

The formation and maintenance of off-channel habitat is primarily influenced by channel constraint, large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, HCP strategies have the greatest potential to influence inputs of large wood and channel constraint. See Section 8.4.2 for more information on large wood recruitment. Roads located in close proximity to and oriented parallel to stream channels can decrease the potential for off-channel habitat and flood plain interactions in channel types that otherwise have those characteristics.

The greatest potential effects are associated with existing roads because current road construction and management policies prevent new road construction in areas likely to develop off-channel habitat. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of old roads. Existing roads located parallel to streams within RMAs pose a risk to floodplain channel interactions and may reduce off-channel habitat.

8.5.5.2. Minimization Programs

When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. HCP road construction policies minimize effects primarily by avoiding new road construction in critical locations such as on flood plains. This practice minimizes effects to off-channel habitat by locating roads in non-critical locations that, if located otherwise, would limit floodplain-channel interactions and development of off-channel habitat.

Refer to Section 8.3.2.2 for a detailed description of the Elliott State Forest road network. Relatively low percentages of roads located near streams or valley bottoms in fifth field watersheds minimize potential risks to flood-plain channel interactions and associated off-channel habitat and refugia. RMA boundaries are measured from the outer edge of high-water level, edge of the stream-associated wetland, side channel or channel migration zone (whichever is farthest from the existing channel location). This practice will minimize the effects of forest management on off-channel habitat by minimizing disturbance on floodplains and providing riparian functions around potential future channel locations and existing side channels.

8.5.6. Stream Bank Condition

8.5.6.1. Effects

Stream bank erosion can occur as a result of natural processes such as wind throw, landslides, and high-flow events. Management-induced changes were more common with practices that did not require leave trees along streams. Restrictions such as riparian leave trees, no ground-based equipment and full suspension through RMAs, omitting roads from riparian areas, and minimizing stream crossings have further decreased potential effects on stream bank erosion.

Forest management activities most likely to affect stream bank conditions include road construction near the stream and stream crossings and forest management near the stream.

8.5.6.2. Minimization Programs

Refer to Section 8.3.2.2 for a detailed description of the Elliott State Forest road network. The HCP riparian strategies treat the inner 25 feet of RMAs on all streams (except “other” small seasonal Type N streams) with a no-harvest, no ground-based equipment buffer. In addition, full suspension is required on all fish-bearing streams and large and medium non-fish-bearing streams. All of these conservation programs minimize potential negative effects of harvest on stream bank condition. Other riparian strategies that apply to the inner and outer zones are described in Sections 8.3.1 and 8.4.2.

8.5.7. Floodplain Connectivity

8.5.7.1. Effects

Floodplain connectivity is primarily influenced by channel constraint, large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, HCP strategies have the greatest potential to influence inputs of large wood and channel constraint. See Section 8.4.2 for more information on effects to large wood recruitment. Roads located in close proximity to and oriented parallel to stream channels can decrease the potential for off-channel habitat and flood plain interactions in channel types that otherwise have those characteristics.

8.5.7.2. Minimization Programs

Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) describe strategies for reducing these effects (see Section 8.3.2). HCP road construction strategies minimize effects primarily by avoiding new road construction in critical locations such as floodplains. This practice minimizes effects to off-channel habitat by locating roads in non-critical locations that, if located otherwise, would limit floodplain-channel connectivity. RMA boundaries are measured from the outer edge of high-water level, edge of the stream-associated wetland, side channel, or channel migration zone (whichever is farthest from the existing channel location). This practice will minimize the effects of forest management on channel/floodplain interactions by minimizing disturbance on floodplains and providing riparian functions around potential future channel locations and existing side channels.

8.6. FLOW/HYDROLOGY: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.6.1. Peak and Base Flows and Increasing Channel Drainage Network

8.6.1.1. Effects

Upland forest management has the potential to influence hydrologic processes. Forest management practices as described in the HCP that have the greatest potential to affect hydrologic processes include landscape-scale strategies such as harvesting and road management. Under the HCP, no more than 5 to 15 percent of the Elliott State Forest will be in an early forest structure.

Available research has evaluated regeneration harvest rates that range from 35 to 100 percent of small watersheds, and rarely separate effects of roads from harvesting. Existing research on changes in peak flows and summer flows that result from forest management suggest that flows with a 0.4- to 5-year return interval are increased when less than 25 percent of the basin is clearcut harvested (Beschta et al. 2000). Increases in summer base flows may also occur, but are not as commonly researched (Beschta et al. 2000). The magnitude of observed changes in peak and low flows are generally small because response flows have low return intervals (Beschta et al. 2000).

Available research on the effects of roads on peak flows suggests that connectivity of roads to streams can increase the channel network, and thus the magnitude of and frequency of peak flows (Wemple et al. 1997). Older road-design standards considered streams to be part of the road drainage system, and directed much of the drainage waters to streams. Wemple et al. (1997) reported that 57 percent of the forest service road network was connected to streams in a study in the Willamette National Forest. Reid and Dunne (1984) reported an even higher value of 75 percent stream connectivity in the Clearwater basin of Washington. Increases in the 25-year return interval were observed as a result of road construction (King and Tennyson 1984). Jones and Grant (1996), Beschta et al. (2000), and Thomas and Megahan (1998) all found increases in peak flows associated with clear-cut harvesting and road building on small watersheds when the peak flow was defined within 0.4- to 5-year return intervals.

Most research has been conducted at small spatial scales (less than 100 hectares). In general, findings from small watersheds cannot be extrapolated to larger watersheds because of differences in hydrologic processes as scale increases (Ziemer 1998). Time frames vary by study and range from 9 to 33 years.

These findings suggest that an effect on peak flows is possible from harvesting as described in the HCP. If one occurs, it is likely to be on small peak flows (half-year to five-year return

intervals) when 25 percent or more of a small basin (0.1 to 1 square kilometers) is in a young stand condition. Research indicates that changes associated with these small basins cannot be extrapolated to larger basins. Furthermore, channel changes associated with increases of these small peak flows are unexpected because of their low stream power. The large peak flows that tend to modify stream channels and transport most of the sediment usually occur during mid-winter. These large events have not been shown to be significantly affected by logging in the HJ Andrews study (Rothacher 1973), Alsea study (Harr 1976; Harris 1977), or Caspar Creek study (Ziemer 1981).

The sensitivity of a stream channel to changes in small peak flows depends on the sediment and wood regime of the watershed (Grant 1987). Grant (1987) writes that "downstream effects of harvest practices on stream channels in the Pacific Northwest suggest that increased sediment delivery (particularly from mass movements) and transport of large woody debris are more important than peak flow increases."

Changes in peak flows or low flows that might occur as a result of forest harvest in the Elliott State Forest are likely to be sufficiently small that changes in flows or channel morphology are virtually non-detectable. Accurate measures of peak flows are expensive, and long monitoring periods are required to accurately assess the effects of management. Alternatives include measures of road connectivity to streams and percent of watersheds in given stand structures.

The greatest risks for increased drainage network are associated with the existing road system. Older roads are more likely to have greater connectivity with streams than newly constructed roads, a characteristic believed to increase the drainage network. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of old roads.

8.6.1.2. Minimization and Mitigation Programs

The HCP describes upland forest management strategies that minimize the percent of the landscape in an early forest structure. No more than 5 to15 percent of the Elliott State Forest will be in an early forest structure—the stand age most likely to result in increased runoff.

An increase in drainage network can occur with poorly managed or constructed roads, which in turn can cause increases in peak flows. The Forest Roads Manual (Oregon Department of Forestry 2000) describes practices to minimize and mitigate this potential effect. This includes road restoration activities designed to minimize connectivity of existing roads to streams. Information on the effectiveness of road restoration suggests that practices as described in the HCP are effective at reducing hydrologic connectivity to streams. This decreases the drainage network and reduces the risk of increased peak flows (see Section 8.3.2 for detail on road strategies).

8.7. SUMMARY

Table 8-1 provides a qualitative summary of aquatic indicators, potential effect to those indicators from forest management, and the rationale for effect findings. In general, practices described in the HCP are expected to result in either a reduced effect, no effect, or a low effect. The rational for these conclusions is that management activities described as part of the HCP will:

- Improve functions over time, improve conditions, and result in "reduced effect over time"
- Prevent effects to aquatic and riparian areas through restrictive BMPs, resulting in "no effect"
- Result in sufficiently small effects (e.g., likely to be immeasurable or short-lived), resulting in a "minor effect"

Aquatic and riparian conditions are linked with landscape processes such as landslides and hydrologic regimes and near stream conditions such as riparian forest structure and shade. Therefore, the HCP approach integrates landscape and site-specific management strategies. The HCP describes a number of integrated habitat conservation strategies for managing at the landscape level to achieve desired riparian and aquatic conditions. These include, but are not limited to, landscape design, watershed analysis, slope stability, and road management strategies. The HCP also describes a detailed set of site-specific approaches to management around fish-bearing streams and non-fish-bearing streams, as well as riparian and aquatic restoration.

Although this assessment described effects in terms of individual indicators, it is important to recognize that a single forest management activity can influence multiple indicators. Likewise, a single indicator can be influenced by multiple forest management activities, and indicators are often interrelated. A conceptual model of this interrelatedness is presented in Figure 8-1. Understanding the connections between management activities, the desired effect on watershed processes, influences on riparian and aquatic habitats, and associated indicators will lead to more effective detection of changes and improvements in forest management over time.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Stream Temperature		X	X	*No effect* because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection including debris flow-prone channels. These measures will maintain shade and in turn stream temperature along F streams and some N streams. *Minor effect* is possible on small N streams with narrower RMAs and fewer leave tree requirements.
Suspended Sediment			X	*Minor effect* from forest roads from fine sediment delivery to streams. The effect is expected to be minor due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels *may* increase large wood recruitment potential during landslides, reduce runout distances associated with debris flows, and in turn decrease sediment delivery to downstream reaches.
Intergravel DO Turbidity		X	X	*No effect* because of *minimization* programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These measures will protect large wood recruitment potential, improve condition of channel substrates, and in turn prevent decreases in intergravel DO. *Minor effects* are unlikely, but may occur if sediment delivery from roads is higher than expected.
Nutrients		X		*No effect* because of *minimization* programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to prevent management impacts on nutrient cycling.
Habitat Access	X	X		*Reduced over time* because existing roads will be brought up to current standards through restoration activities, which will reduce impacts of current conditions over time. *No effects* because all new roads require fish passage for all life stages.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Substrate/ Embedded	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. *No effect* due to minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection including debris flow-prone channels. These additional restrictions are likely to maintain large wood recruitment potential, and in turn maintain or improve condition of channel substrates. *Minor effect* because forest roads can contribute fine sediment to streams. The effect is expected to be low due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels *may* increase large wood recruitment potential during landslides and reduce run out distances associated with debris flows, thus decreasing sediment delivery to downstream reaches. Landslide frequency can be increased due to harvesting, but BMPs to minimize this impact are described.
Large Wood	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. *No effect* due to minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. Removal of trees from some high landslide hazard locations initiation sites may also reduce large wood recruitment to some F streams.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Pool Frequency and Quality	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, large wood begins to fall into streams, and pool frequency and quality improve. Will also improve with large wood placement mitigation projects. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, these practices may increase the pools' frequency and quality. *No effect* because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential and, to the extent that this indicator is influenced by large wood recruitment, prevent impacts on pool frequency and quality. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could decrease pool frequency and quality. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. To the extent this indicator is influenced by wood recruitment from near stream, upstream, and upslope sources, this practice may result in delayed improvement in pool frequency and quality.
Large Pools	X	X		*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, and large wood begins to fall into streams. Will also improve with large wood placement mitigation projects. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, these practices may increase the numbers of large pools over time. *No effect* because of mitigation programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, such practices will maintain current frequencies of large pools. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could decrease pool size.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Off-Channel Habitat and Refugia (*see large wood for wood-related rationale*)	X	X	X	*Reduced over time* because the HCP describes forest road mitigation projects that will reduce the miles of existing roads near streams where off-channel habitat might develop. *No road-related effects* because the HCP describes forest road construction, management, and policies that prevent road construction near streams preventing potential impacts on off-channel habitat. *Minor effect* from existing roads that may constrain development of off-channel habitat.
Width:Depth Ratio in Scour Pools	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. To the extent this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, this improved function may decrease width:depth ratios over time. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. To the extent this indicator is influenced by wood recruitment from near stream, upstream, and upslope sources, this practice may result in short-term increases in width:depth ratios. *No effect* because of minimization programs, which include wide RMAs; managing for mature forest condition within 100 feet of F and some N streams; and more types of streams receiving protection, including debris-flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. To the extent this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, such practices will maintain current width:depth ratios. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could increase width:depth ratios.
Streambank Condition		X		*No effect* because of minimization programs, which include 25-foot no-cut equipment exclusion and full suspension; wide RMAs; and more types of streams receiving protection, including debris flow-prone channels. The HCP describes forest road construction, management, and policies that avoid road construction near streams and aim to minimize stream crossings.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Floodplain Connectivity	X	X	X	*Reduced over time* when roads parallel to streams in floodplains are decommissioned. *No effect* because the HCP describes forest road construction, management, and policies that avoid road construction along floodplains. *Minor effect* from existing road due to the low percentage of roads in floodplains.
Change in Peak Flows & Base Flows	X		X	*Reduced over time:* The Forest Roads Manual describes practices to reduce potential increase in drainage network that may occur on existing roads that otherwise would contribute to increases in small peak flows. *Minor effect* on peak flows is possible from harvesting and existing roads that were not constructed to current standards. If impact occurs, it is likely to be on very small peak flows (one-half-year return interval) when 25 percent or more of very small basins is in a young stand condition. Such changes have only been observed on very small basins (0.1 to 1 square kilometers). Channel changes associated with increases of these small peak flows are unexpected because of their low stream power. An increase in drainage network can occur with poorly managed or constructed roads. The Forest Roads Manual describes practices to minimize this potential effect.
Increasing Drainage Network	X		X	*Reduced over time:* The Forest Roads Manual describes practices to reduce potential increase in drainage network that occur on existing roads that otherwise would contribute to increases in small peak flows. *Minor effect* because Some roads are not fully disconnected from the drainage network. Over time these will be corrected.

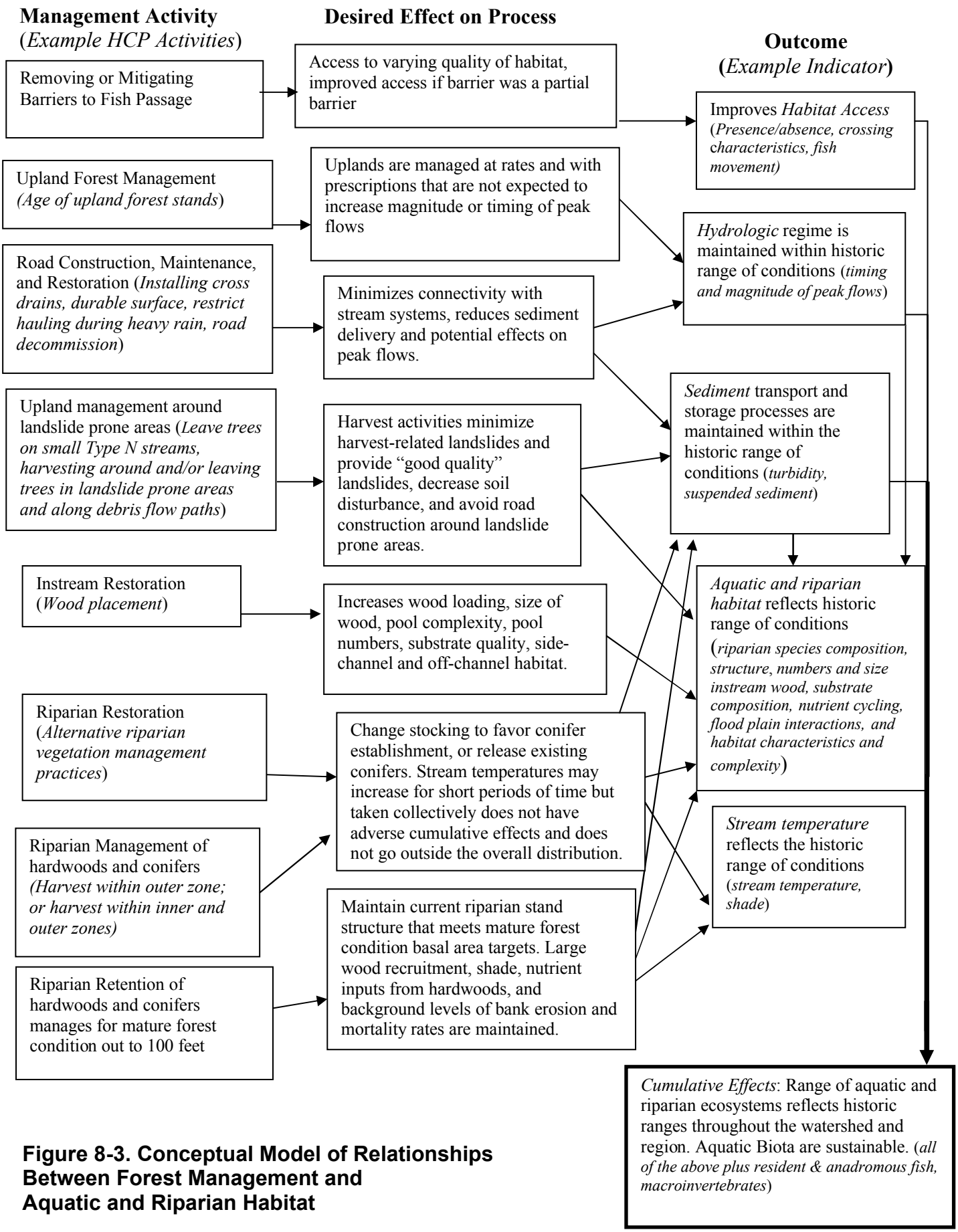

Figure 8-3. Conceptual Model of Relationships Between Forest Management and Aquatic and Riparian Habitat

Chapter 9
Conservation Strategies for Other Species

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The Habitat Conservation Plan (HCP) conservation strategies discussed in Chapters 5 through 7 are expected to provide many of the habitats and conditions necessary to support numerous species, in addition to northern spotted owls, marbled murrelets, and fish. However, some species—especially those that are listed or proposed for listing, whose populations are restricted in distribution or habitat requirements, or whose populations seem to be declining at a regional scale—may require additional, very specific conservation and protection measures to supplement the underlying strategies. The additional vertebrate species being considered for coverage under an Incidental Take Permit (ITP) were selected from species known to inhabit, or whose ranges include, Elliott State Forest lands. The selection process included a review of published and unpublished literature and personal contact with local state, Federal, and private biologists, birders, and other knowledgeable individuals. Table 9-1 contains the full list of bird, mammal, and amphibian species developed through this process. Chapter 4 contains more information on the status of these species on the Elliott State Forest, and Chapter 11 presents a framework for adaptive management. It is necessary to read all chapters to understand completely the Oregon Department of Forestry's (ODF's) habitat conservation strategies.

Table 9-1
Other Species Covered by the Habitat Conservation Plan[1]

Birds	Mammals
Bald eagle	Fisher
Northern goshawk	**Amphibians**
Olive-sided flycatcher	Red-legged frog
Western bluebird	Southern torrent salamander
	Tailed frog

[1] For a complete list of species covered by the HCP, see Table 1-1 or 4-1.

9.1. BACKGROUND

9.1.1. Management Status for Other Species

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 five 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.

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).

The fisher is currently considered to be a candidate species for listing by the USFWS. Previous petitions to list this species were denied for various reasons. The latest petition for the West Coast population of the fisher was recorded in 2003. The finding of the USFWS to this petition was that listing of this population was warranted but precluded because of higher priority actions.

At one time, the northern goshawk 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. This species remains on ODFW's list of sensitive species (critical status) (Oregon Department of Fish and Wildlife 1997).

Other species on ODFW's list of sensitive species include the olive-sided flycatcher, western bluebird, southern torrent salamander, and tailed frog (all vulnerable status); and red-legged frogs (undetermined status). The olive-sided flycatcher is also considered by the USFWS to be a Bird of Conservation Concern in the Northern Pacific Forest region. The southern torrent salamander and tailed frog are also considered to be Species of Concern by the

USFWS. Species of concern is an informal term referring to species that are considered to be in need of concentrated conservation actions. Species of concern receive no legal protection, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species.

9.1.2. Other Species on the Elliott State Forest

Surveys have been conducted on the Elliott State Forest for bald eagles. These surveys have located four bald eagle nest sites that are currently active. Some limited surveys have been conducted for olive-sided flycatchers and western bluebirds. These surveys have located individuals of these species on the Elliott State Forest, but no nest sites have been located. Surveys have also been conducted for red-legged frogs, tailed frogs, and southern torrent salamanders. There are six ponds where red-legged frogs have been found. Tailed frogs and southern torrent salamanders also have been located in some appropriate habitats on the forest. However, the surveys for these species were limited in scope. It is known that they occur on appropriate habitat on the Elliott State Forest, but it is not known whether they are present in all streams.

No surveys have been conducted for northern goshawks or fisher. Northern goshawks are believed to be relatively rare in the Coast Range, but they could occur on the Elliott State Forest. Fisher is not currently known to inhabit the Elliott State Forest. However, if fisher populations expand in the future, the Elliott State Forest may provide habitats suitable for dispersal, foraging, and (potentially) denning.

9.1. CONSERVATION GOALS

The conservation goals for other species of concern on the Elliott State Forest are as follows:

- Maintain and enhance the ability of Elliott State Forest lands to support nesting, roosting, foraging, and wintering by bald eagles through applying protective measures that minimize the likelihood of disturbance and habitat degradation, and developing additional habitats for those functions.
- Maintain and enhance the ability of the Elliott State Forest to support nesting and foraging habitats for northern goshawks through applying protective measures that minimize the likelihood of disturbance and habitat degradation.
- Maintain and enhance the ability of the Elliott State Forest to support nesting and foraging by olive-sided flycatchers and western bluebirds through the development of habitats suitable for these species.
- Improve the quantity, quality, and distribution of mature forest habitats on the Elliott State Forest, to contribute to fisher conservation in areas with the greatest potential for future habitation.
- Maintain and enhance the ability of the Elliott State Forest to support reproduction and population maintenance of red-legged frogs through the application of forest management practices that minimize the likelihood of habitat degradation.
- Maintain habitats for southern torrent salamanders and tailed frogs across the landscape over time by maintaining: cool water temperatures; stream substrates low in fine sediments; large gravel and cobble in the stream substrates; intact and functioning riparian areas; a cool, moist microclimate; and connectivity to other small, non-fish-bearing streams.

9.2. CONSERVATION STRATEGIES

The habitat conservation strategies described in Chapter 5 provide the basis for the protection of all species in this HCP. Specifically, the following habitat conservation strategies contribute to the maintenance and enhancement of habitat for other species of concern on the Elliott State Forest:

- Strategy 5.2: Manage for a Range of Stand Structures Across the Landscape
- Strategy 5.3: Establish Conservation Areas to Protect Special Resources
- Strategy 5.4: Develop Implementation Plans to Achieve a Landscape Design that Provides Functional Habitat for Native Species
- Strategy 5.5. Maintain or Incorporate Habitat Components into the Forest at a Landscape Level
- Strategy 5.6 Aquatic and Riparian Strategies

These conservation strategies are designed to protect existing habitat, develop additional habitat, provide landscape connectivity, and sustain natural processes to benefit species of concern.

The Elliott State Forest is managed to produce a range of early, intermediate, and advanced stand structures across the landscape. By providing a range of stand structures on the landscape, habitat may be provided for a variety of species with different habitat requirements.

Conservation areas have been established to protect special resources, including threatened and endangered cores (T&E cores); steep, unique, or visual areas (SUVs); and riparian management areas (RMAs). In addition to providing habitats for northern spotted owls and marbled murrelets, T&E cores will provide habitats for other species associated with advanced structure, as well as provide connectivity across the landscape for late-successional forest associates. RMAs will protect habitat for fish species by maintaining the integrity and functions of stream channels. These areas also will provide valuable habitat for other species of concern that are associated with streams and streamside habitats, such as amphibian species. Finally, SUVs protect certain habitats that are rare in the Elliott State Forest, as well as areas where management is logistically difficult. In addition to maintaining some unique habitats, many of these areas contain advanced structure habitats. Thus, additional habitats for late-successional associated species will be provided in these conservation areas as well.

The distribution of stand structures across the landscape will achieve the variety of patch types, sizes, and arrangements necessary to provide functional habitat for native species. Forestwide and basin-specific targets for advanced structure stands, coupled with a logical landscape design developed during implementation planning, will provide habitat connectivity across the Elliott State Forest for species associated with advanced structure. In management basins with more advanced structure, connectivity is likely to be provided for many species by the greater amount of this habitat type. However, where advanced structure stand targets are relatively low, the arrangement of advanced structure patches becomes more important.

Snags and logs are stand structural components that are critical to the life cycle of many species of concern. These habitat components are maintained in all stand types, including early structure, and additional snags and logs are provided where needed, contributing landscape connectivity for species associated with these structures. In addition, live trees are retained in regeneration harvests, providing a valuable habitat component in early structure that will continue to provide valuable structure as the stand develops into other structural stages.

The aquatic and riparian conservation strategies protect existing aquatic habitats and their functions, and contribute additional advanced stand structures adjacent to waterways and aquatic habitats (Chapter 5). These strategies will benefit a number of aquatic species of concern, as well as provide complex habitats for other species that use riparian areas.

The following sections describe the habitats with which other species of concern are closely associated, the potential effects of the proposed action on these habitats, and the minimization and/or mitigation expected from the habitat conservation strategies relative to each species. In addition, other fine filter strategies to minimize effects to species of concern are identified as additional conservation measures. Monitoring is a key component of these strategies and monitoring actions associated with each species are described in this chapter as well as in Chapter 11.

9.3. KEY INDICATORS

Key indicators for the success of the habitat conservation strategies for other species of concern include:

- Maintaining known nest and winter roost sites for bald eagles;
- Minimizing disturbance to nesting goshawks and fisher should they be found on the Elliott State Forest;
- Providing habitat for bald eagles, northern goshawks, and fishers through the maintenance and development of advanced structure habitat on the Elliott State Forest through time;
- Providing habitat for olive-sided flycatchers and western bluebirds through retention of live trees and snags in early structure stands on the forest through time;
- Maintaining habitat for red-legged frogs through protection of ponds with known populations of red-legged frogs; and
- Maintaining habitat for tailed frogs and southern torrent salamanders through protection of perennial, non-fish-bearing streams.

The following sections describe each indicator and the potential effects of activities covered under this HCP on the indicator, followed by the minimization and mitigation provided by the conservation strategies.

9.4. POTENTIAL EFFECTS AND MINIMIZATION AND MITIGATION BY SPECIES

9.4.1. All Species

The following conservation measure applies to all species included in this chapter.

Conservation Measure 9.1
Information for Identifying Other Species

- To facilitate identification of other species on the forest, ODF will provide information on how to recognize adults and young animals and their nesting structures. This information will be used for informal training of foresters and others involved in activities on the forest, including monitoring and timber sale activities.
- This information also will be shared with the USFWS, and will be available within one year of plan implementation.

9.4.2. Site Plans

For several species, site plans will be developed in the event that any nesting sites, breeding areas, or other significant habitat locations are discovered on state forest lands. ODF will develop these plans in collaboration with ODFW and USFWS. Site plans will specify any actions necessary to address the most important potential threats to the species and to protect the site from deleterious changes to key habitat characteristics while the site is being actively used. Site plans will be completed within one year of the discovery of important nesting, breeding, or other significant habitat locations, or at the time an operation is planned within the established distance from a site—whichever comes first. Site plans will be reviewed on an annual basis to determine if continuing implementation is warranted. These plans are a conservation strategy for three species: bald eagle, northern goshawk, and fisher.

9.4.3. Bald Eagle

Surveys have been conducted on the Elliott State Forest for bald eagles. These surveys have located four bald eagle nest sites that are currently active.

In the Pacific Northwest, bald eagles nest primarily in multi-layered conifer stands with dominant old-growth trees within the forest canopy. Their nests are built in very large, older trees. Nest sites are closely associated with aquatic foraging areas such as estuaries, lakes, and rivers. Throughout the year, bald eagles spend much 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.

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. 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 overlook a foraging area and the 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 waterbodies. 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. See Chapter 4, Section 4.3 for additional information about bald eagles.

For the purposes of this plan, bald eagle habitat is assumed to be advanced structure with large trees (at least eight trees per acre at least 32 inches diameter breast height (DBH)) within 1 mile of lakes and rivers (Table 9-2).

9.4.3.1. Summary of Potential Effects

Known Sites

Forest management activities have the potential to affect known sites and sites discovered in the future. The most likely potential effects are associated with mechanized timber management and road and landing construction and include:

- Removal or modification of habitat in nesting areas that affects occupancy or reproductive success; and
- Disturbance to nesting birds.

To date, ODF has not inadvertently harvested trees in a bald eagle nest site. During the 50-year length of the permit term inadvertent removal of habitat or activities with the potential to disturb nesting eagles could occur near an unknown and well concealed active eagle nest.

Advanced Structure

Habitat for bald eagles is found primarily in Basins 1, 2, 9, 12, 13, and a small portion of Basin 3, basins which are adjacent to the Umpqua River, Mill Creek, the lower portion of the

West Fork Millicoma River, and Loon Lake. Forest management activities have the potential to negatively affect habitat for bald eagles through final harvest of advanced structure with eight trees per acre greater than or equal to 32 inches DBH within one mile of rivers and lakes. Habitat development is expected to occur as a result of thinning and partial harvest treatments of other advanced and intermediate structure stands that develop, maintain, and enhance the characteristics of advanced structure over the term of the ITP.

9.4.3.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

The four known bald eagle nesting sites are located in conservation areas. By minimizing management activities in these areas and maintaining advanced structure, the nesting sites are expected to be protected throughout the term of the ITP.

There are over 6,200 acres within conservation areas that are within one mile of the Umpqua River, Mill Creek, the West Fork Millicoma River, and Loon Lake. These conservation areas have the potential to provide nesting areas for bald eagles, throughout the term of this ITP. Advanced structure is the primary habitat type within these areas, and over the ITP, further advanced structure will be developed in these areas. If bald eagles establish nest sites in these T&E Cores and SUVs in the future, these nest sites also will be expected to be protected throughout the term of the ITP.

In addition, site plans will be developed for known nesting sites and winter roosting sites as described in the following conservation measure. Eagles and their nests are very visible and eagle nesting behavior predictable enough to allow for a high level of determination of nest locations and implementation of site management plans. Implementation of the site management plans would greatly reduce or potentially eliminate effects from forest management activities.

Conservation Measure 9.2
Develop Site Plans for Bald Eagles

Site plans will be developed for nesting territories or winter roost sites that are on or affect state forestlands within one year of discovery, or any time an operation is planned within one-half mile of these areas, whichever comes first. These territory plans will specify actions that address the most important potential threats to the species and protect the site from deleterious changes to key habitat characteristics. Examples of management actions include:

- Retaining current and historic nesting and perching trees (usually taller and larger diameter trees that may extend above the canopy and that are snags or alive with broken, forked, or irregular tops);
- Providing a forested buffer around known nest tree(s) or roosting areas.;
- Maintaining territory or roost site integrity through buffers and other appropriate tools;
- Prohibiting felling, yarding, road construction, or other habitat alteration within one-quarter (1/4) mile of the active nest tree or perch trees or within one-half (½) mile if the eagles have line-of-sight vision to the disturbance area during the nesting season (January 1 to August 31). These restrictions would be waived if that year's nesting attempt has failed or the nesting territory is unoccupied;
- Managing stands to maintain nesting habitat or develop additional nesting habitat over time;
- Utilizing landscape strategies to maintain and enhance habitat on state forest lands adjacent to nest site(s) located on other ownerships; and
- Annual monitoring of occupancy and reproductive success.

Other formally adopted guidelines from the USFWS may replace these management actions at the discretion of the ODF.

Advanced Structure

Implementation of the conservation strategies over time will maintain both the distribution and the quantity and quality of habitat for bald eagles.

Conservation Areas

Approximately 6,200 acres of advanced structure are present in conservation areas (including T&E cores areas, SUV lands, and RMAs) within one mile of a water body (lakes or large rivers; Table 9-3). Through the limitation on management in conservation areas, and management for mature forest condition in RMAs, these acres will be maintained over the term of the ITP. Approximately 2,500 additional acres of advanced structure is expected to be developed in these areas over the term of the ITP.

Maintenance and Development of Advanced Structure

Figure 9-1 shows the amount of advanced structure projected to be on the forest over time by decade. At least 50 percent of the advanced structure will have at least eight trees per acre of 32 inches DBH or larger. Basin targets (see Table 5-1) guarantee that distribution of advanced structure habitat occurs across the forest in all basins and is not concentrated in one area. The basin targets for advanced structure in Basins 1, 2, and 13 are 50 percent, 40 percent, and 50 percent, respectively. Most of the advanced structure in these basins will be located in the conservation areas. However, some additional advanced structure outside of conservation areas will be located within 1 mile of rivers or lakes in these basins. Advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH will provide potential nesting areas for bald eagles, particularly in parts of the forest near the Umpqua River and Loon Lake.

9.4.3.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of bald eagles in the Elliott State Forest.
  - The maintenance and development of advanced structure within one mile of lakes and rivers will provide habitat for bald eagles throughout the forest.
  - Management for mature forest condition within the RMAs within one mile of lakes and rivers will create and maintain stand conditions with a high likelihood of providing large trees for bald eagles through time and space.
  - Site management plans for bald eagles will protect the site from deleterious changes to key habitat characteristics, and maintain occupancy and productivity of the site through time.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for bald eagles as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Annually monitor known nest sites and roosting areas to determine occupancy and productivity as part of site management plans for bald eagles.

Eagles have very high site fidelity to previous nests and territories. Revisiting these existing territories to assess occupancy and nest success early in the nesting season is a very effective and inexpensive way to monitor eagle occupation and locate alternate nest sites to avoid affecting this species as a result of forest management activities.

9.4.4. Northern Goshawk

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. Goshawk nesting territories are large, and their foraging areas extend to 4,900-5,900 acres. Because goshawks need sizable territories with large trees for

nesting, they prefer expansive patches of late-successional forests with considerable canopy closure.

While northern goshawks are present in Coast Range forests, they are believed to be relatively rare in this region. No surveys have been conducted for northern goshawks on the Elliott State Forest, and it is unknown if there are any current territories on the forest. See Chapter 4, Section 4.4 for additional information about northern goshawks.

Although northern goshawks may use a variety of closed canopy stands to meet their habitat needs, for the purposes of this plan, habitat for northern goshawks is assumed to be advanced structure stands (Table 9-2).

9.4.4.1. Summary of Potential Effects

Known Sites

Forest management activities have the potential to affect nest sites discovered in the future through:

- Removal or modification of habitat in nesting areas that affects occupancy or reproductive success
- Removal or modification of habitat in proximity to nesting areas that affects the suitability of the nest site or increases the susceptibility of nests to predation
- Disturbance to nesting birds

The potential for forest management activities to take an otherwise unknown goshawk nest is low. Given the relative lack of goshawk occupation on the Oregon Coast and the conservation strategies in the HCP, it is unlikely more than a few goshawks would be taken this way in the 50-year permit term.

Advanced Structure

Figure 9-1 shows the amount of advanced structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP.

Final harvest of advanced structure stands has the potential to negatively affect habitat for northern goshawks. Approximately 20,000 acres of advanced structure outside of conservation areas will be harvested during the term of the ITP (Figure 9-2).

During the term of the ITP, approximately 26,000 acres of current advanced structure will be maintained on the forest, both within and outside of conservation areas (Figure 9-2). In addition, approximately 21,000 acres of ingrowth advanced structure will be developed during this period. The maintenance and development of advanced structure stands will positively affect habitat availability for the northern goshawk.

9.4.4.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

The 10,480 acres of advanced structure within T&E cores and SUVs have the potential to provide nesting areas for northern goshawks throughout the term of the ITP (Table 9-3). Advanced structure is the primary habitat type within these areas and, over the ITP term, further advanced structure will be developed in these areas. By the end of the permit term, T&E cores and SUVs will consist of over 14,000 acres of advanced structure. The limitation on management in conservation areas may promote the occupancy of northern goshawks if they move into these areas on the forest in the future.

If goshawks do move onto the Elliott in the future, nests may be discovered either through normal staff field work or through monitoring surveys. The following conservation measure will provide additional assurance that up to four nest sites at any given time that are discovered in the future are protected from the potential effects of habitat removal and disturbance. If more than four nest sites are located during any one breeding season, ODF will collaborate with ODFW and USFWS to determine which four sites will be subject to the following measure.

Conservation Measure 9.3
Develop Site Plans for Northern Goshawks

Site plans will be developed for nesting territories that are on or affect state forest lands within one year of discovery, or any time an operation is planned within one-half mile of these territories, whichever comes first. These territory plans will specify actions that address the most important potential threats to the species and protect the site from deleterious changes to key habitat characteristics. Examples of management actions include:

- Retaining nesting trees
- Providing a forested buffer around the nest tree(s)
- Maintaining territory integrity through buffers and other appropriate tools
- Managing stands to maintain and develop additional nesting habitat over time
- Using landscape strategies to maintain and enhance habitat on state forest lands adjacent to nest site(s) located on other ownerships.
- Periodically monitoring occupancy and reproductive success

A maximum of four goshawk territories will be protected by site management plans at any given time. No more than two of these will be located outside of T&E core areas. However, the following will apply to all actively nesting goshawks:

- Prohibiting felling, yarding, road construction, or other habitat alteration within 660 feet of any known active northern goshawk nest during the nesting season (February 15 through September 15). These seasonal restrictions would be lifted if the nest is abandoned.

Advanced Structure

Figure 9-1 shows the amount of advanced structure on the forest by decade. This advanced structure will be distributed in all basins to meet the basin targets for advanced structure. In some basins, additional advanced structure will be maintained and developed outside of the conservation areas in order to meet the basin target. In other basins, advanced structure within conservation areas will be adequate to meet basin targets.

The maintenance and development of advanced structure on the forest outside of conservation areas will provide habitat for northern goshawks that complements the advanced structure within conservation areas if northern goshawks move onto the forest in the future. The requirement for 500 acres of advanced structure in close proximity that incorporates a T&E core area in each basin (Conservation Measure 5.6) will provide additional assurance that large patches of interior habitat exist for northern goshawks.

9.4.4.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, and those that might be listed in the future, in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- The maintenance and development of advanced structure on the forest both within and outside of conservation areas will provide habitat for northern goshawks throughout the forest.
- Site management plans for northern goshawks will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for northern goshawks as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Approximately 11,600 acres of potential habitat will be surveyed for northern goshawks, beginning at year ten of the plan. A minimum of 20 percent of this acreage will be surveyed during any given year, so that surveys are completed in five years. A randomly selected subset of potential habitat will be identified for surveys, which will use established protocols. Surveys during the early breeding season for goshawks in courtship flights are a very effective way to identify territories and locate nest stands.
- Monitoring activities to determine occupancy and productivity will be established as part of site management plans for northern goshawks.

9.4.5. Olive-sided Flycatcher

Breeding habitat for olive-sided flycatchers is conifer forest, particularly 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. Olive-sided flycatchers are associated with forest openings and forest edges, and are more abundant in landscapes that include high contrast edges between late seral and early seral forest. Altman (1999) describes optimal habitat as early-seral forest with retained live trees and snags over 40 feet tall. See Chapter 4, Section 4.5 for additional information about olive-sided flycatchers.

For the purposes of this plan, habitat for olive-sided flycatchers is assumed to be early structure stands with retained live trees and snags (Table 9-2).

9.4.5.1. Summary of Potential Effects

Nest Sites

ODFs Landscape Management strategies will result in the creation of olive-sided flycatcher habitat through forest management activities that create early seral forest adjacent to mature conifer forest habitats. However, once these habitats are created, there is some risk of the take of olive-sided flycatchers nesting in the adjacent mature forest. Forest management activities have the potential to affect these nest sites through:

- Removal or modification of habitat in nesting areas during the breeding season that affects occupancy or reproductive success
- Disturbance to nesting birds

The felling of trees in mature conifer forest adjacent to early seral forest during the nesting season of June, July, and August has the potential to take an otherwise unknown olive-sided flycatcher nest. Felling of timber may occur at any time of year, but more commonly takes place during the early spring rather than the summer, although some amount of felling may occur from June through August in any given year, and some percentage of this may take place in suitable olive-sided flycatcher habitat.

No potential take of olive-sided flycatchers is expected in riparian management areas adjacent to early seral stands.

It is not known whether or to what extent nesting olive-sided flycatchers may be sensitive to disturbance from nearby activities.

Forest management activities that create edge habitats will provide potential new nesting areas for olive-sided flycatchers.

Early Structure

Figure 9-1 shows the amount of early structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP. During the term of this permit, a range of 5 to 15 percent of the forest will be maintained in early structure. Much of this early structure will be adjacent to intermediate and advanced structure stands that provide potential nesting habitats for olive-sided flycatchers. In addition, virtually all early structure units will contain riparian management areas. Regeneration harvest activities that retain live trees and snags will effectively create additional olive-sided flycatcher habitats so that early structure habitats are present on the forest consistently

through time. Habitat will be lost as early structure stands develop into intermediate structure stands with closed canopies.

9.4.5.2. Summary of Minimization and Mitigation

The conservation strategies will create and maintain stand conditions that have a high likelihood of providing functional habitat elements for olive-sided flycatchers through time and space.

Nest Sites

The occurrence of inadvertent take of olive-sided flycatcher nest sites is expected to be low for the following reasons:

- Only a limited amount of felling will take place during the nesting season of June, July and August. Felling on the Elliott State Forest more commonly occurs prior to June.
- Early structure stands are typically allowed to grow for some time before adjacent mature stands are harvested. The Forest Practices Act prohibits clearcut harvest units within 300 feet of an adjacent clearcut if the combined area would exceed 120 acres until at least four years have passed since the stand was created and it is "free to grow" or the resultant stand of trees has attained an average height of at least four feet. This "green up requirement" ensures that mature forest adjacent to recent clearcuts is maintained for at least four years. Typically, adjacent mature forest is not harvested for ten years or more, delaying and potentially eliminating the chance of potential take of nesting olive-sided flycatchers in these situations.
- Riparian management areas are not subject to timber harvest. No potential take of olive-sided flycatchers is expected in riparian management areas adjacent to early seral stands.

Management for Early Structure

Early structure will be maintained on 5 to 15 percent of the forest through time. Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers through the term of the permit..

Habitat Components

Within regeneration harvest units, an average of three trees per acre will be retained. In addition, all existing snags of all decay classes will be retained where operationally feasible, including at least three hard snags per acre, 15 inches DBH or larger, and at least 20 feet tall. This retention level is expected to provide suitable habitat for olive-sided flycatchers.

Aquatic and Riparian Strategies

The landscape management strategies require retention of trees adjacent to streams. RMAs provide additional retained trees and snags within and adjacent to early structure stands, and also provide areas of high contrast edge adjacent to early structure. The presence of RMAs within and adjacent to early structure stands will contribute to the suitability of these early structure stands for olive-sided flycatchers. Once these riparian management areas are

created through harvest of the adjoining stands, they are not subject to timber harvest activities.

9.4.5.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, and those that might be listed in the future, in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for olive-sided flycatchers within and adjacent to early structure stands.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for olive-sided flycatchers as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Using accepted protocols, periodically sample early structure stands to determine the presence of olive-sided flycatchers. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.

9.4.6. Western Bluebird

Western bluebirds nest in cavities created by other woodpeckers, natural cavities, or artificial nest boxes. They breed in open habitats with low overstory tree densities, including grass-forb, shrub, and early successional forest stands that have suitable nest cavities and structures. This species is often found nesting in cavities along the edges of open fields (Eltzroth 2003). See Chapter 4, Section 4.6 for additional information about western bluebirds.

For the purposes of this plan, habitat for western bluebirds is considered to be early structure stands under ten years of age with retained or created snags (Table 9-2).

9.4.6.1. Summary of Potential Effects

Nest Sites

ODFs Landscape Management strategies will result in the creation of western bluebird habitat through forest management activities that create early seral forest with snags. Forest management activities have the potential to affect these nest sites through:

- Site preparation activities, especially slash burning that disturb breeding birds during the nesting season.
- Removal of nesting snags during the breeding season

Burning slash in recent clearcut units from late March through August has the potential to create atmospheric conditions that western bluebirds might find disturbing. Burning of slash typically occurs during the wet months of the year, but may occur in some units as late as April. Therefore, there is some limited possibility that bluebirds nesting within a unit where slash is being burned may be disturbed by the smoke. This disturbance is unlikely to last for more than one day.

The felling of snags adjacent to early seral forest during the nesting season from late March through August has the potential to take an otherwise unknown western bluebird nest. The landscape strategies (Conservation Measure 5.8) require ODF to retain snags in all decay classes within harvest units. Snags will only be removed when there are safety or operational issues that require a snag to be felled.

Forest management activities that create early structure with snags will provide potential new nesting areas for western bluebirds.

Early Structure

Figure 9-1 shows the amount of early structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP. During the term of this permit, a range of 5 to 15 percent of the forest will be maintained in early structure. Habitat will be lost as early structure stands develop into intermediate structure stands, and will be recreated through regeneration harvest activities that retain live trees and snags, so that early structure is present on the forest consistently through time. However, harvest activities may occasionally result in the loss of individual snags in proximity to early seral stands when safety or operational reasons require them to be felled.

9.4.6.2. Summary of Minimization and Mitigation

The conservation strategies will create and maintain stand conditions that have a high likelihood of providing functional habitat elements for western bluebirds through time and space.

Nest Sites

Conservation Measure 5.8 requires the retention of existing snags of all decay classes where operationally feasible during harvest activities, with a target of at least three hard snags per acre (decay class 1 or 2), 15 inches DBH or larger and at least 20 feet tall. If fewer than three hard snags per acre exist after harvest, one snag per two acres will be created, using live trees greater than 20 inches DBH and a minimum of 20 feet tall. This conservation measure will result in retention and creation of structures potentially suitable for western bluebirds within early structure stands.

The occurrence of inadvertent take of western bluebird nest sites is expected to be low for the following reasons:

- Western bluebirds will most commonly be found using snags within early structure stands or adjacent riparian management areas. These snags are not subject to forest management activities.
- In adjacent stands, only snags that are on the edge of harvest units adjacent to early structure provide potential habitat for western bluebirds. There are seldom operational

issues associated with snags on the edge of units. There may infrequently be safety reasons requiring removal of snags on the edge of units adjacent to early structure during the bluebird breeding season.

- Rarely, slash burning may occur within a unit being used by a nesting western bluebird. This disturbance is unlikely to last for more than one day.

Management for Early Structure

Early structure will be maintained on 5 to 15 percent of the forest through time. Early structure with snag retention will provide potential nesting and roosting habitats for the western bluebird.

Aquatic and Riparian Strategies

The aquatic and riparian strategies, including management of streamside and inner zones as well as special emphasis areas, require retention of trees, snags, and downed wood within and adjacent to regeneration harvests. The retention of snags along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.

9.4.6.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of western bluebirds in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- Early structure with snag retention will provide potential nesting and roosting habitats for the western bluebird.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for western bluebirds as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Periodically sample early structure stands to determine the presence of western bluebirds. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.

9.4.7. Fisher

The fisher is associated with expansive mature to late-successional conifer-dominated stands with a high canopy closure, large amounts of logs, and sizeable snags and trees with cavities. Although fishers have been seen in younger forests on a seasonal basis, even these stands have remnants of older forests present in the form of snags and logs.

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. 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. If fisher populations expand in the future, there is the possibility that they will utilize habitat on the Elliott State Forest. See Chapter 4, Section 4.8 for additional information about the fisher.

For the purposes of this plan, potential fisher habitat is considered to be advanced structure with at least eight trees per acre equal to or greater than 32 inches DBH (Table 9-2).

9.4.7.1. Summary of Potential Effects

Known Sites

Because there are currently no known sites, and it will likely be many years before fisher populations expand to the Elliott State Forest, the likelihood of take of this species is very low. However, forest management activities have the potential to affect fisher activity areas if they expand to the Elliott State Forest in the future. The most likely potential effects are associated with mechanized timber management and road and landing construction and include:

- Removal or modification of habitat in areas of concentrated fisher use that affects occupancy or use of these areas
- Disturbance to animals from forest management activities

Although the likelihood of take is low, during the 50-year length of the permit term, inadvertent removal of habitat or activities with the potential to disturb fishers could occur near an undiscovered activity area.

Advanced Structure

Advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH is the habitat most likely to be used by fishers. Figure 9-1 shows the projected acres of advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH for each decade of this plan. At plan initiation, there were approximately 25,700 acres of advanced structure with large trees throughout the forest. Approximately 34 percent was in conservation areas at the beginning of the ITP term (Table 9-3). By the end of the permit term, approximately 52 percent of the advanced structure with large trees will be located within conservation areas (over 14,000 acres; Figure 9-2). The amount of advanced structure with large trees will remain relatively stable throughout the term of the ITP.

Forest management activities have the potential to negatively affect habitat for fishers through final harvest of advanced structure with eight trees per acre greater than 32 inches DBH. Approximately 12,500 acres of advanced structure with large trees outside of conservation areas will be harvested during the term of the ITP (Figure 9-2). Approximately 11,300 acres of advanced structure with large trees will be developed through the permit term, while approximately 26,000 acres of advanced structure will be maintained, both within and outside of conservation areas (Figure 9-2).

Forest management activities that result in the loss of important structures, including large trees, snags, and downed wood, also could negatively affect potential habitat for fishers.

9.4.7.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

There are currently no known sites, and it will likely be many years before fisher populations expand to the Elliott State Forest. If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional research or survey efforts that include the Elliott State Forest, or conduct its own activities, as described under Monitoring below.

T&E core areas and SUVs have the potential to provide habitats for fisher throughout the term of this ITP. The limitation on management in these areas will promote habitat suitability for fishers should they move onto the forest.

If fisher is found to be using habitats on the Elliott State Forest, ODF will collaborate with USFWS to determine the need to develop a site plan, as described in the conservation measure below.

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Conservation Measure 9.6
Develop Site Plans for Fisher

Site plans will be developed when ODF and USFWS determine that fishers are exhibiting concentrated use of forested habitats on the Elliott State Forest and measures to avoid disturbing fishers during the breeding season are needed to minimize the potential for incidental take. These site plans will be developed within one year of discovery, or any time an operation is planned within one-half (1/2) mile of these areas, whichever comes first. These plans will specify actions to address potential disturbance to fishers during the times of concentrated use. Examples of actions to be implemented include:

- Seasonal restrictions on mechanized timber harvest activities and road and landing construction within one-half (1/2) mile of active areas of concentrated use
- Seasonal restrictions as needed for other forest management activities with the potential to affect areas of concentrated use.
- Using landscape strategies to maintain and enhance habitat on state forest lands adjacent to areas of concentrated use

A maximum of four fisher site plans will be implemented at any given time.

Advanced Structure

The overall landscape strategy of maintaining and developing advanced structure within and outside T & E cores will provide opportunities for fisher to use the Elliott State Forest. Potential fisher habitat also will be provided through the strategy to maintain 40 to 60 percent

of the forest in advanced structure stands over time, with at least 50 percent of the advanced structure having at least eight trees per acre of 32 inches DBH or larger. Figure 9-1 shows the amount of advanced structure with large trees on the forest by decade.

Approximately 11,300 acres of advanced structure with large trees will be developed during the term of the ITP, including approximately 5,900 acres within conservation areas and an estimated 5,400 acres outside of conservation areas. Approximately 16,000 acres of advanced structure with large trees will be maintained, including 7,500 acres outside of conservation areas in addition to the 8,500 acres within conservation areas (Figure 9-2).

The nearly 16,000 acres of conservation areas that are T&E cores and SUVs have the potential to provide habitat for fisher for the next 50 years. Initially, these areas primarily consist of advanced structure, but as further structure develops over time, they move from consisting of 65 percent advanced structure to over 90 percent advanced structure, with only small amounts of intermediate structure and nonforest. The proportion of T&E cores and SUVs consisting of advanced structure with larger trees changes from 43 percent to 70 percent over the 50-year term of the ITP. By the end of the permit term, T&E cores and SUVs will consist of over 11,000 acres of advanced structure with larger trees.

Although T&E core areas and SUVs have the best potential for providing future habitats for the fisher, development of additional advanced structure habitat on the landscape outside of these areas may provide important foraging and dispersal habitats for fishers. To the extent that basin targets for advanced structure are not met within conservation areas, additional advanced structure will be maintained and/or developed within that basin over time (Table 5-1). These basin targets guarantee that distribution of advanced structure habitat occurs across the forest and is not concentrated in one area. The requirement for 500 acres of advanced structure in close proximity that incorporates a T&E core area in each basin provides some assurance that larger patches of advanced structure will be present across the forest (Conservation Measure 5.6). In addition, mapped murrelet habitats retained for marbled murrelets (see Strategy 7.4) will provide additional habitat for the fisher.

Fishers are associated with legacy structures such as snags and logs. These structures are expected to occur as part of natural processes within conservation areas. Outside of conservation areas, stands being developed into advanced structure will be managed for these structures, including at least six snags per acre, two of which must be at least 24 inches in diameter; a total of 3,000 to 4,500 cubic feet of downed logs in all decay classes, or 600 to 900 cubic feet per acre of sound downed logs in decay classes 1 or 2; and multiple tree species, including shade-tolerant species, some trees with defects or decadence, and diverse understory vegetation. These large snags and logs will provide potential future denning and resting sites for fishers.

Finally, retention of snags and logs in RMAs, and management for mature forest condition within the RMAs for fish-bearing streams will create and maintain stand conditions with a high likelihood of providing functional habitat elements for fishers.

9.4.7.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of fishers in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of fishers across the regional landscape.
- T&E core areas and SUVs would provide the best potential habitats for this species if individuals use the Elliott State Forest in the future.
- Site management plans will function to protect fishers from disturbance due to forest management activities during the breeding season .
- Outside of conservation areas, the maintenance and development of advanced structure with numerous snags and logs will provide habitat for fishers throughout the forest.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for fishers as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional fisher research or survey efforts that include the Elliott State Forest, or conduct its own fisher research or survey activities.

9.4.8. Red-legged Frog

Red-legged frogs breed in ponds, marshes, and slow-moving streams, and favor riparian areas with dense undergrowth. Not strictly aquatic, they can wander as far as 300 yards from water. Red-legged frogs were found at 6 of 13 ponds surveyed on the Elliott State Forest in 2001. See Chapter 4, Section 4.9 for additional information about the red-legged frog.

For the purposes of this plan, potential habitat for this species includes all ponds on the Elliott State Forest (Figure 9-2).

9.4.8.1. Summary of Potential Effects

Management activities have the potential to affect habitat for red-legged frogs through:

- Removal of water from occupied sites during the breeding season; and/or
- Degradation of water quality through removal of vegetation near occupied sites and through the use of ground-based equipment near breeding habitats.

Although the occurrence of forest fires on the Elliott State Forest is rare, there are occasions when water is drawn from ponds for firefighting purposes, primarily in the later summer months, July through September. By this time of year, few tadpoles remain in ponds, as most have metamorphosed into froglets. Nevertheless, water removal from red-legged frog breeding ponds may occasionally result in death or injury to red-legged frogs or tadpoles. It is expected that this occurrence will be infrequent over the term of the ITP due to the

infrequent nature of fires on the Elliott, the time of year when firefighting activities are most likely to occur, and the small number of occupied ponds.

9.4.8.2. Summary of Minimization and Mitigation

Riparian Management Areas

The six ponds on the Elliott State Forest where red-legged frogs were found are all less than one-quarter acre in size. The Aquatic and Riparian strategies protect ponds less than one-quarter acre through the following standards (see Table 5-8):

- A 25-foot RMA will be established, within which hardwood trees and brush will be retained in the RMA to protect hydrologic functions.
- Occupied ponds will be identified as important areas for temperature-sensitive amphibians, and will have at least 80 percent shade maintained over the aquatic area.
- Harvest activities or ground-based equipment use will not be allowed within 25 feet of all stream-associated wetlands.

The retention of trees near pond areas will contribute to cover and shade for this species. Limiting the exposure of aquatic and riparian habitats to ground-disturbing activities and removal of vegetative cover will minimize sedimentation and water quality degradation.

Some of the breeding ponds are used by the ODF for fire suppression activities. However, because red-legged frogs breed early in the year, it is highly unlikely that water removal would occur during the breeding season.

9.4.8.3. Monitoring

Assumptions

- RMAs for ponds will protect the functions of these habitats for red-legged frogs.

Activities

- Periodic surveys of all suitable ponds will be conducted at approximately six-year intervals to determine occupancy by red-legged frogs.

9.4.9. Headwater Amphibians

Torrent salamanders are encountered in seeps, springs, small streams, and the margins of large streams with cold water temperatures, and are associated with high gradient streams.

Tailed frogs are highly specialized for life in cold, clear, swift, perennially-flowing mountain streams. Tailed frog larvae show a strong association with coarse substrates, such as cobble, and both adults and larvae are generally negatively associated with fine substrates, such as sand and silt. See Chapter 4, Section 4.11 and 4.12 for additional information about torrent salamanders and tailed frogs.

Although they may be found in a wider range of stream types, for the purposes of this plan, habitat for these headwater amphibian species will be assumed to be small, perennial non-fish-bearing streams. Figure 8.1 (page 8-7) shows the miles of different stream types on the

Elliott State Forest. There are approximately 348 miles of small perennial non-fish-bearing streams on the Elliott State Forest (Table 9-2).

Surveys have located these two species in the Umpqua, Tenmile, and Coos Watersheds, but it is not known if they occur in all small perennial streams in these watersheds.

9.4.9.1. Summary of Potential Effects

Forest management activities have the potential to affect southern torrent salamanders and tailed frogs when they occur in proximity to small perennial non-fish-bearing streams and if they result in increased water temperatures, or in water quality degradation, specifically increasing siltation of rocky substrate. As well, alterations to riparian areas that contribute to lowered humidity, decreased shade, ground disturbance, and lack of large wood are also factors likely to negatively affect these species. Mechanized timber harvest in proximity to small perennial non-fish-bearing streams may result in these effects. In addition, spur road construction to access and harvest timber will involve stream crossings of these non-fish perennial streams in headwater areas that may affect headwater amphibians.

9.4.9.2. Summary of Minimization and Mitigation

Conservation Areas

An estimated eight percent of all small, perennial non-fish-bearing streams on the forest occur in T&E cores and SUVs. Because harvest activities are restricted in these areas, these streams are likely to retain suitable habitat for headwater amphibians throughout the term of the ITP.

Stand Structure Targets

Habitat for headwater amphibians will be maintained in perennial non-fish-bearing streams located within stands managed for advanced structure characteristics. Additionally, intermediate structure stands may support connectivity between and among aquatic habitats over time and space. Thirty to 60 percent of each management basin will be managed for advanced structure, including the conservation areas (Table 5-1) and ten of the 13 management basins will have advanced structure requirements that are in addition to what exists within conservation areas. Between 85 and 95 percent of the forest will be in intermediate and advanced structures at any point in time. Only 5 to 15 percent of the forest will be managed for early structure habitats.

Riparian Management Areas

Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs. RMAs standards for small, perennial non-fish-bearing streams are described in Chapter 5 and include:

- No harvest activities or ground-based equipment use within 25 feet of all perennial streams, and some seasonal streams
- An additional 15 to 25 conifer trees and snags per acre from 25 to 100 feet from the stream

- Retention of all hardwoods, non-merchantable trees, and other conifers as necessary to achieve 80 percent shade over the aquatic zone within 500 feet of a confluence with a Type F stream
- Extension of the 25-foot no harvest buffer on perennial Type N streams to protect the functions and processes for seeps and springs, source areas of perennial streams, stream-associated wetlands, stream junctions, and the splash zone of waterfalls.

These standards will contribute to cover and shade and water quality, as well as microclimates supportive of headwater amphibians. The retention and development of snags, dead, and downed material in the RMA will provide cover and shade for animals dispersing from the stream. Limiting the exposure of aquatic and riparian habitats to ground-disturbing activities and removal of vegetative cover will minimize sedimentation and water quality degradation.

In addition, best management practices described in the Oregon Forest Practices Act include the following to minimize negative effects to these streams:
All permanent crossings must be constructed to:

- Minimize excavation
- Restrict width and height of fill (less than 15 feet deep)
- Prevent erosion of the fill and channel (e.g. durable surfacing, draining road runnoff away from the crossing, etc.)
- Pass a peak flow that corresponds to at least a 50-year return interval

For temporary crossings;

- Operations will limit the number of crossings.
- Structures must be adequate to pass flows that occur during the operation.
- Structures will be located to minimize cut and fill depths (less than eight feet).
- All temporary crossings will be removed immediately after completion of the operation or prior to a runoff that exceeds the flow capacity of the structure, which ever comes first.
- Crossing material will be placed in a location where it will not enter waters of the state.

Additionally, the following conservation measure will further ensure protection of habitats for headwater amphibians during harvest activities:

Conservation Measure 9.8
Retention of Trees in the Inner Zone on Small Perennial Type N Streams

- The aquatic and riparian strategies target the retention of at least 15 to 25 conifer trees and snags per acre in the area located 25 to 100 feet from a small perennial Type N stream (Table 5-6). Unless there are operational or safety constraints, efforts will focus on retaining the trees closest to the stream. In most stands, this would result in retention of all trees within 50 feet of these streams.

9.4.9.3. Monitoring

Assumptions

- T&E core areas and other conservation areas may provide important source habitats for headwater amphibians throughout the forest.
- Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for headwater amphibians as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Within the first five years of plan implementation, conduct a study to determine the effectiveness of RMA standards to protect the functions of small perennial Type N streams. Parameters to be measured include shade, water quality (e.g., stream temperature, macroinvertebrates, or sediment), and presence of headwater amphibians. The study will include surveys before and after management activities in a selection of perennial Type N streams, as well as surveys of small perennial Type N streams within a selection T&E core areas or SUVs. Follow-up surveys will be conducted in five and ten years.

Table 9-2.
Assumptions for Potential Habitat by Species

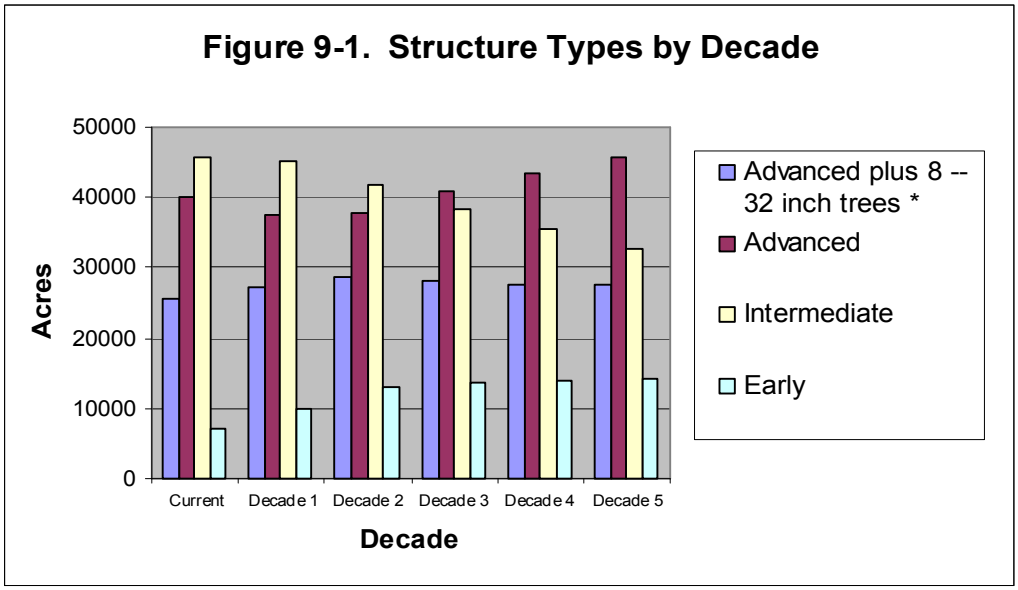
Species	Potential Habitat	Approximate amount of habitat at plan initiation
Bald Eagle	Advanced structure with at least 8 trees/acre at least 32 inches DBH within 1 mile of lakes and rivers[1]	10,800 acres
Northern Goshawk	Advanced structure	41,700 acres
Olive-sided flycatcher	Early structure with retained trees and snags	7,000 acres
Western Bluebird	Early structure with snags	7,000 acres
Fisher	Advanced structure with at least 8 trees/acre at least 32 inches DBH[2]	25,700 acres
Red-legged frog	Ponds	13 ponds
Tailed frog	Small, perennial Type N streams	350 miles
Southern torrent salamander	Small, perennial Type N streams	350 miles

[1] Subset of All Advanced Structure
[2] DBH = diameter breast height

Table 9-3
Current Condition [1]

Structure Type	Total Habitat in Plan Area at Start of Plan	Habitat Within Conservation Areas				Outside Conservation Areas
		Total	T&E Core	SUV	Riparian	
Advanced structure with eight trees per acre at least 32 inches DBH[2]	25,700	8,524	5,859	976	1,789	17,076
Advanced structure with large trees within one mile of rivers and lakes[3]	10,826	6,206	4,033	1,508	664	4,620
All advanced structure	41,716	13,159	8,410	2,070	2,679	28,557
Intermediate structure	44,090	8,723	3,219	1,851	3,653	35,367
Early structure	6,898	396	38	18	340	6,502

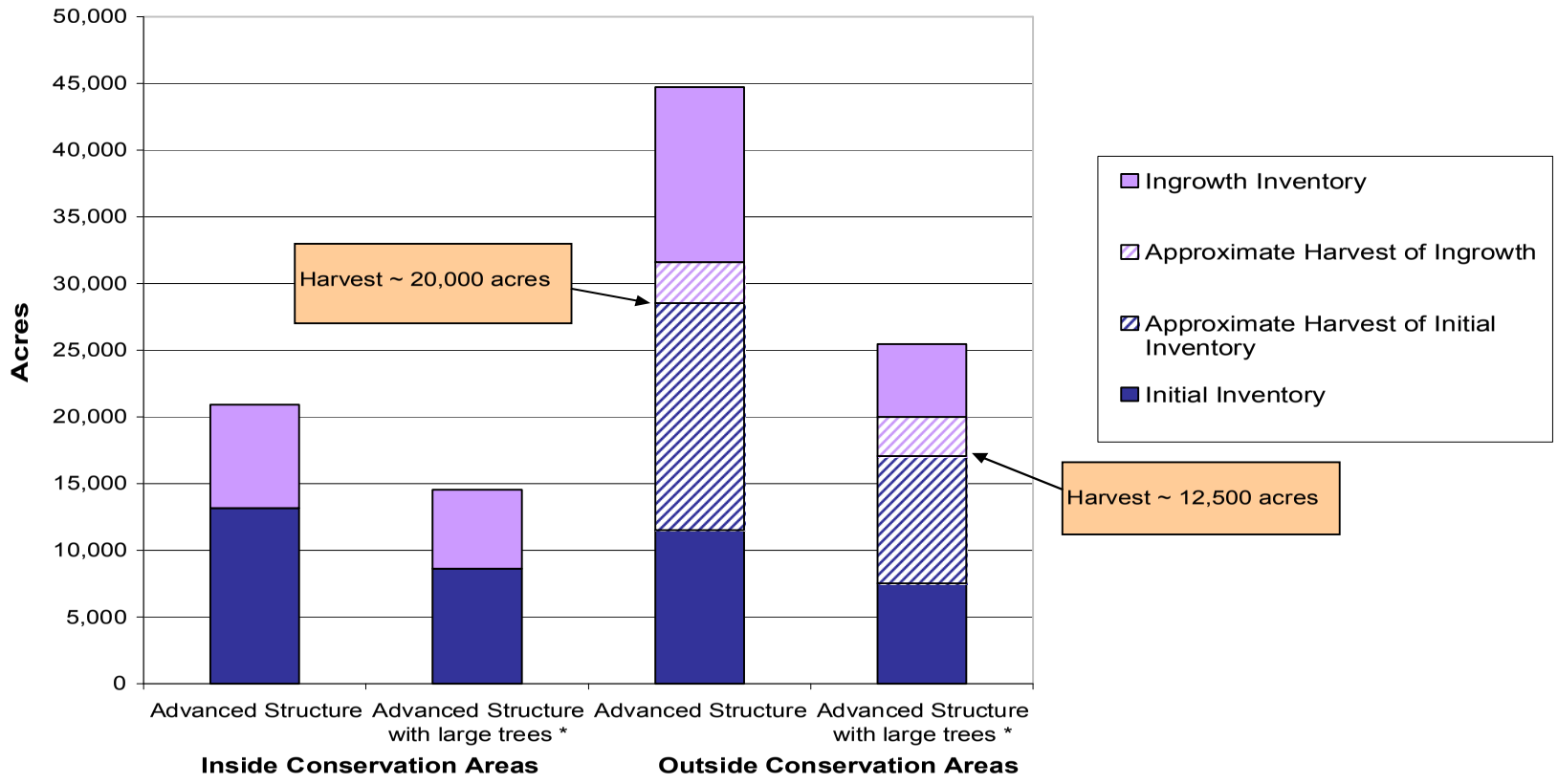
[1] In acres.
[2] DBH = diameter breast height
[3] Subset of Advanced Structure



* Advanced plus 8 – 32 inch DBH trees is a subset of Advanced Structure

Figure 9-2

Inventory of Advanced Structure Within and Outside Conservation Areas [1]



[1] Source for these numbers is output from Model 9u2.

* Advanced Structure with large trees is a subset of Advanced Structure

Ingrowth = acres developed into advanced structure during the 50-year period.

Harvest = total acres of advanced structure regeneration harvested for 50 years

Chapter 10
Conservation Alternatives Considered

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The Habitat Conservation Plan (HCP) team evaluated current and desired forest conditions and developed a range of alternative conservation strategies. Each alternative is a strategy for managing northern spotted owls, marbled murrelets, and other vertebrate species, and their habitats on the Elliott State Forest, while maintaining the ability to manage the forest for other resources, including timber and revenue production to meet legal mandates (Alternative 7, which would produce no timber harvest or revenue, is an exception). The Elliott State Forest contains approximately 93,000 acres in Coos and Douglas Counties. Approximately 90 percent of this land consists of Common School Forest Lands (CSFLs), and the remainder is Board of Forestry Lands (BOFLs). The alternatives presented herein are designed to illustrate the range of reasonable responses to the issues. The alternatives are presented in more detail in the Environmental Impact Statement (EIS) for the HCP.

In meeting the requirements for an HCP, this subsection summarizes the alternative descriptions and discussion from the EIS. Alternative 1 is the no action alternative, involving the continued use of the existing (1995) HCP to manage for northern spotted owls and avoiding any incidental take of marbled murrelets. Alternative 2 is the preferred alternative, and the basis for the conservation strategy. Alternatives 3 through 7 present different management strategies. Alternatives 1, 2, and 3 were developed and analyzed fully. Alternatives 4 through 7 were considered, but eliminated from detailed analysis. This chapter also includes some discussion on the choice of Alternative 2 as the preferred alternative, the basis for the conservation strategy, and why the other alternatives were not selected. The EIS contains detailed information on the effects of each alternative, including the amount of potential incidental take of northern spotted owls and marbled murrelets.

The aquatic and riparian strategies are not the same for all alternatives. Alternative 1 uses the aquatic and riparian strategies in the 1995 Elliott State Forest HCP. Alternatives 2 and 4 use the aquatic and riparian strategies described in Chapter 5. Alternative 3 uses a modified version of the strategies used in the Northwest Forest Plan (USDA Forest Service, et al. 1994a). Alternative 5 describes other riparian management variations that were considered in developing Alternative 3. Alternative 6 uses Forest Practices Act (FPA) standards. Under the Memorandum of Agreement between the State of Oregon and the National Marine Fisheries Service, the Oregon Department of Forestry (ODF) is committed to aquatic conservation strategies that have a high likelihood of maintaining and restoring properly functioning aquatic habitat for salmonids on state forestlands. All alternatives will follow all FPA rules, the policies of the State Land Board and the Board of Forestry, and applicable laws, such as the state and federal Endangered Species Acts (ESAs).

Resource specialists from the ODF developed the alternatives in cooperation with the federal agencies. In addition, the ODF worked closely with the Department of State Lands (DSL) and the Oregon Department of Fish and Wildlife and their resource specialists. The public also contributed to alternative development through the public involvement process described in Appendix G of the Elliott State Forest Management Plan and Appendix D of the EIS, “Consultation with Others.”

10.1. CURRENT MANAGEMENT (ALTERNATIVE 1: NO ACTION)

10.1.1. Description of Alternative

The ODF could continue to manage Elliott State Forest lands under the 1995 HCP for northern spotted owls and avoid incidental take of other threatened and endangered species. Under this alternative, the ODF would not apply for a new Section 10(a)(1)(B) incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS). The ODF would avoid the take of marbled murrelets by using the *Marbled Murrelet Operational Policy for State Forest Lands* (Oregon Department of Forestry 2004). Aquatic and riparian areas would be protected by applying aquatic and riparian management strategy 2 in the 1995 Elliott State Forest HCP.

Under this alternative, some northern spotted owls would be incidentally taken through habitat modification, but this would be mitigated by reserve areas and through nine long rotation basins that encompass about half the forest. Each long rotation basin would maintain 50 to 66 percent of its area in nesting, roosting, and foraging habitat for the northern spotted owl. At least half of the forest would be maintained in dispersal habitat. An ITP associated with the HCP is in effect through 2056.

Marbled murrelets would be protected in accordance with the provisions of the federal ESA under the Marbled Murrelet Operational Policy for State Forest Lands (Oregon Department of Forestry 2004). Occupied stands would be protected from harvest indefinitely, and in effect would become reserves for marbled murrelets. However, if ongoing surveys indicate that a marbled murrelet-occupied stand is vacant for a period of five consecutive years, the stand could become available for harvest. RMAs and non-production lands could provide some habitat for northern spotted owls and marbled murrelets, but would not be specifically managed for that purpose. Production lands would be managed with timber production as the primary use.

Under this alternative, management activities in the Elliott State Forest would be inherently unpredictable because of the mobility of the marbled murrelet. There would be permitted incidental take of northern spotted owls under this alternative, but no incidental take of marbled murrelets. Existing and planned habitat in the Elliott State Forest should provide for 26 northern spotted owls as predicted in the 1995 HCP. Some marbled murrelet habitat will also be protected through the northern spotted owl HCP. In the first few decades, timber harvest opportunities would become increasingly more constrained because of the obligations in the 1995 HCP, coupled with the identification of new marbled murrelet-occupied sites.

10.1.2. Why Alternative was Not Selected

The ODF chose not to pursue this alternative because it does not take advantage of recent advances in the management of riparian and upland habitats. This alternative does not include the concept that forest structural conditions are key to habitat use by wildlife, and does not

integrate the landscape strategies for multiple wildlife species. This alternative does not take advantage of the latest research and information for both northern spotted owls and marbled murrelets. It would not provide the same level of certainty, stability, and flexibility as the proposed HCP.

In addition, this alternative would limit timber harvest unnecessarily. The continued addition of new marbled murrelet-occupied sites would steadily reduce the land base where timber harvesting could occur. Revenue production would be significantly below the potential of the forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent. This alternative would not achieve that goal.

10.2. PROPOSED ACTION ALTERNATIVE (ALTERNATIVE 2)

10.2.1. Description of Alternative

The proposed HCP would manage the Elliott State Forest using principles of sustainable forest ecosystem management. These lands would be viewed as a landscape containing different habitat types within the context of the larger regional landscape. Over time, through forest management and natural processes, patches would develop into other habitat types. High-quality habitat areas called threatened and endangered cores (T&E cores) that are used by northern spotted owls and marbled murrelets would be maintained for these species for the length of the permit period. Outside the T&E cores, habitats of specific types, such as advanced structure, would change in location on the landscape over time and provide additional habitat areas for northern spotted owls and marbled murrelets. Most habitat patches would be forest stands of various ages with various structures. Other types of habitat patches would be a small percentage of the landscape, and might include meadows, wetlands, rock outcroppings, and other habitats. All currently occupied northern spotted owl sites and many occupied marbled murrelet sites would be protected in T&E core areas. Other than for monitoring, there would be no additional surveys for northern spotted owl and marbled murrelet sites, and no new protection sites would be designated.

The application of the landscape strategies would be intended to create forest conditions that would emulate historical conditions and processes relative to aquatic systems. The approach would also incorporate a set of variable, site-specific riparian strategies to address the range of desired conditions along the stream network. Desired conditions would vary depending on the functions provided by streams in different portions of the landscape, and are described in Appendix D of the HCP. All streams would have a 160-foot riparian management area with varying levels of tree retention depending upon stream type. The goal along fish-bearing streams would be to develop habitat conditions similar to mature timber stands. The goal along non-fish-bearing streams would be to develop habitat conditions sufficient to support important stream functions and processes, and to achieve properly functioning conditions in downstream fish-bearing waters.

The Elliott State Forest is part of a regional landscape with diverse forests that have varying characteristics, ownerships, histories, and management. Through landscape management of state forestlands in a regional context, the proposed HCP would contribute to the conservation of northern spotted owls, marbled murrelets, coho salmon and many unlisted vertebrate species throughout their range. While providing this contribution, the proposed HCP would manage the forest in a manner that meets legal mandates and trust obligations.

In the Coos District, most forestland is in federal or private ownership. The federal forests are usually in large blocks managed to provide large areas of northern spotted owl habitat and marbled murrelet nesting habitat within the marbled murrelet range.

The benefits and effects of the proposed HCP strategies for northern spotted owls, marbled murrelets, coho salmon, and other species are described in Chapters 6 through 9.

Adaptive management, a cornerstone of state forest management plans, would allow the ODF to use new knowledge to improve state forest management.

10.3. INCREASED STREAM BUFFERS AND INTENSIVE MANAGEMENT (ALTERNATIVE 3)

10.3.1. Description of Alternative

Approximately 50 percent of the Elliott State Forest would be managed as reserves through establishment of T&E core areas, steep, unique or visual areas (SUVs), and riparian reserve areas. Buffer widths within the riparian reserve areas were modeled after Forest Ecosystem Management Assessment Team stream buffers derived from the Northwest Forest Plan (USDA Forest Service, et al. 1994b), and are larger than stream buffer widths associated with the other alternatives. The remainder of the lands would be managed intensively for timber on a short rotation (40 to 50 years).

T&E core areas would be selected based on known northern spotted owl and marbled murrelet use. All fish-bearing streams would have a 160-foot riparian reserve along each side. All non-fish streams would have a 100-foot riparian reserve along each side. Some thinning could occur within these riparian reserves on a site-specific basis where it would benefit coho salmon and other aquatic species. The site-specific thinnings that may occur would be developed in collaboration with the Services and ODFW. SUVs would be primarily composed of steep areas deferred because of public safety issues.

Within the reserve areas, stands would eventually mature and grow into advanced forest structure. Stands would not gain structural diversity as fast as would occur with active management. Trees in these areas that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in conservation areas through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl and marbled murrelet habitat with minimal fragmentation.

10.3.2. Why Alternative was Not Selected

This alternative was not selected because the ODF considered it a less efficient way to meet the multiple resource demands of the Elliott State Forest. The landscape would not be managed under an integrated set of strategies that consider the long-term structural characteristics of the forest. The extensive reserve areas in this alternative would receive no management, and would take longer to develop suitable northern spotted owl and marbled murrelet habitat than if actively managed. Because of the extensive nature of the reserves, in large part as a result of the riparian areas, timber harvesting would be inefficient and operationally difficult.

10.4. COMBINED RESERVES AND INTENSIVE FORESTRY (ALTERNATIVE 4)

10.4.1. Description of Alternative

This alternative would rely on a combination of reserves and intensive timber management. Approximately half the land in the Elliott State Forest would be managed intensively for commercial timber production on short-rotations of 40 to 50 years or less. The remainder of the lands would be designated as reserves, including riparian management areas (RMAs). The location of reserve areas would be chosen based on information about current northern spotted owl and marbled murrelet use, but a long-term approach to designating these areas would be taken, with the goal of creating large blocks of connected reserve areas. The site-specific aquatic and riparian strategies in this alternative would be the same as those used in Alternative 2 – 160 foot RMAs on all streams with varying levels of tree retention depending upon stream type. The desired condition along fish-bearing streams would be mature forest habitat conditions and the desired condition along non-fish-bearing streams would be habitat conditions sufficient to support important stream functions and processes.

This alternative would contribute to the survival and recovery of northern spotted owls, marbled murrelets and coho salmon by protecting some existing habitat in a managed landscape, and providing RMAs and other lands classified as non-production. The arrangement of reserve areas on the landscape would be partially controlled by the location of northern spotted owl circles and known marbled murrelet nesting areas. RMAs in any location would also count as part of the reserves. The current distribution of stands in the Elliott State Forest is the result of past timber harvests, and is not necessarily a desirable or optimal arrangement for wildlife needs. Many occupied northern spotted owl and marbled murrelet sites would be protected in the reserve areas, but not all. There would be no additional surveys for northern spotted owl and marbled murrelet sites, and no new protection sites would be designated.

Under this alternative, one goal would be to arrange much of the reserve areas in large connected blocks to reduce the fragmentation that currently exists. However, this would mean that not all currently occupied northern spotted owl and marbled murrelet sites would be protected. In the long term, large blocks of older habitat would develop in reserve areas. Outside the reserves, short rotations of 40 to 50 years would be used so that most, if not all, existing northern spotted owl or marbled murrelet habitat would eventually be eliminated in these areas.

10.4.2. Why Alternative was Not Selected

This alternative was not selected because the ODF considered it a less efficient way to meet the multiple resource demands of the Elliott State Forest. The ODF believes this alternative may eliminate some known occupied northern spotted owl or marbled murrelet sites in the first decade, and have more intensive negative effects on watershed processes in the more

heavily harvested basins. The extensive reserve areas in this alternative would receive no management, and would take longer to develop suitable northern spotted owl and marbled murrelet habitat than if actively managed.

10.5. ALTERNATE BUFFER WIDTH EVALUATIONS (ALTERNATIVE 5)

10.5.1. Description of Alternative

In developing Alternative 3 (Section 10.3), the federal lead agencies and ODF reviewed a number of different applications of the Forest Ecosystem Management Assessment Team (USDA Forest Service, et. al. 1993) stream buffer widths for establishing riparian reserves. It was determined the increased stream buffer widths incorporated into Alternative 3 best met both the project purpose and need and the project applicant's stated objectives. The following summarizes the evaluations that were completed for alternatives incorporating alternative buffer widths into designated riparian reserve areas.

10.5.1.1. Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths

This alternative would use the landscape concepts and the conservation areas of the proposed HCP, but increase the stream buffers to match those used in the Northwest Forest Plan (USDA Forest Service, et al. 1994a). For fish-bearing streams, the width of a stream buffer area would typically be equivalent to the height of two-site potential trees, while the width of the stream buffer area for non-fish bearing and intermittent streams would be one-site potential tree. Largely because of these buffers, approximately three-quarters of the forest would be designated as conservation areas and would receive little or no active management. Regeneration and thinning harvests would be limited to the remainder of the forest.

Within the conservation areas, stands would eventually mature and grow into advanced forest structure. Stands would not gain structural diversity as fast as would occur with active management. Trees in these areas that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in conservation areas through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl and marbled murrelet habitat with minimal fragmentation.

10.5.2. Why Alternative was Not Selected

This alternative was not considered because it would not meet the constitutional and statutory obligations to produce revenue for the Common School Fund from CSFLs and to produce revenue for counties and local governments from BOFLs. Revenue production would be significantly below the potential of the forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent. This alternative would not achieve that goal. The large reserves would severely limit the number of acres available for timber harvest, and the placement of the reserves across the landscape would make it difficult and costly to perform management activities on those areas

that were not reserves. The ODF believes that the Aquatic and Riparian Strategies in Alternative 2 (Section 10.2) are a more efficient and effective way to achieve the habitat benefits and produce revenue from timber harvests.

10.6. WOOD EMPHASIS (ALTERNATIVE 6)

10.6.1. Description of Alternative

This alternative would be implemented to maximize timber harvest revenue in the Elliott State Forest consistent with the Oregon Forest Practices Act. Stands would be managed on short rotations, such as 40 to 50 years. This alternative would assume that federal lands would provide sufficient habitat for the survival and recovery of northern spotted owls and marbled murrelets. Surveys for northern spotted owls would continue, and occupied sites would be protected in accordance with the Forest Practices Act until they became vacant. Surveys for marbled murrelets would continue and occupied sites would be protected consistent with ODF policy unless they are shown to be vacant. Vacant northern spotted owl and marbled murrelet sites would become available for harvest. The only areas that would be certain to develop and remain as mature and advanced structure stands over the long-term would be RMAs and non-production areas, where timber harvest is not permitted because of scenic values, resource protection needs, public safety, or special uses. These areas might provide limited amounts of northern spotted owl and marbled murrelet habitat. RMA's would use buffers as prescribed in the administrative rules of the Forest Practices Act.

In the short term, state forestlands would provide habitat for northern spotted owls and marbled murrelets at occupied sites until those sites became vacant. In the long term, the lands would provide some nesting and dispersal habitat for northern spotted owls; northern spotted owls could use the state forest lands to move to federal lands where late successional reserves provide habitat. Northern spotted owl nesting sites would gradually decline over time. Marbled murrelets would be managed under the *Marbled Murrelet Operational Policy for State Forest Lands* (Oregon Department of Forestry 2004). Some marbled murrelet sites may be lost in the first few decades if they are shown to be vacant, but there would be a net gain of occupied sites until a finite amount of marbled murrelet-occupied sites are identified. In the long term, some of this pool of finite sites would be determined vacant and available for harvest.

10.6.2. Why Alternative was Not Selected

This alternative would contribute less to the survival and recovery of northern spotted owls and marbled murrelets than other alternatives. The USFWS likely would not authorize an ITP for this level of take, and implementation of the strategy would take on significantly higher legal risk to compliance with the ESA. This alternative would provide only minimal amounts of mature forest and advanced structure for other species of concern over the long term.

Additionally, this alternative was not selected because of the uncertainty that would be involved in planning forest operations, particularly the potential effects of newly discovered sites occupied by northern spotted owls and marbled murrelets. Because of the uncertainty involved with listed species sites, it is unknown whether this alternative would produce a

sustainable, even-flow harvest of timber, consistent with the Asset Management Plan of the DSL.

10.7. CONSERVATION EMPHASIS (ALTERNATIVE 7)

10.7.1. Description of Alternative

This alternative would require the ODF to manage the Elliott State Forest primarily as habitat reserves for northern spotted owls, marbled murrelets and coho salmon, and no harvesting of timber would occur. Stands would mature and grow into advanced forest structure. Trees that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in the forest through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl, marbled murrelet and coho salmon habitat with minimal fragmentation.

This alternative would not manage the thousands of acres of maturing, even-aged stands in the Elliott State Forest. These stands would undergo some thinning from natural tree mortality, but in denser stands, trees would increase diameter slowly. Stands would not gain structural diversity as fast as would occur with active management. Because there would be no harvested areas, this alternative likely would provide the most acreage of northern spotted owl and marbled murrelet habitat over time. However, because fire protection would suppress the natural creation of larger openings in the forests, this alternative would not provide the mix of habitats needed by many species, a mix that includes younger stands with grasses, forbs, and shrubs.

10.7.2. Why Alternative was Not Selected

This alternative was not considered because it would prevent the ODF from meeting its trust obligations for the Elliott State Forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent.. Not only would this alternative fail to produce an economic return from the forest, but it would result in net operating costs associated with implementation. Additionally, it would not provide quality diverse habitats for Oregon's fish and wildlife native species.

Chapter 11
Plan Implementation

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11.1. IMPLEMENTING AGREEMENT

Implementation of this Habitat Conservation Plan (HCP) will be governed by an agreement between the State of Oregon and the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), collectively referred to as "the Services". The HCP will be funded by the Oregon Department of Forestry (ODF) as a part of ongoing operations. The Implementing Agreement is supplementary to the HCP; together, they fulfill the requirements outlined in the Endangered Species Act (ESA) for issuance of an Incidental Take Permit (ITP). The Implementing Agreement defines the roles and responsibilities of the parties and processes for addressing other issues, some of which are discussed below. The Implementing Agreement is included as Appendix K.

11.1.1. Plan Duration

The *Elliott State Forest Habitat Conservation Plan* will be in effect until it is replaced by a new HCP, or until it is terminated in accordance with the provisions of the Implementing Agreement. It is intended that this HCP be flexible enough to endure significant changes in legal requirements and knowledge base. It is expected that this HCP will be in effect for 50 years, the length of the ITP.

11.1.2. Unforeseen Circumstances

Under the ESA, an HCP is intended to provide property owners with economic and regulatory certainty. This certainty is realized through the establishment of management strategies that minimize and mitigate the likelihood of harm or harassment to listed and unlisted species. In exchange, the ODF will have the opportunity to practice responsible, adaptive, active forest management throughout the time frame of the HCP.

Under the ESA, the Services would not unilaterally impose additional mitigation for a species on a permittee in compliance with the terms and conditions of the Implementing Agreement, ITP, and HCP because of events outside the control of a permittee, referred to as "unforeseen circumstances." Unforeseen circumstances are changes in circumstances that were not or could not reasonably have been anticipated by the permittee and the Services at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of a covered species.

The Services refers to this as the "no surprises" rule (50 Code of Federal Regulations [CFR] Part 17 and Part 22). If unforeseen circumstances were to arise, the Services would seek to negotiate with the ODF on modifications that would, "to the maximum extent practicable, be consistent with the original terms of the HCP." Changes to HCP conservation strategies as a result of unforeseen circumstances would occur only as provided for in the HCP Implementing Agreement. Further mitigation requirements shall not involve additional financial, land, or water commitments, or additional restrictions on the use of land, water, or other natural resources on state forest lands without express, written consent from the ODF.

Any determination by the Services that unforeseen circumstances exist must be clearly documented in writing, and must be based on reliable, current, peer-reviewed technical information regarding the status and habitat requirements of the affected species. The Implementing Agreement further discusses the process for addressing unforeseen circumstances in Section 4.0 of the agreement.

11.1.3. Changed Circumstances

"Changed circumstances" are changes affecting the covered lands or covered species during the term of the HCP that can reasonably be anticipated by the state, and that can be reasonably planned for. Changed circumstances include events that significantly alter or impair the ability of the covered lands to provide the intended conservation benefits, and changes in the status of the covered species that alter the Services' ability to allow the authorized incidental take. While changed circumstances are not certain to occur during the term of the HCP, they have a reasonable potential to occur based on historic occurrences (e.g., wildfire) or credible scientific models. Changed circumstances are not unforeseen circumstances.

The ODF and the Services foresee that certain circumstances could change during the term of the HCP that would warrant adjustments to the conservation measures. Such "changed circumstances" are described in subsection 11.1.3.2, along with the responses that would be made by the ODF and the Services. This treatment of changed circumstances is based on and consistent with 50 CFR 17.22 (b) 5 &17.32 (b) 5.

The Elliott State Forest ITPs will authorize the incidental take of covered species under ordinary circumstances, for adaptive management described in the Implementing Agreement and for the responses to changed circumstances described in the Implementing Agreement (Section 9). (Changes affecting the covered species and/or implementation of the conservation measures beyond those described as changed circumstances would be considered unforeseen circumstances.)

11.1.3.1. Implications to ITP Coverage and HCP Implementation

The Elliott Forest ITPs will authorize the incidental take of covered species under ordinary circumstances and changed circumstances. Changes affecting the covered species and/or implementation of the conservation measures beyond those described as changed circumstances would be considered unforeseen circumstances. If additional mitigation measures or costs beyond those provided in the HCP are deemed necessary to respond to an unforeseen circumstance, the Services will not require additional measures or expenditures without the ODF's prior consent, unless the Services reach a conclusion that a species is at risk of extinction.

11.1.3.2. Treatment of Changed Circumstances

For purposes of the Elliott State Forest HCP, changed circumstances are distinguished from causal factors. Changed circumstances are physical or biological changes in the habitat of the

covered lands or status of the covered species that warrant modification of the conservation measures. Causal factors are the mechanisms or incidents that bring about the changed circumstances. An individual changed circumstance can be the result of a number of different causal factors. For example, significant loss of forest cover on the Elliott State Forest (changed circumstance) could occur from an outbreak of forest insects, drought, wildfire, wind, or a combination of two or more causal factors. This distinction is made because causal factors are largely irrelevant to the discussion of HCP responses to changed circumstances, and preoccupation with causal factors can interfere with the development of effective responses and recognition of actual changes.

11.1.3.3. Changes to the Covered Lands

Temporary Loss of Forest Cover

A temporary loss of forest cover is defined as any temporary reduction in stand density below 22 percent of the maximum stand density index (SDI) that occurs other than through intentional forest management. For the purposes of this HCP, stand density will be determined for stands greater than 20 acres in size as identified in the Elliott State Forest Stand Level Inventory (SLI). Temporary loss of forest cover can result from a number of causes, including wildfire, wind, forest pests, and pathogens.

SDI describes the density of the stand at a reference size, 10-inch-diameter, and is usually expressed as a percentage of the maximum number of trees the site will support. Twenty-two percent was selected because any stand below this stocking would not meet the standards for advanced structure, and would likely take more than 20 years to naturally increase to full stocking.

Such a temporary loss of forest cover could occur over a relatively large contiguous area or in relatively small patches within the forest. A temporary loss of forest cover will be considered a changed circumstance if the loss occurs:

- In a single stand or a number of stands comprising a contiguous area of more than 240 acres within a management basin within a ten-year period, or
- In more than one stand over more than 420 cumulative but non-contiguous acres, within a management basin, within a ten-year period.

Response: When a temporary loss of forest cover results in a changed circumstance:

- The harvest of merchantable dead and dying trees (subject to compliance with relevant provisions of the HCP) will occur, and necessary steps will be taken to re-establish the forest in the affected management basin(s) within a reasonable period of time.
- An update of all forest structure forecasts for the affected management basin(s) will be conducted, and a determination will be made as to whether the HCP forest structure targets can be met without a reduction in anticipated timber harvest volume (including volume from the harvest of the dead and dying trees).
    - If forest structure targets and timber volume objectives (40MMBF annual average over ten years) established by the State Land Board upon adoption of the HCP

and signing of the ITP can still be met for each subsequent ten-year period for the entire duration of the ITP, no changes will be made to the other provisions of the HCP.

- If forest structure targets can be met only through reductions in the timber harvest volume within the affected management basin(s), the state will make the necessary reductions and supplement the lost timber volume through increased harvesting in unaffected management basins, provided the increased harvesting will not result in an overall reduction in advanced structure below the basin target for advanced structure for an individual management basin, or take the forest outside of the forestwide structure ranges for advanced or early structure, in any decade subsequent to the temporary loss of forest cover.
- If a temporary loss of forest cover is of such magnitude that the timber harvest volume objectives (40MMBF annual average over ten years) established by the State Land Board cannot be met for each subsequent ten-year period for the entire duration of the ITP, without a reduction in advanced structure below the basin target for advanced structure for an individual management basin, or take the forest outside of the forestwide structure ranges for advanced or early structure, in any decade subsequent to the initial loss of forest cover, good faith discussions will be entered into for the purpose of adjusting the forest structure objectives of the HCP to be consistent with new forest conditions and the timber harvest objectives. During those discussions, the ITP will remain in effect.

Long-term Change in Forest Cover

A long-term change in forest cover is defined as any change in growing conditions on the Elliott State Forest that is sufficient in magnitude and duration to reduce the average Douglas-fir 50-year site index (King 1966) by more than 20 feet, or alter the overstory species composition of the climax community in favor of non-coniferous species. Such a change will be considered a changed circumstance for purposes of this Agreement. The causes of a long-term change in forest cover could include but are not limited to climate change, global warming, or introduction of forest pathogens that permanently alter the climax vegetation. The changes referred to in this section are broad changes that affect the character of the forest. They are not intended to apply to changes that may occur on small areas within the forest.

Response: In the event of a long-term change in forest cover, good faith discussions will be entered into for the purpose of adjusting the forest structure objectives of the Elliott Forest consistent with new growing conditions. While in those discussions, the ITP will remain in effect.

11.1.3.4. Changes to the Covered Species or Listing Status

Population Declines – Not Directly Related to Forest Management Activities

If predators, disease, competing species, or other agents not related to forest management activities cause or result in a decline in the regional population of a covered species that is likely to jeopardize its continued existence, such a circumstance will be considered a changed circumstance for purposes of this Agreement.

Response: Good faith discussions will be entered into for the purpose of determining whether actions can be taken on the Elliott State Forest to prevent further decline of, or to enhance the likelihood for increasing, the regional population. Such discussions might consider but are not limited to: adjusting threatened and endangered core (T&E core) area boundaries; changing core area locations; altering implementation plans; and modifying upland or riparian management approaches. The standards in the HCP will prevail until any changes are agreed upon. Any such changes will not require the commitment of land, water, or other natural resources beyond the level otherwise agreed to in the HCP, without ODF's consent.

New Listing of Covered Species

The HCP covers listed and unlisted species (i.e., species currently not listed as threatened or endangered under the federal ESA). The implementation of all conservation measures for listed and unlisted covered species, as well as the coverage for incidental take of listed species, will begin immediately upon issuance of the ITP by the Services.

Response: For species under the jurisdiction of the USFWS and NMFS, coverage for incidental take of an unlisted covered species for which conservation measures have been implemented will take effect immediately upon the listing of that species under the federal ESA.

De-listing of Covered species and Maintaining Coverage for De-listed Species

If a covered species is de-listed, coverage for the species may either be maintained or removed. If coverage for the species is maintained, the Services and the state will review the mitigation measures being implemented for that species to determine if they are still necessary to maintain coverage for the species. If it is mutually agreed that continued mitigation is necessary to maintain coverage for the species, mitigation will continue as specified in the HCP. If cessation or modification of the mitigation for that species would allow continued coverage, the HCP will be revised to eliminate or otherwise modify the mitigation measures in question. However, if elimination or modification of mitigation measures initially implemented for the de-listed species would materially reduce the mitigation for another covered species, the mitigation measures will not be eliminated.

De-listing of Covered Species and Removing Coverage

If a covered species is de-listed and coverage for this species is not to be continued, the HCP will be revised to eliminate or otherwise modify the mitigation measures being implemented for that species. However, if elimination or modification of mitigation measures initially implemented for the de-listed species would materially reduce the mitigation for another covered species, the mitigation measures will not be eliminated.

Extinction of Covered Species

In the event that a species covered by the HCP becomes extinct, the mitigation measures being implemented for that species will be reviewed to determine if they are still necessary to meet the requirements of the ESA for the remaining covered species. If it is mutually agreed that elimination or modification of mitigation measures initially implemented for the extinct species would not materially reduce the mitigation for another covered species, the mitigation measures will be eliminated or modified.

New Listings of Species Not Covered by the ITP

If a non-covered species that is present or potentially present on covered lands becomes listed, the Services will determine whether there is a potential for incidental take of the species while covered activities are being conducted. If the potential for take is determined, the ODF may choose to avoid incidental take of the species or to pursue incidental take coverage for the newly-listed species by amending the HCP and the ITP or by submitting a new ITP application for the species to the Services. For either approach, the Services will work with the ODF to identify the measures necessary to avoid take of, jeopardy to, or adverse modification of the critical habitat of the species as a result of covered activities.

If incidental take coverage for the species will be pursued by amending the HCP and the ITP or by preparing a separate HCP, discussions to develop necessary and appropriate mitigation measures to meet ESA Section 10(a) requirements for incidental take coverage will be entered into for the purposes of developing mutually acceptable mitigation measures and securing incidental take coverage prior to final listing of the species. In determining adequate mitigation for the species, the Services will fully consider conservation benefits to the species that have accrued from the time the existing ITP was signed and the HCP was first implemented, although it is recognized that additional mitigation measures may be necessary to satisfy the requirements of the ESA. The mutually-acceptable mitigation measures will be implemented until the permit is amended to include such species, the application is rescinded, or the Services give notification that the measures are no longer needed to avoid jeopardy to, take of, or adverse modification of the critical habitat of the newly-listed species.

If avoidance of take of a newly listed species interferes with full implementation of all the provisions of the HCP, the ODF will consult with the Services to determine how the HCP should be implemented until incidental take coverage is secured for the new species. During such time, the state will be considered in compliance with the HCP and the take prohibitions of the ESA as long as the HCP is implemented to the extent practicable consistent with the consultation or take avoidance of the newly listed species.

11.1.4. Amendments and Flexibility

State forest management is carried out under an approved Forest Management Plan (FMP) developed in accordance with the Oregon Constitution, and the State of Oregon statutes and the accompanying administrative rules. The FMP provides for the maximization of revenue to the Common School Fund (CSF) over the long term, consistent with sound techniques of land management. The ODF anticipates that adjustments to the FMP may be required as social, environmental, and economic factors and information affect forest policy and management. As well, 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 would be appropriate. Modifications and amendments to the ITP are addressed in the Implementing Agreement, which outlines the process to be used.

11.1.5. Funding

The FMP is financially self-supporting from revenues generated by its management activities (no general fund dollars), including the sales of timber and special forest products; user fees; and gas, oil, and mineral leases. Funding is ensured and adequate to fulfill the obligations set forth by the HCP, ITP, and Implementing Agreement, provided that the ODF's obligation to fund implementation of the HCP is subject to the restrictions of Article XI, Section 7 of the Oregon Constitution. Once the Services and the State of Oregon sign the Implementing Agreement, the HCP becomes a legally required activity (see Section 11.2.2).

11.1.6. Land Transactions

Consistent with and in order to implement the Oregon Constitution and Oregon Revised Statutes, the ODF has a program of land acquisition and disposition, including but not limited to transfers, sales, exchanges, and purchases. Nothing in the HCP, ITP, or Implementing Agreement limits the state’s right to acquire additional lands.

Land acquired by the state that is contiguous with the Elliott State Forest may be incorporated into the HCP and ITP as minor amendments in accordance with Sections 11 and 12 of the Implementing Agreement. A major amendment may be necessary should acreages exceed that amount.

Up to 640 acres of covered lands in state ownership may be disposed of or traded as minor amendments in accordance with Sections 11 and 12 of the Implementing Agreement. During the initial implementation period, lands to be disposed of will not include T&E core areas. Section 12 of the Implementing Agreement describes the processes required should the state choose to dispose of additional acreages of covered lands.

Sections 11 and 12 of the Implementing Agreement provide further discussion of the processes related to land transactions.

11.1.7. Transition Activities

Timber sale preparation by the ODF requires approximately 24 months between planning of the sale and its eventual auction. In addition, another two years or more could be required to complete harvest activities. Considering this planning and harvest process, the transition from sales planned under the 1995 HCP and the revised HCP will be handled as follows: Timber sales that have been identified, planned, or prepared under the 1995 HCP and ODF take avoidance policies for the marbled murrelet will continue through completion and harvest. These sales will be conducted and accounted for under the 1995 HCP. Sale planning and preparation under the revised HCP may begin upon HCP approval and issuance of the ITP. These sales will be conducted and accounted for under the revised HCP.

11.1.8. Reporting

The ODF will submit periodic reports to the Services describing actions taken to implement the HCP. Biennially, the ODF will provide an accounting of forest structure and mapped marbled murrelet habitat substantially in the form described in Appendix J and an accounting of the harvest and in-growth for advanced structure and mapped marbled murrelet habitat. Periodically (approximately four years), the ODF will also report on further actions related to the covered activities that have occurred to implement the HCP. These periodic reports would discuss such items as structure development, road-related and restoration activities, stream classification updates, and results of the monitoring program provided for in the HCP. At eight-year intervals, these reports will be presented in a combined format, and be used by the ODF, Services to determine the status of State's compliance with the terms of the HCP and establish a mitigation balance.

11.2. ODF IMPLEMENTATION

11.2.1. Roles and Responsibilities

The State Land Board and the Board of Forestry (BOF) are responsible for reviewing and approving the HCP and any needed changes in strategies. The State Land Board and the BOF are also responsible for entering into an Implementing Agreement with the USFWS, and making amendments if needed. The State Forester delegates to the Southern Oregon Area Director the overall responsibility for implementing the HCP. Implementation of the HCP consists of complying with the terms and conditions of the HCP and Implementing Agreement, determining when changes in strategies are needed, and proposing HCP amendments as needed.

The Coos District Forester is responsible for implementing all aspects of the HCP within the district. Key tasks include implementing the management strategies, district monitoring projects, and public involvement processes. The Assistant District Forester is responsible for coordination within the district. Key tasks include coordinating the development of Implementation Plans (IPs) and Annual Operations Plans (AOPs), monitoring priorities and projects, conducting periodic operational reviews, and managing information exchange.

The geotechnical specialist, wildlife biologists, and silviculturalist are responsible for providing technical assistance to district personnel as they develop IPs, AOPs, and monitoring plans. These specialists are also responsible for providing technical assistance for field reviews and landscape-level and site-specific recommendations for particular management activities. Specialists may also have specific responsibilities in monitoring and research projects.

Salem Forest Management Program staff, including administrators and technical specialists, is responsible for providing guidance and direction on statewide program issues.

The Research and Monitoring Coordinator will coordinate HCP monitoring under the State Forests Monitoring Program on all ODF-managed lands.

11.2.2. Implementation Levels

Many of the habitat conservation strategies require investments of capital. Examples include reforestation, precommercial thinning, habitat enhancement activities, and some monitoring activities. Priorities for resource investments are generally as follows:

- Activities necessary to maximize revenue to the CSF over the long term, consistent with sound techniques of land management
- Legally or contractually required activities
- Full implementation of all strategies and monitoring plans

IPs and AOPs identify the planned activities that will be pursued within given time periods based on the anticipated funding levels.

11.2.2.1. Habitat Conservation Plan and Forest Management Plan

Planning for the HCP, as well as ODF FMPs, is typically at broad spatial and long temporal scales, and identifies general goals and strategies. Information, decisions, and management incorporated into the HCP and the FMPs encompass landscape scales, policy concepts, and social, cultural, and environmental influences that may extend even beyond the ownership boundaries of state forest lands. On the temporal scale, the HCP as well as the FMPs provide a forecast of greater than ten years (generally 30 to 100 years or more).

These plans are reviewed periodically, a minimum of at least every ten years. Because of the nature of the information requirements in these plans, development of adequate monitoring information to indicate the need for change often requires more than ten years. Research efforts that are initiated at the beginning of the planning period may take even longer to produce results; however, ongoing research could produce information that would demand reconsideration of the strategies in these plans at any time.

11.2.2.2. Implementation Plans

The FMP requires the development of an IP that describes the management approaches and activities the district will pursue in carrying out the goals, objectives, and strategies within the FMP. An IP is intended to describe the activities, projects, and efforts for a ten-year period—beginning July 1, 2009 and extending through June 30, 2019. These IP activities reflect the harvest level set for CSFL's by the State Land Board, and those established for BOFL's by the State Forester. The FMP requires that the State Forester approve, modify, or deny the recommended IP. An IP undergoes a public comment period.

The IP is one step in a much larger planning process for state forestlands. The scale of the planning ranges from very broad policy documents such as the BOF's Forestry Program for Oregon (FPFO), to strategic plans such as the FMP and the HCP, to very specific plans such as an AOP. An IP provides a link between broad (strategic policy and the plans) and specific (AOPs). The other policies and planning activities are listed below, in order from the broadest policies and plans to those progressively more focused in strategies, location, and timeframe:

- The Constitutional Mandate for Common School Forest Lands describes the long-term purpose and goal for management of those lands.
- The FPFO is a long-term policy document that addresses all forestry issues in Oregon.
- The Greatest Permanent Value Rule describes the long-term purpose and goal for management of Board of Forestry Lands.
- The FMP and the proposed HCP are long-term strategic plans that are applied to the district IP.
- The Oregon Plan for Salmon and Watersheds is a long-term cooperative effort involving state and federal agencies, private landowners, and volunteers. This plan applies to the entire state, but focuses on managing resources by specific watershed basins, with the objective of restoring salmon populations and watershed health.

- An IP is a ten-year plan describing the activities, projects, and efforts that will be carried out to achieve the FMP goals, objectives, and strategies.
- The AOPs describe state forest management activities that will occur in a given fiscal year.
- The forest land management classification system, though not technically a plan, is developed in close association with the IP.
- Budgets occur in two forms, biennial and fiscal year. They provide the financial framework for accomplishing described tasks in the various plans. They include the costs for personnel, equipment, offices, contracts, and the other financial resources needed to manage the state forests.
- Plans for specific resources or activities also exist or are under development—e.g., the SLI.

11.2.2.3. Annual Operations Plans

The AOPs must achieve the goals set forth in the FMPs and be prepared within the constraints of the fiscal budget guidance. AOPs are developed by the district and describe the actual projects that will be pursued to achieve FMP and HCP goals and strategies during a fiscal year. These plans are consistent with the longer-term IP. Resource specialists from both the ODF and the Oregon Department of Fish and Wildlife (ODFW) have the opportunity to review and provide input on AOPs. Proposed AOPs are available for public review at district headquarters for 45 days prior to being approved or denied by the District Forester. The District Forester must consider any written comments from resource specialists and the public before approving or denying an AOP. Once approved, the AOP may be implemented.

11.3. ADAPTIVE MANAGEMENT

A significant body of scientific information and expertise was used to develop this HCP. However, the long-term effects of HCP implementation on the habitat needs of the covered species cannot be answered with total certainty at this time. Long-term, landscape-scale forest management is challenged by the dynamic, natural system within which it is conducted (the forest) and the limited scientific knowledge and modeling capabilities available to inform decision-making. These uncertainties can be addressed through the ongoing application of adaptive management.

Adaptive management is the process by which management practices are incrementally improved through the implementation of plans that provide opportunities to learn from experience, both successes and failures (Holling 1978; Walters 1986, Walters and Holling 1990). It is a formalized approach that integrates research, monitoring, and management designed to test and improve the effectiveness of management prescriptions. Adaptive management is based on clear "experimental" hypotheses developed from real policy options informed by previous experience and understanding. In recognition of the uncertainties inherent in the proposed management strategies, the HCP will be implemented using an adaptive management approach; thereby allowing the ODF to evaluate and modify strategies to ensure the continued achievement of the HCP's conservation objectives.

A detailed discussion of the adaptive management process can be found in Chapter 6 of the FMP. The following subsections discuss adaptive management and the role of research and monitoring under this HCP, and also identify where adaptive management may be applied. Adaptive management is linked to the ongoing State Forest Program research and monitoring activities that will provide the data and information needed to identify if, or when, adjustments to the conservation strategies may be required.

11.3.1. Effecting Change through Adaptive Management

Timely changes in strategies, approaches, and prescriptions in accordance with new knowledge provide the cornerstone for a successful HCP. As new information from monitoring, research, field trials, or day-to-day management becomes available, the information must be evaluated in the context of the HCP's guiding principles, goals, and strategies, as well as the relevant FMPs. The information must be evaluated in terms of its scientific, biological, or technical implications to the affected resources, and upon the operational feasibility and implications of implementing the change.

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 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 without a formal approval process.

Adaptive management decisions will occur at four planning levels within the ODF:

- FMP or HCP
- IP
- AOPs
- Management activities

The range of decisions that will be made, how they will be made, and who will make them are described in more detail in Table 11-1. At all four planning levels, various sources of information can trigger change: public input, monitoring information, research information, and operational input. When ODF managers and staff receive new information, they recommend changes to the appropriate decision-making official, as shown below, and the appropriate official makes the final decision.

Planning Level		Who Decides
Forest Management Plan and Habitat Conservation Plan	→	State Land Board/BOF, in consultation with appropriate other agencies (e.g., USFWS, NMFS, ODFW)
Implementation Plans	→	Director of Department of State Lands, State Forester
Annual Operations Plans	→	District Forester
Management Activities	→	Management Unit Forester

The State Land Board, BOF, Director of the Department of State Lands, and State Forester will weigh the scientific, operational, and public information in a formal process to determine changes to the HCP. The ODF will collaborate with the Services and other state agencies as necessary to obtain the best available information to evaluate the necessity for modifications to the HCP.

11.3.2. Evaluation of Technical Information

In accordance with the *State Forests Monitoring Program Strategic Plan* (Oregon Department of Forestry, 2002a), a team with the necessary technical and operational expertise will be assembled as needed to evaluate the body of information from research, monitoring, operational input, and other appropriate current sources. This group will also make recommendations for change based on its review of the information. Proposed changes may involve minor adjustments in management practices or may require significant changes at policy and planning levels, depending on the purpose and implications of the gathered information. This team also may provide guidance in identifying specific research and monitoring projects critical to evaluating the success of the HCP's conservation objectives.

Table 11-1
Effecting Change

Forest Management Plan & Habitat Conservation Plan (Long Term—10 Years or More)	Implementation Plans (Periodic—Maximum 10-Year Interval)	Annual Operations Plans (Annual)	Management Activities (As Appropriate)
EXAMPLES OF WHAT MIGHT CHANGE			
Forest Management Plan Stand type percents Arrangement **Habitat Conservation Plan** Northern spotted owl strategies Marbled murrelet strategies	Landscape design Silvicultural approaches, i.e., sequence of treatments, etc. Management opportunities & objectives	Approaches to meeting objectives, e.g., silvicultural prescriptions Monitoring projects	Techniques for culvert installation, snag creation, etc.
EXAMPLES OF MONITORING			
Framework Implementation Are we doing what we said we would? Effectiveness Are the management practices producing the desired results? Validation Are the planning assumptions valid, or are there better ways to meet goals and objectives?	**Identify and Implement Projects** What is the condition of State Forests based on stand type percentages and habitat availability? Is active management promoting habitat development by moving stands toward advanced structure? Are the silvicultural practices used to achieve forest structures sufficient to maintain a full array of forest products? Is sustainable forest ecosystem management helping to improve forest health on State Forests? Protocol development and implementation Data gathering and analysis Evaluation Communication		

Table 11-1 (continued)

Forest Management Plan & Habitat Conservation Plan (Long Term—10 Years or More)	Implementation Plans (Periodic—Maximum 10-Year Interval)	Annual Operations Plans (Annual)	Management Activities (As Appropriate)
EXAMPLES OF PUBLIC INVOLVEMENT			
Formal Board of Forestry Meetings Oregon Administrative Rules Process Public Meetings Federal Processes for HCP Technical Specialist or Citizen Input Committees **Informal** Voluntary Participation in Monitoring Program Regular Reporting Processes, including Monitoring Reports Public Submittal of Information	**Formal** Public review and comment processes Public meetings Technical specialist or citizen input committees **Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information	**Formal** Review and comment period **Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information	**Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information

The goal for evaluation and analysis of technical information is to offer explanation of the data, their weaknesses and strengths, identification of triggers and thresholds that apply to the data set and resource, conclusions, and the management recommendations that emerge from those conclusions. Analysts will be responsible for identifying triggers and thresholds for effecting change related to the specific monitoring or research question, resource, or species, if these have not already been identified during the project development phase or the information gathering phase.

Triggers and thresholds are critical to helping resource managers determine if information indicates a need for change. In a complex ecosystem, triggers or thresholds are rarely achieved with unequivocal certainty. More often, some degree of a threshold is reached, and the analysis will be required to determine if the information indicates a sufficient risk to the system, given normal variability and error in data collection. To add to the complexity, biological triggers may differ from social or political triggers and thresholds.

In some instances, determining if a trigger or threshold has been reached or exceeded will be relatively easy. In these cases, the direction and/or need for change is more clearly identified. However, when monitoring and research information is considerably confounded by the natural variability of the system due either to insufficient replication or natural conditions, triggers and thresholds can be difficult to determine. Recommendations for change become less clear and risk assessment becomes a significant component of the adaptive process.

Risk evaluation is a critical concept linking monitoring and research information to effective and efficient adaptive management decisions. In instances where the system or population is particularly sensitive or the degree of risk is determined to be high, thresholds will be lower and triggers are set to be more sensitive to indicate the need for change. Where risk to the resource is not as great, the threshold may be higher and the triggers may be set to be more demanding to indicate the need for change. More data may be needed to justify a change.

Thresholds and triggers for change may be developed at any of various points:

- Prior to initiating management activities
- During development of the monitoring question(s) and/or project
- After monitoring has provided more information

In addition, reevaluation may be required at points in <u>all</u> of the above processes.

Even during technical analysis, situations may arise where people will not agree on the interpretation of the data, particularly when making management recommendations. A process for issue resolution will be developed, to help the team clearly articulate their concerns and differences and arrive at (as close as possible to) a consensus before offering their conclusions and recommendations. If technical issues cannot be resolved, the only option may be to include a set of technical information and recommendations, with accompanying identification of resource risks and the range of differing opinions that were expressed by the team.

11.3.3. Research and Monitoring

In adaptive management, research blends with monitoring to provide the data and information needed to evaluate and adjust management activities. Both rely on testable hypotheses implemented through experiments that address a range of variables. Scientists lead research, maintaining tight control of a study design that intensively measures several variables on a relatively small area or part of the system. Research on parts of a system can improve predictions about how the system might respond to management intervention. However, such response predictions can ultimately only be tested in an operational setting, leading to the design of monitoring projects to test research findings. Through monitoring, these management experiments measure a small set of carefully selected key variables to understand the effect of management on a system as a whole. Information gained through both research and monitoring is fed back into the adaptive management process to inform future decisions and effect changes in management.

The following subsections discuss the research and monitoring program, and its funding sources and reporting activities. As well, the subsections present some of the research areas and monitoring assumptions that will be used to frame the specific projects and associated questions to be developed under this HCP. Finally, some possible monitoring activities that will be considered for testing the identified assumptions regarding the HCP strategies are presented, as well as those activities that will be conducted.

11.3.3.1. Research and Monitoring Program

The State Forests Research and Monitoring Program will manage the research and monitoring projects associated with the HCP consistent with existing policy.

The current State Forests Research Policy, adopted by the State Forester in 1995, is “to acquire knowledge in a timely and cost-effective manner concerning questions of significant importance to achieving the Program’s mission, and ensure that knowledge is effectively and efficiently transferred and applied.” There is considerable overlap between the HCP research priorities and those envisioned for the FMP. However, it is important to note that the goals and strategies of the FMP set the context for much broader research objectives and different overall research priorities than those that are part of this HCP.

In keeping with the State Forests Program’s research policy guidelines, it is not the intent of the ODF to develop an extensive research infrastructure to accomplish the needed investigations. Instead, the ODF, through the State Forests Program, will sponsor research, working with qualified research institutions through cooperative agreements and contracts. In some situations that require close coordination with State Forests Program field operations, ODF scientists and resource specialists may provide in-kind or cooperative participation in the research. Therefore, an important part of the State Forests Program research activities will be to stay in touch with other relevant research programs, and both exchange and assimilate information that can be used to meet information needs.

The ODF recognizes the substantial financial commitment required for research and monitoring. Policy states that approximately five percent of the State Forests Program's annual budget can be invested in research, monitoring, and technology transfer related to

program-wide commitments. The proposed biennial and annual budgets are based on projected revenues to the program fund, or the state's share of receipts generated from the sale of forest products and certain other fees collected. The State Forests Program receives no general fund support from the State Legislature.

As a result of the "dedicated" funding structure, biennial and annual expenditures are somewhat variable in response to shifting revenue levels that are largely beyond the agency's control. Because annual budget revenue estimates are generally more accurate, the funding and prioritization described in this subsection will be applied through the fiscal budget process, and in keeping with the State Forests Program's policy. The approximate intervals included in some of the possible HCP monitoring activities will provide the ODF flexibility in determining the most cost-effective, affordable schedule for conducting the monitoring activities.

11.3.3.2. Research and Monitoring Procedures and Reports

Research and Monitoring Procedures

To implement each aspect of HCP research and monitoring, projects will be developed and detailed questions and procedures will be prepared. Project questions and procedures that may be developed will build off the research areas and monitoring assumptions and the monitoring activities identified. The monitoring procedures to be used will align as much as possible with guidance established by the USFWS in its *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (USDI Fish and Wildlife Service and National Marine Fisheries Service 1996). The ODF Research and Monitoring Coordinator will work with a team of scientists, biologists, and field staff from ODF and other agencies to prepare the research and monitoring projects and the associated questions and procedures.

Monitoring Reports

Timely reporting of research and monitoring information will be of the utmost importance. Under the State Forests Monitoring Program, analyzed information, with recommendations for management action, will be presented in an annual report prepared in coordination with other reporting requirements (e.g., reports to the State Land Board) so that a single report can satisfy more than one requirement.

This report will form the basis for determining the possible need to adapt management policies, biological or habitat goals, or monitoring activities. This report will be available to the State Land Board, the public, and other state and federal agencies. Special project reports that stand alone as individual studies or technical papers may also be available, and monitoring program updates and project descriptions will be available on the ODF web site.

11.3.3.3. Management Activities in Progress

Management activities in progress or underway when the HCP is adopted that are exempt from compliance with the conservation strategies (see Section 11.1. and Section 8 of the

Implementing Agreement) will not be reported as part of implementation monitoring for the purposes of this HCP. Otherwise, such activities will not be monitored.

11.3.3.4. Research Priorities

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

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

The research areas that have been identified as supportive of the HCP will be considered and prioritized accordingly, and are presented below.

11.3.3.5. Priority Research Topics

Conservation Strategies

- Research that allows the ODF's State Forest Program to increase its ability to accelerate development of functional habitat in conjunction with active management (commercial silvicultural activities and timber harvest), and compares this active management to areas on the landscape managed through a more passive approach—*research priority 1*
- Research to determine how to design, create, and manage landscape-level habitat patterns for the benefit of the species covered by the HCP using various forest ages and structures in a geographic area, and to best move these patterns across the landscape to allow maximum timber harvest flexibility—*research priority 1*
- Research to evaluate riparian area management and instream large wood levels—*research priority 1*
- Research to identify large wood sources in streams and to assess the level to which large wood enters aquatic systems from upslope sources—*research priority 2*
- Research to determine the best management approach to ensure properly functioning landslide processes and minimize the incidence of management-induced landslides—*research priority 2*
- Research to determine background levels of sediment from natural sources in forest streams that will provide a benchmark for evaluating the effects of human activities on sediment contribution—*research priority 2*

Species-Specific Strategies

- Research to determine the effectiveness of managed stands to provide productive habitats for covered species—*research priority 1*
- Research to determine the effects of forest management activities on prey of covered species—*research priority 2*
- Research to improve general understanding of the biology and ecology of species covered by this HCP—*research priority 3*
- Research to determine how to manage and harvest timber at or near breeding sites to minimize effects on covered species—*research priority 1*

11.3.3.6. Monitoring Objectives

The ESA, under Section 10 regulations, requires that an HCP specify measures that will be taken to monitor the impacts of take resulting from project actions (50 CFR 17.22(b)(1)(iii)(B) and 50 CFR 222.22(b)(5)(iii)). Monitoring for the HCP will focus primarily on the following three monitoring objectives:

- Determine whether the conservation strategies are implemented as written.
- Determine whether anticipated habitat conditions have resulted from implementation of the conservation strategies.
- Evaluate cause-and-effect relationships between habitat conditions resulting from implementation of the conservation strategies and the animal populations that these strategies are intended to benefit.

These three objectives are referred to as implementation monitoring, effectiveness monitoring, and validation monitoring, respectively:

- **Implementation Monitoring**—Used to determine if objectives, standards, and management practices specified in the HCP conservation strategies are being accomplished. Implementation monitoring is used to determine whether specified actions or criteria are being met.
- **Effectiveness Monitoring**—Used to determine if the design and execution of the prescribed management practices are achieving the HCP conservation objectives. Every management decision is intended to achieve a given set of future conditions. Effectiveness monitoring can be used to compare existing conditions to both past and desired future conditions to describe the overall progress or success of the management activities.
- **Validation Monitoring**—Used to determine whether data and assumptions for predicting outcomes and effects are correct. Validation monitoring seeks to verify the assumed linkages between cause and effect. Validation monitoring is long term, and will be accomplished through formal research and effectiveness monitoring projects.

11.3.3.7. Management Strategy Assumptions and Priority Research and Monitoring Activities

Due to potential fluctuations in budgets (Section 11.3.3.1.), postponement of some projects may be required until sufficient funding is available. However, the ODF will conduct at least the following monitoring activities under this HCP: implementation monitoring; effectiveness and validation monitoring; and conservation strategies.

Implementation Monitoring

Implementation monitoring will document the types, amounts, and locations of forest management activities carried out on ODF-managed land on a representative subset of operations, both inside and outside areas addressed by the conservation strategies. Activities in areas addressed by the HCP will be sufficiently described to document compliance with the requirements of the conservation strategies. Implementation monitoring will be used to document trends in landscape-level habitat conditions. Implementation monitoring will be conducted according to the sampling protocols developed by the State Forests Research and Monitoring Program.

Effectiveness and Validation Monitoring

Under this HCP, effectiveness monitoring will be carried out on a representative subset of stands to document changes in habitat conditions (e.g., in-stream large wood, marbled murrelet nesting platforms) that result from timber harvest and other forest management activities. Effectiveness monitoring will be prioritized according to the amount of risk presented by a management activity. Specifically, the ODF will establish a project in a subset of stands to test an underlying assumption of the Marbled Murrelet Conservation Strategies that stands will develop characteristics suitable for marbled murrelet nesting (see Section 7.5)

Effectiveness of management activities will be evaluated both in the short term (five to ten years after harvest) and over the life of the HCP. Over the long term, aggregated information from research and monitoring projects will help validate a number of important assumptions that form the basis for the development of the conservation strategies.

Conservation Strategies

The following subsections discuss assumptions for each conservation strategy and activities that will be considered for use or that are used in testing these assumptions. The assumptions form the basis from which research and monitoring projects are already being conducted or will be developed. Estimates for the timing, frequency, and costs of monitoring activities are summarized in Table 11-2.

The ODF expects that the HCP landscape management strategies, aquatic and riparian management strategies, and upland management strategies (the integrated habitat conservation strategies) will provide needed habitat and maintain and restore properly functioning aquatic systems on state forest lands. The species-specific strategies will also contribute to ensuring habitat needs for the species covered by this HCP in the short term. These hypotheses are supported by assumptions made regarding each of the short- and long-term strategies that provide the framework of this HCP.

When large-scale disturbance events such as severe fire or insect and disease outbreaks occur, conservation areas will be evaluated through an adaptive management process to determine if they can still function for their intended purpose. Active management, including salvage, may be applied if the evaluation indicates that it would help restore the conservation area's function faster. Salvage of downed wood in T&E cores would occur only to facilitate the maintenance or development of advanced structure, one of the conservation measures for these areas.

Through time, monitoring information from throughout the forest and research information from a variety of sources will be evaluated. If the Services and ODF agree that such information indicates silvicultural treatments or other management activities would benefit the covered species and be cost effective, such management activities may be conducted in conservation areas. However, at the time of the preparation of this HCP, the only anticipated management activities are those discussed in this subsection or in Section 5.3.

Northern Spotted Owl Habitat Conservation Strategies

Assumptions

The landscape management strategies will provide habitat sufficient for the persistence of northern spotted owl sites in the Elliott State Forest, and provide habitat sufficient to accommodate movement and interaction of the northern spotted owl across the regional landscape.

- T&E core areas will maintain habitat sufficient to allow northern spotted owl pairs to persist.
- Advanced stand structure provides nesting, roosting, and foraging habitats for northern spotted owls.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow northern spotted owls to persist.
- Active silvicultural management can result in the development of habitat for northern spotted owls.
- Intermediate structure stands provide some foraging habitat and allow for movement and interaction of northern spotted owls across the regional landscape.
- Implementation of landscape design principles results in a landscape that provides connectivity for northern spotted owls.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and northern spotted owl habitat suitability as an objective of activities described in Section 11.3.3.5 at ten-year intervals. This study would determine what proportion of advanced structure stands also have characteristics of northern spotted owl habitat. Northern spotted owl habitat suitability would be determined by similarity to inventoried stands occupied by northern spotted owls (see Table 6-1).

- Conduct periodic density studies to assess the population and locations of northern spotted owls on the Elliott State Forest. Studies would use established density protocols for one year and survey all suitable habitat. Studies would occur at approximately eight-year intervals. These studies would address the questions of whether northern spotted owls are persisting on the Elliott State Forest; whether they are continuing to use T&E cores; and whether or not northern spotted owls are using developed habitat.

Marbled Murrelet Habitat Conservation Strategies

Assumptions

The landscape management strategies will maintain habitat sufficient for the persistence of marbled murrelet sites in the Elliott State Forest through time.

- T&E core areas provide sufficient protection to maintain occupied marbled murrelet sites.
- Advanced stand structure provides nesting habitats for marbled murrelets.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow marbled murrelets to persist.
- Active silvicultural management can result in the development of habitat for marbled murrelets.

Activities

- Conduct periodic surveys of marbled murrelet T&E core areas to determine what proportion remain in occupied status. Surveys would be discontinued when marbled murrelet occupancy is confirmed, or after a period of five consecutive years of survey. Surveys would use established protocols and would occur at ten-year intervals.

Other Listed and Unlisted Species Habitat Conservation Strategies

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, in the Elliott State Forest, and those that might be listed in the future, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- The maintenance and development of advanced structure within one mile of lakes and rivers will provide habitat for bald eagles throughout the forest.
- Management for mature forest condition within the Riparian Management Areas (RMAs) within one mile of lakes and rivers will create and maintain stand conditions with a high likelihood of providing large trees for bald eagles through time and space.
- Site management plans for bald eagles will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.

- The maintenance and development of advanced structure on the forest both within and outside of conservation areas will provide habitat for northern goshawks throughout the forest.
- Site management plans for northern goshawks will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.
- Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for olive-sided flycatchers within and adjacent to early structure stands.
- Early structure with snag retention will provide potential nesting and roosting habitats for western bluebirds.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.
- T&E core areas and SUVs would provide the best potential habitats for the fisher if individuals use the Elliott State Forest in the future.
- Site management plans will function to protect fishers from disturbance due to forest management activities during the breeding season.
- Outside of conservation areas, the maintenance and development of advanced structure with numerous snags and logs will provide habitat for fishers throughout the forest.
- RMAs for ponds will protect the functions of these habitats for red-legged frogs.
- T&E core areas and other conservation areas may provide important source habitats for headwater amphibians throughout the forest.
- Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for other listed and unlisted species, as an objective of activities described in Section 11.3.3.5, at ten-year intervals.
- Annually monitor known nest sites and roosting areas to determine occupancy and productivity as part of site management plans for bald eagles.
- Establish monitoring activities to determine occupancy and productivity as part of site management plans for northern goshawks
- Approximately 11,600 acres of potential habitat will be surveyed for northern goshawks, beginning at year ten of the plan. A minimum of 20 percent of this acreage will be surveyed during any given year, so that surveys are completed in five years. A randomly selected subset of potential habitat will be identified for surveys, which will

use established protocols. Surveys during the early breeding season for goshawks in courtship flights are a very effective way to identify territories and locate nest stands.

- Periodically sample early structure stands to determine the presence of olive-sided flycatchers and western bluebirds. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.
- If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional fisher research or survey efforts that include the Elliott State Forest, or conduct its own fisher research or survey activities.
- Periodic surveys of all suitable ponds will be conducted at approximately six-year intervals to determine occupancy by red-legged frogs.
- Within the first five years of plan implementation, conduct a study to determine the effectiveness of RMA standards to protect the functions of small perennial Type N streams. Parameters to be measured include shade, water quality (e.g. stream temperature, macroinvertebrates, or sediment), and presence of headwater amphibians. The study will include surveys before and after management activities in a selection of perennial Type N streams, as well as surveys of small perennial Type N streams within a selection T&E core areas or SUVs. Additionally, follow up surveys would be conducted in five and ten years.

Riparian Management Strategies

The combination of landscape and site-specific strategies will provide an array and frequency of riparian stand conditions across the landscape and through time that provides for desired future conditions of riparian areas, aquatic habitat, and watersheds. At the core of this broad assumption are multiple goals and assumptions regarding riparian and landscape strategies and the desired effects on riparian, aquatic, and watershed conditions. There is a general need to understand implementation of the aquatic and riparian strategies, including the amount of riparian areas with management in the inner zone.

Vegetation will be retained or managed within the stream bank and the inner zones of fish-bearing and large and medium non-fish-bearing streams, to achieve mature forest condition with the goal of protecting aquatic and riparian resources. Salvage of downed wood in these areas would occur only to facilitate the establishment of mature forest conditions, and only in consultation with the ODFW and the Services.

Assumptions

- Tree retention standards along 75 percent of small perennial non-fish-bearing stream reaches are sufficient to meet management goals related to properly functioning conditions, and to meet water quality standards established by the State of Oregon under the mandates of the federal Clean Water Act.

Activities

- Implementation Monitoring: Conduct comprehensive monitoring on a subset of harvest units to determine implementation of riparian and aquatic strategies. Utilize

methods to quantify proportion of harvest plans that manage in riparian inner zones or apply alternative vegetation treatments.

- Shade, Riparian Characteristics, and Water Quality on Small Perennial Type N Streams: On a subset of harvest units with small perennial Type N streams, monitor riparian and buffer characteristics, shade, and water quality parameters (e.g., stream temperature, macroinvertebrates, or sediment) before and after harvesting. This project will be coordinated with the amphibian-related monitoring described in Chapter 9 and above.

Table 11-2
Sample Monitoring and Surveying Matrix[a]

Species	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Northern Spotted Owls																				
Monitor to determine development of stand structure for northern spotted owl habitat suitability.[b]																				
Northern spotted owl density studies to determine presence.																				
Marbled Murrelet																				
Digitize habitat and measure vegetative characteristics.																				
Survey T&E core areas for marbled murrelet occupancy.																				
Other Species																				
Monitor to determine development of stand structure and habitat suitability for other listed and unlisted species.																				
Monitor a subset of harvest units with perennial Type N streams before/after management for riparian and buffer characteristics, shade, and water quality parameters.																				
Annual monitoring of known bald eagle nest sites.																				
Survey a subset of habitat for northern goshawks, beginning at year ten of the plan, and completing surveys in 5 years.																				
If fisher populations expand in the future, participate in or conduct research or survey efforts in the region.	To be determined																			

Table 11-2 - continued

Species	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Periodic surveys of early structure stands to determine presence of western bluebirds and olive-sided flycatchers.																				
Surveys before/after management activities in a selection of perennial Type N streams to determine presence of southern torrent salamanders and tailed frogs. Follow-up surveys in five and ten years.																				
Periodic surveys of ponds with red-legged frogs to determine continued presence.																				
Cost/Year	**150**	**150**	**150**	**150**	**50**	**100**	**180**	**210**	**150**	**100**	**80**	**80**	**80**	**180**	**100**	**80**	**180**	**80**	**60**	**40**

[a] This is an example timeline for how monitoring projects may be distributed through time.
[b] A project designed and conducted under the State Forests Monitoring Program Strategic Plan to address both FMP and HCP information needs.

Appendix A
Glossary

The following references were among those used in developing the glossary (see full reference citations in Appendix B):

- USDA Forest Service, et al. 1994a
- Dunster and Dunster 1996

abiotic	The non-living components of the planet not currently part of living organisms, such as soils, rocks, water, air, light, and nutrients.
active channel width	The average width of the stream channel at the normal high water level. The normal high water level is the stage reached during average annual high flow. This high water level mark often corresponds with the edge of streamside terraces; a change in vegetation, soil, or litter characteristics; or the uppermost scour limit (bankfull stage) of a channel.
active nest tree	A tree or snag in which a nest is tended during the breeding season by a pair of northern spotted owls.
activity center	The nest tree, or the location best describing the focal point of the activity of a northern spotted owl or pair of northern spotted owls when the nest location is not known.
adaptive kernel	A method for determining home range. In the adaptive kernel method, local adjustments are applied to the width of individual kernels. Observations in areas of high density get less smoothing (tighter fit), and observations in areas of low density get more smoothing (looser fit).
adaptive management	Adaptive management is a system of making, implementing, and evaluating decisions, which recognizes that ecosystems and society are always changing. It is a systematic and rigorous approach to learning from actions, improving management, and accommodating change.
advanced structure stand	Stands with advanced structure are more developed than intermediate structure stands in the understory reinitiation stage. Tree crowns show significant layering from the tallest trees to the forest floor. Advanced structure stands that are highly diverse may develop structural characteristics typically linked with older forests or old growth.
aggregate	Sand and pebbles added to cement to make concrete, or that are used in road construction.
alluvial	Soil, debris, and other materials that have been deposited by currents of water.
ambient	Surrounding.
anadromous fish	Species of fish (e.g., salmon) that hatch and rear for a portion of their life history in fresh water rivers and streams, then mature in the ocean, and then migrate back into freshwater rivers and streams to spawn.

aquatic	In or on the water; aquatic habitats are in streams or other bodies of water, as contrasted with riparian habitats, which are near water.
aquatic zone	The area that includes the stream channel(s) and associated aquatic habitat features. This zone includes beaver ponds, stream-associated wetlands, side channels, and the channel migration zone.
aquifer	A sand, gravel, or rock formation that is capable of storing or transporting water below the surface of the ground.
archaeological and historical resources	Districts, sites, buildings, structures, and artifacts that possess material evidence of human life and culture of the prehistoric and historic past.
archaeological object	An object that is at least 75 years old; is part of the physical record of an indigenous or other culture found in the state or waters of the state; and is material remains of past human life or activity that are of archaeological significance, including, but not limited to, monuments, symbols, tools, facilities, technological by-products, and dietary by-products (Oregon Revised Statutes [ORS] 358.905).
archaeological site	A geographic locality in Oregon, including but not limited to, submerged and submersible lands and the bed of the sea within the state's jurisdiction, that contains archaeological objects and the contextual associations of the archaeological objects with each other, or with biotic or geological remains or deposits (ORS 358.905). Specific types of sites, as defined in Oregon law, are: **pre-historic archaeological site—**Created and/or used by humans indigenous to the area before Euro-American inhabitance. **historic archaeological site**—Created and/or used by humans since the time of Euro-American inhabitance; usually belowground and/or aboveground diminishing remains. **historic site**—Created and/or used by humans since the time of Euro-American inhabitance; usually aboveground structurally intact remains. **site of archaeological significance—**Any archaeological site on, or eligible for inclusion on, the National Register of Historic Places as determined in writing by the State Historic Preservation Officer, or any archaeological site that has been determined significant in writing by an Indian tribe (ORS 358.905).

average annual high flow period	High flows generally occur between November and March, with some variability in timing year to year. Average high flows are typically represented with a 2.5-year return interval.
average high water level	The stage reached during the average annual high flow period. This level often corresponds with the edge of streamside terraces, marked changes in vegetation, changes in soil or litter characteristics, or the bankfull stage of a channel.
basal area	The area of the cross-section of a tree stem near the base, generally at breast height (4.5 feet above ground) and including the bark. The basal area per acre is the total basal area of all trees on that acre.
biodiversity *or* biological diversity	The genetic variation and the variety of microbial, plant, and animal life.
biotic	Any living aspect of the planet.
board foot	The amount of wood equivalent to a piece of wood one foot wide by one foot high by one inch thick.
Board of Forestry	The Oregon Board of Forestry (BOF) is a seven-member board appointed by the Governor and confirmed by the state Senate. At least one member must reside in each of the state's three administrative regions (east, south, and northwest). No more than three members may receive any significant portion of their income from the forest products industry. The BOF supervises all matters of forest policy within Oregon; appoints the State Forester; adopts rules regulating forest practices; and provides general supervision of the State Forester's management of the Oregon Department of Forestry (ODF).
Board of Forestry Lands	Board of Forestry Lands were acquired by the BOF under ORS 530.010 to 530.040. Most were transferred from counties to the BOF in exchange for a portion of future revenue from the lands. Some lands were acquired by direct purchase.
bog	A wetland that is characterized by the formation of peat soils and that supports specialized plant communities. A bog is a hydrologically closed system without flowing water. It is usually saturated, relatively acidic, and dominated by ground mosses, especially sphagnum. Bogs are distinguished from other wetlands by the dominance of mosses and the presence of extensive peat deposits.
burial	Any natural or prepared physical location, whether originally below, on, or above the surface of the earth, into which, as a part of a death rite or death ceremony of a culture, human remains were deposited (ORS 358.905).

buffer habitat	Stands surrounding occupied stands that do not have the characteristics of suitable habitat, but that buffer the occupied stand from wind and other environmental factors as well as from other potential deleterious effects of edge, such as increased predation.
candidate species	Species being considered by the Secretary of the Interior for listing as an endangered or a threatened species, but not yet the subject of a proposed rule.
channel migration zone	An area adjacent to an unconfined stream channel where channel migration is likely to occur during high-flow events. The presence of side channels or oxbows, stream-associated wetlands, and low terraces are indicators of these zones. The extent of these areas will be determined through site inspections using professional judgment.
chlorosis	Yellowing of normally green plant tissue due to destruction or limited production of chlorophyll; often a symptom of mineral deficiencies, disease (such as Swiss needle cast), feeding by sucking insects, root or stem girdling, or serious light deficiencies.
Clean Air Act	Federal law passed in 1970, and amended several times since. The authority to implement the act is delegated to the states. The Clean Air Act is implemented, in part, through a permit system.
clearcut	Traditionally, a silvicultural system in which the entire stand of trees is cleared from an area at one time. Clearcutting and planting (if needed) results in the establishment of a new even-aged stand of trees. In the Elliott State Forest, a modified clearcutting system is used, in which live trees, snags, and downed wood remain on the unit after harvest.
coarse filter – fine filter	For the Elliott State Forest, an operational approach to managing for biological diversity is the "coarse filter – fine filter" concept proposed by. The coarse-filter component is based on the premise that maintaining a range of seral stages, stand structures, and sizes, across a variety of ecosystems and landscapes, will meet the needs of most organisms. Fine-filter management superimposes specific management actions for individual species or habitats that require special consideration, such as species with unique or limited distributions.
co-dominant	Trees with crowns that form a general level of crown stratum and are not physically restricted from above, but are more or less crowded by other trees from the sides.

cohort	A group of trees regenerating after a single disturbance. The age range within a cohort may be as narrow as one year or as wide as several decades, depending on how long trees continue invading after a disturbance.
colluvial	Soil, debris, and other materials that have been moved downslope by gravity and biological activity.
Common School Forest Lands	A subset of the Common School Trust Lands that have been listed by the State Land Board for the primary use of timber production.
Common School Fund	A permanent fund or account managed to provide revenues to the common schools. The State Land Board (Governor, Secretary of State, and Treasurer) is the trustee of the Common School Fund (CSF).
Common School Trust Lands	State lands owned by the State Land Board. In Oregon, the lands originally granted by Congress under the Oregon Admission Act included approximately six percent of the new state's land for the use of schools. The primary goal in managing Common School Trust Lands is the generation of the greatest amount of income for the CSF over the long-term, consistent with sound techniques of land management.
commonly used road	A road that receives frequent traffic during the marbled murrelet breeding season, including but not limited to, a mainline road and roads connecting mainline roads. Roads not commonly used may include, but are not limited to, spur roads and blocked or decommissioned roads.
composition	The different species of plants and animals that live in an ecosystem. The dynamic attributes of a forest ecosystem are composition, function, and structure. Composition is the proportion of various species. Function is the processes taking place in the system. Structure includes kinds and distribution of stand components such as trees, snags and logs of various sizes and shapes.
concept	An abstract or generic idea generalized from particular instances.
confirmed occupancy	Occupied behaviors observed on more than one visit.

conifer stand These stands occupy most of the Elliott State Forest. The ODF classifies as conifer stands those in which conifer species compose 30 percent or more of the tree canopy. Although conifers are the principal species with economic value in these stands, the stands may also include substantial amounts of other vegetation types such as hardwoods, brush, grass, and ferns, which contribute to a diverse forest ecosystem. These types are either intermixed with the conifers or are in clumps too small to map and inventory separately.

connectivity A measure of how well different areas (patches) of a landscape are connected by linkages, such as habitat patches or corridors. At a landscape level, the connectivity of ecosystem functions and processes is of equal importance to the connectivity of habitats.

conservation area Designated land where conservation strategies are applied for the purpose of attaining specific conservation objectives; this may include cultural or biological aspects. In the Elliott State Forest, conservation areas include habitats utilized by northern spotted owls and marbled murrelets, riparian management areas, rare or unique habitats, and areas requiring special protection for visual or other resource values. Management within conservation areas is aimed at maintaining desired conditions.

core area An area of contiguous suitable habitat surrounding a nest site or activity center.

core use area Areas of concentrated use within the home range identified by calculating an average observation density of all locations for an individual northern spotted owl and determining the contour where the observation density is greater than average. This contour does not have a connotation of statistical significance, but it delimits an area of concentrated use. The advantage to this approach is that it avoids arbitrary selection of contours, and each core area is based only on the density of locations for that particular northern spotted owl.

corridor Areas of habitat that connect separate but similar habitat patches, within the landscape mosaic. For example, an area of mature timber, such as a riparian buffer, may connect larger patches of mature timber.

critical habitat	The specific areas within the general geographic area occupied by a federally listed species in which physical and biological features occur that the U.S. Fish and Wildlife Service (USFWS) has determined to be essential to the conservation of the species. Critical habitat is designated by USFWS pursuant to the federal Endangered Species Act (ESA). Not all of the area encompassed by critical habitat contains the necessary habitat characteristics to support a particular species.
culmination of mean annual increment	Mean annual increment is the total increment of growth of a stand divided by the age of the stand. The culmination age is the age at which the mean annual increment reaches its maximum. If maximization of wood volume is the objective for the stand, this age is generally used as the rotation age. Periodic thinning enhances growth and extends the culmination age.
danger tree	A standing tree, alive or dead, that resents a hazard to personnel due to deterioration or physical damage to the root system, trunk (stem), or limbs, and the degree and direction of lean.
debris flow	A rapidly moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than grains of sand.
debris torrent	Rapid movement of a large quantity of materials, including wood and sediment, down a stream channel. This generally occurs in smaller streams during storms or floods, and scours the stream bed.
decadence	Process of decay, or condition of being in a decayed state, particularly as related to trees or stands of trees. Typified by the presence of pathogens causing various forms of rot, and often used to refer to the presence of snags and downed wood. A process influential in multiple aspects of ecosystem development from providing cavities for wildlife, to creating gaps in the canopy, to altering forest floor climate and structure.
demographic study	A study of population dynamics; the quantitative analysis of population structure and trends in size, growth rate, and distribution.
density	The number or size of a population (trees, species, etc.) in relation to a unit of space. In silviculture, stand density is measured as the amount of tree biomass per unit area of land. This can be measured as the number of trees, basal area, wood volume, or foliage cover. Also see “stand density” and “stand density index.”
desired future condition	An explicit description of the physical and biological characteristics of the Elliott State Forest in the future, as described in the forest vision.

detection	Sighting or hearing of one or more birds acting in a similar manner, i.e., a single bird or flock.
diameter breast height	The diameter of a tree, measured 4.5 feet above the ground on the uphill side of the tree.
dissected	A landscape that has been cut into hills and valleys by the process of erosion.
disturbance	A force that causes significant change in an ecosystem's structure and/or composition. Disturbance can be caused by natural events such as fire, flood, wind, earthquake, and insect or disease outbreak, or by human activities. The disruption of marbled murrelet reproductive activities.
dominance	Trees with crowns that extend above the general level of crown cover of other trees of the same stratum and are not physically restricted from above, although possibly somewhat crowded by other trees on the sides.
downed wood	Fallen trees or pieces of trees on the forest floor or in the stream channel that provide many important functions such as mineral cycling, nutrient mobilization, maintenance of site productivity, natural forest regeneration (nurse logs), substrates for mycorrhizal formation, and diverse habitats for fish and wildlife species.
early structure stand	Following a disturbance, an early structure stand develops through the stand initiation process. In the early years of this stage, the site is occupied primarily by tree seedlings or saplings, herbs, grass, or shrubs. In later years, increasing crown closure shades the ground, and herbs, shrubs, and grasses begin to die out or lose vigor. At this point, the stand transitions from an early stand initiation stage to an intermediate stem exclusion stage, leading to an intermediate structure stand.
earthflow	Movement of material, both sediment and vegetation, down a slope. Earthflows are typically large, but move only a few centimeters each year. (See also "landslide.")
ecosystem	A complex system comprising populations of organisms considered together with their physical environment and the interacting processes between them (e.g., marsh, watershed, lake ecosystem). Ecosystems do not have boundaries fixed in time or space because the form and function of ecosystems change at various rates, depending on prevailing environmental factors.
ecosystem functions	The many and varied biotic and abiotic processes that make an ecosystem functional, changing, and interactive (e.g., biogeochemical processes, nutrient cycling, decomposition, regeneration, and succession).

ecosystem management	A management practice and philosophy aimed at selecting, maintaining, and/or enhancing the ecological integrity of an ecosystem to ensure continued ecosystem health while providing resources, products, or non-consumptive values for humans. The actions taken reflect the management goals and range from protection from human influence through to an increasing intensity of interventions to serve human needs.
edge	The point where two different plant communities (different vegetation types, successional stages, or conditions) meet. Edges may be created by a soil or topographical feature of the site, or where short-term effects are created by natural or human-caused disturbances.
endangered species	As defined by the ESA: Any species (including subspecies or qualifying population) that is in danger of extinction throughout all or a significant portion of its range.
ephemeral stream	Ephemeral streams occur in direct response to precipitation, running only during or shortly after periods of heavy rainfall or rapid snowmelt.
effectiveness monitoring	Used to determine if the design and execution of the prescribed management practices are achieving the Habitat Conservation Plan (HCP) conservation objectives. Every management decision is intended to achieve a given set of future conditions. Effectiveness monitoring can be used to compare existing conditions to both past and the desired future conditions to describe the overall progress or success of the management activities.
evolutionarily significant unit	An evolutionarily significant unit (ESU) is a group of stocks or populations that: 1) are substantially reproductively isolated from other population units of the same species; and 2) represent an important component in the evolutionary legacy of the species. This term is used by the National Marine Fisheries Service (NMFS) as guidance for determining what constitutes a "distinct population segment" for the purposes of listing Pacific salmon species under the ESA. For example, the "Oregon Coast chinook ESU" is a delineation that encompasses all populations of chinook salmon from the Necanicum River on the northern Oregon coast, to Cape Blanco on the south coast.
extensive management	Extensive forest management is a term used for protection of the forest from fire and insects, and the reliance on natural regeneration for provision of the next forest.
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.

fixed kernel	A method of determining home range. In the fixed kernel method, a single smoothing width is used on all the observations in the sample. The fixed kernel generally produces estimates of home-range size and contours with lower bias than the adaptive kernel in simulation studies.
Forest Land Management Classification System	Under OAR 629-035-055, state forest lands are classified according to the management that will be applied. The classification describes the management emphasis for the land as determined by Forest Management Plans and any applicable HCP. State forest lands are classified as General Stewardship, Focused Stewardship, or Special Stewardship. Focused and Special Stewardship classifications are used when a particular forest resource may need a more focused approach or priority in management compared to other resources.
formation	A group of strata, or layers, of the same sort of rock or mineral, or rock having common characteristics.
fractal	Irregular shapes and surfaces that cannot be represented by classical geometry. Fractal dimension is an index of the complexity of spatial patterns.
fragmentation	The relationship of the landscape matrix to other types of patches; as fragmentation increases, the matrix becomes geometrically more complex. Maximum landscape fragmentation occurs when no dominant patch exists. Fragmentation is also defined as the spatial arrangement of successional stages across the landscape as the result of disturbance, and is often used to refer specifically to the process of reducing the size and connectivity of late successional or old growth forests.
fry	For salmonids, young fish that have just emerged from the gravel and are actively feeding.
function	An activity or process that occurs in an ecosystem; some typical functions are plant growth, animal reproduction, and decay of dead plants.
geographic information system	A system for management analysis and display of geographic knowledge that is represented using a series of information sets such as maps and globes, geographic data sets, processing and workflow models, data models, and meta data.
geotechnical	The study of soil stability in relation to engineering.
geothermal	Of or relating to the internal heat of the earth.

goals	A concise, broad statement of an organization's end or process that programs are designed to achieve. A goal is normally expressed as a broad, general statement of purpose, is usually not quantifiable, and is timeless in that it usually has no specific date by which it is to be completed.
groundwater	The subsurface water supply (below the water table) that saturates the pores and fractures of sand, gravel, and rock formations.
guidelines	A set of recommended or suggested methods or actions that should be followed in most circumstances to assist administrative and planning decisions, and their implementation in the field. They are provided as a broad framework of recommended actions to be taken, and thus provide some flexibility for decision-making.
guiding principles	The overall rules, goals, and responsibilities that guide the planning process for the Elliott State Forest.
Habitat Conservation Plan	A comprehensive planning document that is a mandatory component of an Incidental Take Permit (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).
Harvest Unit	Delineated forest parcels that reflect potential logical harvest operation areas considering topography and access. A unit for clearcut and thinning choices.
hardwood stand	These stands are found on a minority of Elliott State Forest lands. The ODF classifies as hardwood stands those in which hardwood species comprise more than 70 percent of the tree canopy.
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).
headwall	The steep slope or rocky cliffs at the head of a valley.
high water line	The stage reached during the average annual high flow period. This level often corresponds with the edge of streamside terraces, marked changes in vegetation, or changes in soil or litter characteristics.

historic artifacts	Three-dimensional objects including furnishings, art objects, and items of personal property that have historic significance. "Historic artifacts" do not include paper, electronic media, or other media that are classified as public records (ORS 358.635).
historic property	Real property that is currently listed in the National Register of Historic Places, established and maintained under the National Historic Preservation Act of 1966, or approved for listing on an Oregon Register of Historic Places.
home range	The area within which an animal conducts its activities during a defined period of time (generally determined through radio-telemetry monitoring).
hydrology	The study of the properties, distribution, and effects of water on the landscape, under the surface, in the rocks, and in the atmosphere.
implementation monitoring	Used to determine if objectives, standards, and management practices specified in the HCP conservation strategies are being accomplished. Implementation monitoring is used to determine whether specified actions or criteria are being met.
Implementation Plan	An ODF plan that describes in more detail than the long-range Forest Management Plan how the management strategies will be applied. These plans are designed to describe forest management activities for a ten-year period, and are revised at least every ten years.
incidental take	Take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities.
Incidental Take Permit	An Incidental Take Permit (ITP) is a federal exemption to take prohibition of Section 9 of the ESA; the ITP 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.
inner RMA zone	The next area away from the stream, adjacent to the stream bank zone.
integrated pest management	A systematic approach that uses a variety of techniques to reduce pest damage or unwanted vegetation to economically and socially tolerable levels. Integrated pest management techniques may include the use of natural predators and parasites, genetically resistant hosts, environmental modifications, and, when necessary and appropriate, chemical pesticides or herbicides.

integrated resource management	The management of two or more resources in the same general area and period of time (e.g., water, soil, timber, grazing, fish, wildlife, and forests). For the Elliott State Forest, integrated resource management means that the design and application of management practices must consider the effects and benefits of all of the forest resources in such a way that those effects and benefits lead to achieving the goals in the Forest Management Plan over time and across the landscape.
intensive management	Intensive forest management: A management concept promoting basic forest management in combination with juvenile-stand improvement and/or the use of artificial regeneration to ensure reasonably uniform stand establishment and stocking. Intensive silviculture: Any silvicultural practices designed to accelerate stand development and improve the stand value and final yields in stands that are well established.
interior habitat area	The portion of the older forest patch that remains effective when the negative effects of high contrast edge are removed.
intermediate structure stand	As early structure stands develop and transition into the stem exclusion stage, trees fully occupy the site and form a single, main canopy layer. The stem exclusion process begins when new trees, shrubs, and herbs no longer appear and existing ones begin to die, due to competition for light, nutrients, and moisture. Later, as more of the trees die, the understory reinitiation process begins, when enough light and nutrients become available so that herbs, shrubs, and young trees again appear in the understory.
intermittent stream	A stream with surface flow only part of the year. In the Forest Practices Act, defined as a stream that normally does not have summer surface flow after July 15.
jacks	Sexually mature male salmon that reached maturity earlier than usual for their species.
landscape	Many sets of stands that cover an area ranging from many hundreds to tens of thousands of acres.
landslide	The dislodging and fall of a mass of earth and rock. There are many types of landslides, including debris slides, earthflows, rock block slides, slumps, slump blocks, and slump earthflows. The different types of landslides vary tremendously in how they occur, how far they move, what type of materials move, etc.

late successional habitat	A forest stand whose typical characteristics are a multi-layered, multi-species canopy dominated by large overstory trees; numerous large snags; and abundant large woody debris (such as fallen trees) on the ground. Other characteristics such as canopy closure may vary by the forest zone (lodgepole, ponderosa, mixed conifer, etc.).
leave area	An area of standing timber retained among areas of logging activity to satisfy management objectives, such as seed source, wildlife habitat, or landscape management constraints.
legacy structures	Structural components within a forest stand that are retained during harvest operations, and that provide habitat diversity in the future stand. Examples of legacy structure include live trees, snags, and downed wood.
lieu lands	"Lieu lands" were offered by the federal government to the state to compensate for original land grants that had conflicting claims. The Elliott State Forest includes approximately 7,700 acres of lieu lands.
likely nesting habitat	Occupied marbled murrelet habitat that is considered to be the most likely location for nesting sites, based on information from surveys, aerial photos, stand information, and the judgment of biologists or others familiar with the area. Stand type breaks or topography may be used to delineate the boundaries of likely nesting habitat.
lithic scatter	A location where prehistoric stone tools were made, usually from obsidian. The tools and weapons were used locally or traded.
loading	The quantity of a substance entering a body of water.
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 drainage basins and watersheds. Basin boundaries are generally consistent with 5th and 6th field Hydrologic Unit Codes as developed by the U.S. Geological Survey.
management prescription	The management practices and intensity selected and scheduled for application on a specific area to attain predefined goals and objectives.
marbled murrelet management area	The area designated for the protection of marbled murrelets, according to ODF policy. (The acronym "MMMA" is sometimes pronounced "trima.")

mature forest condition	Desired mature forest condition consists of a stand dominated by large conifer trees, or where hardwood-dominated conditions are expected to be the natural plant community, a mature hardwood/shrub community. For conifer stands, this equates to a basal area of 220 square feet or more per acre, inclusive of all conifers over 11 inches diameter breast height. At a mature age (80 to 100 years or greater), this equals 40 to 45 conifer trees 32 inches in diameter breast height per acre.
minor tree species	For a given stand, tree species that occur as a relatively small component of the stand, such as western redcedar or alder in a stand consisting mostly of Douglas-fir trees.
monitoring	The measurement of environmental characteristics and conditions over an extended period of time to determine status or trends in some aspect of environmental quality. **implementation monitoring—**Asks the question, "Did we do what we said we would do?" **effectiveness monitoring—**Asks the question, "Are the management practices producing the desired results?" **validation monitoring—**Asks the question, "Are the planning assumptions valid, or are there better ways to meet planning goals and objectives?"
morphology	Form and structure.
National Environmental Policy Act	The National Environmental Policy Act (NEPA) was signed into law in 1969. NEPA requires all federal agencies to consider and analyze all significant environmental impacts of any action proposed by those agencies; to inform and involve the public in the agency's decision-making process; and to consider the environmental impacts in the agency's decision-making process.
native	Indigenous to Oregon and not introduced.
natural ecosystem	An ecosystem that is minimally influenced by humans and that is, in the larger sense, diverse, resilient, and sustainable.
near-stream riparian	Areas directly adjacent to the stream. Large wood is delivered by the tree falling directly into the stream from the adjacent streambank or hillslope.
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.
nonpoint source	Entry of a pollutant into a body of water from widespread or diffuse sources, with no identifiable point of entry. The source is not a distinct, identifiable source such as a discharge pipe. Erosion is one example of a nonpoint source.

non-salmonid fish	Any fish species outside the family *Salmonidae*. A salmonid may be resident or anadromous; examples are Pacific lamprey and sculpins.
non-silviculturally capable	Areas that are rocky, swampy, covered by water, or for various other reasons have little to no commercial value for timber production. The Elliott State Forest has a few parcels of rocky or swampy lands scattered throughout the forest. Most are less than 5 acres, although a few are as large as 20 acres.
northern spotted owl circle	An area defined by the provincial radius circle around a northern spotted owl activity center.
northern spotted owl site	A territory occupied by northern spotted owls.
not commonly used road	Roads not commonly used may include, but are not limited to, spur roads and blocked or decommissioned roads.
nutrient cycling	Circulation or exchange of elements, such as nitrogen and carbon dioxide, between living and nonliving portions of the environment.
objective	A clear and specific statement of results to be achieved within a stated time period. An objective is measurable and implies precise time-phased steps to be taken and resources to be used, which, together, represent the basis for defining and controlling the work to be done.
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.
occupied habitat	Suitable habitat that has been surveyed and determined to be occupied by marbled murrelets.
occupied sites	Sites determined to be occupied by marbled murrelets based on the observation of subcanopy behaviors during protocol surveys, or the observation of nest trees, eggshell fragments, or other evidence of marbled murrelet reproductive activities.
old growth	A forest stand whose typical characteristics are a patchy, multi-layered, multi-species canopy dominated by large overstory trees, some with broken tops and decaying wood; numerous large snags; and abundant large woody debris (such as fallen trees) on the ground. In western Oregon, old-growth characteristics begin to appear in unmanaged forests at 175 to 250 years of age. (See “late successional habitat.”)

open road/active use	This category includes any road open for travel with a motorized vehicle. It includes permanent roads and also temporary roads that are currently in use or will be used in the near future. These roads are usually available for use at any time of the year. Use may be continuous or intermittent. Roads in this category require active maintenance and have a full maintenance obligation under the Forest Practices Act.
orographic	A process in which air masses are lifted up by mountains or similar obstructions, leading to higher amounts of precipitation on the windward side of the mountain.
outer RMA zone	The portion of the riparian management area farthest away from the stream.
Ownership, Site, Cover, Use, and Recommendations	The old inventory system developed by the ODF, that includes 1:12,000 scale maps and overlays, data files by type and various sorts, and data summaries. The system is now being replaced by the Stand Level Inventory.
owl circle	The area defined for the purpose of identifying the home range of a northern spotted owl pair or resident single northern spotted owl; the circle size varies by physiographic province. In the Oregon Coast Range, the radius of an owl circle is 1.5 miles, encompassing the area of 4,766 acres. Guidelines established by the USFWS (later rescinded) required protecting 70 acres of northern spotted owl habitat immediately around a northern spotted owl activity center, 500 acres within 0.7 miles, and 1,906 acres within 1.5 miles.
owl site	A territory occupied by northern spotted owls.
particulate	Small particles in smoke produced by burning wood and other forest debris. Two kinds of particulate are controlled under federal and/or state requirements: total suspended particulates and PM_{10} (particulate matter less than 10 microns in diameter).
patch	The landscape patch is an environmental unit between which "quality" differs, such as a habitat patch.
perennial stream	A stream with year-round surface flow. In the Oregon Forest Practices Act, a perennial stream is defined as a stream that normally has summer surface flow after July 15.
platform	A relatively flat surface at least 5 inches in diameter and at least 50 feet high in the live crown of a coniferous tree. A platform includes the limb and any deformities of, or epiphyte cover growing on, the limb. For instance, a four-inch-diameter limb with moss cover that increases the overall diameter to five inches is a platform.

platform tree	Any tree having a single platform capable of hosting a nest for a marbled murrelet.
point source	The release of a pollutant from a pipe or other distinct, identifiable point, directly into a body of water or into a water course leading to a body of water.
policy	A definite, stated method or course of action adopted and pursued by an entity that guides and determines present and future decisions and actions. A policy establishes a commitment by which an entity is held accountable.
pollutant	A substance of such character and existing in such quantities as to degrade an environmental resource (i.e., water, air, or soil) by impairing its usefulness (including its ability to support living organisms).
population	The organisms that constitute a particular group of a species, or that live in a particular habitat or area. A group of fish (e.g., Nehalem River fall chinook salmon) that spawn in a particular area at a particular time, and that do not interbreed to any substantial degree with any other group spawning in a different area, or in the same area at a different time are considered a population (OAR, Division 7, 635-07-501(38)).
potential murrelet habitat	Potential 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.
potential habitat	Stands with the characteristics of occupied marbled murrelet habitat, but that have not been surveyed for the presence of this species.
prescribed burning	Controlled fire burning under specified conditions to accomplish planned objectives; also called slash burning, as a frequent objective is to reduce the amount of slash left after logging. Objectives may include site preparation for planting and reduction of fire hazards or pest problems.
presence	A stand of potential habitat where marbled murrelets have been detected at the stand, but subcanopy behaviors have not been documented.
properly functioning aquatic systems	The range of diverse aquatic and riparian conditions over time and space that emulate the habitat conditions that resulted from natural disturbance regimes under which native species evolved. There is no one condition that is properly functioning.

recruitment nesting habitat	Stands that do not exhibit the characteristics of occupied habitat, but that could be managed to develop such characteristics in the future.
redd	Location selected by a female salmon or trout for laying eggs; female digs a "nest" in the stream gravels with her tail.
Reforestation Organization Operations Tracking System	The Reforestation Organization Operations Tracking System (ROOTS) is the next step in the development of the State Forests Program Integrated Information System. ROOTS contains the following three main functions: 1) Stand Level Inventory (SLI): Tools for importing, updating, analyzing, viewing, and reporting on SLI information. 2) Silvicultural Treatment Records: Tools for managing. Analyzing, viewing, and reporting on information related to forest management activities such as harvesting, site preparation, planting, animal damage protection, vegetation management, interplanting, fertilization, and pruning. 3) Planning Units: Tools for making and recording a plan for future activities needed to achieve the desired future condition (DFC) for a specific geographic location.
refugia	Locations and habitats that support population of organisms that are limited to small fragments of their previous geographic range, and areas that remain unchanged while surrounding areas change markedly (the areas serve as a refuge for those species requiring specific habitats). The changes could be short term, such as wildfires or human activity, or much longer term, such as periods of glaciation.
regeneration	Regeneration refers to the process of renewal of a forest or stand of trees, or to the young trees in a stand.
regeneration harvest	The removal of trees to make regeneration possible or to assist in the development of the established regeneration (young trees). The most common type of regeneration harvest in the Elliott State Forest is a modified clearcut, leaving specified amounts of live trees, snags, and downed wood.
reserve	An area of land set aside to maintain it in a desired condition, e.g., as functional habitat for wildlife.
resident fish	Fish species that complete their entire life cycle in freshwater; non-anadromous fish. One example is a resident population of cutthroat trout.
residual live trees	Live trees that are retained to provide short-term habitat needs of wildlife species, to serve as a source of future snags and downed wood, and to provide legacy trees in future stands. This term also refers to live trees present in a stand that are legacies of a previous cohort of trees.

riparian area	Three-dimensional zone of direct influence and/or interaction between terrestrial and aquatic ecosystems. The boundaries of the riparian area extend outward from the stream bed or lakeshore.
riparian management area	A riparian management area (RMA) is a protected area with site-specific boundaries established by the ODF; the width varies according to the stream classification or special protection needs. The purpose of the RMA is to protect the stream, aquatic resources, and riparian area. Aquatic resources include water quality, water temperature, fish, stream structure, and other resources.
rock block slide	Type of landslide in which the weakness and initial breaking is in the underlying rock, not the soil. (See also "landslide.")
rotation	Also called tree age rotation. The time needed from regeneration of a crop of trees through to harvestable timber, or the time period to reach other stand criteria (e.g., complex habitat function).
salmonid	Fish species belonging to the family *Salmonidae*; includes trout, salmon, and whitefish species.
salvage	Salvage cutting is the utilization of standing or down trees that are dead, dying, or deteriorating, for whatever reason, before the timber values are lost.
seasonal stream	A stream with surface flow only part of the year. In the Forest Practices Act, defined as a stream that normally does not have summer surface flow after July 15.
seral stages	Developmental stages that succeed each other as an ecosystem changes over time; specifically, the stages of ecological succession as a forest develops.
silviculture	The art, science, and practice of controlling the establishment, composition, health, quality, and growth of the vegetation of forest stands. Silviculture involves the manipulation, at the stand and landscape levels, of forest and woodland vegetation, and the control or production of stand structures such as snags and down logs to meet the needs and values of society and landowners.

site class

Site class is a measure of an area's relative capacity for producing timber or other vegetation. It is an index of the rate of tree height growth, with lower values indicating faster growing trees. The site index is expressed as the height of the tallest trees in a stand at an index age. In this document, an age of 50 years is used. The five site classes are defined below. Most of the Elliott State Forest is site class II or III.

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

site index

A measure of forest productivity, expressed as the height of the tallest trees in a stand at an index age. In this document, an age of 50 years is used. (See "site class.")

site status

The occupancy status of a surveyed area, as defined by the survey protocol.

Pair Status—Established by any of the following:

- A male and female are heard and/or observed (either initially or through their movement) in proximity (less than one-quarter mile apart) to each other on the same visit; or
- A male takes a mouse to a female; or
- A female is detected (seen) on a nest; or
- One or both adults are observed with young.

Resident Single Status—Established by:

- The presence or response of a single northern spotted owl within the same general area on three or more occasions within a breeding season; or
- Multiple responses over several years (e.g., two responses in year 1 and one response in year 2, from the same general area).

The presence or response of two birds of the opposite sex where pair status cannot be determined and where at least one member meets the other resident single requirements. (Note: This is considered "two birds, pair status unknown" in the survey protocol. This is lumped with the resident single category because management options are the same as for resident singles.)

slope stability

The degree to which a slope resists the downward pull of gravity. The more resistant, the more stable.

slump	A type of landslide; involves a failure in the soil, tends to be spoon-shaped, and the base often oozes out. (See also "landslide.")
slump blocks, slump earthflows	Types of landslides. (See "landslide," "slump," and "earthflow.")
smolts	Juvenile salmon that are leaving freshwater and migrating to the ocean.
snag	A standing dead tree.
spatial forest modeling	Spatial forest modeling is the assignment of harvest activities to specific forest parcels, thereby controlling the size and juxtaposition of treatment areas. Examples of spatial control include the size of regeneration harvests, the shape and size of older forest patches, establishing and maintaining connectivity, scheduling of transportation, and coordination of upslope and riparian activities. Spatial forest modeling is contrasted with strata-based forest modeling where parcels with common characteristics are merged together into strata with harvest activities assigned to percentages of the strata. However, with strata-based modeling, it is not known which parcels in the strata are scheduled, and it is not possible to control the size and juxtaposition of treatments.
species	When referring to the federal ESA, species also means: "…any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature" [Section 3(15) of the ESA].
stand	A group of trees that forms contiguous potential marbled murrelet habitat with no gaps wider than 100 meters.
stand density	In silviculture, stand density is measured as the amount of tree biomass per unit area of land. This can be measured as the number of trees, basal area, wood volume, or foliage cover.
stand density index	A relative measure of stand density; converting a stand's current density into a density at a reference size. It is usually expressed in the equivalent number of trees that are 10 inches in diameter, e.g., 65 trees per acre that average 26 inches in diameter have the same stand density index as 300 trees per acre that average 10 inches in diameter.
stand initiation	This stand development process begins when a disturbance such as timber harvest, fire, or wind has killed or removed most or all of the larger trees, or when brush fields are cleared for planting.

Stand Level Inventory	The ODF's Stand Level Inventory acquires and updates state forest vegetation information at the specific site level (forest stand). This information is used for tactical and operational decision-making. The Stand Level Inventory includes vegetation sampling protocols, forest stand data arranged in a database, computer programs for managing and using the information, and documentation of inventory elements.
stand structure	For the purposes of this HCP, a series of three stand structures have been defined depicting the typical progression of stand development following a natural or human-caused disturbance. The stand initiation process is represented by the **early stand structure**. The stem exclusion and early understory reinitiation processes are represented by the **intermediate structure**. Structural complexity and larger tree size inherent to the advanced understory reinitiation process are characteristic of the **advanced stand structure**. Old growth stands are included in the advanced stand structure.
standard	A working principle that establishes the measure of performance extent, values, quantity, or quality for a given activity or item.
State Agency Coordination Program	Required under law for each state agency, to establish procedures to assure compliance with statewide land use goals and acknowledged city and county comprehensive plans and land use regulations.
state forests	In this HCP, "state forests" or "state forest lands" refers to Common School Forest Lands owned by the State Land Board, and to lands owned by the BOF, and managed by the ODF.
State Historic Preservation Office	Oregon's State Historic Preservation Office was created in 1966 by federal statute. It administers the Statewide Plan for Historic Preservation and submits Oregon's nominations for the National Register of Historic Places.
State Land Board	The Oregon State Land Board is composed of the Governor, Secretary of State, and State Treasurer. It was established under the Oregon Constitution to manage Common School Trust Lands and serve as trustee of the CSF.
Statewide Planning Goals	Statewide Planning Goals are adopted by the Land Conservation and Development Commission to set standards for local land use planning. They have the force of law.

steep, unique, or visual lands

- Areas almost exclusively associated with the steep, rocky slopes on either side of major rivers or streams, including the Umpqua River, Mill Creek, and the West Fork Millicoma River. These protected corridors vary from 1,000 to 4,000 feet in width. Slopes affected by public safety considerations fall within this category.
- Areas classified as non-silviculturally capable because they are rocky, swampy, or covered by water, or for various other reasons have little to no commercial value for timber production. Currently, the Elliott State Forest has a few parcels of rocky or swampy lands scattered throughout the forest. Most parcels are less than 5 acres, though a few are as large as 20 acres.
- Areas where scenic values are the primary values to be maintained, including areas buffering recreational areas, highway corridors, river corridors, lakeshores, and other scenic attractions.

stem exclusion process The stem exclusion process begins when new trees, shrubs, and herbs no longer appear and existing ones begin to die, due to competition for light, nutrients, and moisture.

stock For the purposes of fisheries management, a stock is an aggregation of fish populations that typically share common characteristics such as life histories, migration patterns, or habitats (OAR, Division 7, 635-07-501(51)). For example, "north-mid coast fall chinook salmon" can be defined as a stock. This stock includes a number of fall chinook "populations" from basins in this area such as the Siuslaw, Yaquina, and Tillamook Bay watersheds.

stocking A measure of the adequacy of tree cover on an area. Unless otherwise specified, stocking includes trees of all ages.

strategy A carefully considered plan or method, more encompassing and larger scale than tactics, for achieving an objective.

stream To qualify as a stream, a water course must have a distinct channel that carries flowing surface water during some portion of the year, including associated beaver ponds, oxbows, side channels, and stream-associated wetlands if these features are connected to the stream by surface flow during any portion of the year. Ephemeral overland flow is not a stream, as this type of flow does not have a defined channel.

stream-associated wetland A wetland that is immediately adjacent to a stream. This includes wetlands that are adjacent to beaver ponds, side channels, or oxbows that are hydrologically connected to the stream channel by surface flow at any time of the year.

stream bank zone — The land nearest to the stream, including the stream banks. Most riparian functions are supported to some extent by vegetation in this zone, which provides aquatic shade, delivers downed wood and organic inputs (leaves and tree litter) to the stream and riparian area, stabilizes the stream bank, contributes to floodplain functions, and influences sediment routing processes

stream classification — Under the ODF's Forest Practices Act, streams are classified in two categories based on their beneficial use.

Type F — Fish-bearing stream

Type N — Not a fish-bearing stream

Streams are also classified by size and amount of flow. Large streams have an average annual flow greater than ten cubic feet per second (cfs); medium streams have an average annual flow of two to ten cfs; and small streams have an average annual flow less than two cfs.

perennial streams—Year-round surface flow. In the Forest Practices Act, defined as a stream that normally has summer surface flow after July 15.

intermittent streams—Surface flow only part of the year. In the Forest Practices Act, defined as a stream that normally does not have summer surface flow after July 15. Ephemeral streams may run only during or shortly after periods of heavy rainfall or rapid snowmelt.

stream reach — A section of stream that is geomorphically distinct, and that can be delineated from other adjacent sections based on channel gradient, form, or other physical parameters.

structure — The physical parts of an ecosystem that can be seen and touched; typical structures in a forest are tree sizes, standing dead trees (snags), and fallen dead trees.

stumpage — The price charged for the right to harvest timber from publicly or privately owned forest land.

sub-canopy behavior — Behaviors occurring at or below the forest canopy, and strongly indicating that the site has some importance for breeding, including flying through the canopy, circling below canopy, and landing.

succession — A series of changes by which one group of organisms succeeds another group; a series of developmental stages in a plant community.

suitable habitat — Stands with the characteristics suitable for marbled murrelet nesting (including occupied habitat and potential habitat).

suppressed	Trees with crowns entirely below the general level of dominant and codominant trees and are physically restricted from immediately above.
sustainability	Sustainability is the ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time. Sustainable forest management describes forest management regimes that maintain the productive and renewal capacities, as well as the genetic, species, and ecological diversity of forest ecosystems.
Sustainable Economic and Social Benefit	Key strategies in the Elliott State Forest Management Plan. These strategies focus on legal mandates and trust obligations, predictable and dependable products and revenues, and social benefit through forest management.
Sustainable Forest Ecosystem Management	Key strategies in the Elliott State Forest Management Plan. A management approach that is based on the synthesis of knowledge from various disciplines, including forestry, fisheries, wildlife, and hydrology. It is an approach to forest management that seeks to achieve a broad range of resource goals and provide a balance of social, economic, and environmental benefits from the forest over time. In addition, Sustainable Forest Ecosystem Management is a landscape approach to the management of forested ecosystems utilizing silvicultural tools emulating natural disturbances to provide forest products, maintain forest health, and retain a high level of social value.
sustained yield	(1) An ideal forest management objective at which point the volume of wood removed is equal to growth within the total forest. Sustained-yield management implies continuous production planned to achieve at the earliest practical time a balance between increment to the mature forest and its cutting. (2) Achieving and maintaining in perpetuity a nearly equal annual or regular periodic output of the various renewable resources, without impairment of the productivity of the land.
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)).
tectonic	Resulting from changes in the earth's crust.

telemetry	The process of remotely monitoring an animal and its movements by radio transmissions from a device attached to the animal.
territory	The area that an animal defends, usually during breeding season, against intruders of its own species.
threatened and endangered species	Federal and state agencies make formal classifications of wildlife species, according to standards set by federal and state ESAs. The various classifications are defined below. Federal designations are made by the UUSFWS or NMFS. State of Oregon designations are made by the Oregon Department of Fish and Wildlife (ODFW). **Federal Classifications** **candidate species—**Those species for which the USFWS or NMFS has sufficient information on hand to support proposals to list as threatened or endangered. **endangered species—**A species determined to be in danger of extinction throughout all or a significant portion of its range. **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. **proposed threatened or endangered species—**Species proposed by the USFWS or NMFS for listing as threatened or endangered; not a final designation. **threatened species—**Species likely to become endangered throughout all or a significant portion of their range within the foreseeable future. **State Classifications** **endangered species**—Any native wildlife species determined by the State Fish and Wildlife Commission to be in danger of extinction throughout any significant portion of its range within Oregon, or any native wildlife species listed as endangered by the federal ESA. **sensitive species—**A watchlist, developed by the ODFW, of wildlife species that are likely to become threatened or endangered throughout all or a significant portion of their range in Oregon. Subdivided into four categories: critical, vulnerable, peripheral, and undetermined status. **threatened species—**Any native wildlife species that the State Fish and Wildlife Commission determines is likely to become endangered within the foreseeable future throughout any significant portion of its range within Oregon.

threshold phenomenon	Pattern or trend in population growth (climate, etc.) that exhibits relatively long periods of slow change followed by sudden increase or decrease in response to a gradually changing environment.
triad approach	An approach in which three land use types are distinguished that can coexist without compromising the goal of sustaining biological diversity. The land use types are: 1) intensive commodity production areas; 2) areas with little or no resource use by people except low-intensity recreation; and 3) areas in which modest resource use is allowed while ecological values are protected (maintenance of diversity and ecosystem function takes precedence over commodity production).
unclassified stand	These stands are currently under contract for harvesting, or have already been harvested and will be planted soon.
understory reinitiation	The understory reinitiation process begins when enough light and nutrients become available to allow forest floor herbs, shrubs, and tree regeneration to again appear in the understory. The amount of brush and herbaceous species is minimal at the beginning, but increases to a substantial part of the stand by the end of the stage.
unsaturated zone	The layer of soil or rock between the aquifer and the surface of the ground. In this layer, some water is suspended in the spaces between soil or rocks, but the zone is not completely saturated.
upslope	Zero-order channels (zero-order channels are small unbranched draws), hollows, or hillslopes. Areas outside of the riparian area. Large wood is delivered by a landslide or landslide-debris flow combination that moves the wood into the stream channel from these areas.
upstream riparian	Near-stream riparian sources that are upstream of the reach of concern. High water and/or a debris flow transport large wood to its current location after initially falling into the stream from the riparian area.
validation monitoring	Used to determine whether data and assumptions for predicting outcomes and effects are correct. Validation monitoring seeks to verify the assumed linkages between cause and effect. Validation monitoring is long term and will be accomplished through formal research and effectiveness monitoring projects.
watershed	In general, a watershed is defined as an area within which all water that falls as rain or snow drains to the same stream or river. Watersheds can vary greatly in size, from that of a small stream to a larger waterbody such as the Umpqua River.

watershed analysis	A process in which data are evaluated and interpreted in order to understand causal linkages between watershed-scale processes. This process informs the design and execution of management plans and activities.
water table	The top of the groundwater. The water table is generally subsurface; marshes and lakes form where the water table meets the land surface.
wetland	As defined in Oregon's Forest Practice Rules OAR 629-24-101 (77), wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."
windthrow	Trees felled by high winds.

Appendix B
References

This appendix lists the books, reports, and other publications referred to in the plan. Listings are alphabetical. The following format is used.

Author's name in bold. Year published. Title of publication. Publisher, publisher's location.

The following abbreviations are used in this appendix. Standard two-letter postal abbreviations are used for the names of states.

BLM	Bureau of Land Management
DEQ	Oregon Department of Environmental Quality
GTR	General Technical Report
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ONHP	Oregon Natural Heritage Program
PNW	Pacific Northwest Research Station (part of USDA Forest Service)
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior

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Appendix C
Forest Condition

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C.1. DISTRICT OVERVIEW

This appendix discusses the current conditions in the Elliott State Forest. The information for this appendix comes from the Implementation Plan (IP) (developed by the district in 2005) and the Forest Management Plan (FMP).

More detailed information can be found in the IP and FMP.

C.2. LAND OWNERSHIP

The Elliott State Forest is located primarily in the Oregon Coast Range, with some scattered tracts in the Klamath Mountains. 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 is located immediately north of the forest. To the west, the Elliott State Forest extends within six miles of the ocean. On the east, it extends about 21 miles inland. The contiguous Elliott State Forest covers approximately 93,000 acres, mostly located in Coos and Douglas Counties.

In addition to its main block, the Elliott State Forest includes approximately 4,000 acres of scattered Common School Forest Lands (CSFLs) located in Coos, Curry, and Douglas counties. These scattered tracts are distributed across a broad geographic area ranging from the California border to just north of the Umpqua River, and from the Pacific Ocean to Winston in the interior Umpqua River valley. Only the main block of the Elliott State Forest is included in this Habitat Conservation Plan (HCP).

Approximately 91 percent of the state forest lands in the Elliott State Forest are CSFLs, owned by the State Land Board; the remaining 9 percent of lands are Board of Forestry Lands (BOFLs), owned by the Board of Forestry (BOF).

Table C-1
Coos District Acres,[1] by County and Ownership

County	Board of Forestry	Common School	Total Acres
Coos	7,147	53,206	60,353
Douglas	1,783	32,851	34,634
Curry	0	2,035	2,035
Total Acres	**8,930**	**88,092**	**97,022**

[1] Acreage includes scattered tracts; not acres included in the HCP.

C.3. HISTORY

The Elliott State Forest, which consists of about 96 percent of the state land managed by Coos District, holds the honor of being Oregon's first state forest. Officially established in 1930, today it is well known for producing habitat for fish and wildlife species, recreational opportunities, and high-quality timber.

Prior to its official creation, 84 percent of the Elliott State Forest was public domain or national forest land administered by the U.S. Forest Service (USFS). All other state forests in Oregon were predominantly owned by private landowners.

Oregon has suffered two catastrophic events in the past 150 years that affected the Elliott State Forest: the Coos Bay Fire of 1868 and the Columbus Day Storm of 1962. The healthy, growing forest and thriving wildlife populations today show the forest's ability to recover from catastrophic disturbances. Despite the fire and windstorm, the Elliott State Forest currently has the oldest timber stands found in any of Oregon's state-owned forests.

Native Americans, including the Coos and Umpqua tribes, originally lived in the area that is now the Elliott State Forest and its surrounding area (Beckham 2001). Trappers were the earliest Euro-American presence, moving up and down the coast between northern California and Fort Clatsop in Astoria, Oregon from the 1820s to the 1840s.

Early descriptions of the Elliott State Forest area mention vast stands of Douglas-fir, western hemlock, Western red cedar, Port Orford cedar, and large stands of Sitka spruce. Settlers also sighted stands of red alder, willow, and maple along the rivers and streams.

The earliest known fires in the Elliott State Forest area include a large fire of unknown size in 1770 along the Elliott State Forest's eastern edge, and another large fire of unknown size in 1840 along the northeast portion. These fires left untouched most of the area that is now the Elliott State Forest.

The historic Coos Bay Fire of 1868 burned 90 percent of the area that is now the Elliott State Forest. It is believed that the fire started near Scottsburg from a settler's clearing fire, in an area known as Greenacres. The fire burned westward along the north bank of the Umpqua River until it jumped the river near the mouth of Mill Creek. From there, it burned in a southwesterly direction, burning nearly all of the Elliott State Forest area except for the southeast portion and small parts of the northwest portion.

The origin of the Elliott State Forest dates back to 1859, when the Oregon Territory became the State of Oregon. At that time, the federal government made Oregon the first state to receive two sections for each township in the state. Oregon was to use these lands to finance schools. The land grant amounted to about 3.5 million acres of grazing and forest lands, called Common School Trust Lands.

To turn the isolated parcels of Common School Trust Lands into one manageable block of state-owned forest land, State Forester Francis Elliott and Governor Oswald West decided to trade the state parcels inside the National Forests with the federal government for one large block of federal land. This block of land became Oregon's first state forest.

The new Elliott State Forest was to be managed as a demonstration forest for private landowners, to show the value of investing in forest management. However, the year the Elliott State Forest was officially dedicated, 1930, was the first year of The Great Depression. Although the Oregon Legislature placed the State Forester in charge of administering the forest, it provided no funds for him to complete the work. Despite the forest's potential to produce timber, formal management did not commence.

In 1940, Coos County deeded 6,500 acres of tax-delinquent forest land adjacent to the Elliott State Forest to the BOF. In return, Coos County was to receive 63¾ percent of the revenue from these lands.

Before the 1950s, the timber market was sluggish, and timber prices remained low. The Oregon Department of Forestry (ODF) set up only two timber sales, at the request of a mill owner. The mill owner paid about $2 per thousand board feet (MBF) for stumpage. By the end of World War II, demand and prices for timber increased significantly.

In 1962, the historic Columbus Day Storm had a major impact on the Elliott State Forest's management. In just a few hours, the storms blew down about 100 million board feet (MMBF) of timber. Most of the blowdown was in the western half of the forest, where few roads existed because the trees were younger. To salvage the timber before it rotted, many miles of roads had to be quickly built. Nearly one-third of the 550 miles of road that exist today in the forest were built in the early 1960s to salvage blowdown . Foresters cut an additional 200 MMBF of timber to get to the blowdown, increasing the total to 300 MMBF of timber harvested in a short amount of time.

An additional 7,000 acres of CSFLs were added to the Elliott State Forest through exchanges of isolated state parcels for privately-owned land within or next to the forest. These acquisitions helped make the forest a contiguous block, making it easier to manage.

The Elliott State Forest now includes over 93,000 acres of forest lands south of the Umpqua River, and east of Tenmile Lakes. Another 4,000 acres of scattered tracts in Coos, Curry, and Douglas counties are managed by the Elliott State Forest and included in this HCP. A majority of the timber in the forest is 90 to 160 or more years old. Douglas-fir is the dominant species, with minor amounts of western hemlock, western red cedar, red alder, and bigleaf maple. The Elliott State Forest contains an estimated 2.7 to 3.0 billion board feet of mature timber. Based on a recent analysis of the Elliott State Forest by M.B.&G., Coos District forest lands are estimated to be worth $284 to $567 million. The actual value is likely in the upper end of this range.

C.4. PHYSICAL ELEMENTS

C.4.1. Geology and Soils

The Elliott State Forest is located in the southern portion of the Oregon Coast Range physiographic province. The underlying rocks of the Coast Range province are classified as early Eocene period. The deep marine basin present at that time received massive quantities of sediment from the ancient Klamath Mountains located at the basin's southern end. The Tyee formation, which underlies most of the Elliott State Forest, is believed to have been formed from massive underwater landslides. When this material settled, the heavier sand was deposited first, and then covered by the finer silt and clays. This process created the layered siltstone over sandstone rock that is visible in many of the deeper road cuts in the Elliott State Forest. Subsequent periods of marine deposition, tectonic uplift, sea level changes, and erosion have created the landforms visible in the Elliott State Forest today.

The soils of the Elliott State Forest are composed of several different soil series. Approximately 83 percent of the forest soils are residual soils. Alluvial soils make up a small percentage of the land, and are found in river terrace areas. Agricultural land, rock outcroppings, lakes, ponds, and rivers constitute approximately one percent of the land. Most of the Elliott is Site Class II or III, indicating that trees reach heights of 95 to 134 feet at the age of 50 years (King 1966).

C.4.2. Topography

The topography on the Elliott State Forest is generally rugged and highly dissected with steep, narrow canyons, although the southeast part of the forest is less steep. The dissected landforms contain many ridges and swales. Across the forest, slopes face in all directions with no dominant exposure. Elevations range from near sea level to 2,100 feet above sea level.

C.4.3. Water

The Elliott State Forest drains into three major basins. The eastern and northern portions of the forest drain into the Umpqua River. The west side of the forest drains into the Tenmile Lake basin. The West Fork Millicoma runs through the center of the forest toward the south, and is part of the Coos River system. Loon Lake, a popular recreation site, has approximately one mile of shoreline on the Elliott State Forest. Elk Lake, also known as Gould's Lake, is a small pond located within the Elliott State Forest on Elk Creek. Outside the Elliott State Forest, Tenmile Lake is influenced by waters draining from the forest.

C.4.4. Climate

The Elliott State Forest has a strong maritime influence from the nearby Pacific Ocean. As a result, temperature fluctuations are relatively moderate and rainfall amounts are high. The

mean minimum January temperature in the Elliott State Forest is approximately 32° F, and the mean maximum July temperature is 76° F.

Recorded rainfall varies across the Elliott State Forest. Rainfall averages 65 inches per year at lower elevations on the western edge of the forest, and reaches a high of 115 inches per year on the high interior ridges. Rainfall declines slightly on the eastern side of the Elliott State Forest, to 90 inches per year. Snowfall on the forest is normally light to moderate, both in amount and duration. There is no residual snowpack.

C.4.5. Natural Disturbance

Forests along the Oregon Coast, including the Elliott State Forest, result from a typical progression of stand structures following large, relatively infrequent disturbance events and subsequent smaller, more frequent disturbances. Relatively recent, large-scale events such as the Coos Bay Fire (1868) and the Columbus Day Storm (1962) influenced the distribution, composition, and structure of vegetation across the forest. Small-scale disturbances caused by subsequent small fires, windstorms, disease, insects, and harvesting also significantly affect the characteristics of the forest across the landscape.

C.4.5.1. Fire

Fire is the primary coarse-scale disturbance agent in the western hemlock zone of the Oregon Coast (Wimberly 2000). The frequency of fire occurrence is variable, and is determined by long-term climate changes (Long et al. 1998). The average regional fire-return interval for the coastal zone is estimated at 230 years, but stands much older than this indicate the variability of a fire return interval (Long et al. 1998; Agee 1993). The randomness of natural disturbances results in some stands burning repeatedly on short cycles, while other stands escape for much longer periods (Seymour et al. 1999). The lack of long-term fire records, variability, and climate changes do not allow inference of cyclic patterns of fire return (Agee 1993). Large fires have been important historically to the development of forests in the hemlock zone.

Fire size and severity increase as the fire return interval lengthens. However, large fires do not generally burn uniformly, and fire severity varies over the area. Topographic features had a greater influence on the probability of reburns after a major fire than on the occurrence of high-severity crown fires. Dry sites have a higher probability for reburning than moist sites (Wimberly and Spies 2001). The severity of a fire is a factor in determining the successional pathway of an area. The effect of fire size and severity on seed sources is a factor in determining the structure and composition of post-fire vegetation. Forests experiencing high severity fires may require 200 years before stands develop old-growth characteristics. Areas of moderate severity fire can develop many characteristics of old growth in a much shorter time (Wimberly et al. 2000).

C.4.5.2. Wind

The continuum of disturbance by wind is difficult to characterize. Wind can cause coarse-scale disturbances (such as the Columbus Day Storm of 1962) or fine-scale disturbances.

Major wind events occur along the coast about every 20 years (Wilson 1998). Depending on the intensity, large-scale wind disturbances can create even-aged stands or increase the complexity of stand structures. The effect of wind on a forest depends on stand composition, canopy structure, size, age, and vigor. Wind direction and severity, soil and site properties, and the influence of mountains on wind flow and rainfall are also factors (Nowacki and Kramer 1998). In a study conducted on the Oregon coast, about 25 percent of the sites showed evidence of wind disturbance, characterized by one or more uprooted trees, or trees that had portions of the main stem snapped off (Wimberley and Spies 2001).

C.5. BIOLOGICAL ELEMENTS

C.5.1. Vegetation

Most of the Elliott State Forest is located within the Oregon Coast Range Ecoregion. The precipitation levels and geology of the Coast Range differ from those of its neighbors, the Klamath Mountain and Willamette Valley Ecoregions. These unique qualities result in a distinctive combination of plants within the forest ecosystem. These plants provide habitat and forage, add organic matter to forest soils, and influence the micro-climate.

No comprehensive assessments or basic systematic surveys for rare plants have been conducted in the Elliott State Forest. In the late 1990s, individual harvest units were surveyed for rare plants. The ODF has developed a list of state-listed plants, using the Oregon Natural Heritage Program list of May 2004, with the assistance of the botanist from the local office of the Bureau of Land Management (BLM).

Of the 25 species found in Coos and Douglas Counties, only 3 plant species have habitat and ranges that coincide with the forest. Most of the potential species were eliminated because they occur only on serpentine soils (a soil type not found in the main block of the Elliott State Forest), high elevations, coastal dunes, or boggy areas in the dunes. Other potential species appeared to have habitat requirements similar to those found in the forest, but there have been no discoveries within this range (i.e., north coast to south coast). None of the three listed species are confirmed to be present in the forest, although they have been discovered within reasonable proximity on other ownerships.

The three species likely to be present on the main block are Bensonia, tall bugbane, and Howell's montia. Bensonia has been found above 2,500 feet at Signal Tree, above Camas Valley. Tall bugbane is found in lowland Douglas-fir forests with maple and sword fern. There are known populations on adjacent BLM lands. Howell's montia is found on moist lowland areas in vernally wet sites. These three species are on the state candidate list.

The remaining plants have a low probability of being present on the main block of the Elliott State Forest, although the Oregon Natural Heritage Program plant list is reviewed annually for updated information regarding changes in ranges and habitats. The ODF is not aware of any other federally listed threatened or endangered plant species that are likely to occur on the main block of the Elliott State Forest.

C.5.1.1. Rare Plants

Bensoniella oregona (Bensonia) Status: State Candidate

Found in wet meadows and moist streamside sites in pre-cretaceous meta-sedimentary rock at elevations above 2,500 feet. Known at Signal Tree above Camas Valley, the northern-most location with lowest elevation confirmed.

Cimicifuga elata (tall bugbane) Status: State Candidate

Found in lowland Douglas-fir forests with maple and sword ferns.

Montia howelii (Howell's montia) Status: State Candidate

Found in moist lowland areas, vernally wet sites, often on compacted soil less than 400 meters in elevation.

Conifer forest covers most of the land in the Elliott State Forest. Before these lands became state forests, large fires killed or removed most of the older conifer forests. About half of the conifer stands in the Elliott State Forest are more than 95 years old. Conifer species found in the forest are Douglas-fir, western hemlock, western red cedar, Sitka spruce, and grand fir, with a small amount of pacific yew. Other types of vegetation dominate the remaining acres, including grass, brush, and various species of hardwood trees, such as alder and bigleaf maple.

C.5.2. Insects and Disease

The current condition of the Elliott State Forest can be ascertained partially by examining long-term trends in damage from major disturbance agents. The Elliott State Forest has not experienced the widespread deterioration that has occurred in eastern Oregon forests as a result of fire suppression and high-grade logging. Aerial and ground surveys conducted during the past 50 years show little evidence of major pest outbreaks in the Elliott State Forest. Substantial blowdown has occurred during periodic major winter storms.

Several diseases have reached noticeable levels of damage in recent decades. Swiss needle cast, the highly visible foliage disease of Douglas-fir, is causing serious growth decline over a large area along the west slope of the Coast Range. In northwest Oregon, growth reduction is severe enough on some sites that heavily infected young stands are being clearcut so more resilient multispecies stands can be planted. Though Swiss needle cast affects some stands in the district, it has not become severe enough to modify silvicultural activities. However, the amount of western hemlock and red cedar being planted has been significantly increased.

Laminated root rot, a native disease of conifers, has damaged Douglas-fir on some sites, but current management practices will stabilize or reduce unwanted effects of this disease.

Black stain root disease has reached epidemic proportions in some locations in southwest Oregon, but is found infrequently in Douglas-fir in the Elliott State Forest.

Few insect problems occur in the mid- to late-successional Douglas-fir stands that are found in the Elliott State Forest. Most insect damage on the Oregon Coast is caused by the Douglas-fir bark beetle, which tends to affect low vigor trees weakened by other factors. Major beetle populations build up after significant disturbance events such as major windthrow events. Increases in beetle populations tend to be short lived unless continued disturbance provides new habitat. The Sitka spruce weevil continues to limit Sitka spruce management. The present lack of significant insect pests in the Elliott State Forest contrasts with the situation in eastern Oregon where both bark beetles and defoliators are major pests of Douglas-fir.

Continued monitoring through aerial and ground surveys will provide early warnings of new problems, and gradually improve the ability to maintain a healthy forest.

Currently, there are no reported cases of Sudden Oak Death in the district.

C.5.3. Fish and Wildlife

The Elliott State Forest provides habitats for most native species found in forests in the Oregon Coast Range (Johnson and O'Neil 2001). Chapters 4 and 5 of the FMP describe the resource management strategies that will provide habitats to help maintain or enhance native wildlife populations at self-sustaining levels, and contribute to properly functioning aquatic habitats for salmonids and other native fish and aquatic wildlife.

Of the many wildlife species potentially found in the Elliott State Forest, four species are listed as threatened or endangered under either (or both) federal and state Endangered Species Acts (ESAs): northern spotted owl, marbled murrelet, bald eagle, and peregrine falcon. The presence of three of these species (northern spotted owl, marbled murrelet, and bald eagle) has been confirmed in the Elliott State Forest. Some species are classified in various special designations such as candidate or sensitive categories.

Bald eagles (*Haliaeetus leucocephalus*) are found on or near the Elliott State Forest year-round, and use the state forests and waters for nesting, foraging, and roosting. Because a pair of eagles often uses alternate nest sites, each nesting territory can include multiple nesting sites. In 2004, there were three occupied bald eagle nesting territories in the Elliott State Forest.

The American peregrine falcon was removed from the federal threatened and endangered species list in 1999, but is still on the state list of endangered species. No active nest sites are currently known in the Elliott State Forest.

The marbled murrelet, which was federally listed as threatened in 1992, is a seabird that nests on natural, moss-covered platforms in mature and old growth coniferous forests within 50 miles of the ocean. Surveys for marbled murrelets have been conducted in the Elliott State Forest since 1992. In addition, research on the habitat characteristics of marbled murrelet nesting habitat on state forest lands, including the Elliott State Forest, was conducted between 1993 and 1998 (Hamer and Meekins 1996; Nelson and Wilson 2002). Through surveys and research, 11 nests were located and subcanopy behaviors were observed in many survey areas in the Elliott State Forest. As of 2003, approximately 10,000 acres were

protected in Marbled Murrelet Management Areas. Additional acres of potential habitat in the Elliott State Forest have not been surveyed for marbled murrelets.

The northern spotted owl was listed as threatened by the U.S. Fish and Wildlife Service (USFWS) in 1990. Surveys for northern spotted owls took place in the Elliott State Forest and adjacent suitable habitat out 1.5 miles from the Elliott State Forest between 1990 and 1993. In addition, research on the demographics, habitat use, and habitat characteristics of northern spotted owls on state forest lands, including the Elliott State Forest, took place between 1993 and 1998 (Anthony et al. 2000a, 2000b; Tappeiner et al. 2000). In 1997 and 1998, only minimum estimates were obtained in the Elliott State Forest because only previously known sites were surveyed. Over the five years of the study, there was an apparent loss of territories, experienced in a wide range across all ownerships, but the demographic study found that the rate of population change remained relatively steady. A density survey of all suitable northern spotted owl habitat in the Elliott State Forest in 2003 was comparable to the 1996 density survey. In 2003, 12 pairs and one resident single northern spotted owl were located. However, in 2003, low productivity occurred for the northern spotted owl range-wide, including in the Elliott State Forest, where none of the pairs reportedly reproduced.

The streams, rivers, lakes, and other water bodies in the Elliott State Forest provide habitats for a variety of fish species. At least 30 species of fish use habitats in the HCP area for part or all of their life history, or use habitats downstream from the Elliott State Forest that may be influenced by state forest management.

Native salmonid species utilizing streams entirely or partially in the Elliott State Forest include fall Chinook salmon, coho salmon, chum salmon, winter steelhead, and resident populations of both anadromous and resident races of cutthroat trout. Native non-salmonid fishes include various species of lamprey, sculpin, dace, sucker, and others.

Anadromous salmonid populations have been generally depressed throughout western Oregon for a variety of reasons, including, but not limited to, reduced ocean survival, reduced productivity of freshwater habitats, and sport and commercial harvest. In recent years, numbers of spawning adults in the Elliott State Forest have improved, likely due to improved ocean conditions and a significant amount of in-stream habitat improvement projects conducted on Elliott State Forest streams since the early 1990s. Listed fish species are discussed further in Chapter 4.

Resident cutthroat trout are widely distributed and appear stable, although special consideration is warranted for populations isolated above natural barriers. There is much less information about the status of non-salmonid species. The Pacific lamprey is of concern due to limited distribution, reduced abundance, and/or special habitat needs.

C.6. HUMAN USES

C.6.1. Forest Management

In past FMPs, the predominant land use was timber production, with 95 percent of Elliott State Forest forests in this classification. The remaining acres were allocated to uses such as roads, stream buffers, inoperable terrain, watershed use, recreation use, service and transmission line use, scenic and protective conservancy, and non-commercial lands. Timber harvest was generally targeted to a sawlog market. Anticipated harvest ages for well-stocked stands ranged from age 30 to 45 years for young commercial thinning, with most clearcutting performed in stands from age 90 to 130 years.

During the six-year period from 1991 through 1996, the volume harvested on the Elliott State Forest was heavily influenced by the northern spotted owl, which was federally listed as threatened in 1990, and the marbled murrelet, also listed as threatened in 1992. The average annual volume harvested during this period was 17.74 MMBF. Because of the listing of the northern spotted owl, the State Land Board directed the ODF to prepare a new FMP for the Elliott State Forest not based on "moving northern spotted owl circles," but providing more certainty to the management of the Elliott State Forest and the production of income. In addition, the ODF decided to pursue an Incidental Take Permit (ITP) for northern spotted owls and marbled murrelets through a HCP with the USFWS.

The HCP was approved in October 1995, and the new FMP was approved in 1994. The first timber sale plan implemented under the new FMP was the fiscal year 1995 plan (July 1, 1994 through June 30, 1995). The ODF estimated an annual harvest of approximately 28 MMBF per year. From fiscal year 1997 through 2002, the average annual harvest in the Elliott State Forest was 29.54 MMBF.

The harvest volume over the past six years (above 28 MMBF) is due to the variation in the volume per acre of the stands harvested. It is also due to harvest timing, an increase in young commercial thinning, and the thinning of two mature stands in a long rotation basin. It is not due to increasing the acres that were clearcut.

The increase from an average of 17.74 MMBF per year in the six-year period from 1991 through 1996, to an average of 29.54 MMBF per year during the 1997 through 2002 fiscal years, is 67 percent.

C.6.2. Roads on State Forest Lands

The district's primary road network is an established system that has been in place for 40 to 60 years. It provides access for forest management activities, fire suppression, and public travel. Visions, guiding principles, and goals for managing the district's road network are discussed in the *Forest Roads Manual* (Oregon Department of Forestry 2000).

Roads are built or improved as projects on timber sales. They are designed and constructed to standards that provide for good road maintenance and safe log transportation. Main access

roads are surfaced with rock to provide for all-weather use and to minimize impacts from rainfall and runoff. Secondary spur roads are built to the same maintenance standards, but may have lesser specifications for width and surfacing. In many instances, secondary spurs are blocked off after a timber sale or other forest management activity is completed, to minimize disturbance of elk and deer and for other management reasons. These roads are still subject to road maintenance requirements unless they are legally closed or decommissioned by removing culverts and providing necessary long-term drainage. A significant portion of state forest land is accessed by roads that go through privately owned forest land. Legal easements are necessary when these roads are used to haul logs from timber sales or for other forest management activities. The ODF has acquired easements for many roads, and the acquisition of other easements is still required. Depending on the district's needs and the private owner's desires, easements can be temporary or permanent, and allow either public use or use only by the agency's employees and contractors.

The ODF policy on forest roads states that roads will be developed and maintained to provide access for the sale of timber and other forest products, for timber management activities, for protection from fire, and for public access. It also states that forest roads will be designed, constructed, and maintained to meet or exceed rules of the Forest Practices Act (FPA). These rules set construction and maintenance standards intended to protect water quality, forest productivity, and fish and wildlife habitat. In addition to establishing the policy, the ODF *Forest Roads Manual* sets road standards, gives design guidelines, sets an excavation and appraisal policy, and provides a wide variety of specifications and costs (Oregon Department of Forestry 2000).

The district's total system of mainline roads, collector spurs, and minor spurs currently consists of about 550 miles of single-lane roads with turnouts. A portion of the district's mainline roads were built in the late 1930s and 1940s by the Civilian Conservation Corps. The remaining mainlines and collector spurs were primarily built in the 1960s and 1970s to access timber sale units. Many of these roads were constructed with inadequate drainage systems, poor surfacing, and little regard for slope stability and fish passage. Over the past 20 years, many of these roads have been upgraded, and now have improved width, alignment features, rock surfacing, and drainage structures that provide for water management and fish passage. This road system will be maintained and expanded over time as necessary to access future harvest operations.

Elliott State Forest forest roads and private roads with easements are maintained under a road maintenance contract or by contractors as a requirement of a timber sale contract. District personnel monitor road use, determine maintenance needs, and develop maintenance plans. These plans include road surface maintenance (grading and rock application), ditch, waterbar and culvert maintenance, roadside vegetation control, storm monitoring, and damage repair.

In general, the district road network can be divided into the following categories and subcategories:

Open Road/Active Use—This category includes any road open for travel with a motorized vehicle. It includes permanent roads and also temporary roads that are currently in use or will be used in the near future. These roads are usually available for use at any time of the year.

Use may be continuous or intermittent. Roads in this category require active maintenance and have a full maintenance obligation under the FPA.

Restricted Access Road—Most roads identified as being suitable for decommissioning have been decommissioned.

This group includes two sub-categories of roads closed to vehicle use and requiring maintenance under the FPA.

- **Closed Road**—These roads have restricted access for part or all of the year. This involves placing a semi-permanent barricade at the start of the road. This barricade can be a gate, large boulders, stumps and logs, or a trench. This strategy does not significantly alter the nature of the road, and the obligation to maintain the road remains. Road maintenance needs and sediment loads are reduced due to the elimination of traffic-related wear.
- **Partially Vacated Road**—Partial vacation involves barricading the road and installing minor drainage structures, which might include the construction of water bars or rolling dips. This strategy is best suited for roads that will be needed again after long periods (perhaps as much as 15 to 20 years) of inactivity. Ridge-top roads or other roads where drainage and sediment issues are negligible are good candidates. The nature of the road may be altered somewhat through the addition of waterbars and other drainage structures, but the obligation to maintain the road remains. Sediment loads are reduced due to the elimination of traffic-related wear, and road maintenance needs are greatly reduced.

Retired Road—This group includes two sub-categories of roads not available for vehicle use and not requiring maintenance under the FPA.

- **Fully Vacated Road**—Full vacation involves removing all stream crossing structures, installing maintenance-free drainage (outsloping, water bars, rolling dips, etc.), pulling back any sidecast material, seeding grass on disturbed soil, and barricading the road. The road is effectively "put to bed." All access is prevented, and there is no maintenance obligation. Cross-drain culverts may be left in place, but will not be considered as a functional drainage feature.
- **Abandoned Road**—These roads are no longer used or maintained, but have not been formally vacated according to FPA standards. These roads were generally constructed, used, and abandoned prior to the advent of the FPA, and are unavailable for use due to encroaching vegetation or road failures preventing vehicle use.

The roads in these last two categories are predominantly short spur roads and some collector spur roads. These roads are closed to reduce or minimize vandalism, dumping, operational conflicts, road wear, water quality impacts, and maintenance costs.

The Open and Restricted Access Roads have been classified into three separate road use standards as defined in the *Forest Roads Manual* (Oregon Department of Forestry 2000), pages 3-6 and 3-7. These standards provide guidance on how roads are constructed, improved, and maintained, and are defined below:

Low Use Standard—These are individual short spur roads designed primarily for pickups and log trucks. Low use roads generally provide access to a single harvest unit. Their use is short term and may be temporary. They may be seasonal or open year-round. Use may be heavy during periods of log hauling but minimal at other times.

Medium Use Standard—These are longer spur roads designed primarily for pickups and log trucks. Medium use roads may provide access to several harvest units, and are often referred to as collector spurs. They may be seasonal or open year-round. Their use is more permanent.

High Use Standard—These are longer roads designed for all types of traffic, including large equipment. High use roads are generally permanent, can be used year-round, and provide access to large areas. They are referred to as mainline roads.

Table C-2 shows the approximate number of miles by road use standard.

Table C-2
Coos District Road System

Road Use	Standard Miles
Low use	277
Medium use	160
High use	113
Total Miles	**550**

A Road Hazard Assessment survey was conducted on the forest in 1996 to 1997. This information was gathered to identify areas of concern, prioritize needed repairs, and plan road management activities. This survey did not include enough detailed information about the road system to be useful for the long term. Therefore, another detailed inventory will be conducted in the near future. The following information has been gathered through geographic information system and a portion of the road hazard assessment.

- Approximately 57 percent of the roads are located on ridgetops, 33 percent mid-slope, and ten percent in the valley bottoms or streamside.
- Of the active and restricted access roads in the forest, 52 percent are surfaced to an All-Weather standard. A large portion of the remaining roads have had surfacing applied in the past, but will not support All-Weather traffic at present.
- The forest has 22 permanent rock stockpile locations. This rock is primarily used for the maintenance of the surfacing on the mainline roads.
- There are approximately 16 miles of fully vacated road on the forest. There are also a few abandoned roads in the forest, which are not accounted for in the vacated miles total.
- There are approximately 2,050 culverts installed across the roads in the forest. Of those, approximately 475 are located at stream crossings. Of the stream crossings (culverts or bridges), 85 percent are on non-fish-bearing streams, and 12 percent are on fish-bearing streams. Most of the fish-bearing crossings, that had barriers to fish

passage, have been upgraded with fish passage pipes in the last few years. The remaining crossings that have barriers will be systematically corrected in the near future.

- A large portion of the remaining non-stream crossing or ditch relief culverts are new. This is due to an aggressive road maintenance program that replaced old culverts or inserted new culverts where they were needed in order to disconnect ditch runoff.
- There are 18 bridges on the roads in the forest. One of these, a railcar bridge, is closed to traffic because it has been deemed unsafe. The remaining bridges are all in operable condition.

The type and level of road activity that will occur during the planning period is discussed in Chapter 8, Section 8.3.2.2 Minimization and Chapter 5, Section 5.6.7, Employ Slope Stability Management.

C.6.3. Recreation

Recreation use within the Elliott State Forest is concentrated in several small areas. The rest of the Elliott State Forest has little recreation use. The heaviest use occurs on long holiday weekends in the summer, and during deer and elk hunting seasons in the fall. Most forest visitors are local residents who like the forest because it is undeveloped and relatively unregulated, with little competition for favorite sites. Future demand will be moderate for the recreation activities currently popular.

The Elliott State Forest provides numerous areas for dispersed camping along roads and streams. Popular areas include Elk Creek and the West Fork of the Millicoma River. Use levels at other sites throughout the forest vary widely. The BLM operates the Loon Lake Recreation Area near the northeast border of the forest. This recreation area is one of the more popular destination sites in the Reedsport vicinity, with an average of 70,000 to 80,000 visitors each year.

Some visitors to the Elliott State Forest use old skid roads and trails for preseason scouting and hunting in off-highway and four-wheel drive vehicles. Most people use existing roads, many of which have been blocked off to regular vehicle activity. There is also some summer use of motorcycles and all-terrain vehicles.

Horse riding, hiking, picnicking, and mountain biking occur across the forest, but in lower to moderate levels. Hiking and mountain biking trails have not been developed, as use is fairly infrequent.

Winter steelhead fishing is popular on the West Fork Millicoma River. The Salmon Trout Enhancement Program created an increase in steelhead fishing opportunities at the Millicoma Interpretive Center.

Most recreational hunting in the forest occurs during the big game hunting season, which begins in late August and continues through November. Recreational shooting occurs throughout the forest, but few people participate in this activity due to concerns about public safety.

A small number of people use the forest for other specialized activities. Kayakers use the West Fork Millicoma River. Sightseers use the backcountry roads. School groups, universities, and forestry organizations also use the forest for various educational tours. The Millicoma Interpretive Center, which is managed by Oregon Department of Fish and Wildlife (ODFW), is used heavily by school groups.

C.6.4. Scenic Resources

State Highway 38 is designated as scenic for the purpose of visual corridor management, and is adjacent to state forest lands in the Elliott State Forest. The visually sensitive corridor is defined as the area within 150 feet of the outermost right-of-way boundary along both sides of the highway. Special rules apply to timber harvest in this corridor. Due to public safety concerns with regard to landslides, a much wider area along this highway is off limits to any harvesting activities.

Two state forest land management classifications are used to designate areas for visual sensitivity. Where legal requirements or the management of visual resources dominates over the management of other resources, the lands are classified as Special Stewardship–Visual. Where the management of visual resources allows for integrated management of other resources, but is subject to legal restrictions, supplemental planning, and/or modified management practices, the lands are classified as Focused Stewardship–Visual.

On private lands between the river and the Elliott State Forest, the lower Umpqua River along Highway 38 and its immediate visual foreground is protected either by Department of Transportation-owned scenic buffers or by scenic statutes and FPA rules. For areas farther back from the highway but still visible from the road, which are considered mid-ground scenic areas, many acres of the Elliott State Forest are designated as Special Stewardship–Visual. This means that harvesting is only allowed to enhance the visual characteristics of the forested landscape and/or viewshed. The background areas adjacent to these lands are classified as Focused Stewardship–Visual. Management activities for these areas are adjusted for visual considerations.

C.6.5. Timber

Conifer forest covers most of the land in the Elliott State Forest. Before these lands became state forests, large fires killed or removed most of the older conifer forests. About half of the conifer stands in the forest are more than 85 years old.

Other types of vegetation dominate the remaining acres, including grass, brush, and various species of hardwood trees, such as alder and bigleaf maple. All resource information in this section is based on the Stand Level Inventory Program inventories as of December 2004.

Forests are naturally divided into stands—areas of five to several hundred acres occupied by trees or other vegetation similar in age, stocking, size, and species. Each stand is identified, mapped, and described in the ODF inventory. The inventory recognizes three main types of stands:

- **Conifer Stands**—These stands occupy most of the Elliott State Forest. The ODF classifies as conifer stands those in which conifer species compose 30 percent or more of the tree canopy. Although conifers are the principal species with economic value in these stands, the stands may also include substantial amounts of other vegetation types such as hardwoods, brush, grass, and ferns, which contribute to a diverse forest ecosystem. These types are either intermixed with the conifers or are in clumps too small to map and inventory separately.
- **Hardwood Stands**—These stands are found on a minority of Elliott State Forest lands. The ODF classifies as hardwood stands those in which hardwood species constitute more than 70 percent of the tree canopy.
- **Unclassified Stands**—These stands are currently under contract for harvesting, or have already been harvested and will be planted soon.

When forest management activities were started in the Elliott State Forest in the 1950s, the forest predominantly consisted of Douglas-fir, with a minor component of other conifers (mainly hemlock and very small amounts of Western red cedar and Sitka spruce). On most Elliott State Forest timber sales, the volume of these other conifers has been less than five percent of the sale volume. It is estimated that, when management began in the Elliott State Forest, less than ten percent consisted of hardwoods, and much of that acreage was located in riparian areas. Most of the riparian hardwoods are red alder, with lesser amounts of bigleaf maple and myrtle. A higher amount of red alder is located in the Marlow Creek drainage, which was railroad logged in the 1920s to 1930s. Significant amounts of myrtle exist on south slopes in the western half of the Elliott State Forest. Other native hardwoods in the Elliott State Forest include very small amounts of bitter cherry, cascara, madrone, chinquapin, and dogwood.

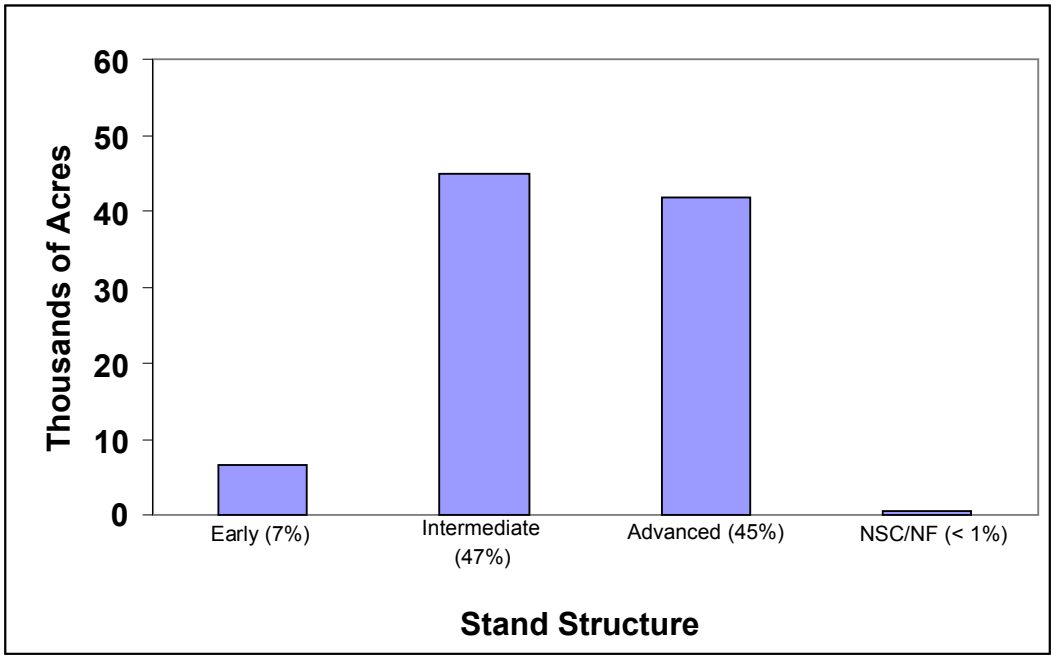
C.6.6. Forest Stand Structure: Current Condition

The current stand condition for the contiguous Elliott State Forest (93,282 acres is displayed in Figures C-1 and C-2.

Figure C-1 shows the current stand structure, acreage, and percentage. The current stand structures in the contiguous Elliott State Forest were determined by aerial photograph interpretation, coupled with Ownership, Site, Cover, Use, and Recommendations inventory and the newer Stand Level Inventory information. The Stand Level Inventory data represent the best stand structure information (e.g., information on understory species composition, nonmerchantable tree species, layering).

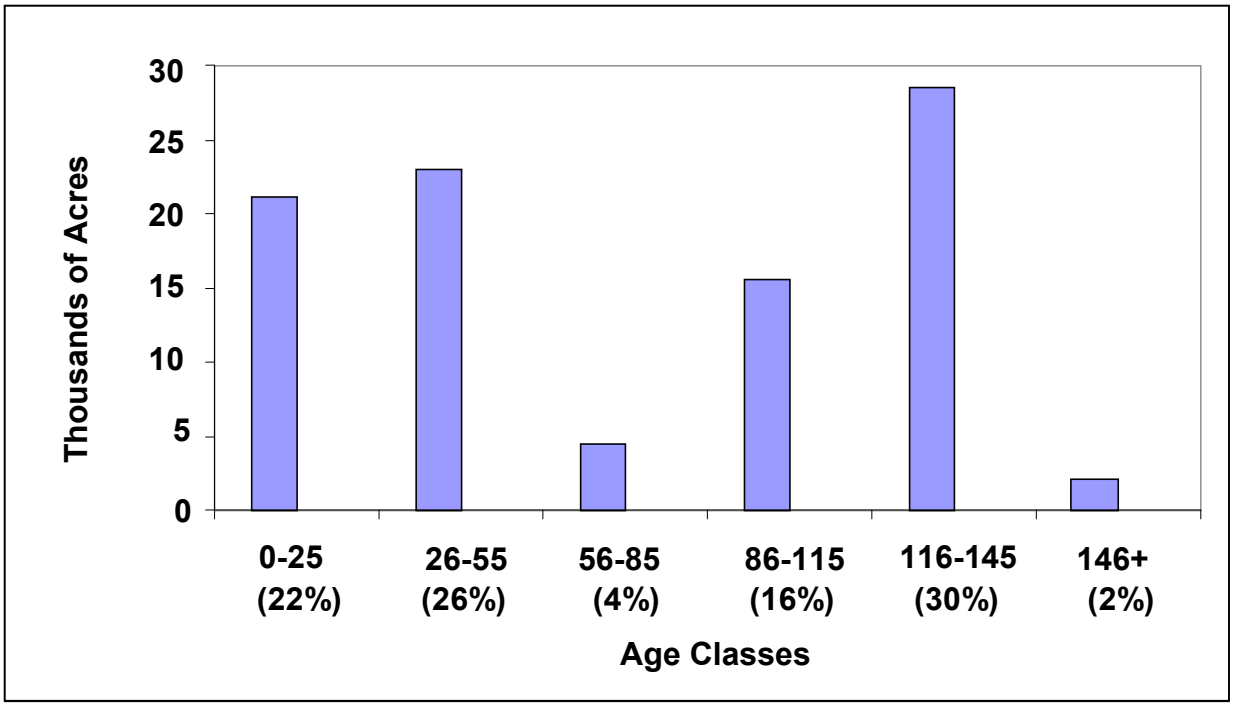
Figure C-2 shows the current age distribution of the Elliott State Forest, regardless of structure, by acreage and percentage.

Figure C-1. Current Stand Structure, by Acres and Percent



SUMMARY OF FOREST STRUCTURE					
Forest Structure	**Early**	**Intermediate**	**Advanced**	**NSC/NF**	**Total**
Acres	6,898	44,090	41,716	578	93,282
Percent	7%	47%	45%	<1%	100%

Figure C-2. Stand Age Distribution, by Acres and Percent



SUMMARY OF STAND AGE CLASSES							
Age Class (years)	**0-25**	**26-55**	**56-85**	**86-115**	**116-145**	**146+**	**Total**
Acres	20,734	24,253	3,731	14,925	27,985	1,654	93.282
Percent	22%	26%	4%	16%	30%	2%	100%

C.7. CURRENT CONDITION ANALYSIS

C.7.1. Stand Structures Interaction

The Current Condition Analysis and the Landscape Design sections of this HCP describe the amount of each of the identified forest stand types. As described in the FMP, the stand types represent only three points along a continuum of forest development. Three stand types were developed as a means of planning for and assessing the development of the forest toward a range of forest types over time. Because the three types are only points along a continuum, they do not express three specific habitat types nor are they perceived as discrete habitats by wildlife species. This is discussed in detail in Appendix C of the FMP.

The following concepts involve the current condition and desired future condition of the Elliott State Forest as they relate to wildlife habitat. Appendix C of the FMP contains more detail.

Three fundamental landscape patch types exist for wildlife. Table C-3 compares these three patch types to the stand types described in the FMP.

Table C-3
Comparison between Landscape Patch Types and Stand Types

Landscape Patch	Stand Type
Young forest	Early Structure
Pole-sized forest	Intermediate Structure
Mature forests	Intermediate and Advanced Structures

In examining the current and desired future conditions described by stand types, it is important to consider the combinations and aggregations of different stand types that function together to provide the benefits for each of the three broad patch types used by wildlife.

The entire array of all stand types has not been depicted because it is virtually impossible to predict how each stand on the landscape will develop over the next several decades. By focusing on where the development of layered and older forest structure stands are anticipated, the local manager is provided with the management blueprint necessary to move the landscape in the desired direction. Future adjustments will undoubtedly be required as natural disturbances, insects, and disease (or other factors) result in the failure of some stands to develop in accordance with management plans.

C.7.2. Hardwoods

In the 1950s, when forest management activities started in the Elliott State Forest, the forest predominantly consisted of Douglas-fir, with a minor component of other conifers (mainly

hemlock and very small amounts of red cedar and Sitka spruce). With most Elliott State Forest timber sales, the volume of these other conifers has been less than five percent. It is estimated that, when management began in the Elliott State Forest, less than 10 percent consisted of hardwoods, and much of this was in riparian areas. Most of the riparian hardwoods are red alder, with lesser amounts of big leaf maple and myrtle. A higher amount of red alder is located in the Marlow Creek drainage, which was railroad logged in the 1920s to 1930s. Significant amounts of myrtle exist on south slopes in the western half of the forest. Other native hardwoods include very small amounts of bitter cherry, cascara, madrone, chinquapin, and dogwood.

Under the FMP, a significant hardwood component will be located in riparian areas and threatened and endangered cores (T&E cores), and in other areas of the forest designated as advanced structure. In addition, hardwoods will be retained as an important component of live tree retention, with a particular emphasis on the less abundant myrtle and big leaf maple, which are especially important to wildlife. In addition, a certain amount of red alder that exists in current plantations and that will seed into new regeneration harvests will be retained in these stands. Overall, the strategy for hardwoods is to retain about the same amount and composition of species as was present in the forest when the FMP was first implemented. ODF estimates that approximately 10 percent of the forest is in the hardwood cover type. However, much of the hardwood forest occurs as small patches or riparian stringers within larger stands of conifer forest, and thus does not appear as hardwood stands in the forest inventory. Hardwood stands are defined as having at least 70 percent of the canopy composed of hardwoods.

C.7.3. Early Structure

Early structure covers 6,898 acres, or seven percent of the contiguous Elliott State Forest. The desired future condition target for early structure is 5 to 15 percent. This structure is currently characterized by young, even-aged Douglas-fir plantations resulting from recent clearcut harvests. These stands have two main trajectories: the first is a young clearcut harvest where high densities will be maintained throughout the life of the stand with the primary purpose of revenue production. The second is to an advanced structure stand. Stands with this trajectory will have several thinnings to promote a diverse stand structure. Some early structure stands will be tagged for an advanced structure trajectory, but for many this designation will wait until an intermediate structure is reached.

C.7.4. Intermediate Structure

The intermediate structure accounts for 44,090 acres, or 47 percent of the contiguous Elliott State Forest. The desired future conditions target for intermediate structure is 25 to 55 percent. This structure is characterized by the closed crowns of the overstory trees, which prevent light from reaching the majority of the forest floor. This low light level precludes the natural regeneration of both brush and shade tolerant tree species, thus leaving the forest floor sparsely vegetated. Overstocking results in competition for light, water, and nutrients, often leaving the stand susceptible to insects, disease, wind, or fire. Of all the structure types, this type is least used by wildlife species, especially those requiring more complex habitats.

In the Elliott State Forest, this stand type is typically in the 16- to 65-year-old age class; most conifer stands in this stand type are the result of planted and managed stands. This type also encompasses mature forest types that do not have the structural components of advanced structure. Hardwood stands in this stand type, on the other hand, are naturally regenerated. A portion of stands in this class are mixtures of managed stands with areas of low stocking that naturally regenerated in alder. Intermediate stands have two potential pathways. The first path is to a clearcut harvest as intermediate structure, and the second path is to advanced structure. Those stands designated for clearcut harvest will not receive thinnings. Clearcut harvest will occur in the 40- to 50-year age range to maximize return. The remaining stands designated for advanced structure will require one or more thinning entries.

C.7.5. Advanced Structure

The advanced structure currently covers 45 percent, or 41,716 acres of the contiguous Elliott State Forest. The desired future condition target for advanced structure is 40 to 60 percent. The advanced structure stand type is the result of continued growth and development of the intermediate stand, and is therefore more complex in vertical canopy arrangement. In addition, the vertical layering offers a diverse array of habitat niches for more complex shrub and herb plant communities as well as wildlife species. Most of the advanced structure is the result of the 1868 Coos Bay fire, and is 120 to 130 years old. A portion of the advanced structure, mostly located in the Marlow creek drainage, is in the 65-year age class, and developed after early logging in the 1920s to 1930s. A small portion of the advanced structure is considered old growth, and these stands are in reserves. For this HCP, advanced structure stands have at least 20 trees per acre of 18 inches or larger diameter breast height (DBH) and 100 feet or more in height. Ten overstory trees per acre are at least 24 inches DBH. Understory trees average 30 feet in height. Unless located in reserves, advanced structure will be designated for clearcut harvest when a surplus is attained in the basin.

C.7.6. Non-Silviculturally Capable

Non-silviculturally capable lands do not constitute a significant acreage (approximately 517 acres are in this classification). These lands are characterized by geologic and hydrologic conditions unsuitable for the commercial growth and harvest of forest tree species. Geologic conditions include rock cliffs, talus slopes, rock slopes and outcroppings, and other substrate conditions incapable of supporting forest tree species. Hydrologic conditions include floodplains, marshes, beaver ponds, and other aquatic conditions that prevent the growth of trees. These lands provide for plant and animal communities not associated with the other forest structures. These lands are not considered part of the commercial forest land base, and will not be managed for the growth and harvest of forest tree species.

C.8. CURRENT STREAM CONDITIONS

C.8.1. Water Quality

C.8.1.1. Temperature

Maximum water temperature is often expressed as the greatest seven-day running average of the maximum daily temperature. The Oregon Department of Environmental Quality (DEQ) adopted 64º F (17.8º C) as the maximum seven-day water temperature that generally applies to forested streams in the summer. Water temperature records were available for 14 sites in the West Fork Millicoma Basin (1996, 1997, or 1999) and 7 sites in the Tenmile Lakes Basin (2002). No temperature data are available for Elliott streams in the Umpqua Basin. Ten of the sites in the West Fork Millicoma Basin exceeded the DEQ temperature standard, and three in Tenmile Lakes Basin exceeded the DEQ water quality standard (Oregon Department of Forestry 2003c). The greatest annual seven-day average maximum water temperature in the Coos system was 76.1º F (24.5º C) degrees, recorded on the West Fork Millicoma. In the Tenmile region, Benson Creek had the highest recorded seven-day average maximum temperature at 70.2º F (21.2º C).

Habitat surveys conducted in the Elliott State Forest have revealed a moderate to high level of riparian shade along streams in all three regions of the forest (Kavanagh et al. 2005). Current management practices retain all vegetation within 100 feet of perennial fish-bearing streams and 50 feet of perennial non-fish-bearing streams. Streams exposed to full sunlight years ago when riparian areas were not protected from harvest have grown back to dense stands of trees (Oregon Department of Forestry 2003c).

The best available data demonstrate that many streams do not meet DEQ water quality standards. This condition may not be the direct result of low shade levels in the Elliott State Forest as, overall, streams have been found to be well shaded. In some specific cases, there may be areas of low riparian shade that elevate water temperature in a stream. Given that observed shade levels on the forest were generally not within the low classification, observations of high stream temperature may be a function of other factors. For example, stream temperature is generally expected to increase in a downstream direction from the drainage divide. This distance ranged from 1.9 miles to 35.9 miles for the monitoring locations in the Elliott State Forest. Hyporheic flow may also reduce stream temperatures. A lack of gravels in the monitored reaches may also contribute to high stream temperatures.

C.8.1.2. Suspended Sediment

Based on ODFW aquatic habitat surveys conducted in the Elliott State Forest from 1993 to 2004, average percent fines within riffle habitats was approximately 12 percent forestwide. Thirty surveyed reaches covering 40 kilometers in the Tenmile Lakes region averaged 18 percent fines in riffles. In the Umpqua basin, 31 reaches were surveyed, covering 43 kilometers with an average of 8 percent fines, and the Coos basin averaged 13 percent fines in 117 reaches over 206 kilometers (Kavanagh et al. 2005).

The amount of fine sediment embedded within riffle habitat was considered moderate (8 to 22 percent) for the Tenmile and Coos regions, while the Umpqua region met the desirable value (less than 8 percent) in comparison to similar reference reaches.

C.8.1.3. Dissolved Oxygen

Information on dissolved oxygen (DO) is scarce for streams in the plan area. DO data for six sites were collected between 1994 and 1999. Expressed as percent saturation, oxygen levels ranged from 87 to 100 percent (morning and afternoon combined) and represent favorable summer rearing conditions for fish. No data are available for the fall, which is the time most likely to experience DO problems due to low stream flows combined with the decay of leaves and algae (Oregon Department of Forestry 2003c).

There are no known data sources for intergravel DO in the Elliott State Forest to monitor the re-aeration capacity of gravels. Based on a limited amount of surface water DO samples, this water quality indicator is assumed to be properly functioning.

C.8.1.4. Nutrients

The Elliott State Forest watershed analysis (Biosystems et al. 2003) reports nutrient data collected by various agencies for seven sites in the forest. Summer orthophosphate levels were extremely low, ranging from less than the detection limit of 0.005 milligrams per liter to a maximum of 0.012 milligrams per liter. The lack of phosphorus likely limits nitrogen uptake by algae. Accordingly, summer nitrate plus nitrite concentrations are more variable, ranging from 0.04 milligrams per liter to 0.56 milligrams per liter. These values are sufficiently low that potential effects of eutrophication are not a concern in the Elliott State Forest.

Tenmile Lakes are somewhat unique in that the streams and associated sediment flow into the lake system. Sediment with phosphorus attached is deposited in the lake in the winter. Some of this phosphorus can enter the water column during the summer if DO levels on the lake bottom are low. Increasing the available phosphorus in the lakes has the potential to accelerate algae growth (Oregon Department of Forestry 2003c). This lake system is currently listed as a water quality listed stream by the DEQ for “aquatic weeds or algae.” Tenmile Lakes are not within the Elliott State Forest, but the Tenmile region drains into the lake system.

C.8.1.5. Chemical Contamination

Herbicide use in the Elliott State Forest averaged approximately 550 acres per year during the 1999 to 2002 period. Most of these acres were treated with a combination of glyphosate and imazapyr. These chemicals are typically applied aerially during dry weather in September. Other chemicals used in a limited capacity during this period include: clopyralid, triclopyr, sulfometuron, and 2,4-D.

No studies have been conducted in the Elliott State Forest to monitor chemical concentrations in streams following treatments. Monitoring of similar application techniques in western Washington showed glyphosate concentration within streams typically at 0.03

percent of the 50 percent lethal toxicity concentration (LC50) for salmonids. The concentration of imazapyr was approximately 0.001 percent of the LC50 concentration for salmonids (Oregon Department of Forestry 2003c).

Insecticides and fungicides have not been used in the Elliott State Forest, and there is no anticipated need for these chemicals in the near future.

C.8.2. Habitat Access

Many of the significant artificial fish migration barriers in the Elliott State Forest have been replaced or removed. The ODF is working to address the remaining barriers over time. The 2003 watershed analysis identified 32 barrier culvert sites in fish-bearing streams. Five of these sites had been removed and the road decommissioned. Two of the sites had been washed out during high flows and not replaced. Eleven culverts were recently replaced and are expected to provide fish passage. There are 14 older culverts in place that pose some level of barriers to fish passage. Seven had a two-foot or higher outlet drop, four percent or greater gradient, or an upswept inlet creating a barrier to fish passage. The remaining culverts may have conditions less severe, but also delay passage seasonally based on water flow. Not all of the fish-bearing streams have been identified, so the actual number of culverts on fish streams is likely larger than presented in the ODF watershed analysis (Oregon Department of Forestry 2003c). According to the Streamnet barrier database, artificial barriers restrict access to approximately three miles of habitat. Fish passage will be provided for adult and juvenile fish at all stream crossing installation or replacement projects conducted in streams historically inhabited by native migratory fish.

A number of natural barriers exist in the forest that prevent or delay fish passage. Fishways have been constructed at two of these sites (Elk Creek and Stulls Falls) to facilitate fish passage at a greater range of stream flows. It is unlikely that any additional fishways will be constructed to address natural barriers.

C.9. HABITAT ELEMENTS

C.9.1. Substrate Character/Embeddedness

Based on ODFW aquatic habitat surveys conducted in the Elliott State Forest from 1993 to 2004, the average amount of gravel within riffle habitats was approximately 41 percent forestwide. Thirty surveyed reaches covering 40 kilometers in the Tenmile Lakes region averaged 40 percent gravel in riffles. In the Umpqua basin, 31 reaches were surveyed, covering 43 kilometers, which averaged 34 percent gravel in riffles. The Coos basin had 117 reaches surveyed over 206 kilometers and averaged 45 percent gravel in riffles (Kavanagh et al. 2005). In a number of streams, minimal gravel retention likely was associated with low levels of large wood present to retain gravel. The wide channels of the West Fork Millicoma have limited amounts of large wood, and also have minimal amounts of gravel retention. Overall, the amount of gravel in the streambed was considered moderate for all three regions in comparison to the identified reference streams.

The ODFW surveys also estimated the percent of substrate composed of bedrock. Forestwide, bedrock averaged 19 percent of the surveyed reaches. Broken down by basin, percent bedrock was 21 percent in Tenmile lakes, 14 percent in the Umpqua, and 19 percent in the Coos basin. This high level of bedrock composition was one of three primary areas of concern identified in the aquatic habitat surveys (Kavanagh et al. 2005). All three regions fell within the undesirable range (more than 11 percent) compared to reference streams. Stream reaches with large amounts of bedrock typically have less spawning habitat and less complex habitat available for rearing juveniles.

C.9.2. Large Woody Debris

Wood volume in forest streams with an active channel width less than 40 feet averages 28 percent in nearby reference streams bordered by 88- to 118-year-old timber, and 14 percent in those reference streams within old-growth timber. The West Fork Millicoma and Mill Creek, two of the largest streams in the Elliott State Forest, have very little wood other than areas where wood was recently added to improve habitat. Spawning habitats in the Elliott State Forest are impacted by the limited amounts of wood available to help retain and sort gravels (Biosystems et al. 2003).

Large key pieces of wood in the stream channel are an important base for forming complex pools and habitat. ODFW aquatic habitat surveys define key pieces of wood as those greater than 0.6 meter (24 inches) in diameter and greater than 12 meters (39 feet) long. Based on reference streams similar to the Elliott State Forest with low amounts of human-associated impacts, a moderate level of key pieces of wood is within 0.5 to 3 key pieces per 100 meters. The forestwide average of surveyed streams in the Elliott State Forest was approximately 1.1 key pieces per 100 meters, with a median at 0.3 key pieces per 100 meters. By basin, the number of key pieces averaged 1.2 per 100 meters (median 0.5) in Tenmile Lakes, 0.2 per 100meters (median 0.2) in the Umpqua, and 1.3 per 100 meters (median 0.4) in the Coos (Kavanagh et al. 2005).

The low level of large wood in the channel was one of three primary areas of concern identified in the aquatic habitat surveys (Kavanagh et al. 2005). Many restoration projects in recent years have been implemented to add wood to streams in the Elliott State Forest. Increasing instream large wood will create more opportunities to retain gravel in bedrock dominated substrates and improve rearing habitat by creating more complex cover.

C.9.3. Pool Frequency and Quality

Pool habitat is considered a good indicator of aquatic habitat quality. Based on ODFW aquatic habitat surveys conducted in the Elliott State Forest from 1993 to 2004, the average percent pool area was 34 percent in Tenmile and 27 percent in the Coos region, both achieving a moderate abundance level. Pool abundance in the Umpqua averaged 15 percent and is considered low in relation to reference streams. A moderate level of pool abundance in this area is considered between 19 percent and 45 percent (Kavanagh et al. 2005).

Surveyed stream reaches less than four percent gradient in the Elliott State Forest in the Coos Basin averaged 27 percent pool area, and 4.7 pools per mile considered complex due to the presence of at least three pieces of wood. The Tenmile Basin averaged 40 percent pool area and 9.7 complex pools per mile. The Umpqua Basin surveys found 25 percent of the stream area in pool habitat, with 3.2 pools per mile considered complex. While a number of streams had desirable pool habitat quality, most of the stream reaches had pool habitat values below their potential. The current low levels of large wood contribute to the lower pool area and complexity (Biosystems et al. 2003).

Pool habitat on the forest is relatively simple, with low to moderate amounts of large wood present.

C.9.4. Deep Pools

Deep pools are at least one meter deep according to ODFW survey methodology. These pools are valuable for adult holding areas, and may provide temperature refugia during the summer. Based on ODFW aquatic habitat surveys conducted in the Elliott State Forest from 1993 to 2004, the forest averaged one deep pool per kilometer. By basin, this figure was 0.5 deep pool per kilometer in the Tenmile Lakes basin, 1.2 deep pools per kilometer in the Umpqua, and 0.6 deep pools per kilometer in the Coos region (Kavanagh et al. 2005). These figures all fall within the moderate range (zero to three) in relation to reference streams. Although the Umpqua had a low level of pool abundance, as discussed previously, the number of deep pools reached the moderate classification range.

C.9.5. Off-channel Habitat/Refugia

The aquatic inventory data were incorporated into two different models to generate an assessment of conditions for coho salmon. The Habitat Limiting Factors Model focuses on the availability and type of pool habitat, particularly the amount of beaver pond and off-channel habitat that is important for winter refuge during high flows. The HabRate model considers the complexity of habitat, incorporating a combination of structural components

such as large wood, big substrate, and undercut banks, as well as gradient, secondary channels, and pool habitat.

These model runs suggest that winter rearing might be the primary factor limiting coho salmon production in the Umpqua and Coos regions of the Elliott State Forest. The capacity and quality of winter habitat in all three regions was rated low by the Habitat Limiting Factors Model. Joes Creek was an exception to this situation. It was the only stream to receive a high rating for both winter capacity and quality. The HabRate model identified a few more streams in the upper Millicoma and Palouse Creek as moderate and high-quality reaches. Downstream habitats off the Elliott State Forest are likely important to the winter survival of juvenile fish. The Tenmile Lakes region is unique in that it offers a large coastal lake environment for rearing. Coho returns in this region have remained relatively high, even with the introduction of Largemouth bass in the lakes that may prey on juvenile coho.

In contrast to the limited winter rearing opportunities, modeling suggests that high-quality spawning and summer rearing habitat is more plentiful in streams in the Elliott State Forest.

C.10. CHANNEL CONDITION AND DYNAMICS

C.10.1. Stream Bank Condition

Stabilized stream banks are valued in the aquatic environment as they are more likely to develop undercut banks, an important cover component, and contribute less turbidity than actively eroding banks. Stream bank stability has not been specifically analyzed in the Elliott State Forest. Undercut banks are a component of the HabRate model, discussed in Section C.9.5. According to this model, high-quality spawning and summer rearing habitat is present in the Elliott State Forest, but winter rearing opportunities are limited.

Current management practices utilize a 100-foot no harvest buffer adjacent to perennial streams and 75 feet adjacent to intermittent fish streams. These riparian practices reduce the likelihood that harvest activities are impacting bank stability in fish-bearing streams.

C.10.2. Floodplain Connectivity

Many of the channels in the Elliott State Forest are confined, implying a concentration of streamflow and fluvial energy. Stream channels in narrow valleys are constrained from lateral movement by adjacent hillslopes or bedrock walls.

ODFW aquatic habitat surveys report the valley width index as the number of active channels that fit between the hillslopes across the valley floor. Valley width indices less than 2.5 are considered narrow valleys with stream channels constrained from lateral movement. Valley characteristics and channel morphology are especially significant during high-flow events. During high flows, streams are more likely to form secondary channels in broad valley floors that provide important resting and over-winter habitat for fish.

Of the 117 reaches surveyed in the Elliott State Forest since 1993, 71 (61 percent) were considered constrained. The Tenmile Lakes region had the smallest percent of confined channels at 50 percent. The Coos (64 percent) and Umpqua (65 percent) regions are more laterally constrained and less likely to provide quality off-channel habitat for winter refuge.

The primary management action that could reduce floodplain connectivity is road building. As shown in Table C-4, the Elliott State Forest road system is predominantly installed on ridgeline and mid-slope locations. It is unlikely that roads located in upland areas are responsible for decreasing floodplain connectivity. Approximately 4.4 percent of the roads are located within 100 feet of a stream channel, and are likely preventing some stream areas from interacting with a floodplain. Current road management practices call for avoiding the installation of roads in the riparian area.

Table C-4
Elliott State Forest Roads Located by Landscape Position

Fifth Field HUC	Road Miles (percent)			
	Riparian	Valley	Mid-slope	Ridge
Lower Umpqua	2.7 (3.5%)	0.8 (1.0%)	23.7 (30.2%)	51.2 (65.3%)
Mill Creek [1]	2.6 (4.6%)	4.4 (8.0%)	20.8 (37.8%)	27.8 (50.5%)
Tenmile Lakes	0 (0%)	1.9 (20%)	30.2 (30.5%)	67 (67.5%)
Coos Bay	1.2 (3.3%)	0.3 (0.8%)	10.3 (30.0%)	22.7 (65.9%)
Millicoma River	16.9 (6.3%)	21.6 (8.0%)	92.4 (34.3%)	138.2 (51.4%)
Forest Total	**23.3 (4.4%)**	**29 (5.4%)**	**177.5 (33.1%)**	**306.4 (57.1%)**

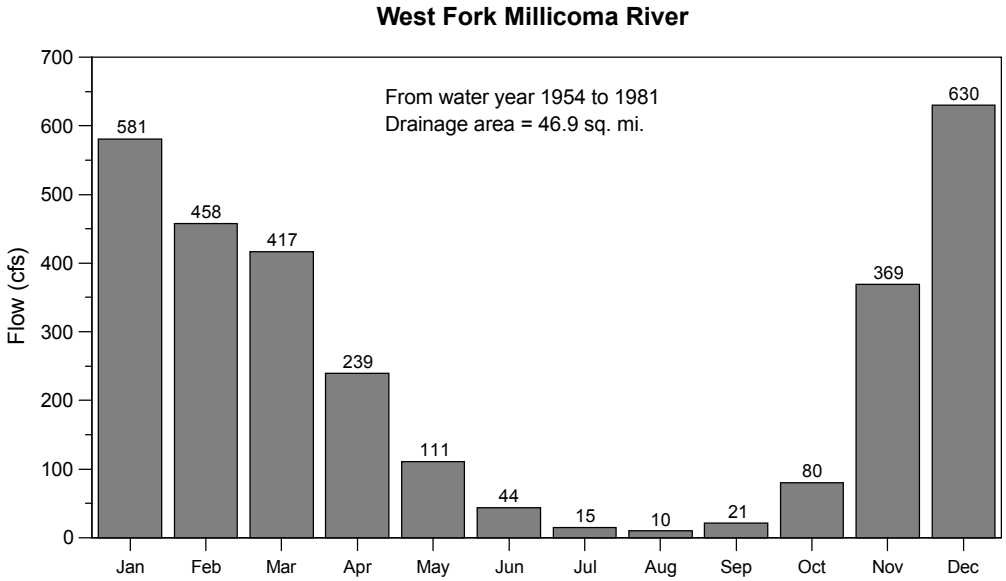
[1] Mill Creek includes 211 acres of the Middle Umpqua fifth field HUC (Biosystems 2003).

C.10.3. Flow/Hydrology

C.10.3.1. Change in Peak/Baseflows

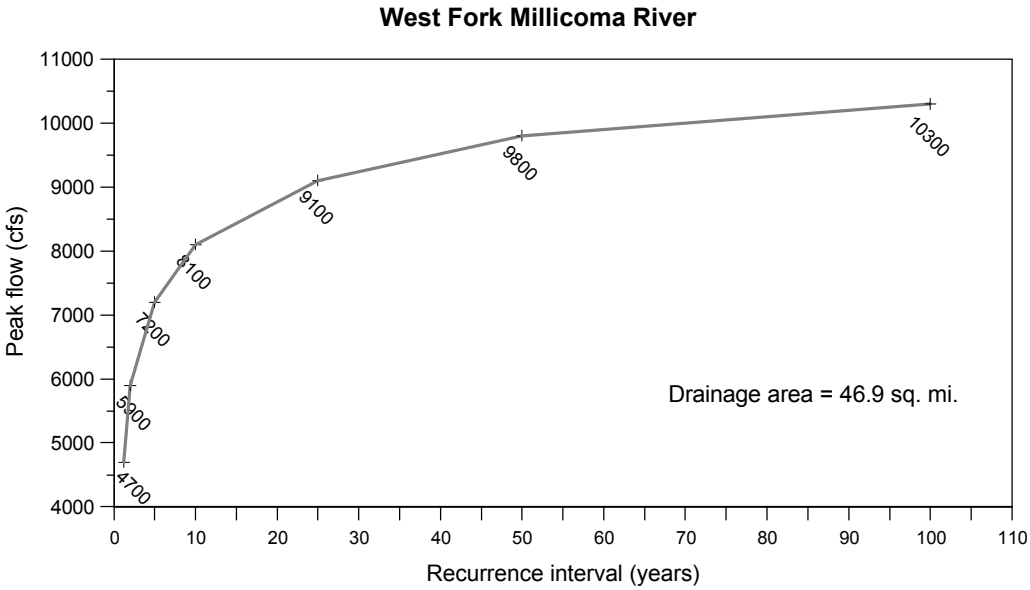
The West Fork Millicoma has the only gauging site on or near the Elliott State Forest with a record long enough to evaluate stream flow characteristics. Most of the land upstream from the gauge site is part of the Elliott State Forest. The average monthly flow from 1954 to 1981 was highest in December, with a flow of 630 cubic feet per second (cfs) and lowest in August at 10 cfs (Figure C-3). Unfortunately, no gauging data were available for a similar watershed without timber harvest that could be used as a control to examine how flows in the West Fork Millicoma changed over several decades of timber harvest and road construction (Biosystems et al. 2003).

Figure C-3. Monthly Flows for the West Fork Millicoma River



The peak flow associated with the 50-year recurrence interval was 9,800 cfs, or a unit flow of 208 cfs per square mile of drainage area for the West Fork Millicoma River (Figure C-4). This is typical for low elevation mountains of the central Coast Range (Biosystems et al. 2003).

Figure C-4. Relationship Between Peak Flow and Recurrence Interval for the West Fork Millicoma River.



Research on Pacific Northwest streams indicates that clearcut harvesting has the potential to increase peak and summer flow when a large percentage of the basin consists of early structure. Detectable changes in the streamflow regime are unlikely in basins with less than 20 to 25 percent of the land area in early structure (MFG, Inc. 2005). Basin 12 has the largest percentage of land in the early structure classification, at 17 percent in 2005 (R. Fields, personal communication, 2005).

At the Elliott State Forest or management basin scale, there are no data to suggest that changes in peak or baseflows due to timber harvest are currently occurring. Some individual small stream basins may experience a level of harvest that exceeds 25 percent, and could create a detectable change in the streamflow regime for that stream.

C.10.3.2. Increase in Drainage Network

There is no available information to assess increases in active channel length due to human caused disturbances related to roads, trails, conveyance ditches, compaction, or impervious surfaces that may lead to changes in stream flow regimes. The drainage network cannot be considered consistent with historic landscape conditions with the addition of the road system. However, the location of the roads, their proximity to stream channels, and the level of disconnection from the stream network have a large effect on whether or not the drainage network is extended.

The majority of the road system is established on ridgelines, with approximately 4.4 percent of the roads within 100 feet of a stream (Table C-4).

Roads in the Elliott State Forest are managed in accordance with the Forest Roads Manual (Oregon Department of Forestry 2000). Under this manual, roads are managed to minimize the disruption of natural drainage patterns through the following guidelines:

- Avoid increasing road mileage next to streams.
- Avoid increasing disturbance area associated with roads.
- Avoid increasing hydrologic connectivity to streams.
- Maintain or properly vacate roads not in use.

The road system in the Elliott State Forest is well maintained with improvements continuing to be made. Roads are generally located outside the riparian area, but some locations pose a risk to the aquatic environment, and the drainage network likely has been altered to some degree.

C.11. WATERSHED CONDITIONS

C.11.1. Road Density and Location

The road system in the Elliott State Forest is relatively old and in place. Approximately 1.5 miles of road are built annually to serve new landings or harvest sites. The age of this road system has allowed weak sections of road to fail. These areas are identified through routine maintenance, and then are upgraded and maintained, which contributes to the current infrequency of road-related landslides. This older road system has stabilized through time, but remains subject to fill failures due to road location, road drainage malfunctions, and sections of roadways remaining with side-cast construction. Studies in the Elliott State Forest indicate that interior roads were fairly stable during large precipitation events, such as the 1996 storm, but that the potential for a road fill failure delivering sediment to fish-bearing streams is a concern for some legacy roads that do not meet current standards.

A number of roads and road segments are identified for improvements to benefit water quality, but current maintenance practices generally keep roads in good condition (Oregon Department of Forestry 2003c).

Table C-4 lists the miles and percent of roads located by landscape position. Riparian roads are those within 100 feet of streams; valley roads are located in broad flat plains outside the 100-foot riparian zone; and ridgeline roads are those with less than 1/20 acre of upslope drainage. Mid-slope roads are those that do not meet any of the above criteria.

The majority of roads in the Elliott State Forest are situated on ridgelines, which are generally good locations to minimize fill failure hazards and the hydrologic connectivity between the road system and the stream system.

C.11.2. Disturbance History

Habitats typically vary in quality and quantity through a natural range of conditions as a result of large-scale habitat disturbances such as wildfires, floods, windstorms, tectonic uplift, mass wasting events, and debris flows. These natural disturbances have affected and created Oregon's forests for thousands of years. There is considerable debate about the frequency and magnitude of these events, and forest disturbance frequencies appear to vary considerably throughout Oregon's forests, based on location, climate, and ecosystem. The disturbance history of the Elliott State Forest is described in detail in the 2006 FMP. An overview of how past land uses have contributed to current habitat conditions in the Elliott State Forest is provided below. A more complete description is provided in the ODF Watershed Analysis (Biosystems et al. 2003).

Large stand replacing fires are thought to have occurred in the Elliott State Forest in 1850 and 1868. The fires consumed trees believed to have originated in the late 1650s (Oregon Department of Forestry 2003c). While not frequent (occurring approximately every hundred years), such large-magnitude catastrophic fires burned riparian vegetation, adversely

influencing various physical processes and functions of riparian zones and similarly influencing aquatic habitats.

The fires changed vegetative succession pathways. Periods of accelerated surface erosion and stream sedimentation likely followed the fires. As a large proportion of sediment discharged from the upper basins to storage locations in low elevation, fluvial channel environments on the Elliott State Forest may have been delivered in pulses from fire-driven events. However, the fires may also have contributed to cycling nutrients and stream substrates as well as the formation of the stream channel structure. The frequency of large stand-replacement fires in the Coast Range is typically on the order of centuries. With the advent of fire suppression, these frequencies are likely much longer today compared to a century earlier.

Streams in the Elliott State Forest generally experienced floods generated by high rainfall storm events. Floods have helped shape aquatic habitat in the Elliott State Forest by impacting channel morphology, sediment transport and deposition, and adjacent stream vegetation. Habitat quality for fish and other aquatic organisms is formed by the interaction of these elements. Channel forming flows are generally considered to occur in 2 to 2.5-year return intervals. Large catastrophic floods seem to occur every several decades to centuries.

The Elliott State Forest is in the direct path of large winter storms from the Pacific Ocean. Extreme windstorms hit the Coast Range in 1880, 1951 (blowing down 3.7 billion board feet of timber), and 1962 (the Columbus Day storm, when approximately 3 billion board feet of timber blew down) (Ruth and Yoder 1953). Less severe windstorms have also blown down trees along the edges of clearcuts, including riparian buffer areas. For the Coast Range, windstorms severe enough to cause substantial tree uprooting along clearcut edges have occurred in 1971, 1973, 1981, 1983, and 2002 (Oregon Climate Service 2003). Wind storms have shaped the Elliott State Forest by toppling trees, creating canopy openings, and changing vegetative succession. Aquatic habitats can be beneficially influenced following wind storms, with a pulse of downed wood levels across the landscape and in stream channels. However, salvage operations and stream cleaning activities prior to the 1980s removed much of this wood from the channel. As such, the riparian areas have diminished wood recruitment potential from windthrow without a corresponding benefit to in-channel wood loading levels.

Debris flows and dam-break floods are initiated by small landslides, but subsequently sustained by water and debris mass inertia. They may accumulate additional mass and volume as they travel downslope. These flows are capable of abrasive scour into bedrock. They also are capable of dislodging and transporting large boulders and wood down steep slopes. In general, debris flow return intervals in the Elliott State Forest are linked with rainfall precipitation events, and a typical event frequency is several decades to a half century. These types of flood events are common in the Elliott State Forest, and have had a direct influence on channel structures, riparian vegetation, and aquatic habitats. This natural process has redistributed both soil and wood downslope from the hillslopes to the channel systems. Similar to wildfires, a large proportion of sediment discharged from the upper basins to storage locations in low elevation environments in the Elliott State Forest may have been delivered in pulses from debris flows or dam-break floods.

Mass wasting events, like shallow-rapid landslides, are a natural occurrence in the Elliott State Forest, given the steep topography and highly dissected channel network. Landslides reaching stream channels can provide a source of coarse and fine sediment inputs and woody debris inputs to the channel network. The influence of landslides on a watershed scale, without the development of associated debris flows or dam-break floods, is generally localized. Aquatic habitats can be either beneficially or adversely influenced, depending on the level of sediment deposition. Fish spawning habitat in particular is dependent on gravel deposits and a well-sorted supply of gravels free of embedded fine sediments. Thick plugs of coarse sediment or high levels of fines are not desirable, and can reduce survival of developing fish. Channels need streambed structure such as large boulder clusters or large wood to store and stabilize the bedload of sediment inputs. Channel structure to retain the existing level of sediment inputs in the Elliott State Forest is currently lacking.

Through the 1970s, trees were commonly harvested along streams and yarded through streams. Timber harvest also was conducted on unstable slopes, and roads were often built along mid-slopes and frequently without adequate drainage systems. Removing large wood from streams was a normal course of timber harvest practices in the mid-1900s as a means of cleaning the channels. In some limited instances, heavy equipment was operated in streams and splash dams were present in channels throughout the region. These activities detrimentally affected many riparian areas and streams, resulting in soil erosion, mass wasting, loss of large woody debris from channels, and loss of most large trees within riparian areas. These activities have substantially reduced in-channel loading of large wood and the future large wood recruitment potential to channels for many decades. The current low level of large wood has been identified as one of the primary habitat indicators of concern.

Historic timber practices included the use of splash dams to store large quantities of wood and water. The timber was inexpensively transported downstream by means of sluicing with a sudden dam breach. However, compared to many other areas on the south-central Oregon Coast, the Elliott State Forest had relatively little historic splash damming activity. Splash dams were outlawed in 1956, prior to the beginning of extensive timber harvests in the Elliott State Forest. Although documentation is sparse, only four splash dam sites in or adjacent to the Elliott State Forest have been identified. Although they were generally located outside the Elliott State Forest, splash dams in headwater regions may have impacted downstream conditions within the Elliott State Forest.

Damage caused to streams and rivers by early logging operations (splash dams, slash disposal in streams, log drives, etc.) often resulted in substantial logjams. In some cases, these jams could be one mile or more in length, and may have impeded anadromous fish passage. As a result of this debris accumulation in streams, the Oregon Game Commission in the 1930s required loggers to prevent woody debris from entering streams. There is evidence of stream cleaning in the Elliott State Forest beginning in 1956, and this practice likely extended into the mid-1980s. The contribution of large wood in streams can last for many decades and/or centuries prior to depletion, decay, or downstream transport. Given the time required to grow and recruit functional-size pieces of large wood in the riparian zones, the stream cleaning efforts will have a lasting effect on the wood loading conditions of streams and rivers in the Elliott State Forest.

Roads have the potential to increase on-site erosion and sediment delivery to stream channels, and can contribute to increased peak flows in streams (Beschta 1978). In general, stream crossings present a risk for chronic sediment delivery to streams, especially during wet weather (Dent et al. 2003). Roads within riparian zones have the potential to reduce shade and disrupt future sources of large wood recruitment to streams. Road crossing failures can be a major source of sediment to streams, and may lead to catastrophic increase in stream channel sediment (Sidle et al. 1985; Robison et al. 1999). Road failures can also increase the frequency of debris flows and dam-break floods compared to natural conditions. These effects can influence aquatic habitats by increasing fine sediment levels, reducing pool volumes, increasing channel width, and increasing seasonal temperature extremes. Culverts can also be a common migration barrier to fish (Furness et al. 1991).

Road building in the Elliott State Forest began with the first "truck roads" in 1935. The first large increase in road building occurred in concert with timber sales beginning in 1955. During the seven-year period from the start of forest management until the Columbus Day windstorm, approximately 143 miles of road were built. The 1962 Columbus Day windstorm accelerated the road-building program to accomplish timber salvage harvests. An estimated 150 miles of new roads were built to access the sale areas. These roads generally were below prior engineering standards. Construction involved an abundance of side-cast, no surfacing or ditches, and a minimal 14-foot width. Starting in 1966, roads were upgraded in the Elliott State Forest (including surfacing, building of ditches, and upgrading of bridges from log stringers to concrete). By 1968, an all-weather road system in the Elliott State Forest was completed. Currently, the road building program includes extending spur roads to access individual timber harvest sites, upgrading and maintaining roads and culverts to improve their performance, and disconnecting water and sediment delivery from roads to streams.

The human-caused disturbance history has created watershed conditions that are functioning at some amount of risk for salmonid fishes due to: 1) legacy timber harvests and channel modifications (stream cleaning efforts); 2) road building and road-related failures at stream crossings and on unstable slopes; and 3) potential fish migration barriers at culverts. Recent management practices, however, avoid direct disturbances to unstable areas, riparian reserves, and known aquatic refugia. Current management practices are less destructive to watershed conditions and processes than historic management approaches.

C.11.3. Riparian Areas

The ODF Watershed Analysis characterized current streamside forests along all fish-bearing streams in the Elliott State Forest, using color orthophotos from 1996. The results indicate that the streamside vegetation is a patchy array of conifer, mixed, and hardwood-dominant vegetation classes, reflecting the history of harvesting, road building, debris flows, and natural disturbances in the Elliott State Forest. In addition, young hardwood trees along some of the large streams, especially in the Tenmile region, are a result of tree invasion into streamside areas that were previously pasture. Hardwoods are the most dominant stand type found within 100 feet of the stream for all stream size classes. Hardwood dominance decreases with increasing distance from the streams. Nevertheless, hardwoods occupy one-third of the land within 150 to 200 feet bordering large streams. Mixed conifer/hardwood stands occupy the majority of the area at distances of 100 to 200 feet from the stream.

Conifer-dominated stands constitute a minority of the streamside area for all stream size class and distance intervals (Oregon Department of Forestry 2003c). The ODFW aquatic habitat surveys found that the number of large riparian conifers was low for all three regions, with only a few individual reaches meeting the 75th percentile of reference reaches (Kavanagh et al. 2005).

Hardwood stands provide abundant shade and nitrogen-rich leaf litter to the aquatic environment. Hardwood trees provide some aquatic structure when they fall into the stream, but are short lived compared to conifers, and the ability of these stands to create a volume of large wood similar to historic levels is limited (Oregon Department of Forestry 2003c).

Beginning in the 1960s, the first riparian buffer strips were left along streams during timber harvest. The current FMP was adopted in December 1993. Under this plan, fish-bearing perennial streams have had a 100-foot Riparian Management Area, with no harvest except specific habitat enhancement projects. Fish-bearing intermittent streams were managed with a 75-foot no harvest buffer, and non-fish-bearing perennial streams with a 50-foot buffer.

Appendix D
Desired Future of Conditions for Elliott Watersheds

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D.1. PRINCIPLES

Watersheds, riparian, and aquatic areas change over time and space with disturbances such as landslides, floods, debris flows, windthrow, and fires. These disturbances result in a wide range of conditions, both longitudinally and laterally, throughout a stream network. Such conditions defy precise definitions; thus, oversimplified and singular measures or benchmarks are generally used. However, no single value can accurately characterize "healthy" fish habitat and watersheds. Fish are adapted to a range of conditions, including variability generated from natural disturbance. Therefore, state and federal partners agreed to define and use a *range* of desired future conditions (DFCs) for riparian and in-channel aquatic habitat conditions for the Elliott State Forest plan area. These conditions will be used to analyze the Habitat Conservation Plan (HCP) in the Environmental Impact Statement (EIS), and are not considered benchmarks.

In this document, ecologically significant metrics of riparian, aquatic, and watershed conditions are proposed that are sensitive to management and likely to have an effect on aquatic biota (Table D-1). A range of conditions are defined for these metrics that are likely to meet the functional goals for riparian and upland management as described in the Elliott State Forest Management Plan (FMP) and HCP. Numerous other metrics can be and are in use at this time. The Oregon Department of Forestry (ODF), in collaboration with federal and state partners, has selected this subset for the EIS analysis, but may continue to evaluate the validity of the defined ranges as well as the potential for other metrics. At this time, the proposed metrics to be used in the EIS are:

- **Riparian Condition** (for coniferous and deciduous stands):
  - basal area
  - stand density
  - quadratic mean diameter (QMD)
  - number of large diameter conifers and hardwoods
  - shade over streams
- **Aquatic Condition**:
  - stream temperature
  - large wood in streams
- **Watershed Condition**:
  - hydrologic connectivity to streams
  - roads parallel to and within 100 feet of streams
  - riparian stand structure
  - wood recruitment from near-stream and upland sources

Table D-1
Summary of Proposed Metrics, Data Sources, and Proposed Ranges of Conditions for Riparian and Aquatic Resources

Resource	Selected Metric [a]	Data Sources	Proposed Range of Conditions
Riparian Condition (Type F and Large and Medium N, unless otherwise noted)	**Basal Area** (square feet per acre) 25th to 75th percentile (median)	FIA: Evaluation of FIA data representative of older forests in the Mid and South Coast Region AIP: ODFW AIP riparian data in the Oregon Coastal Region. Elliott: Riparian Data from the Elliott State Forest and the Bureau of Land Management	CON: (FIA): 203-286 (256) HWD (Elliott): 66-121 (86) MIX (Elliott): 94-253 (153)
	Total Tree Density (trees per acre) 25th to 75th percentile (median)		CON: (FIA): 61-143 (83) HWD (Elliott): 45-121 (54) MIX (Elliott): 47-133 (110)
	QMD: (inches) 25th to 75th percentile (median)		CON (Elliott): 25-41 (28) HWD (Elliott): 11-17 (14) MIX (Elliott): 16-20 (17)
	Density of **Large Diameter** (>20" DBH) Trees (trees per acre) 25th to 75th percentile (median)		CON (AIP): 41-99 (78) HWD (Elliott): 3-21 (13) MIX (Elliott): 11-29 (16)
	Shade (All Stream Types)	ODFW AIP shade angles. [AIP observed range= 76-91%, need to stratify by stream size]	Small: 80-87 Medium: 85-94 Large: 71-93

Resource	Selected Metric [a]	Data Sources	Proposed Range of Conditions
Aquatic Condition (all stream sizes and types)	Stream Temperature (7-day moving mean of daily maximum - ºC) 25th to 75th percentile	ODFW AIP for model inputs [Reference water temperatures for the stream network less than 10 miles from the topographic divide based on median stream sizes and median AIP shade levels]. Elevations based on feet above mean sea level. Use the regression equations from the Elliott State Forest Watershed Analysis (attached) for reference water temperatures for the stream network greater than 10 miles from the topographic divide	Small (10 feet): 13.5 ºC – 17.0 ºC Medium (20 feet): 13.0 ºC - 16.6 ºC Large (38 feet.): 13.1 ºC-17.7 ºC
	Large Wood in Streams: Total pieces per reach length 25th to 75th percentile (median)	ODFW AIP (53 sites) [AIP observed range = 9.4 to 29.7 pieces per 100 meters, need to stratify by stream size]	Small: 13.8-28.7 Medium: 11.5-30.7 Large: 8.2-26.6
	Large Wood in Streams: Number of Key Pieces per reach length 25th to 75th percentile (median)	ODFW AIP (124 sites because small streams were under-represented) [AIP observed range = 0.6 to 4.0 pieces per 100 meters, need to stratify by stream size]	Small: 0.9-4.3 Medium: 0.9-3.3 Large: 0.5-2.1
Watershed Condition (All Stream Types)	Hydrologic Connectivity to Streams	Numeric Range: Policy Decision	20 percent or less of road connected to streams < 0.5 percent of watershed area with roads connected to streams
	Roads: Parallel and Within 100 feet of streams	Numeric Range: Policy Decision	No net increase ≤ 5% of road network

Resource	Selected Metric [a]	Data Sources	Proposed Range of Conditions
Watershed Condition (All Stream Types) —continued	Riparian Structural Diversity: Percent of riparian areas by structural classes. Structural classes relate to species diversity, layering, and presence of snags and downed wood. Advanced structure has the greatest diversity, multiple canopy layers, and high levels of snags and downed wood.	Benda and Dunne 1997 (summarized in R2 Resource Consultants 2005); Wimberly at al. 2000; Numeric Range: Policy Decision that reflects management for mature forest condition but acknowledges disturbance is common in riparian areas	Early: 5-15% Intermediate: 15-45% Advanced: 45-70%
	Large Wood Recruitment	Near Stream Sources: Van Sickle & Gregory 1990; McDade et al. 1990; Bilby and Bisson 1998 [observed range from literature = 70% to 100%] Upslope Sources (from landslides and debris flows): Benda and Sias 1998; Benda et al. 2003; May and Gresswell 2003; Reeves et al 2003; [observed range from literature = 10% to 72%] Numeric Range: Policy Decision	70% to 100% of the natural disturbance regime's large wood recruitment from all sources (near stream and upslope sources). NOTE: Total percent of channel wood originating from upslope areas will vary by stream order (May and Gresswell 2003); larger order streams have less wood from upstream sources.

Notes:

[a] Metric is reported for conifers, hardwoods, or all trees in conifer-dominated, hardwood-dominated, and mixed stands, respectively.

CON = conifer; HWD = hardwood; MIX = mixed riparian forests

AIP = Aquatics Inventories Project; FIA = Forest Inventory and Analysis

DBH = diameter breast height; ODFW = Oregon Department of Fish and Wildlife

ºC = degrees Celsius

D.2. APPROACH AND AVAILABLE DATA

A combination of data from "reference" streams (Kavanagh et al. 2005), older upland forests (USDA Forest Service 2006), older riparian forests on the Elliott (Biosystems et al. 2003), Oregon Department of Fish and Wildlife (ODFW) Aquatics Inventories Project (AIP) reference riparian areas (http://rainbow.dfw.state.or.us/nrimp/default.aspx?p=259), and values from published literature (Table D-2) were used to describe a set of DFCs. The selected metrics were reported as a range (25th to 75th percentile) and median where analysis techniques and available data allowed. In some cases, available data were lacking or the literature did not provide a useful numeric range. In such cases, literature was used to guide a policy decision on the proposed range.

D.2.1. Aquatic Metrics

For the purposes of this HCP, reference streams represent a range of conditions for sites with minimal human perturbation. ODFW reference sites were selected from all AIP habitat surveys. These surveys are conducted by the ODFW using a process outlined in Thom et al. (2001). The ODFW AIP reference sites represent watershed areas with low impact from human activities such as roads, development, and forest management. The ODFW believes the sites are an accurate depiction of the stream sizes, geology, and ecoregions, and that they are representative of aquatic conditions in minimally influenced streams that exist in coastal drainages of western Oregon (Thom et al. 2001). Reference sites were chosen from coho streams, and the gradient is generally less than 5 percent; thus, they may be less representative of steep streams. The AIP surveys have been conducted since 1992. Data from streams in the plan area have been summarized by Kavanagh et al. (2005) and represent the observed range of conditions that may have occurred under inherent disturbance regimes without the additional perturbation of forest management.

D.2.2. Riparian Metrics

Riparian forest characteristics were attained through an analysis of three data sources: Forest Inventory and Analysis (FIA) (USDA Forest Service 2006), ODFW AIP surveys (http://rainbow.dfw.state.or.us/nrimp/default.aspx?p=259) (which included riparian transects), and riparian surveys from the Elliott State Forest (Biosystems et al. 2003). A subset of the FIA data collected in older forested areas (80 to 205 years old) provides a complete data set from which to derive data for all the riparian metrics, but represents mostly upland stands within the Mid and South Coast regions. ODFW AIP reference sites in the same region represent older riparian forests (no specific age available), but involve lumped data by diameter classes; thus, they cannot be used to populate all the riparian metrics. Finally, data from older riparian forests (86 to 210 years old) on the Elliott State Forest were summarized and provide a descriptor of riparian structure within the plan area but have a small sample size. The desired future conditions for shade over streams were based on reference conditions from the ODFW AIP surveys (Kavanagh et al. 2005).

D.2.3. Watershed Metrics

The desired future conditions for watersheds relied mostly on reports in the literature. Policy decisions were needed for some of the proposed ranges and are noted accordingly.

Table D-2
Data Sources for Describing Aquatic and Riparian Reference Conditions

Data Source	Description	References
ODFW AIP: Habitat Data	The ODFW AIP data were collected to provide quantitative information on habitat condition for streams throughout Oregon (Moore et al. 2002). As part of this effort, data were collected on 124 reference reaches, which were considered by the ODFW to represent a natural range of conditions (Kavanagh et al. 2005). While no explicit age limit was set for these sites, they represent low human impact (wilderness/roadless area, late-successional, or mature forest). • 53 Mid and South Coast Reference sites • 124 sites in the entire Coast Reference were used if needed due to otherwise small sample size from Mid and South Coast	Kavanagh et al. 2005
ODFW AIP: Riparian Data	Of the 124 AIP sites (as described above), 54 sites had an accessible, riparian dataset. Sites represent coho streams with least human disturbance	ODFW web site provided in text
Elliott State Forest Watershed Analysis: Riparian Data	The Elliott riparian data were collected and summarized by independent contractors to characterize riparian conditions in the Elliott State Forest. ODF re-analyzed a subset of the data consisting of all plots 86 to 210 years old (average of 150 years). These included 15 plots: 4 conifer-dominated, 5 hardwood-dominated, and 6 mixed riparian forests.	Biosystems et al. 2003
Federal FIA: For Riparian Metrics	These data are collected as part of a national project to characterize vegetation using a systematic sampling design. Independent contractors evaluated FIA data representative of forests 85 to 205 years old (average of 117 years), in the Mid and South Coast Region. A subset of plots provided 14 conifer-dominated sites and 4 alder sites with site indices of I, II, or III.	USDA Forest Service 2006
ODF Watershed Analyses	Describes current and desired conditions in the watersheds being analyzed.	ODF Watershed Analyses: Elliott (Biosystems, et al. 2003); Miami (J. Jenkins et al. 2005); Upper Nehalem (R2 Resource Consultants 2005)
Literature: References provided in text and listed under Appendix B	Published literature is used to put sideboards on potential ranges from which to establish the policy decision.	See Appendix B

D.3. RIPARIAN CONDITIONS

D.3.1. Selected Metrics

- Basal area
- QMD
- Stand density
- Numbers of large diameter conifers and hardwoods (greater or equal to 20 inches diameter breast height [DBH])
- Shade over streams

D.3.2. Rationale

Riparian areas fill a special environmental niche between aquatic and terrestrial systems and provide a unique linkage from the headwaters of a basin to the outlet. Structural characteristics of riparian areas vary greatly, in part, because plant communities reflect fluvial and fire disturbances, soil and geomorphic characteristics, and a range of historic and current management practices (Hayes et al. 1996). Riparian vegetation is important for fish because it provides nutrients from litter fall, root masses for bank stability, shade for temperature control, and large wood for habitat complexity. Upland conditions and processes influence the conditions and functions of aquatic and riparian conditions as well. Examples include landslide and debris torrents that deliver wood, boulders, and sediment to streams; wildfires that create a mosaic of upland and riparian stand structure; and roads that can chronically deliver sediment to streams or change the timing and magnitude of high stream flow events. Small headwater channels have riparian areas that can be more indicative of upland stands and are important conduits of structure and nutrients.

Decisions to manage or not manage near streams have direct influences on riparian conditions. Under the Elliott FMP and HCP, riparian areas are managed to achieve mature forest conditions within 100 feet of Type F streams and medium and large Type N streams. Once mature forest condition is achieved, these areas will not be harvested. A few studies have documented the range of riparian stand structures for old growth and mature riparian forests (Andrus and Froehlich, 1988; Carlson et al. 1990, Heimann 1988; Ursitti V.L. 1990; Pabst and Spies 1999; Thom et al. 1999) and report a wide range of conditions. A multitude of indices can be used to describe riparian forest structure, including age, basal area, stand density, mean diameter, QMD, cover, number of large trees, layering, shade over streams, downed wood, and snags. Riparian stand metrics (basal area, stand density, QMD, numbers of large diameter trees), which are responsive to management, easy to measure, and likely to register a detectable change over the plan period (approximately 50 years), were selected.

Large wood is a principal contributor to high quality fish habitat. In particular, sources of large conifer wood to streams may be more beneficial than hardwoods for the creation of pools and habitat complexity. Conifers attain larger diameters, tend to be more stable during high flows, and last longer in the stream than hardwood species. As a consequence, they offer

improved function as key pieces for the creation of wood jams and long-term habitat features. Most coastal streams are significantly lacking large wood, and in particular key pieces of large wood. Given these circumstances, it is important to evaluate the effects of the HCP on coniferous sources of large wood to streams. The numbers of large-diameter conifer trees in riparian areas provides an index of how management influences recruitment of large coniferous wood to streams. While trees with a larger DBH than 20 inches are important for channel complexity, it takes longer for trees to enter the larger size classes. "Large" is defined as greater than 20 inches DBH because it is useful for detecting change within the time period of the plan.

Hardwoods are an important component of riparian structure as well; it is likely that hardwoods historically dominated significant miles of near-stream riparian areas in the Oregon Coast Range. This is because hardwoods tend to have a competitive advantage over conifers in the highly disturbed zones next to streams and along debris torrent pathways. Current research has documented differences in nutrient cycling and nitrogen levels from streams that are alder-dominated in the coast range (Compton et al. 2003) and from small non-fish bearing alder-dominated streams in Alaska (PNW 2004). Nitrate and dissolved organic nitrogen increases as the percent of red alder increase (Compton et al. 2003). Researchers suggest that red alder increases habitat quality for wildlife; stream productivity; and nutrients for fish, amphibians, songbirds, and other invertivores. Ecological function of red alder is increased if it is grown in patches rather than as a mixed stand (PNW 2004). Hardwood riparian metrics were included in recognition of the common occurrence and important ecological function of hardwoods along streams in the Elliott State Forest.

Many riparian forests are a patchwork or mixture of hardwoods and conifers; one element of mature forests is the presence of multiple species and a layered composition. For these reasons, measures of mixed riparian forests were included in the DFCs.

D.3.3. Desired Future Conditions

Three data sets were used to determine the range of conditions, including one based on mature riparian forests in the Elliott State Forest, an ODFW data set taken from reference coho streams in the Oregon Coast Range, and FIA data collected in upland stands throughout the coast range.

In 2001, data were collected on the Elliott State Forest by Integrated Data Management (Barnes 2001) using a modification of the protocol developed by Andrus (2001a) in which all trees greater than six inches DBH were measured. These data were subsequently summarized and analyzed by Andrus (2001b) in the Elliott State Forest Watershed Analysis (Biosystems et al. 2003). For the present analysis, ODF re-analyzed the Elliott data on a sub-set of plots exceeding 80 years of age. These were further queried to derive only plots within 100 feet of streams. Riparian areas in this subset ranged in age from 86 to 210 years, and averaged 150 years.

The ODFW AIP reference stream data were available on 53 forested reaches in which all trees greater than 1.2 inches DBH were tallied into lumped diameter-class categories. Of all the riparian metrics, only the large conifer count may be compared with the other data because of the significantly lower DBH cutoff and the lumping methodology.

The Elliott and AIP plots were classified as hardwood-dominated, conifer-dominated, or mixed stands, and yielded the sample sizes shown in Table D-3. The following criteria were used for the stand-type determination:

- Conifer dominated: more than 70 percent of basal area in conifer
- Hardwood dominated: less than 30 percent of basal area in conifer
- Mixed: 30 to 70 percent of basal area in conifer

Finally, the current (2006) version of the FIA Integrated Dataset was queried to identify forest stands within Western Oregon, with an elevation less than or equal to 1,250 feet, and a stand age of 85 to 205 years old (with an average of 117 years). Data were collected on all trees with a DBH greater than 7 inches. The query produced 46 sample stands:

- 27 stands classified as Douglas-fir or western hemlock
- 4 stands classified as other conifer types (e.g., spruce, cedar, pine)
- 4 stands classified as red alder
- 11 stands classified as other hardwood types (e.g., madrone, oak, willow)

Of the 27 Douglas-fir or hemlock stands, those with a site index of I, II, or III were selected. This eliminated two stands with 30 percent hardwood basal area or more, which are more typical of dry sites in the eastern part of the region, one stand classified as hemlock, and ten stands with Site Class IV or V. The result was 14 Douglas-fir dominated stands for further analysis (Table D-3).

Table D-3
Sample Size by Forest Type for the Elliott, ODFW AIP, and FIA Data Sources

Data Source	Sample Size by Forest Type		
	Conifer	Hardwood	Mixed
Elliott	4	5	6
AIP	14	19	20
FIA	14	4	0

For each of the riparian metrics, the median, 25th percentile, and 75th percentile were determined. These non-parametric statistics were used because the sample size was too small to assume a normal distribution. The three datasets produced different ranges (Table D-4).

Table D-4
Summary of Results from Analysis of Three Data Sets Used to Characterize Desired Future Conditions of Riparian Areas Within 100 feet of Large Type F and Large and Medium Type N Streams

Riparian Metric	Data Set Results- 25th to 75th Percentile (Median)		
	AIP	FIA	Elliott
Conifer Basal Area in Conifer-dominated Riparian Areas (square feet/acre)	Not available	**203 to 286 (256)** (square feet/acre)	142 to 309 (228) (square feet/acre)
Total Tree Density in **Conifer**-dominated Riparian Areas (trees/acre)	Not available at the same DBH cutoff	**61 to 143 (83)** (trees/acre)	60 to 91 (73) (trees/acre)
Conifer QMD: (inches)	Not available	21 to 29 (25) (inches)	**25 to 41 (28)** (inches)
Density of **Large Diameter** (>20" DBH) **Conifers** (trees/acre)	**41 to 99 (78)** (trees/acre)	26 to 50 (36) (trees/acre)	25 to 38 (33) (trees/acre)
Hardwood Basal Area in Hardwood-dominated Riparian Area (square feet/acre)	Not available	62 to 119 (92) (square feet/acre)	**66 to 121 (86)** (square feet/acre)
Total Tree Density in **Hardwood**-dominated Riparian Area (trees/acre)	AIP: Not available at the same DBH cutoff	42 to 111(77) (trees/acre)	**45 to 121 (54)** (trees/acre)
Hardwood QMD: (inches)	Not available	27 to 34 (27) (inches)	**11 to 17 (14)** (inches)
Density of **Large Diameter** (>20" DBH) **Hardwoods**: (trees/acre)	Not available	1 to 15 (8) (trees/acre)	**3 to 21 (13)** (trees/acre)
Total Basal Area in **Mixed** Riparian Forests (square feet/acre)	Not available	Not available	**94 to 253 (153)** (square feet/acre)
Total Tree Density in **Mixed** Riparian Forests (trees/acre)	Not available at the same DBH cutoff	Not available	**47 to 133 (110)** (trees/acre)
QMD in **Mixed** Riparian Forests: Diameter at Breast Height (inches)	Not available	Not available	**16 to 20 (17)** (inches)
Density of **Large Diameter Trees** (>20" DBH) in **Mixed** Riparian Forests: (trees/acre)	Not available	Not available	**11 to 29 (16)** (trees/acre)

Note: **Bold text** represents the proposed range for this HCP.

The Elliott and FIA data sets provide more complete data than the ODFW AIP data set to populate the DFC metrics. Reference values based on the Elliott, however, are vulnerable to small sample size across all stand types. The same is true for hardwood stand types from the FIA data set. At present, the small set of criteria and the lack of comparability limit the usefulness of the ODFW data set. However, the original data collected by the ODFW did have tree size information that would improve the comparability with the Elliott data set. If the ODF were able to procure the original data, the relatively large sample size of the ODFW data would likely provide useful reference values for the full set of DFC metrics.

The one comparable parameter between the three data sets was the number of large trees.[1] Although no formal statistical tests were applied, the ODFW data do appear to come from a population with larger trees than were present on the Elliott and AIP plots. The reason for this difference is not immediately clear. The Elliott and FIA data were selected for stands greater than 80 years old, which represents the management objective of the FMP. While the age of the reference riparian forests from the ODFW AIP is not given, the numbers of large trees is evidence that a large proportion of the reference stands are likely well over 80 years of age. In many cases, they may represent stands that are well beyond the ODF's ability to achieve over the next 50 years.

A comparison of the FIA Douglas-fir plots to McArdle's (McArdle et al. 1949) description of unmanaged upland forests generally supports use of the 14-plot sample as representative of unmanaged Douglas-fir forest in western Oregon. For example, the sample mean QMD was 24.3 inches, versus 24.0 inches for McArdle's (*normal*) unmanaged Douglas-fir forest. The sample mean total basal area was 257 square feet, versus 258 square feet for McArdle (*average*). The sample mean tree density was 98 trees per acre, versus 101 trees per acre for McArdle *normal* (*average* stocking would be expected to be greater than *normal*, and contain more small trees). The sample mean for total conifer basal area is over 96 percent of McArdle *average* (suggesting insignificant difference for this parameter). The sample mean for basal area of conifers 12 inches DBH and larger is over 93 percent of McArdle *average,* again suggesting an insignificant difference. The sample mean density of conifers 12 inches DBH and larger is about 58 percent of McArdle *normal.* No data are available for McArdle *average* for this parameter, but the sample is likely to be slightly below *average* for tree density due to the presence of hardwoods.

While the analyses of three different data sets often resulted in different numeric ranges, for the purposes of this DFC, one range was needed. For conifer stands, a combination of data sets was selected to describe the DFC. Ideally the DFC should be derived from a single data set because stand characteristics are in large part dependent on each other. However, the advantage of mixing the data sets is to attain a set of values that is more environmentally conservative. The FIA data were selected to describe basal area and stand density because of the relatively larger sample size as compared with the Elliott. The lumping methodology for the AIP data prevents use for characterizing basal area and the small DBH cutoff prevents applicability to a stand density DFC. The Elliott data were selected for QMD because the values provide a more environmentally conservative value than the FIA data, and again

[1]It should be noted that the ODFW hardwood/conifer/mixed riparian forest classification is based on tree count, while the Elliott is based on basal area. It is not known how this would influence the reference values.

QMD could not be derived from the AIP data. The AIP data were selected for the numbers of large diameter conifer trees. The AIP data provide the advantage of conservatism and a larger sample size than the Elliott. Additionally, the ODFW large tree data provide consistency with the shade measurements, which are also based on AIP data. However, these advantages come at the cost of inconsistent data sets used for the other riparian metrics (QMD, stand density, and basal area) derived from the AIP and Elliott data sets. Because of this mixing of data sources, more information is needed to increase confidence in the riparian conifer values.

The Elliott hardwood plot data and the FIA red alder samples are both small (five sample plots for the Elliott and four sample plots for FIA) and highly variable. This suggests the use for DFC reference is questionable. However, in general, the results compare well between data sets for basal area and stand density. Results depart in terms of QMD and number of large diameter trees. FIA reports a higher QMD but fewer numbers of large-diameter trees than the Elliott. The selected values were based on the Elliott data because the data were collected from riparian areas. These results will be used to analyze the HCP. However, because of the small sample size, if these results are to be used for other purposes, more information is needed to increase confidence in the values.

The Elliott data are currently the only data available for describing mixed stands. These results will be used to analyze the HCP. Again, because of the small sample size (six sample plots), if these results are to be used for other purposes, more information is needed to increase confidence in the values.

Conifer Riparian Forests

- Basal Area: 203 to 286 square feet per acre (256 square feet per acre)
- Quadratic Mean Diameter: 25 to 41 inches (28 inches)
- Number of Large-Diameter Trees (greater or equal to 20 inches DBH): 41 to 99 trees per acre (78 trees per acre)

Deciduous Riparian Forests

- Basal Area: 66 to 121 square feet per acre (86 square feet per acre)
- Quadratic Mean Diameter: 11 to 17 inches (14 inches)
- Number of Large-Diameter Trees (greater or equal to 20 inch DBH): 3 to 21 trees per acre (13 trees per acre)

Mixed Riparian Forests

- Basal Area: 94 to 253 square feet per acre (153 square feet per acre)
- Quadratic Mean Diameter: 16 to 20 inches (17 inches)
- Number of Large-Diameter Trees (greater or equal to 20 inch DBH): 11 to 29 trees per acre (16 trees per acre)

Stream Shade

Shade DFCs were derived from ODFW AIP data, and represent the 25th to 75th percentile of the distribution and (median) from coastal reference sites.

- Small: 80 to 87 percent (84 percent)
- Medium: 85 to 94percent (88 percent)
- Large: 71 to 93percent (85 percent)

D.4. AQUATIC CONDITIONS

D.4.1. Selected Metrics

- Stream temperature
- Large wood in streams

D.4.2. Rationale

Stream temperature is proposed as an indicator because it is sensitive to management. Temperature also plays a critical role for a variety of fish species, with increases in temperature at certain times of their life cycle causing stress and/or mortality (Beschta et al. 1987). DFCs are presented as thermal ranges that represent reasonably achievable surface water temperatures consistent with historical conditions under occasional disturbances of mature forest conditions. DFC values are based on the same metric used in state water quality numeric criteria (seven-day moving mean of daily maximum) with an approach that is consistent with that used by the Department of Environmental Quality (DEQ) to develop total maximum daily loads (TMDLs). The advantage of this modeling approach over use of the DEQ numeric criteria is it produces a range of conditions that vary with stream and riparian characteristics rather than a relying on a single value applied to all streams.

Large wood in streams provides multiple important biological functions, including cover from predators, gravel retention, pool scouring, and creation of backwater and slow water habitat. Forest management has the potential to indirectly affect large wood loading by reducing recruitment from riparian and upslope areas. Factors influencing wood frequencies include size and topography of upstream drainage basin, valley bottom configuration, floodplain width, substrate composition, and channel sinuosity. The DFCs were derived from ODFW data (Kavanagh et al. 2005) from reference streams in the vicinity of the Elliott (numbers of pieces of wood) and throughout the coast range (numbers of key pieces). The upper and lower ends of the range represent the 25th and 75th percent quartiles observed at reference streams.

D.4.3. Desired Future Conditions

D.4.3.1. Stream Temperature

Reach-specific indicators were developed using a view-to-sky model (WFPB 1997) to predict a likely range in stream temperature. In this model, predicted summer surface water temperatures is a function of channel size (width and depth), elevation, riparian canopy, and closure levels. The model started with current riparian stand and shade conditions, and then grew stands forward to estimate DFCs for temperature. Model reliability declines when streams reach a width of approximately 50 feet and an elevation less than 1,000 feet. This typically will occur at approximately 10 miles from the divide. Streams and associated temperatures along the channel network greater than 10 miles from the divide are larger, low-

gradient, low-elevation channels that become too wide and deep to respond in a typical fashion to riparian shade. Therefore, a distance-to-divide model (Biosystems et al. 2003) was used for streams greater than 10 miles from the divide. Neither model can adequately account for substantial contribution of cool ground water or, conversely, warm runoff from ponded waters. These inputs are site specific and cannot be accounted for in the proposed analyses.

This approach is consistent with that used to develop TMDLs for the region. For TMDLs, the Heat Source model includes such aspects as the natural thermal potential (NTP) of a waterbody based on: 1) channel widths compared to potential vegetation heights and densities, including an allowance for canopy openings due to natural disturbances; 2) effective shade per ecoregion (meaning the potential shade from different vegetation canopy classes that can grow in an area); 3) natural streamflows; and 4) tributary inputs. The NTPs in the Umpqua ranged in classes from less than 16 degrees Celsius (ºC) in headwater areas to well over 25 ºC in low land areas. More than 50 percent of the stream miles assessed in the watershed had NTPs greater than 22 ºC and more than 70 percent had NTPs greater than 19 ºC. The Department of Environmental Quality concluded that there is no thermal assimilative capacity for waste load allocations (temperature heat sources) in sections of the basin where temperatures exceed numeric criterion.

The following model results are the predicted temperatures (25th to 75th quartile [and median]) for the reported elevations (feet above mean sea level). Ranges in water temperatures for the stream network were modeled based on median AIP stream sizes and shade levels.

- **Small (5 to 13 feet): 13.5 to 17.0 ºC**
  - 1,960 feet 13.5 to 14.0 ºC (13.7 ºC)
  - 1,640 feet 14.3 to 14.8 ºC (14.5 ºC)
  - 1,160 feet 15.0 to 15.5 ºC (15.2 ºC)
  - 680 feet 15.8 to 16.3 ºC (16.0 ºC)
  - 200 feet 16.5 to 17.0 ºC (16.7 ºC)
- **Medium (13 to 26 feet): 13.0 to 16.6 ºC**
  - 1,960 feet 13.0 to 13.6 ºC (13.5 ºC)
  - 1,640 feet 13.8 to 14.4 ºC (14.2 ºC)
  - 1,160 feet 14.5 to 15.1 ºC (15.0 ºC)
  - 680 feet 15.3 to 15.9 ºC (15.7 ºC)
  - 200 feet 16.0 to 16.6 ºC (16.6 ºC)
- **Large (26 to 103 feet.): 13.1 to 17.7 ºC**
  - 1,960 feet 13.1 to 14.7 ºC (13.8 ºC)
  - 1,640 feet 13.8 to 15.5 ºC (14.5 ºC)
  - 1,160 feet 14.6 to 16.2 ºC (15.3 ºC)
  - 680 feet 15.3 to 17.0 ºC (16.0 ºC)
  - 200 feet 16.1 to 17.7 ºC (16.8 ºC)

Anticipated water temperatures for streams more than 10 miles from the topographic divide were based on a multiple linear regression equation derived for the Millacoma River (BioSystems et al. 2003). For these purposes, shade was based on the ODFW AIP data. Stream temperature is a function of distance and shade:

*Temperature (°F) = 81.0 + 3.17 * ln (Distance) - 0.243 * shade;*
(adjusted square multiple R = 0.89)

At a distance of 30 to 40 miles from the divide, channels become too wide for complete shading and too deep for rapid daily responses of stream temperatures to solar radiation (Sullivan et al. 1990). Therefore, farther downstream from this point, water temperatures tend toward ambient air temperatures. Results of the linear regression combined with the very large stream response beyond 40 miles from the divide are presented in Table D-5.

Table D-5
Regression Results as a Function of Distance from the Divide with 100% Shade Levels

Distance (miles)	Natural Log of Distance ln (Distance)	Maximum Shade (%)	Moving Mean of Daily Maximum Stream Temperature Regression Results	
			Fahrenheit (°F)	Celsius (°C)
3.8	1.33500107	100	61	16.0
8.9	2.18605128	100	64	17.5
10	2.30258509	100	64	17.8
11.8	2.46809953	100	65	18.0
20	2.99573227	100	66	19.0
30	3.40119738	100	67	19.7
36.8	3.60549785	100	68	20.0
40	3.68887945	100	68	20.2
50	3.91202301	100	69	Ambient
75	4.31748811	100	70	Ambient
100	4.60517019	100	71	Ambient

D.4.3.2. Large Wood

Large wood DFCs were derived from ODFW AIP data and represent the 25th to 75th percentile of the distribution (and median) from coastal reference sites.

Total pieces per reach length (diameter is greater than 6 inches and length is 6 feet or longer):

- Small: 13.8 to 28.7 pieces per 100 meters (19.1 pieces per 100 meters)
- Medium: 11.5 to 30.7 pieces per 100 meters (16.2 pieces per 100 meters)
- Large: 8.2 to 26.6 pieces per 100 meters (15.7 pieces per 100 meters)

Number of key pieces per reach length (key piece is 24 inches in diameter or larger and 50 feet in length or longer):

- Small: 0.9 to 4.3 key pieces per 100 meters (2.3 pieces per 100 meters)
- Medium 0.9 to 3.3 key pieces per 100 meters (2.3 pieces per 100 meters)
- Large 0.5 to 2.1 key pieces per 100 meters (1.3 pieces per 100 meters)

D.5. WATERSHED CONDITION

D.5.1. Selected Metrics

- Hydrologic connectivity to streams
- Roads within 100 feet of streams
- Riparian forest structure
- Large wood recruitment

D.5.2. Rationale

Road management is an important component of the Elliott State Forests upland strategies for minimizing management effects on aquatic and riparian areas. Road-associated changes in sediment delivery have no correlation to a natural process; therefore, sediment from roads represents an increase over background conditions. Excessive fine sediment deposited in stream channels can cause decreased survival of salmonid eggs and alevin by reducing water flow through streambed gravel, thereby suffocating the eggs or preventing the eggs from hatching. Massive increases in fine sediment delivery and channel deposition can reduce pool frequency, depth, and volume. This issue has been investigated through a number of research and monitoring studies. Research has shown that newly constructed or reconstructed roads may have ten times more surface erosion during the first winter than during subsequent years after construction (Luce and Black 1999). Most fine sediment from surface erosion processes is relatively chronic. Road use during wet periods can greatly increase turbidity (Bilby et al. 1989; Reid and Dunne 1984). Research and monitoring has shown that, among other factors, road location and drainage practices can influence sediment delivery to streams (Bilby et al. 1989; Bilby 1985a; Sullivan 1985; Dent et al. 2003).

Hydrologic connectivity to streams is an accepted measure of potential impacts of roads on stream systems in western North America (Forman et al. 2003; Bilby et al. 1989; Dent et al. 2003; Reid and Dunne 1984; Wemple et al. 1997). Hydrologic connection exists when water is intercepted by the road prism and routed directly to streams, rather than to an area where drainage waters will re-infiltrate into soils. A lower value represents better conditions. Undisturbed forest soils in many areas (including most of Oregon) are extremely porous (high infiltration rates), and design standards have changed to direct as much drainage onto these porous soils and away from direct entry to streams as possible. Hydrologic connection may be by ditch, gully, or overland flow; values of 57 percent to as high as 75 percent have been reported in older studies (Reid and Dunne 1984; Wemple et al. 1997). More recently, designed or improved roads have a hydrologic connectivity between 15 and 34 percent (Weaver and Hagens 1994; Bilby et al. 1989). Without hydrologic connectivity, eroded sediment carried in drainage water cannot flow to streams.

Riparian areas are considered conservation areas under the Elliott HCP. They function to protect streams by filtering sediment, providing terrestrial food sources, cover, shade, and large wood. Riparian areas will be managed or left unharvested to achieve these functional goals. While riparian areas are managed to meet mature forest conditions, they are subject to

natural disturbances such as floods, landslides, debris flows, wind storms, insect attacks, disease, and fires. As a result, riparian structure will vary throughout the Elliott State Forest, and can be classified in the same structural categories used to define upland. Early, intermediate, and advanced forest structure for upland stands are described in detail in Chapter 5 (section 5.2.1). While riparian forest conditions may differ from upland stands, the structural type descriptions are applicable to riparian DFCs regarding development of species diversity, canopy layers, snags, and downed wood. Of the three structural types, advanced structure provides the greatest diversity. In forests with advanced structure, the understory develops (understory reinitiation) when enough light and nutrients become available to allow herbs, shrubs, and tree regeneration to grow and develop in the understory. The new understory may grow very slowly at higher stand densities. The vertical structure of advanced structure stands is more developed than that of intermediate structure stands in the understory reinitiation stage. Tree crowns show significant layering from the tallest trees to the forest floor. Shrub and herb layers are diverse, in terms of species and vertical arrangement. A mixture of shade-tolerant (e.g., western red cedar, western hemlock, bigleaf maple) and shade-intolerant tree species (e.g., Douglas-fir); and shrub and herb species (vine maple, huckleberry, salmon berry, and sword fern) may be present. The plant community provides a wide range of habitat niches from the forest floor through the canopy, including snags and downed wood.

Riparian and landslide-prone areas are important sources of large wood recruitment to streams. Research has established that 70 to 100 percent of large wood in the near stream zone is recruited from within 100 feet of the stream (Van Sickle and Gregory 1990; McDade et al. 1990; Bilby and Bisson 1998). More recently, research has established that small streams can be important sources of large wood to larger downstream reaches. When a landslide and subsequent debris-flows occur, it can travel through a small stream, eventually stopping and depositing large wood and gravel along lower gradient, larger stream reaches, or at junctions between small and larger streams. In this way, small streams can provide a linkage between landslides and channel conditions.

D.5.3. Desired Future Conditions

D.5.3.1. Roads

The literature establishes that proper implementation of best management practices for roads can reduce the negative effects of roads on water quality. However, for the selected metrics, a threshold value has not been reported. Therefore, the following values reflect a policy decision based on what has been demonstrated in the literature:

- Road hydrologic connectivity to streams
  - 20 percent or less of road connected to streams
  - less than 0.5 percent of watershed area with roads connected to streams
- Roads parallel and within 100 feet of streams:
  - no net increase in roads adjacent to streams
  - less than 5 percent of the road length

D.5.3.2. Riparian Structure

Several studies have typified riparian structure in Oregon coast range watersheds as "patchy" or "heterogeneous" at multiple scales owing to both regional and site specific gradients (Hibbs and Giordano 1996, Pabst and Spies 1998, Pabst and Spies 1999, Minore and Weatherly 1994, Nierenburg and Hibbs 2000). These findings are common to studies of both managed or unmanged riparian forests as well as a study that evaluated riparian vegetation succession on a debris flow deposit (Pabst and Spies 2001).

At the basin scale riparian structure can vary with stream order, valley floor width and proximity to the ocean (Pabst and Spies 1999). At the site scale multiple factors dictate the vegetative community including distance from stream, stream gradient, elevation above the stream, time since disturbance, soil moisture, and landform.

In a study of unmanaged riparian forests, Past and Spies (1998) conclude that while riparian structure is highly variable it is ordered along a gradient from streamside to hillslope. They propose that riparian plant communities are a function of (1) hillslope processes and associated moisture gradients, (2) hydrologic disturbance, (3) species tolerance of saturated valley floor soils, (4) shade tolerance, and (5) mineral soil disturbance.

Hardwoods, shrubs and treeless areas are major components in unmanaged riparian forest structures. Red alder tends to dominate the lower elevation 3rd and 4th order streams where shrub competition can be severe, while conifers are more common in 1st order, constrained, high gradient streams with steep valley walls (Minore and Weatherly 1994, Pabst and Spies 1999). In a study focused on unmanaged riparian areas Nierenburg and Hibbs (2000) report 24 to 52 percent of plots as lacking trees completely with sites closer to the stream more commonly lacking trees than those farther from the stream.

Disturbances associated with floods and debris flows are common disturbance agents in coastal watersheds and affect riparian plant communities through scour and deposition that both damages riparian forests as well as creates openings and seedbeds for regeneration. Such disturbances can also transport seed and rhizomes to downstream locations. Pabst and Spies (2001) studied vegetation succession on a debris flow deposit in the central Oregon coast range and identified five "floristically distinct" areas along the deposit (about 120 meters in length by 10 to 20 meters wide). Within ten years red alder and salmonberry dominated plant communities on the deposit.

These studies clearly establish that riparian structure varies at both the watershed and site scales due to hydrologic and geomorphic processes, climatic constraints and plant community interactions. The research describes factors at the watershed and site scales that may control riparian structure and composition and help explain observed range of conditions. Less clear is the relative percent of riparian areas that can be expected to be in a given stand structure and how that could vary over time. Benda (1990) estimates that 13 to 25 percent of forests in the Oregon Coast range were in early successional stages. Although not riparian specific, Benda and Dunne (1997) modeled forest structural conditions that vary over time and space as a result of long-term forest disturbance regimes such as landslides, windthrow, disease, and fire. In the Upper Nehalem Watershed Analysis (R2 Resource Consultants 2005) the Benda and Dunne model was used to predict forest structural distribution on average over thousands of years. For that watershed, approximately 16

percent of the area was estimated to have forests less than 50 years old, 30 percent would have forests less than 100 years old, and 50 percent of the area would have forests greater than 250 years old. Another study of upland forests suggest that the percentages of older stand types ranged from 30 to 70 percent of the landscape for any point in time (Teensma et al. 1991). At smaller scales the variability could have been even greater ranging from 15 to 85 percent (Wimberly et al. 2000)

There is common agreement in the literature that unmanaged riparian structure is expected to vary at large and small spatial and temporal scales. However, an expected relative range in structural types (i.e. early, intermediate, advanced) specific to riparian areas has had limited attention. Therefore a policy decision was used to describe DFCs for riparian structure. Given HCP goals to manage for mature forest condition, it is likely that a greater percent of riparian areas will be in older forest structure than might otherwise be expected. This will likely be balanced by environmental gradients, geomorphic, and fluvial disturbances that dictate riparian succession effectively limiting potential to achieve advanced structure. The following DFC values are informed by the research and attempt to reflect this balance between advanced structure goals and riparian ecology:

- Early Structure: 5 to 15 percent
- Intermediate Structure: 15 to 45 percent
- Advanced Structure: 45 to 70 percent

D.5.3.3. Large Wood Recruitment

Large wood is recruited to streams sources from both the nearstream area and from upslope sources. The area within 100 feet of a stream is likely to capture 70 to 100 percent of the nearstream source. However, for any given reach, the proportion of large wood recruitment from upslope areas is highly variable, and in part depends on stream order. The potential for small-stream wood delivery to downstream reaches is dependent on many factors, including the likelihood of a debris flow occurring, channel gradient, and junction angle where the small stream joins the larger stream. Given the range of stream and hillslope conditions, the importance of wood recruitment from steep slopes and debris flows varies for larger fish-bearing streams. Reported ranges vary from ten to 72 percent in the Oregon Coast Range (Reeves et al 2003; Benda and Sias 1998; Benda et al. 2003; May and Gresswell 2003). Because of the variability associated with large wood recruitment, the DFC regarding large wood recruitment from nearstream and upslope sources reflects a policy decision:

- 70 to 100 percent of the natural disturbance regime's large wood recruitment from all sources (nearstream and upslope sources).

Appendix E
Habitat Conservation Plan Requirements and Guidelines

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E.1. INCIDENTAL TAKE PERMIT PROCESS

The Incidental Take Permit (ITP) process has three phases, which are described briefly below.

E.1.1. Application Phase

The U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration Fisheries Service ((NMFS) works with the applicant while the application is being developed, providing advice on minimizing and mitigating the effects of proposed activities as well as other aspects of the Habitat Conservation Plan (HCP). This phase ends when the applicant sends a complete application package to the appropriate USFWS and NMFS Regional Offices.

An application for a Section 10(a) permit must be submitted on an official form (Form 3-200) and be accompanied by the following attachments:

- A complete description of the activity for which the ITP is being sought.
- The common and scientific names of the species to be covered by the ITP.
- An HCP that specifies:
  - The impact that will likely result from the proposed taking of the species;
  - Steps the applicant will take to monitor, minimize, and mitigate such impacts;
  - The level and source of funding available to implement such steps;
  - Procedures that will be used to deal with unforeseen circumstances;
  - The names of the responsible party or parties;
  - Alternatives to the taking and the reasons why they were not pursued; and
  - Other measures required by the USFWS and the National Marine Fisheries Service (NMFS) as necessary or appropriate;
- A signed Implementing Agreement to legally bind the state and the federal agencies to their respective obligations under the HCP.

The HCP is accompanied by a National Environmental Policy Act (NEPA) document—an Environmental Impact Statement (EIS)—which informs the public of the environmental analysis completed in developing the HCP. Using the analysis in the EIS, the USFWS and NMFS will determine if issuance of the ITP would result in significant effects to the human environment. The agency's findings will be issued in a Record of Decision.

E.1.2. Permit Application Processing Phase

The USFWS and NMFS Regional Offices review the application package for biological and statutory completeness. It is then announced in the Federal Register that the ITP application was received and that the EIS is available for public review and comment. There is also a consultation process under Section 7 of the Endangered Species Act (ESA). Once the

documents are found to be complete and public comments are addressed, the USFWS and NMFS determine if the application meets ITP issuance criteria, and if so, issues the ITP.

E.1.2.1. Issuance Criteria for an ITP

The application must meet the following issuance criteria for the ITP to be granted:

- The taking will be incidental.
- The ITP applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
- The applicant will ensure that adequate funding for the HCP and procedures to deal with unforeseen circumstances will be provided.
- The taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild.
- The applicant will ensure that other measures that the USFWS may require as being necessary or appropriate will be provided.
- The USFWS has received such other assurances as may be required that the HCP will be implemented.

E.1.3. Post-Issuance Phase

The USFWS and NMFS may publish notice of the ITP issuance in the Federal Register, although this is not required by the ESA. The post-issuance phase also includes monitoring of the permittee's compliance with the HCP and monitoring of the HCP's effects.

E.2. GUIDELINES FOR HABITAT CONSERVATION PLANS

The USFWS and NMFS requirements for a HCP are summarized below. The sections in the HCP are not required to appear in the same sequence as listed below.

Impacts likely to result from the proposed taking of one or more federally listed wildlife species

The following four tasks must be completed to determine the impacts:

- Delineate the boundaries of the HCP area.
- Collect and synthesize the biological data for all species covered by the HCP.
- Identify the proposed activities that are likely to result in incidental take.
- Quantify anticipated take levels.

The impact assessment must also meet the requirements of NEPA and the ESA (Section 7).

Measures the applicant will undertake to monitor, minimize, and mitigate such impacts; the funding that will be made available to undertake such measures; and the procedures to deal with unforeseen circumstances

HCP mitigation programs are extremely varied. Section 10(a) of the ESA requires that ITP issuance does not "appreciably reduce the likelihood of the survival and recovery of the species in the wild." The ESA does not require that HCPs result in the recovery of species covered under such plans. In fact, such a standard would be nearly impossible to meet. Most landowners manage only small percentages of a species' total range or population. Much of the threat to a species is therefore beyond the control or influence of management actions undertaken on any given ownership.

Congressional intent and related agency policy do, however, indicate that, as a condition of ITP issuance, each HCP must contain measures and result in impacts that are consistent with the long-term survival of covered species. Long-term survival is defined not as mere persistence, but as the maintenance of genetically and demographically healthy, viable, well-distributed populations throughout the range of a species.

The specific measures and permissible impacts that can accommodate this will vary by species, location, and time, according to the status and needs of the species, as well as the type of management being proposed. In some cases, reductions in baseline conditions will be consistent with long-term survival. In other cases, maintenance or even enhancement of baseline conditions may be necessary.

The Section 10(a) regulations require that a HCP describe the specific monitoring measures the applicant will carry out during the proposed activities.

The applicant and the USFWS and NMFS must agree on procedures to deal with unforeseen circumstances.

Alternative actions the applicant considered that would not result in take, and the reasons why such alternatives are not being utilized

This section of the HCP should include at least two alternatives: a no-take alternative and a no-action alternative (no activities would be carried out).

Economic considerations may be cited as a reason for rejecting project alternatives.

Additional measures the USFWS and NMFS may require as necessary or appropriate for purposes of the plan

The most significant additional measure required by the USFWS and NMFS is the Implementing Agreement, which is a legal contract that identifies the responsibilities of all HCP participants, legally binds the parties to their obligations, and is signed by all parties with HCP responsibilities or statutory authority over the HCP program.

Appendix F
Final Report: Northern Spotted Owl Surveys Elliott State Forest 2003

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F.1. INTRODUCTION

The Oregon Department of Forestry (ODF) manages approximately 800,000 acres of state forestlands within the physiographic range of the northern spotted owl. This includes the 93,500-acre Elliott State Forest in the west Coast Range of Douglas and Coos counties, Oregon.

In 1990, ODF personnel began conducting northern spotted owl surveys on some state lands, including the Elliott State Forest. In 1991, Oregon Department of Fish and Wildlife (ODFW) crews surveyed a larger portion of state lands. In 1992, the Oregon Cooperative Fish and Wildlife Research Unit (OCFWRU) of Oregon State University began conducting northern spotted owl surveys on state lands throughout western Oregon. These survey efforts included density study areas on the Elliott State Forest and in the Astoria District, demographic study areas on the Elliott State Forest and on the North Coast, and timber sale surveys. OCFWRU crews completely surveyed the Elliott State Forest for northern spotted owls from 1992 through 1996. In 1997 and 1998, only known sites were surveyed. Telemetry data were also collected at a number of northern spotted owl sites on the Elliott State Forest in 1997 and 1998 to assess home range and habitat use.

In 1995, the ODF obtained approval from the U. S. Fish and Wildlife Service (USFWS) to implement a Habitat Conservation Plan (HCP) for the northern spotted owl on the Elliott State Forest. As part of the HCP monitoring, a density survey of northern spotted owls was conducted on the Elliott State Forest in 2003. A density survey involves surveying all potential habitat within the study area. These survey results are used to estimate the density of northern spotted owl activity centers on the Elliott State Forest and to provide site occupancy and reproductive information. 1996 marked the last year in which a complete density survey for northern spotted owls was conducted on the Elliott State Forest. Density estimates were also made for 1997 and 1998 when only known sites were surveyed.

F.2. ACKNOWLEDGEMENTS

Kingfisher would like to thank Randy Smith, who served as the ODF contract administrator for this project, and Marcia Humes and Rosemary Mannix for administrative support. We also thank Mike Wilson at the Salem office for his help throughout the season. We appreciate the assistance of everyone at the Coos Bay District office. We also thank Stuart Love of the ODFW, and Greg Kreimeyer and Norma Kline of the ODF for their assistance in designating northern spotted owl activity centers.

F.3. SURVEY AREA

The 2003 density survey area was located in the Oregon Coast Range near Reedsport and Coos Bay, and included the 378-square kilometer Elliott State Forest, plus a small area of Coos Bay Bureau of Land Management (BLM) land adjacent to northeast Elliott State Forest (43° 24'- 43° 42' N, 123° 50'- 124° 05' E). Most of the survey area was in the western hemlock (*Tsuga heterophylla*) vegetation zone. The Sitka spruce (*Picea sitchensis*) zone is represented on the western edge of the survey area. The forest is dominated by conifers, primarily Douglas-fir (*Pseudotsuga menziesii*), western hemlock, and western red cedar (*Thuja plicata*) (Franklin and Dyrness 1988). Red alder (*Alnus rubra*) often pioneers on disturbed sites or is associated with bigleaf maple (*Acer macrophyllum*), and Oregon-myrtle (*Umbellularia californica*) is well distributed throughout the forest.

In 1868, the Coos Bay Fire burned about 90 percent of the Elliott State Forest; thus, most of the forest is less than 140 years old. As of 1995, approximately ten percent of the forest was clearcuts and saplings, 53 percent was early-successional forest (pole-aged, younger mixed age, or alder-dominated), and 33 percent was late-successional forest (mature or old forest) (OCFWRU 2000). The topography is very steep with narrow ridges and deeply incised drainages; the elevation ranges from approximately 100 to 800 meters above mean sea level. The climate is maritime with mild, wet, and cloudy winters, and dry summers. Annual precipitation typically ranges from 1,700 to 3,000 millimeters (Franklin and Dyrness 1988).

F.4. METHODS

All potential northern spotted owl habitat (forest with trees 11 inches diameter breast height [DBH] or larger) on the Elliott State Forest was surveyed using the six-visits, one-year survey method, in accordance with the 1992 Revised Version of "Protocol For Surveying Proposed Management Activities That May Impact Northern Spotted Owls," endorsed by the USFWS. Surveys were conducted from March 15, 2003 to August 31, 2003. Survey visits were conducted at night to determine initial occupancy. Day visits were conducted to determine site status and reproductive success.

The crude density estimate of northern spotted owl activity centers is based on the combined number of pair and resident-single sites divided by the size of the survey area, i.e., 378 square kilometers. From 1992 through 1996, crude density estimates for the Elliott State Forest were calculated based on demographic survey protocol (Miller et al. 1990). In 2003, northern spotted owl surveys on the Elliott State Forest were conducted following the six-visit methodology outlined in the protocol for surveying proposed management activities. This protocol is less rigorous, in terms of survey effort to determine reproductive success, than survey protocol for demographic studies. However, the protocol for management activities does provide the necessary information for determining the number of individual northern spotted owls and activity centers present over a given area. The difference in protocols does not affect the overall density estimate, and how density was calculated in 2003 is comparable to how it was calculated for data collected on the Elliott State Forest from 1992 through 1996, when the entire forest was surveyed for northern spotted owls.

An activity center meeting was held on September 16, 2003 at the Western Lane District office in Veneta, Oregon, where representatives from ODF and ODFW determined the status of each northern spotted owl detected and the location of its respective activity center. Kingfisher facilitated these meetings and provided technical information and input to the process. Activity center locations are typically designated in accordance with the "Guidelines for Identifying and Designating Northern Spotted Owl Activity Centers," recommended by the ODFW on June 29, 1992 and amended October 1, 1994.

F.5. PERSONNEL

All Kingfisher personnel went through intensive class work and field training prior to the survey season. To prepare surveyors for fieldwork, survey protocol and northern spotted owl biology and ecology were thoroughly covered. Kingfisher also provided information about other northern spotted owl species and safety and emergency procedures, and conducted map and compass orienteering in the field.

Amy Ellingson served as Project Manager, and John Perkins served as Field Coordinator for this project. John Perkins, Tim Grubert, and Robert Potts conducted all station setups, surveys, and follow-up visits. The primary district representative for the ODF was Randy Smith, Southern Oregon Area Wildlife Biologist, and the primary contact at the Salem office was Mike Wilson, Staff Biological Specialist.

F.6. RESULTS

F.6.1. Surveys

In 2003, Kingfisher surveyed all potential habitat on the Elliott State Forest for northern spotted owls using the six-visit, one-year survey method. A total of 47 northern spotted owl sites (including prior non-territorial response locations and historic status sites) on the Elliott State Forest were surveyed using protocol for management activities.

Based on the survey protocol for management activities, there were 12 active pair sites, including the new West Glenn Creek site, and 1 resident-single site, for a total of 13 activity centers (active pair and resident-single sites combined). Based on the more rigorous protocol for demographic studies, there were ten active pair sites and three resident-single sites (two with pair status unknown) for a total of 13 activity centers.

There were no known nesting attempts at any of the known northern spotted owl sites on the Elliott State Forest in 2003. The Fourmile pair reportedly attempted to nest on private land close to the Elliott State Forest, but failed.

Non-territorial single ("floater") northern spotted owls were detected at four sites, including Palouse Creek, Luder Creek, East Hakki Ridge, and Shake Creek. A female northern spotted owl was detected on nearby Coos Bay BLM lands (Upper Sock Creek); however, stations in that area were dropped in early May, because it was not actually intended to be part of the density survey. That response received a Status Unknown designation. Biologists observed the uncommon appearance of an additional male at the Wind Creek pair site in early May.

The Bickford Creek site, on adjacent private property, was downgraded from pair to historic status, for the following reasons: the historic male was found dead in 1998; there was only one male night response during surveys conducted by consultants from 1999 through 2001; and the core area has since been clearcut. Panther Creek received resident-single status, because a male was detected at that site on three occasions. Regardless of survey results for this year, all other sites retain their previous status per the management protocol, because no northern spotted owl surveys have been conducted on the Elliott State Forest since 1998.

Barred owls (*Strix varia*) were detected at eight northern spotted owl sites, including Alder Creek, Benson Creek, Bickford Creek, Johnson Creek, Murphy Creek, Roberts Creek, Tom Fool Creek, and Upper Mill Creek. Bickford Creek and Murphy Creek northern spotted owls sites were not active in 2003.

F.6.2. Density Estimates

Part of the monitoring component of the HCP is to estimate the density of northern spotted owls and northern spotted owl activity centers on the Elliott State Forest. Crude density is the number of northern spotted owls or activity centers divided by the size of survey area, i.e., 378 square kilometers. Based on demographic protocol, there were ten pair sites, two resident-single sites with pair status unknown, and one resident-single site, for a total of 25

northern spotted owls and 13 activity centers in 2003. As with past estimates, the Fourmile northern spotted owl site on nearby private land was included in the 2003 density estimates for the Elliott State Forest (see Table F-1).

Table F-1
Number of Northern Spotted Owls and Northern Spotted Owl Activity Centers Observed, and the Crude Density of Northern Spotted Owls and Activity Centers, Elliott State Forest (378 square kilometers), 1991–1998, 2003

Year	Number Observed[a]		Density (per square kilometer)[b]	
	Activity Centers	Northern Spotted Owls	Activity Centers	Northern Spotted Owls
1991	25	51	0.066	0.135
1992	22	44	0.058	0.116
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] 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

F.7. NORTHERN SPOTTED OWL SITES

The updated survey results for each known northern spotted owl site on the Elliott State Forest through 2003 are discussed in this section. Tables F-2, F-3, and F-4 (in Section F.8) summarize the survey results and present the status of the northern spotted owl sites investigated.

Please note that northern spotted owl sites are separated into two categories. The first group includes all sites that are currently occupied by resident northern spotted owls or that had resident northern spotted owls at one time (as defined by the management protocol). This includes pairs; resident singles; two birds, pair status unknown (with at least one bird meeting resident single status); and historical sites. The second group includes response areas where the residency criteria of the management protocol were never met. These include non-territorial singles and status unknown.

F.7.1. Pairs, Resident Singles, and Historic

Alder Creek 2924 (Pair)

This pair site was established in 1991. The female (green-right) that nested and was banded at the Noble Creek site in 1991 moved to Alder Creek in 1992. In 1992, the non-nesting pair was found farther to the north, and the activity center was moved. The male was banded (orange-left) in 1992. This pair produced two young in 1993, both of which were banded. The nest tree was not located, and the activity center location was moved to the earliest juvenile location. The pair did not nest in 1994. The pair produced one young in 1995, which was banded. The activity center was moved to the nest tree location 0.4 mile to the northwest. The 1996 season resulted in two male responses at night during nine visits. There were no responses in 1997 or 1998, and the site retained pair status with two years of vacancy. In 2003, there was one nighttime pair response and several individual male and female responses, and the female took one mouse from the road at nighttime. No bands were read, and nesting status was unknown. Barred owls were detected near this site.

Benson Creek 2929 (Pair)

This pair site was established in 1991. In 1992, the pair was found nesting just outside state land on Sun Studs property. The pair produced at least one young. Both adults and one juvenile were banded in 1992 (female, yellow-right; male, white-left). In 1993, only the historic male was found. Pair status and activity center were unchanged. The historic male was found in 1994 paired with a new female, which was banded as a juvenile in the Coos Bay BLM district (re-banded, black-left). The pair did not nest and the activity center was not changed. In 1995, the female was found once during the day. The historic male was found during the day in June and then found dead in July during a day visit. A new male was found near this activity center a week after the historic male was found dead. This new male had been re-banded (black with orange tab-left) at the Upper Palouse Creek site in 1993. In August, he was seen again in the same vicinity. Nesting status was unknown, and the pair status and activity center remained the same. In 1996, the pair was confirmed and observed

to be non-nesting. The activity center was moved to the northeast to more accurately reflect habitat usage. In 1997, a new male (yellow/black/yellow with blue tab-right) was paired with the historic female. He was banded at the Roberts Creek site in 1996 as a juvenile. They did not nest. The pair occupied this site in 1998 but did not nest. Site and location status did not change. In early June 2003, the historic female ate all four mice offered her. There was one nighttime pair response, and the unidentified male took three mice that night. On another night, the female took two more mice. Both sexes were twice heard on other nights. Nesting status was unknown, but observations suggest the pair was not nesting.

Bickford Creek 2932 (Historic)

This pair site was located in 1991, and the male was banded (orange-left). Early visits to the site produced no responses in 1992. Further survey responsibility for this site was then given to Beak Consultants surveyors, because they were surveying adjacent Weyerhaeuser land. Beak Consultants surveyors heard a pair and juveniles at night. The OCFWRU crew visited the site with Beak Consultants surveyors and banded the female (green-right) and two juveniles. They also confirmed the presence of the 1991 male. In 1993, only the historic male was found near the activity center. In 1994, the pair fledged one young, which was banded. In 1995, the same pair was found, but they did not nest. In 1996, the same pair attempted to nest in the same tree as 1994 but failed. Only the male was found at this site in 1997, when a radio transmitter was attached to him. In 1998, the male occupied the site until August, when his carcass and transmitter were found in Surprise Creek. Pair status and activity center location remained the same. The landowner contracted Mason, Bruce, and Girard, Inc. to conduct surveys from 1999 through 2001. A single nighttime male response was heard in 2001. In 2003, no northern spotted owls were detected at this site. Site status has been downgraded to historic, because there was only one northern spotted owl response after three years of surveys (1999 to 2001), and the Bickford Creek activity center on private land has recently been clearcut. A male barred owl was detected in the area on several visits.

Big Creek 2923 (Historic)

A pair was found at this site in 1991. The 1992 survey was incomplete, because surveyors did not survey land owned by International Paper. One pair and two male responses on International Paper land were heard from state land on separate nights, and a female was heard near the 1991 activity center. It is likely that the northern spotted owls used both ODF and International Paper lands. The 1992 activity center was closer to International Paper land, but still on state land. The data likely did not reflect the true activity center because of the incomplete survey. No northern spotted owls were banded at the Big Creek site, and pair status remained for 1992. In 1993, OCFWRU surveyors heard a male on two separate nights, and Beak Consultants surveyors heard a male at night and once on a day follow-up visit. The 1993 data did not produce evidence for either an activity center or status change. There were no responses in 1994, and the status and activity center location remained the same. In 1995, there was a male response at night, northeast of the activity center. However, the response was attributed to the Noble Creek site due to northern spotted owl behavior. No responses were detected at this site in 1996, so the site received historic status after three years of vacancy. There were no responses in 1997, 1998, or 2003.

Charlotte Creek 2917 (Historic)

In 1991, there was a resident single female at this site. There were two female responses near the site in 1992. Resident single female status remained for 1992. In 1993, a pair was heard at night early in the season and a sub-adult male was found during the day. On subsequent and separate night visits, one unknown, one male, and two female responses were detected. A pair was found at this site at the end of the season. The female was banded (red-right). The site received pair status in 1993, and the activity center location remained the same. Early in the 1994 survey season, a sub-adult male was found at this site during the day, and the 1993 female was found here once late in the season. The male that was re-banded (orange with blue tab-right) at the Luder Creek site earlier that year was also found at this site in mid-season. There were numerous male and female responses at night. Site status and activity center location remained the same. In 1995, the male re-banded at the Luder Creek site in 1994 was paired at this site with the female banded in 1993. They did not nest, and site status remained the same. Daytime locations were centered about 1.25 miles northeast of the activity center, but it did not change. There were no responses in 1996, 1997, or 1998, and pair status changed to historic after three years of vacancy. There were no responses at this site in 2003.

Dean Creek 2916 (Pair)

A male was heard in this area in 1987. The site was first established in 1990 with a pair that nested. In 1991, a non-nesting pair occupied the site. The male was banded (black-right). In 1992, the pair nested in the same general area as in 1990, and the female (green-left) and two juveniles were banded. In 1993, the pair was found near the historic activity center. The first day visit identified a nesting attempt in a different tree than in previous years. Subsequent visits indicated that the nest had failed. In 1994, the same pair fledged two young. Return visits to band the juveniles were unsuccessful, and it is thought that both may have died. The pair did not nest in 1995. In 1996, the pair attempted to nest, but failed. In 1997, the pair was observed once attempting to nest, but subsequent visits yielded non-nesting behavior. In 1998, the female was detected multiple times, but there was only one response at night from a male. The pair did not nest. Site status and activity center location remained unchanged. A pair occupied this site in 2003, but biologists were not able to find the pair during the day to determine reproduction.

Deer Creek 4170 (Historic)

In 1991, there was one response from a single male in this area; its status was designated as “other single” and it was named Upper Charlotte Creek. In 1992, there was one male response, but follow-ups and additional night calling detected no response. The site was classified as status unknown. In 1993, this site was renamed Deer Creek and given pair status after an ODFW murrelet surveyor heard a pair response and a response from a single male on separate nights. OCFWRU surveyors did not detect any northern spotted owls during six night surveys and two daytime follow-up visits to the site. There were no responses in 1994, 1995, or 1996. Site status was changed to historic after three years of vacancy. The site was not surveyed in 1997 or 1998. There were no responses in 2003.

East Hakki Ridge 2914 (Historic)

This site was classified as a resident single in 1991 when a male was banded (blue-right). In 1992, the bird banded in 1991 was found paired with the female at the Fish Creek site, so the resident status was dropped and East Hakki Ridge was considered a historic site. No responses were heard in 1993 or 1994. In 1995, one male response was heard at night early in the season on private land, but inability to contact the landowner resulted in no follow-up. This northern spotted owl was considered a non-territorial single. No responses were detected in 1996. The site was not surveyed in 1997 or 1998. In early April 2003, a northern spotted owl of unknown sex was heard near the 1991 response site. A single male hoot was heard in the area on the daytime follow-up visit, but biologists were unable to visually locate the bird. No other responses were detected at this site in 2003.

Fish Creek 2926 (Historic)

This pair site was discovered early in the 1992 field season. In 1991, a single female response was heard from nearby Fish Ridge. This response was combined with the Fish Creek site for 1992. The female was banded in 1992, and the male had been banded in 1991 at the East Hakki Ridge site, a movement of eight miles (female, yellow-right; male, blue-right). The pair did not nest in 1992. In 1993, this male moved an additional three miles to the Middle Mill Creek site during the middle of the summer. The original female remained in the Fish Creek site, and the activity center did not change. In 1994, the male returned to Fish Creek and was paired with a female. Surveyors were unable to see the female's band, but her behavior was indicative of the historic female. In both 1993 and 1994, the same pair was consistently found to the east of the activity center. The activity center was, therefore, moved to that location. There were no responses in 1995, 1996, 1997, or 1998. Site status changed to historic in 1997 after three years of vacancy. There were no responses at this site in 2003.

Fourmile Creek 3977 (Pair)

This site was established in 1994 when a male (white-right) northern spotted owl and a female barred owl were found. The male was banded, and the site was designated “two birds, status unknown” for 1994. In 1995, Beak Consultants surveyors monitored the site and detected three male responses at night, two of which were on the same night. The male banded at this site in 1994 was found at the Hodges Creek site in 1995, 1.25 miles to the southeast, and it was thought that these three responses may be from that same northern spotted owl. In 1996, Beak Consultants surveyors monitored the site and detected two male responses at night. A male was seen on a day visit, but the bands were not read. However, it is likely that this was the male re-banded on May 20 at Marlow Creek. It was decided at the activity center meeting that these responses should be attributed to the Lockhart Road site. Beak Consultants again monitored the site in 1997 with no responses. Surveyors found a pair at this site in 1998. As a result, the site received pair status in 1998. The activity center location did not change. A pair was present at this site in 1999, but there were no responses in 2000 or 2001. The pair nested at this site in 2002 and fledged one young. In 2003, Environmental Services Northwest, Inc. and Pacific Biota found a pair at this site (female, white/sky blue/white-right; male, green-left). The pair attempted to nest on private land, very close to the Elliott State Forest border, but the attempt was determined a failure when biologist visited the site in mid June.

Johnson Creek 2933 (Pair)

In 1990, there were two responses from a northern spotted owl of unknown sex, and there was one male response in this area. A resident-single male occupied this site in 1991. In 1992, a nesting pair was found less than 0.25 mile from the 1991 activity center, and both adults and two juveniles were banded (female, white-right; male, green-left). The South Fork Johnson Creek pair site from 1991 was located about 0.5 mile away, but no northern spotted owls were found there in 1992. It is possible the same pair of northern spotted owls used both sites in 1991. For this reason, the data for both sites were combined in 1992 and called Johnson Creek. In 1993, the 1992 pair nested in the same tree again and produced one young, which was banded. Only the male was found at this site in 1994 and 1995. In 1996, the 1992 male paired with a sub-adult female, who had been banded as a juvenile in Martin Tributary by Roseburg BLM the previous year. She was subsequently re-banded (yellow/black/yellow-right). They did not nest. In 1997, the pair nested and fledged one young that was banded. Status remained the same, as did the activity center, given that the 1997 nest tree is in the existing core area. The female was not found in 1998, but the male was present. Site and location status did not change. In 2003, the Roberts Creek male was found near the Johnson Creek activity center, but he was later found paired with the historic Roberts Creek female to the north. The historic Johnson Creek female was found occupying the drainage to the south of the historic activity center. Later in the season, she was found paired with a new male in that area. He was subsequently banded (blue-left), and the female's broken band was replaced (horizontal orange/black-left). They did not attempt to nest. Barred owls were detected near this site.

Larson Creek 2936 (Historic)

A pair was banded at this site in 1991 (female, yellow-left; male, blue-left). In 1992, the pair was found in late June and two juveniles that were with them were banded. The activity center was located adjacent to state land on private property. In 1993, 1994, and 1995, only the banded male was found, and pair status and activity center location remained the same. Biologists were unable to determine nesting and site status, because they were unable to acquire permission to survey on private land. In 1996, no responses were detected, and the 1991 male from this site was found at the Palouse Creek site paired with a 1992 female juvenile from Johnson Creek. Site status was changed to resident single. In 1997 and 1998, there were no responses, and site status was changed to historic in 1998 after three years of vacancy. There were no responses at this site in 2003.

Lower Camp Creek 2922 (Historic)

This site had pair status in 1991. In 1992, the pair was heard near the 1991 site on two nights. On both occasions, the female responded first, and the male flew in from BLM land at the head of the drainage. The male was heard but not seen during the day on BLM land. There were no responses in 1993 or 1994, and the status and activity center location remained the same. Surveys in 1995 detected three pair and two male responses. A male was eventually found and re-banded (white with blue tab-left), but the female was not seen. The male had been banded as a juvenile in 1993 at the Alder Creek site. In 1996, two male responses at night were later associated with the Upper Mill Creek site. The male found at the Lower Camp Creek site in 1995 was found paired with an un-banded female at the Upper Mill

Creek site. In 1997, there were no responses. One female response in 1998 was later attributed to the Lower Mill Creek site, and there were no other responses from this site. As a result, site status was changed to historic in 1998. There were no northern spotted owl responses attributed to this site in 2003. Two female responses detected between the Lower Camp Creek and Lower Mill Creek activity centers were attributed to the Lower Mill Creek site.

Lower Mill Creek 2919 (Pair)

This site had a known pair as early as 1986 when the male was banded. A pair nested at this site in 1990. A non-nesting pair resided here in 1991. In 1992, a sub-adult female (red/white/red-right) that was radio-tagged replaced the 1991 female. The pair was non-nesting. The pair was found but did not nest in 1993, and site status remained the same. In 1994, the pair fledged one young. The female was re-banded (white-right), and the juvenile was banded. The activity center was moved to the 1994 nest tree location. The pair did not nest in 1995. In 1996, the pair fledged two young, and both were banded. The pair did not nest in 1997. The pair was found in this site in 1998, but they did not nest. Site status and activity center location remained the same. In 2003, the historic female was found paired with an un-banded male. They did not attempt to nest.

Lower Millicoma 3529 (Historic)

In 1992, a resident-single female (red-right) occupied this site. That year, the male from Eleven Creek #2 was heard once at night near the area, and the Jim Whitty floater male (yellow-right) was found in the area, but there did not seem to be any pair association. In 1993, there was one night response from a northern spotted owl of unknown sex. Site status and activity center location remained the same. In 1994, a male was heard in the area at night and the following day, but status was changed to historic, because the 1992 female was found on Coos Bay BLM land. There were no responses in 1995. In 1996, there was one male (triangle, red with yellow-left) visual response, which was identified as the bird banded the same year at Marlow Creek. This response was associated with the Lockhart Road site. In 1997, there were no responses, and historic site status remained unchanged. A sub-adult male was re-banded (white-left) at this site in 1998. He was originally banded as a juvenile at Big Creek on Weyerhaeuser ownership. Weyerhaeuser surveyors found him later in the season at Packard Creek. Site status did not change. There were no northern spotted owl responses at this site in 2003.

Luder Creek 2920 (Historic)

There was a female response here in 1982, and a male response in 1990. A pair site was established here in 1991. In 1992, the female was heard several times at night, and was eventually found during the day. The male was with her but was unable to vocalize. They were both banded (female, black-left; male, red-right). The birds were not seen in 1993, but one male response was heard at night, one night response from a northern spotted owl of unknown sex was heard, and one female daytime response was detected. The male still had a very weak vocalization. Site status and activity center location remained the same. Early in 1994, biologist “moused” the 1992 male at this site. In May, however, the banded female was paired with a sub-adult male that was re-banded (orange with blue tab-right). This male had

been banded as a juvenile in 1992 at the Roberts Creek site. This male was also found at the Charlotte Creek site mid-season. The original male was not seen again in 1994. Non-nesting was confirmed, and site status and activity center location remained the same. In 1995, there were three male responses but no visual was obtained. There were no responses in 1996, 1997, or 1998, and site status changed to historic after three years of vacancy. In 2003, a northern spotted owl of unknown sex was heard in this area, but nothing was found on the follow-up visit, and no other responses were detected at this site.

Marlow Creek 2938 (Pair)

There was a northern spotted owl of unknown sex at the site in 1982, a resident single male in 1991, and a pair in 1992. The female was banded that year (orange-right). Repeated attempts to band the male were unsuccessful. The activity center was moved to the location of the daytime pair response. In 1993 and 1994, there were no responses at this site. In July 1995, Beak Consultants surveyors detected a nighttime response from a northern spotted owl of unknown sex, but OCFWRU crews detected no responses during six night visits. Pair status was changed to status unknown. In 1996, two separate males and a female were seen at the site. In late May 1996, a sub-adult male was re-banded (triangle, red with yellow-left). He was originally banded as a juvenile at the Roberts Creek site in 1995. A female from the North Fork Coquille site (Coos Bay BLM) that had been banded as a juvenile in 1994 was re-banded here in late August (blue with black tab-right). A second male was believed to occupy this site in late August, because the sub-adult male was found at the Lower Millicoma site 1.5 miles away later that evening. The activity center remained at the same location. The status of this site was changed from status unknown to resident-single male with pair status unknown. In 1997, OCFWRU and Beak Consultants surveyors confirmed pair status at this site with the 1996 female and the 1992 Jim Whitty male who was re-banded (green-right). Nesting status was not determined to protocol, but there was no evidence of reproduction. The site was upgraded from resident single to pair status, and the activity center was moved 1.25 miles to the northeast. The 1997 pair was found at the site in 1998, but they did not nest. There was no change in site status or activity center location. The historic pair occupied this site in 2003, but they did not nest. The female's broken band was replaced (white with blue dots-right).

Marlow Ridge 2937 (Historic)

A resident-single male occupied this site in 1991. In 1992, no northern spotted owls were detected at this site, but surveys were incomplete due to access problems on private land. The resident of a private house on the West Fork Millicoma River reported hearing northern spotted owls frequently behind his house from January to April 1992. No northern spotted owls were banded at this site. There were no responses at this site in 1993. That year, a new Lower West Fork Millicoma site was established on Weyerhaeuser land. Marlow Ridge was considered an historic site, because it may have been the northern spotted owl from Lower West Fork Millicoma. There were no responses at this site in 1994, 1995, or 1996. The site was not surveyed in 1997 or 1998. There was one male night response from this general area in 2003, but that was attributed to the Marlow Creek site.

Middle Mill Creek 2921 (Historic)

This site has existed since 1986 when a pair of northern spotted owls was present. A resident-single male was present from 1987 to 1991. In 1992, a non-nesting pair was banded near the 1991 site, and the site received pair status (female, green-right; male, white-left). In 1993, the male from the Fish Creek site (blue-right) moved to Middle Mill Creek and was found with the Middle Mill Creek female. He was re-banded (black-right) in 1993 to avoid confusion with the male at Upper Mill Creek. In 1994, the 1992 female paired with a new sub-adult male that was re-banded (orange-left). They did not nest. This male had been banded as a juvenile on the Roseburg BLM district. The 1993 male occupied the Fish Creek site in 1994. In April 1995, a biologist "moused" the 1994 male at this site. However, only one subsequent response that year was attributed to this site—a male 1.25 miles northwest of the activity center. The male was then found in early July on the Coos Bay BLM district 7.7 miles to the southeast, paired with an established female. Pair status and the activity center location remained the same. In 1996, the Upper Mill Creek male (white with blue tab-left) was seen here twice. These responses were attributed to the Upper Mill Creek site. The Upper Mill Creek male was seen here again in 1997, and the response was attributed to the Upper Mill Creek site. There were no responses in 1998, and site status was changed to historic after three years of vacancy. There were no northern spotted owl responses at this site in 2003.

Murphy Creek 2918 (Pair)

A male was heard in this area in 1990, and a pair was heard in 1991 when an activity center was established. In 1992, a female was detected several times close to the 1991 site on Sun Studs property, and a male was found close to the creek bottom twice. Both northern spotted owls were banded and the activity center was moved to the location of the 1992 female daytime sightings (female, green-left; male, white-right). The pair did not nest. In 1993, the non-nesting pair was found several times about one mile to the east of the 1991/92 site, but site status and activity center location remained the same. In 1994, the 1992 female paired with a new un-banded adult male that was subsequently banded (blue-right). They were found several times one mile to the east of the activity center, in the same area as in 1993. As a result, the activity center was moved to that area and is now on state land. They did not nest. In 1995, the male was found several times, but the female was only heard. Nesting status was unknown. In 1996, the 1992 female paired with the 1995 Noble Creek male (yellow/black/yellow-left) at this site. This male was seen later in the year at the Wind Creek site, but he was not seen paired with the Wind Creek female. There were no responses in 1997 or 1998. In 1998, the 1992 female moved to the Palouse Creek site. Site status and activity center location remained the same with two years of vacancy. No northern spotted owl responses were detected at this site in 2003.

Noble Creek 2925 (Resident single)

This site had a nesting pair in 1991, and the female was banded (green-right). No northern spotted owls were detected at this site in 1992. The female that was banded in 1991 moved to the adjacent Alder Creek site and was paired with another male. In 1993, surveyors heard one nighttime male response, and Beak Consultants surveyors heard three nighttime male responses at this site. There were no responses at this site in 1994, and the pair status was changed to resident single. In 1995, there were several male responses, and a sub-adult male

was re-banded (yellow/black/yellow-left) 0.75 mile west of the activity center. He was originally banded as a juvenile at the Roberts Creek site in 1994. There was one response at night, but two different males were found at this site. There were no responses in 1996. In April 1997, there was one visual of a female at night, and several female responses were detected in August. A female was identified only once in late August when the northern spotted owl was re-banded (yellow/black/yellow-right). She was originally banded as a juvenile at the Roberts Creek site in 1996. There were no responses in 1998, and site status remained resident single, with one year of vacancy. There were no northern spotted owl responses at this site in 2003.

Palouse Creek 4362 (Pair)

A northern spotted owl of unknown sex was detected at this site in 1990, and a pair occupied this site in 1991. In 1992, there were no responses, but the site retained pair status. In 1993, a sub-adult male was twice found during the day. Beak Consultants and OCFWRU surveyors also heard him several times at night. Pair status and the activity center location were retained. There were no responses at this site in 1994. It was decided that the sub-adult male found in 1993 was probably the Upper Palouse male. This site received historic status in 1994, because no birds were banded at this site. In April 1995, there was a male nighttime response; a sub-adult male was found on the follow-up visit. Surveyors also heard a male response during the day a month later, but no visual was obtained. The site was classified as status unknown. In 1996, a pair was found at this site. The male (blue-left) was identified as the Larson Creek northern spotted owl, and the female (red-left) was a 1992 juvenile from Johnson Creek. This pair nested and fledged one young, which was banded but not found on later visits. The site received pair status, and the activity center was moved to the 1996 nest site. In 1997, the same pair was found nesting in the 1996 tree. They fledged one young, which was subsequently banded. It should be noted that, during one night of calling the Upper Palouse Creek site, the male from Palouse Creek responded and flew into the Upper Palouse Creek area. In 1998, the female (green-left) from Murphy Creek paired with the 1997 male from this site. They did not nest. Site and location status did not change. In late April 2003, an un-banded male was found in the area. On a rainy follow-up visit, he ate one mouse and refused more. No more northern spotted owls were detected at this site in 2003.

Panther Creek 4641 (Resident single)

This site was designated as “other single” female in 1991. No birds were heard near the activity center after six visits in 1992, but there was a response from a male approximately 0.75 mile away near the Millicoma River. The status of this site was not determined in 1992. In 1993, there was one male response near this area, but it was considered to be a non-territorial single. There were no responses at this site in 1994. In 1995, there was one male response at night near the activity center that was considered to be a non-territorial single. There were no responses in 1996, 1997, or 1998. In mid-July 2003, a male northern spotted owl was heard at this site. He was heard twice more on additional night visits to the area, and surveyors were able to “mouse” him on the road at night. Surveyors were unable to find him on follow-up visits, so no bands were read. The site received resident-single status, and the activity center was placed in the center of all three responses.

Roberts Creek 2931 (Pair)

A pair occupied this site in 1991. In 1992, the pair was found nesting very close to the 1991 activity center. Surveyors banded the male (red-left) and two young. The female had been banded as a juvenile in 1987 at a BLM site 15 miles to the east. In 1993, the pair was re-observed, the female was re-banded (orange-left), and non-nesting was determined. In 1994, the pair fledged two young, which were banded. In 1995, the pair fledged one young that was banded. In 1996, the pair nested in the 1994 nest tree and fledged two young, which were banded. The pair was confirmed in 1997. They did not nest. The pair did nest in 1998 and fledged two young, which were banded. Site status and activity center location did not change. In 2003, the historic Roberts Creek pair was non-nesting. They were detected on a number of occasions over a large home range, mostly to the east of the historic activity center location. The Roberts Creek male was also found near the historic Johnson Creek activity center to the south in mid-May. An aggressive male barred owl occupied the historic Roberts Creek activity center.

Salander Creek 2928 (Pair)

Although there was a northern spotted owl of unknown sex seen here in 1982, the site was not given pair status until 1991 when both adults were banded (female, yellow-left; male, red-right). The pair occupied the site in 1992 and nested close to the 1991 activity center. Surveyors saw two juveniles soon after fledging but never relocated them. Feathers from one juvenile were found, indicating possible predation. The pair did not nest in 1993. In 1994, the pair fledged one young that was banded. In 1995, the pair nested in the 1992 nest tree, and they fledged two young that were banded. The activity center location remained the same. In 1996, the pair nested and fledged one young that was banded. The pair nested in the same tree used in 1992 and 1995, and the location of that tree was determined using a global positioning system (GPS) unit. This changed the activity center location slightly and placed it on private land. In 1997, the pair nested in the 1994 nest tree and fledged two young, which were banded. In 1998, the pair nested in the 1992 nest tree and fledged one young that was banded. Site status and activity center location remained unchanged. In mid-April 2003, the historic male was found north of the historic activity center. Later in the season, the pair was found together at the historic activity center and determined to be non-nesting. The female's broken band was replaced (striped, black with white-left).

Shake Creek 3530 (Historic)

In 1991, a response was heard from a single male, and "other single" status was given to this site. In 1992, surveyors detected two male responses at night and one daytime audio response by a male. Site status was changed to resident single, and the activity center was moved to the 1992 daytime location. There were no responses at this site in 1993. In 1994, a male that had been banded as a juvenile in 1993 at the Alder Creek site was found and re-banded here (yellow/black/yellow-right). One female response was also heard at this site, but there was not enough evidence to determine pair status. The activity center location remained the same, and site status was classified as "two birds, status unknown." In 1995, there were two female responses at night. Even though the first response was between the Trout Creek and Shake Creek sites, it was attributed to the Shake Creek site because of the subsequent response near the Shake Creek activity center. There were no responses in 1996. In 1997, there were no

responses, and pair status unknown was changed to resident-single status with two years of vacancy. There were no responses in 1998, and site status was changed to historic after three years of vacancy. In mid-May 2003, an un-banded female, which was subsequently banded (dots, black with white-left), was found at the historic activity center. “Mousing” her at that time suggested non-nesting status. This was the only northern spotted owl detection at this site the whole season.

Sock Creek (BLM) 3158 (Resident single)

This site was first surveyed in 1990 by the BLM. A pair was present in 1991 (female, vertical red with yellow-right), in 1992 (female, diagonal green with white-right; male, vertical red with yellow-right), and in 1993 and 1994. An active nest was found at this site in 1993, but failed. The pair was non-nesting in 1994. The site was not surveyed in 1995. In 1996, the OCFWRU began surveying the site for the BLM; only the banded male was present. Pair status was retained, and the activity center location was changed to the 1993 nest site. In 1997, there were no responses attributed to this site, but a male heard in early April was believed to be the Tom Fool Creek male. On a subsequent visit, the Tom Fool Creek male was heard in the same general area and flew to the Tom Fool Creek site as daybreak neared. The site was occupied in 1998 by the 1996 male. Site status changed to resident-single (male); the activity center location did not change. In mid-April 2003, a male northern spotted owl was heard near the historic activity center, but a male barred owl responded at the same time. Surveyors were unable to find the male northern spotted owl on the follow-up visit. No other northern spotted owls were detected at this site after five additional nighttime surveys, so that male response was attributed to the nearby Tom Fool pair.

Tom Fool Creek (BLM) 3159 (Pair)

The Coos Bay BLM began surveying this site in 1988. That year, a male and female (yellow-left) were found at the site. No northern spotted owl responses were detected during surveys in 1989 and 1990. A pair was found at this site in 1991 (male, white-left), in 1992, in 1993 (female, diagonal, pink with purple-left; male, vertical yellow with black-left), and 1994. An active nest tree was found in 1994 and presumed to have failed. The activity center was re-located at this nest tree site. This site was not surveyed in 1995. In 1996, the OCFWRU began surveying the site for the BLM. There was one male response at night, in which the band was partially identified and presumed to be the historic male. The pair was present in 1997, but nesting protocol was not met. No young were detected. The male was heard at the Sock Creek activity center on at least one night, and two males were heard simultaneously on one night. The female was heard first at the end of June, but she was not observed until August. The 1997 pair nested on a rock shelf in 1998 and fledged two young, which were banded. The nest rock location was determined using a GPS unit and found to be inside the Elliott State Forest boundary. Site status and location did not change. In 2003, the female banded at this site in 1993 was paired near the 1994 activity center with an un-banded male. They were non-nesting. Surveyors replaced her broken band (stripe, green with white-left), and the male was also banded (orange-right). Timing and other convincing evidence suggest that this pair occupied the nearby Upper Mill Creek site early in the season. The activity center was moved to the 1998 nest cliff location, because this was the most recent known nest site, and it was closer to the 2003 locations.

Trout Creek 2934 (Historic)

In 1991, two male responses were heard at night in this area. Two female night responses were also heard 0.75 mile south of the male responses. Both response sites were given resident-single status. In 1992, there was one response at night from a northern spotted owl of unknown sex. This response was combined with the 1991 male responses, and the site retained resident-single status. The 1991 female responses were within 0.25 mile of the 1992 male responses at Eleven Creek, so her records were moved to the Eleven Creek #1 file. There were no northern spotted owl responses in this area in 1993, 1994, 1995, 1996, 1997, or 1998. This site was assigned historic status in 1995. There were no northern spotted owl responses in this area in 2003.

Upper Mill Creek (BLM) 2176 (Pair)

This site was first surveyed by the BLM in 1986 when a pair fledged two young. A pair occupied this site through 1993, but 1988 was the only year young were found (female, red-right). The birds attempted to nest in 1993, but were unsuccessful. The nest was found and believed to be the nest used in past years. There were no responses in 1994, and the site was not surveyed in 1995. In 1996, the OCFWRU began surveying this site, and a pair was found. The male (white with blue tab-left) was identified as the 1995 Lower Camp Creek northern spotted owl. The un-banded female was banded (blue-left). In 1997, the pair nested in a new tree and fledged one young. The female and juvenile were last seen at the end of June, and subsequent visits yielded only male responses. In 1996 and 1997, the male at this site was also observed at the Middle Mill Creek activity center. In 1998, the 1997 male paired with an un-banded sub-adult female that was banded (fluorescent pink-left). The pair did not nest, and site status and activity center location did not change. In mid-April 2003, a pair was detected at the activity center. An un-banded male was found the next day; he ate two mice and refused more. No northern spotted owls were found at this site during the rest of the season, and a male barred owl occupied this site after that. About the same time that this northern spotted owl pair disappeared, the very nearby Tom Fool pair was detected. At the activity center meeting, it was decided that the Upper Mill Creek pair moved to the Tom Fool site after being displaced by the barred owl. They were determined to be non-nesting (see Tom Fool site for more information).

Upper Millicoma 2927 (Historic)

In 1991, this site was designated a resident-single site, and the male was banded yellow/ black/yellow-right). There were no responses in this area during 1992, 1993, 1994, or 1995, so site status was changed to historic. In 1994, the male that was banded at this site in 1991 was found on the Siuslaw National Forest. In 1996, one nighttime female response was designated as a non-territorial single. There were no responses in 1997, 1998, or 2003.

Upper Palouse Creek 2935 (Historic)

A pair was heard at this site in 1991. In 1992, no responses were heard at or near the site. The site was classified as status unknown in 1992, because of concern that the northern spotted owls heard in 1991 were the same as those found at the Palouse Creek site. In 1993, a sub-adult male, banded as a juvenile at Dean Creek in 1992, was found near this site several times and re-banded (black with orange tab-left). The site received resident-single status, and

the activity center location was moved. There were male responses at this site in 1994, but it was the Johnson Creek male on at least one occasion. In 1995, there were three male responses at night, but follow-up visits yielded no results. There were no responses in 1996 or 1997. In 1997, however, the Palouse Creek male (blue-left) was found near the Upper Palouse Creek area. In 1998, one nighttime female response was heard, but that was attributed to the Palouse Creek site. Site status changed to historic after three years of vacancy. In 2003, no northern spotted owl responses were detected at this site.

Upper Roberts Creek 2930 (Historic)

In 1991, a pair was heard twice at this site. In 1992, no responses were heard in three night visits. One night in 1993, two northern spotted owls of unknown sex were heard issuing four-note calls at each other. They were in the area between the Roberts Creek and Upper Roberts Creek sites. Pair status and the activity center location were retained. There were three responses at night from a male at this site in 1994. The activity center was moved to the approximate center of these three responses, and site status was changed to resident single. In 1995, there was one male response at night. There were no responses at this site in 1996, but the Benson Creek male was confirmed near this site. Subsequently, the 1995 response was attributed to the Benson Creek site. There were no responses in 1997. This was the third year of vacancy, and site status was changed from resident single to historic. There were no responses in 1998. In 2003, barred owls displaced the Roberts Creek pair further to the east into the Upper Roberts Creek site. The Roberts Creek birds were the only northern spotted owls confirmed in this area in 2003.

West Glenn Creek 4636 (Pair)

In late May 2003, a pair of northern spotted owls was found at the headwaters of West Glenn Creek. The sub-adult female was originally banded as a juvenile at the Noti site in 2001. She was re-banded (dot, white with red-right). The un-banded sub-adult male was subsequently captured and banded (black-left). They were determined to be non-nesting. Later in the season, this pair was found farther to the west near Gould's Lake. The activity center was placed at the May 29 pair location.

Wind Creek 2915 (Pair)

In 1982, a northern spotted owl of unknown sex was heard twice in Wind Creek, 1.5 miles to the west of the current activity center. A male was heard here in 1987, closer to the current activity center. In 1990, a non-nesting pair occupied this site. By 1991, these birds had moved to Dry Creek and established a nest site. Both birds were banded (female, black-left; male, orange-right). These birds used the area near the 1991 Scholfield Creek site in 1992, so the two sites were combined into the Wind Creek site. They did not nest in 1992. The pair nested in 1993 and fledged one young that was banded. The same pair did not nest in 1994. In 1995, the pair nested in the 1991 nest tree and fledged one young that was banded. In 1996, the female was found, as was the 1996 Murphy Creek male (yellow with black stripe with orange tab-left), but never together. In 1997, the female was paired with the 1996 Murphy Creek male. They nested in a new tree, but the nest failed. The same pair nested in 1998 in a new nest tree, and fledged two young, which were banded. Site status and location did not change. In 2001, Beak Consultants surveyors located the historic male and heard a

female at night. Nesting status was unknown. In 2003, the historic pair occupied the activity center. They were non-nesting. A second male (banded, dots-blue with white-right) northern spotted owl was found with the historic female at the site in early May.

F.7.2. Non-territorial Singles and Unknowns

Beaver Creek 7021 (Non-territorial single)

In 1991, there were no responses in this area. Beak Consultants surveyors heard a pair in the area in June 1992. Two days later, a male was heard about one mile from the pair location. Three additional visits at night yielded no responses, and the area was classified as status unknown. The activity center was located at the male location of the pair response because of its proximity to potential habitat. There were no responses in 1993 or 1994, and the status was dropped to non-territorial single. In 1995, there was one male response at night. There were no responses in 1996. The area was not surveyed in 1997 or 1998. There were no responses in 2003.

Benson Ridge 7009 (Non-territorial single)

A single female response at night was heard in 1991. This northern spotted owl was considered a non-territorial single. There were no responses in 1992, 1993, 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. In early April 2003, a female was seen at night near the 1991 floater response site, but this female response was attributed to the Benson Creek site.

Eleven Creek 7016 (Non-territorial single)

In 1991, a female was heard on two nighttime surveys and during a daytime follow-up. She was presumed to be associated with the 1991 Trout Creek male. She was not found at this site in 1992, and site status was changed to status unknown, because the 1991 responses did not meet full protocol for residency. In 1992, there were two responses from a single male at night 0.25 mile south of where the female was heard in 1991. Initially, this male was called Eleven Creek with status unknown. Names for the 1991 female and 1992 male responses were changed to Eleven Creek #1 (the female) and Eleven Creek #2 (the male), because it was confusing to have the 1991 Trout Creek site so close to the 1992 Eleven Creek site. A common activity center was established in the best habitat intermediate between these two locations. In 1993, no responses were detected in this area, and the two Eleven Creek sites were combined into a single Eleven Creek site. All responses were considered to be from non-territorial singles. There were no responses at this site in 1994, 1995, 1996, 1997, 1998, or 2003.

Howell Creek 7047 (Non-territorial single)

In 1996, two nighttime male responses were assigned non-territorial single status. The area was not surveyed in 1997 or 1998. There were no responses at this site in 2003.

Johanneson Creek 7049 (Non-territorial single)

In 1991, a female response was heard in the Johanneson Creek drainage, but it was grouped with the Dean Creek site. In 1992, a male was heard at night in the same drainage, but he did not show any strong territorial behavior. The next day a male was heard, but again he was not aggressive. The area was visited a total of six times, so this northern spotted owl was considered a non-territorial single. There were no responses at this site in 1993, 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. In 2003, a female was heard in this area, but that response was attributed to the Dean Creek site.

Otter Creek 7011 (Non-territorial single)

In 1991, two female responses were attributed to a non-territorial single. There were no responses in 1992, 1993, 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Scholfield Creek 7007 (Non-territorial single)

In 1990, there were two responses from a northern spotted owl of unknown sex, and a pair was found there in 1991. In 1992, it was determined that the Wind Creek pair used both this site and their current site. Therefore, the 1991 data from both sites were combined and called Wind Creek. In 1993, both a pair and a single male were heard farther up Scholfield Creek than the 1991 responses. The new area was given the old site name and classified as status unknown, because concern was expressed that they may have been the Wind Creek birds. There were no responses at this site in 1994. That year, it was decided that the pair responses in 1993 were Wind Creek birds, and the single male response was classified as a non-territorial single. There were no northern spotted owl responses at this site in 1995 or 1996. The area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Schumacher Ridge 7050 (Non-territorial single)

In 1993, there was one female response at night in this area that was determined to be a non-territorial single. There were no responses in this area in 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Totten Creek 7015 (Non-territorial single)

In 1991, a non-territorial single male was detected in this area. There were no responses in 1992, 1993, 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Umpcoos Ridge 7051 (Non-territorial single)

In 1995, an un-banded sub-adult male was detected at night. He was considered to be a non-territorial single. There were no responses in 1996, and the area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Upper Benson Creek (Non-territorial single)

In 1995, a female was detected at night. She was considered to be a non-territorial single. There were no responses in 1996, and the area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Upper Johnson Creek 7053 (Non-territorial single)

In 1993, a northern spotted owl of unknown sex was detected at night. This bird was considered to be a non-territorial single. There were no responses in 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. There were no northern spotted owl responses in this area in 2003.

Upper Noble Creek 7010 (Non-territorial single)

In 1991, a single female was detected in this area. This response was classified as a non-territorial single in 1992 when no birds were detected in the area during three night visits. There were no responses in 1993, 1994, 1995, or 1996. The area was not surveyed in 1997 or 1998. In early May 2003, a male was heard near the 1991 response location, but this response was attributed to the Benson Creek site.

Upper Sock Creek 7093 (Status unknown)

In 2003, there was one nighttime female response during two visits to this area, but no birds were found on the follow-up visit. The ODF determined that it was not necessary to survey this area, because it was not part of the original density study area; thus, additional visits were not conducted.

F.8. RECOMMENDATIONS FOR FUTURE NORTHERN SPOTTED OWL SURVEYS

When future northern spotted owl surveys are conducted on the Elliott State Forest, it is recommended that survey station/compartment associations be rearranged so that stations in compartments with known northern spotted owl sites are geographically centered on that northern spotted owl site. This one step will simplify paperwork and reduce confusion when planning surveys and interpreting data.

Table F-2
Number of Northern Spotted Owl Pairs, Pair Status Unknowns, Resident Singles, Total Activity Centers (used for density estimates), Status Unknowns, and Non-Territorial Singles Found on or Adjacent to the Elliott State Forest During 2003 Surveys

Survey Protocol	Pairs[b]	Pair Unknowns	Resident Singles	Total[a] Activity Centers	Status[b] Unknowns	Non-territorial Singles
Demographic Protocol	10	2	1	13	1	4
Management Protocol	12	0	1	13	1	4

[a] Numbers for Pair and Total Activity Centers include the Fourmile northern spotted owl site on private land, a site included in previous density estimates for the Elliott State Forest.

[b] The only Status Unknown was a site on Coos Bay BLM land that was dropped from surveys in early May.

Note: Numbers are presented based on demographic and management protocols. Demographic protocol typically requires two responses from a northern spotted owl pair or single to determine status, instead of the one or three required by the management protocol.

Table F-3
Total Number of Northern Spotted Owl Pair Sites, Pair Status Unknown Sites, Resident Single Sites, Status Unknown Sites, Non-Territorial Single Sites, and Historic Sites on or Adjacent to the Elliott State Forest, 2003

Pair* (PR)	Pair Status Unknown (PU)	Resident Single (RS)	Status Unknown** (SU)	Non-territorial Single (FL)	Historic (HS)
16	0	4	1	11	16

[a] Pair sites include the Fourmile and Lockhart Road northern spotted owl sites on adjacent private land. Northern spotted owls from these sites were detected on the Elliott State Forest at least once during the 2003 survey season.

[b] The only Status Unknown site was a site on Coos Bay BLM that was dropped from surveys in early May.

FL = non-territorial, single; HS = historical site; PR = pair site; PU = two birds, pair status unknown; RS = resident single (male or female); SU = status unknown

Table F-4
Site Name, Status, and Occupancy for
Northern Spotted Owl Sites in the Elliott State Forest, 2003

Site Name	Site Status	Survey 2003	Adult/ Sub-adult Males	Adult/ Sub-adult Females	Unknown Sex	Young
Alder Creek	PR	Yes	1	1	0	0
Beaver Creek	FL	Yes	0	0	0	0
Benson Creek	PR	Yes	1	1	0	0
Benson Ridge	FL	Yes	0	0	0	0
Bickford Creek (Pvt)	HS	Yes	0	0	0	0
Big Creek	HS	Yes	0	0	0	0
Charlotte Creek	HS	Yes	0	0	0	0
Dean Creek	PR	Yes	1	1	0	0
Deer Creek	HS	Yes	0	0	0	0
East Hakki Ridge	HS	Yes	1	0	0	0
Eleven Creek	FL	Yes	0	0	0	0
Fish Creek	HS	Yes	0	0	0	0
Four-Mile (Pvt)[a]	PR	Yes	1	1	0	0
Howell Creek	FL	Yes	0	0	0	0
Johanneson Creek	FL	Yes	0	0	0	0
Johnson Creek	PR	Yes	1	1	0	0
Larson Creek	HS	Yes	0	0	0	0
Lockhart Road (Pvt)[a]	PR	Yes	1	1	0	0
Lower Camp Creek	HS	Yes	0	0	0	0
Lower Mill Creek	PR	Yes	1	1	0	0
Lower Millicoma	HS	Yes	0	0	0	0
Luder Creek	HS	Yes	0	0	1	0
Marlow Creek	PR	Yes	1	1	0	0
Marlow Ridge	HS	Yes	0	0	0	0
Middle Mill Creek	HS	Yes	0	0	0	0
Murphy Creek	PR	Yes	0	0	0	0
Noble Creek	RS	Yes	0	0	0	0
Otter Creek	FL	Yes	0	0	0	0

Table F-4 – continued

Site Name	Site Status	Survey 2003	Adult/ Sub-adult Males	Adult/ Sub-adult Females	Unknown Sex	Young
Palouse Creek	PR	Yes	1	0	0	0
Panther Creek	RS	Yes	1	0	0	0
Roberts Creek	PR	Yes	1	1	0	0
Salander Creek	PR	Yes	1	1	0	0
Schumacher Ridge	FL	Yes	0	0	0	0
Scholfield Creek	FL	Yes	0	0	0	0
Shake Creek	HS	Yes	0	1	0	0
Sock Creek	RS	Yes	0	0	0	0
Tom Fool Creek	PR	Yes	1	1	0	0
Totten Creek	FL	Yes	0	0	0	0
Trout Creek	HS	Yes	0	0	0	0
Upper Johnson Creek	FL	Yes	0	0	0	0
Upper Mill Creek	PR	Yes	0	0	0	0
Upper Millicoma	HS	Yes	0	0	0	0
Upper Noble Creek	FL	Yes	0	0	0	0
Upper Palouse Creek	HS	Yes	0	0	0	0
Upper Roberts Creek	HS	Yes	0	0	0	0
Upper Sock Creek[b]	SU	Yes	0	1	0	0
West Glenn Creek	PR	Yes	1	1	0	0
Wind Creek	PR	Yes	2	1	0	0

[a] The Lockhart Road and Fourmile northern spotted owl sites are located on private industry lands that border southern portions of the Elliott State Forest. Pacific Biota and Environmental Services Northwest, Inc. surveyed these two sites.

[b] Upper Sock Creek was the only Status Unknown site. This Coos Bay BLM site was dropped from surveys in early May.

Appendix G
Marbled Murrelet Management Areas on the Elliott State Forest 2006

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G.1. INTRODUCTION

This document summarizes the survey information for each of the Marbled Murrelet Management Areas (MMMAs) that have been established on the Elliott State Forest. MMMAs are designated on ODF lands for marbled murrelet occupied sites. These areas are subject to special management considerations for the purpose of maintaining habitat suitable for successful nesting.

Considerations in designating MMMAs include contiguous suitable habitat and likely nest locations, with a focus on providing interior forest conditions to minimize edge effects. Survey results and related habitat and landscape information are used to determine the boundaries of these areas.

ODF has conducted surveys for marbled murrelets on the Elliott State Forest since 1992 for a variety of reasons. The majority of surveys have been conducted for the purposes of conducting management activities. Survey areas for management activities are given an identifier beginning with ESF followed by a number, for example ESF100. Other types of surveys were conducted for different purposes, such as transect surveys to gather general information about the presence of murrelets in the forest (GEN); extra surveys at occupied sites to gain more information about the habitat murrelets were using, or to attempt to locate nest trees (NSS, FCS, or RTS); and surveys to determine the need for continuing seasonal restrictions (SRS). In 2002, survey contractors conducted both general and intensive surveys within 240 acre grids for the purposes of locating additional occupied sites in areas of the forest where few surveys for management activities had been conducted (GRID). These other acronyms are labels for the other types of surveys, as the ESF is a label for the management activity surveys.

Survey and research information has been examined, and each occupied detection or nest location has been assigned to an occupied site. In some cases, multiple detections in the same area over one or many years are considered part of the same site. In other cases, detections during surveys of the same survey site may have been split into different occupied sites due to habitat, distance, topography, or some other factor. MMMAs often include several different survey areas and may include one or several occupied sites. The descriptions in this document note how many occupied sites are contained within each MMMA, as well as which survey areas have covered all or a portion of the MMMA.

Some sub-canopy behaviors are not associated with a MMMA. These are described in the section following the MMMA descriptions. In some cases, these detections were determined not to be indicative of occupied sites in the immediate vicinity. In other cases, the sites were considered to be occupied, but the detections were within another protected designation (such as a habitat conservation area). MMMA designation has been postponed in other areas pending additional surveys.

Further information about individual MMMAs, including their location and boundaries, is on file with the Oregon Department of Forestry (ODF)

G.2. MARBLED MURRELET MANAGEMENT AREAS

G.2.1. Beaver Headwaters MMMA (EST. 1994)

199 Acres

Surveys were conducted by the ODF in 1992 at planned timber sales Beaver Creek No. 2 and Beaver Creek No. 3, with no resulting detections of marbled murrelets. In 1993, surveyors from the Oregon Department of Fish and Wildlife (ODFW) observed occupied sub-canopy behaviors on two occasions, along with detections indicating presence at survey area ESF902. The MMMA was established in 1994 as a result of these detections. In 1995, three nests were located within this MMMA at Silver Creek as part of a research project. In 1996, a nest tree was located at Silver Beaver (also called Beaver Creek) in this MMMA as part of this same research project. In 2000, ODF staff conducted two surveys to evaluate the need for continued seasonal restrictions, and recorded occupied sub-canopy behavior. Multiple occupied behaviors were recorded again in 2004 during a one-survey monitoring effort at survey area ESF22.

Occupied Sites: 1

(Includes survey areas ESF1, ESF22, ESF902, ESF903)

G.2.2. Benson Headwaters MMMA (EST. 2003)

92 Acres

This area was first surveyed in 1994 as Upper Joes Creek thinning. Contracted biologists reported no marbled murrelet detections. In 2003, the area was surveyed again as Shoefly Joe and included two survey sites. Site 1 had one survey with presence detected. Site 2 visits resulted in three surveys with presence, with one of the presence surveys accompanied by a sub-canopy marbled murrelet detection. The MMMA was established in 2003 as a result of these detections. In 2004 and 2005, surveys were conducted in two sites in close proximity to the MMMA boundary. There were no detections in 2004, but presence was recorded during two surveys in 2005.

Occupied Sites: 1

(Includes survey areas ESF75, ESF148, and ESF158)

G.2.3. Big Deer MMMA (EST. 1995)

472 Acres

The ODFW first surveyed the Upper Deer Creek and Deer Creek No. 5 areas in 1993. Marbled murrelet presence was detected during two surveys. Contractor surveys began in 1994 at Deer Creek No. 5, Upper Deer Creek, and Upper Joes Creek Thinning. Four surveys

yielded multiple sub-canopy detections within these survey areas (ESF34, ESF44, and ESF75). A MMMA encompassing contiguous habitat in all three survey areas was established in 1995. In 2003, surveys at the Shoefly Joe area detected marbled murrelet presence during three surveys. During these three years of surveys, a cumulative total of 44 presence detections were reported inside the MMMA boundary.

Occupied Sites: 3

(Includes survey areas ESF34, ESF44, ESF75, and ESF148)

G.2.4. Charlotte Headwaters MMMA (EST. 1994)

736 Acres

First surveyed as Charlotte Luder (ESF906) in 1992 and 1993, there were 98 presence detections recorded and two surveys, one each year, that yielded detections of sub-canopy marbled murrelets. A second major survey effort, Deer Knife Thinning (ESF54), took place in and around the southern region of the current MMMA boundary in 1994. These surveys recorded 50 presence detections and two surveys with sub-canopy behavior, including one with a marbled murrelet observed landing. Surveys were conducted in 2003 and 2004 in and around the southern portion of the MMMA for East Deer Top (ESF147). During these surveys, a total of 28 presence detections, all occurring in 2004, were observed by survey biologists inside the current MMMA boundary.

Occupied Sites: 3

(Includes survey areas ESF54, ESF114, ESF147, and ESF906)

G.2.5. Daggett Headwaters MMMA (EST. 2006)

21 Acres

The W. Fork Headlands A:3 was surveyed by contractors during 2005 and 2006. The first year of surveys resulted in a single survey with four presence detections of marbled murrelets. Surveys in 2006 captured 35 marbled murrelet presence detections and a single sub-canopy behavior at 0.1 canopy height. A MMMA was established based on these observations. This is an isolated patch of habitat surrounded by plantations less than 40 years old.

Occupied Sites: 1

(Includes survey area ESF162)

G.2.6. Dry Ridge MMMA (EST. 2003)

97 Acres

Timber sale surveys for Dry Moby were initiated in 2002 and resulted in no marbled murrelet detections. This same year, grid surveys were conducted in the vicinity, which also resulted in no marbled murrelet detections. In 2003, four surveys of the Dry Moby timber sale

detected marbled murrelet presence, and two surveys detected sub-canopy behaviors, including one observation of marbled murrelets seen landing. The MMMA was established in 2003 based on these observations.

Occupied Sites: 1

(Includes survey areas ESF120 and ESF Grid 42)

G.2.7. Elk Forks MMMA (EST. 1994)

304 Acres

Surveys by ODF staff in Elk Forks confirmed a single marbled murrelet presence detection in 1992. In 1993, ODFW surveyors observed multiple sub-canopy behaviors during a single survey at ESF913. There were presence detections to the north in 1992, 1993, 1994, and 1995. A MMMA was designated in 1994 that incorporated this occupied site, as well as the area of presence detections to the north. Nest search surveys were conducted in 1995, and five surveys resulted in sub-canopy behavior detections and the location of a nest. Additional surveys to the Elk Forks area resulted in only one survey with marbled murrelet presence in 1995, no detections in 1996, but sub-canopy observations in 2001. Surveys of Middle Elk (ESF135) in 2003 resulted in a single sub-canopy observation in the northern portion of the MMMA, establishing another occupied site, already included in the MMMA.

Occupied Sites: 2

(Includes survey areas ESF03, ESF35, ESF89, ESF135, and ESF913)

G.2.8. Elk Pass MMMA (EST. 1994)

358 Acres

ODF staff surveys in the West Fork Glenn Creek area in 1992 resulted in no detections of marbled murrelets. The ODFW conducted surveys at the Elk Pass No. 3, Elk Creek Divide, and West Fork Glenn Creek areas in 1993. Sub-canopy behaviors were observed during seven surveys at these three areas (ESF39, ESF914, and ESF 939). In 1994, one contractor survey had sub-canopy behavior at ESF39. In 2003, a survey at ESF135 adjacent to the MMMA resulted in one sub-canopy marbled murrelet observation. This contiguous habitat consisting of approximately nine acres was added to the MMMA.

Occupied Sites: 5

(Includes survey areas ESF39, ESF51, ESF135, ESF914, ESF938, ESF939, and ESF940)

G.2.9. Fish Knife MMMA (EST. 1993; Revised 1994 and 1995)

780 Acres

Murrelets were first detected in this area in 1993, during surveys of Knife Otter (ESF925) and Fish Ridge No. 2 (ESF916) by ODFW. Previous surveys by ODF in the area in 1992 had resulted in no observations of marbled murrelets in the vicinity. The observations in 1993 included four surveys with occupied sub-canopy behaviors, including a bird landing. An occupied site was established in 1993 based on these observations. Contractor surveys in the Fish Ridge Thinning (ESF81) and Panther Creek areas in 1994 resulted in an additional five surveys with sub-canopy behavior. In 1994, the MMMA was created to include these occupied sites as well as the earlier observations. A nest search in 1995 resulted in discovery of an inactive nest cup in occupied site 59. An addition to the MMMA in 1995 incorporated this site. In early August 1999, a survey performed by ODF staff to determine whether seasonal operating restrictions were necessary resulted in the detection of a sub-canopy marbled murrelet. Contractor surveys in the Kelly Fish No. 3 area, along with a seasonal operating restriction survey by the ODF, revealed no marbled murrelets in 2000. In 2001, a sub-canopy marbled murrelet detection was recorded in the MMMA boundary, and a single monitoring survey inside the MMMA in 2005 recorded no marbled murrelet activity.

Occupied Sites: 4

(Includes survey areas ESF4, ESF27, ESF81, ESF104, ESF144, ESF145, ESF909, ESF916, ESF924, ESF925, ESFMMMA2, FCS Panther Creek, SRS Fish Knife MMMA, SRS Knife Creek, and SRS Elk Creek)

G.2.10. Footlog Ridge MMMA (EST. 2006)

34 Acres

Umpcoos Ridge A:1 site 1 was surveyed in 2005 and 2006 by ODF contractors. Three surveys were conducted, with a total of 11 marbled murrelet presence detections reported in 2005. Five surveys with marbled murrelet presence, including one survey with a single sub-canopy observation, were reported in 2006. The MMMA was established based on this observation.

Occupied Sites: 1

(Includes survey area ESF 163)

G.2.11. Glenn Headwaters MMMA (EST. 1994)

142 Acres

In 1992, surveys performed by ODF staff resulted in one survey with presence detections at Glenn Top. The ODFW continued surveys at Glenn Top and the Bickford Creek Thinning area in 1993, with no marbled murrelet detections. Contractors began a larger scale survey effort in 1994 at the Bickford Creek Thinning area and Cedar Creek No. 5 that resulted in

three surveys with sub-canopy marbled murrelet behaviors and four surveys with presence at ESF50. The MMMA was established in 1994 as a result of these detections. In 1996, a morning and an evening survey at the Glenn Headwaters area produced no marbled murrelet observations. Contractor surveys in 2002 to the Cedar Glenns area resulted in one survey with a single marbled murrelet presence detection. Surveys to the same area in 2004 did not detect marbled murrelets.

Occupied Sites: 1

(Includes survey areas ESF24, ESF50, ESF130, ESF917, ESF918, and SRS Bickford Creek)

G.2.12. Goody Ridge MMMA (EST. 1994)

118 Acres

Initial surveys to the Goody Ridge No. 2 sale in 1992 conducted by ODF staff resulted in no observation of marbled murrelets. In 1993, surveys by the ODFW and contractors at Goody Ridge No. 2 (ESF23) resulted in two observations of sub-canopy behavior during one survey. In 1994, contractors detected sub-canopy behavior during one survey, and three presence detections during a separate survey. The MMMA was established based on these detections.

Occupied Sites: 1

(Includes survey areas ESF23 and ESF919)

G.2.13. Henry's Bend MMMA (EST. 1994)

263 Acres

Two sites were surveyed as Henry's Bend in 1994. Thirty plus sub-canopy behaviors were observed over three surveys in site 1, including two observations of marbled murrelets landing. Site 2 had a cumulative total of 15 presence detections over two surveys. Both sites are included within the MMMA boundary. Two surveys in the vicinity of the sub-canopy detections were conducted in 1996, with presence detections during one survey. Grid surveys conducted in 2002 in this vicinity resulted in no detections of marbled murrelets.

Occupied Sites: 1

(Includes survey areas ESF56 and ESF Grid 12)

G.2.14. Indian Charlie Johanneson MMMA (EST. 2002)

90 Acres

In 2002, surveys of West Charlotte Creek resulted in sub-canopy activity during three surveys accompanied by 35 presence detections over the season. The activity was in both the Johanneson Creek and the Indian Charlie Creek basins. Surveys were halted after the first

year of effort, and the MMMA was designated. During grid surveys in 2002 in this vicinity, marbled murrelet presence was detected.

Occupied Sites: 2

(Includes survey areas ESF118 and ESF Grid 15)

G.2.15. Joe Buck MMMA (EST. 1993; Revised 2006)

670 Acres

Occupied sites were established in this area in 1993 following observations of sub-canopy behavior on five occasions along with numerous presence detections during surveys of Buck Ridge and Knife Otter in 1992 and 1993 (ESF904 and ESF925). The MMMA was created in 1994 and included three separate occupied sites. Nest search surveys were conducted in 1994 with nine sub-canopy surveys reported including a landing. In 1996, surveys were conducted with no detections. Surveys to evaluate the need for seasonal restrictions were performed late in the season in 1999, with additional sub-canopy behaviors observed. Surveys in 2002 produced one survey with presence detections, but there were no detections in 2003. Areas in the vicinity of the MMMA were surveyed again in 2006 under the site names Lower Deer (ESF168) and North Buck (ESF169). The Lower Deer surveys resulted in 20 surveys with marbled murrelet presence detections, including four surveys where sub-canopy behavior was observed. Surveys at North Buck yielded seven surveys with marbled murrelet presence detections, including one survey with multiple sub-canopy behaviors reported. As a result of sub-canopy marbled murrelet detections during the 2006 survey year, 90 acres were added to the Joe Buck MMMA.

Occupied Sites: 7

(Includes survey areas ESF2, ESF124, ESF168, ESF169, ESF904, ESF922, ESF925, FCS1, NSS1, SRS Joe Buck, and SRS Joe Buck MMMA)

G.2.16. Kentuck Ridge MMMA (EST. 2001; expanded in 2003)

279 Acres

A single subcanopy behavior was observed during surveys of Kentuck Ridge No. 4 (ESF94) in 1999 and 2000. Previous surveys in 1994 and 1995 for Kentuck Ridge No. 3, had recorded seven total presence detections in 14 surveys, but no occupied behaviors. A MMMA was established in 2001 for this occupied site. In 2003, a survey at the Stonehouse Point survey area (ESF136) north of the MMMA resulted in sub-canopy behavior, accompanied by numerous presence detections during six surveys in two sites. The MMMA was expanded in 2003 to include these two additional occupied sites.

Occupied Sites: 3

(Includes survey areas ESF65, ESF94, ESF100, ESF136, ESF161, and ESF912)

G.2.17. Knife Forks MMMA (EST. 1994)

265 Acres

A single ODFW survey in the Knife Forks area (ESF32) in 1993 resulted in the observation of occupied sub-canopy behaviors. A contractor survey in Knife Forks in 1994 also observed marbled murrelets exhibiting sub-canopy behaviors. In addition, Fish/Knife restricted team surveys resulted in two additional surveys with sub-canopy marbled murrelet observations further up in the headwaters of Knife Creek. The MMMA was designated in 1994 to include these two occupied sites. There were no observations of marbled murrelets during 1995 (a single survey to Knife Ridge No. 3), 2000 (Knife Fork seasonal restriction surveys), 2001, or 2002 (timber sale surveys of Knife Ridge No. 5).

Occupied Sites: 2

(Includes survey areas ESF32, ESF40, ESF54, ESF60, ESF115, RTS Fish/Knife Restricted Team Survey, and SRS Knife Fork)

G.2.18. Knife Point MMMA (EST. 2003)

34 Acres

In 2003, a single sub-canopy detection of a marbled murrelet diving to 0.2 canopy occurred during surveys of Knife Point (ESF146) in July, leading to the creation of this MMMA. Surveys at the adjacent (within 330 feet) Western Knife survey area in 2005 detected no marbled murrelets. Earlier surveys of the Knife Ridge No. 2 sale area in 1992 detected murrelet presence.

Occupied Sites: 1

(Includes survey areas ESF27 and ESF146)

G.2.19. Larson Bottom MMMA (EST. 2005; Revised 2006)

78 Acres

This area was surveyed by contractors in 2005 as Larson Creek No. 2 (ESF165). During one survey, seven sub-canopy behaviors were reported. Additionally, seven of the ten total surveys performed within the MMMA boundary resulted in marbled murrelet presence detections. The MMMA was established in 2005 to include the survey station with the sub-canopy detections and nearby mapped habitat. Contractors continued surveys of Larson Creek No. 2 in 2006 and reported 25 surveys with marbled murrelet presence detections, including five surveys where sub-canopy behaviors were observed. As a result of the sub-canopy marbled murrelet behavior during 2006 surveys, 83 acres were added to the Larson Bottom MMMA.

Occupied Sites: 2

(Includes survey area ESF165)

G.2.20. Larson Point MMMA (EST. 2003)

59 Acres

This area was surveyed by contractors in 2002 and 2003 as Larson Point. There were no detections of marbled murrelets in 2002. Surveys performed in 2003 resulted in two surveys with sub-canopy marbled murrelet behaviors observed and four surveys with marbled murrelet presence detections. The MMMA was established in 2003 as a result of these surveys.

Occupied Sites: 1

(Includes survey area ESF131)

G.2.21. Lower Charlotte MMMA (EST. 2002)

74 Acres

During grid surveys in 2002, there was one observation of a sub-canopy marbled murrelet in this area. There were additional presence detections during these surveys. The MMMA was designated in 2002 based on these surveys.

Occupied Sites: 1

(Includes survey area ESF Grid 24)

G.2.22. Lower Mill MMMA (EST. 2001; Revised 2002, 2003)

1,127 Acres

General surveys in the area in 1994 resulted in two surveys with sub-canopy marbled murrelet observations. Additional general surveys in 1995 resulted in a single presence detection. In 1999, protocol surveys at Clinton Head (ESF93)resulted in sub-canopy behavior reported on three separate occasions, including an observation of birds landing after the survey time. A new round of contractor surveys in 2000 and 2001 in the Camp Creek No. 3 area (ESF106) resulted in three surveys with sub-canopy behavior. The MMMA was established in 2001 based on the detections in 1999-2001. This MMMA incorporated lands classified as SUVs that connected five separate occupied sites. In 2002, grid surveys resulted in three surveys documenting sub-canopy behaviors at two sites. The MMMA was expanded to include these additional two occupied sites. In 2003, protocol surveys of the Curvy Puckett area yielded three surveys with sub-canopy marbled murrelet observations. Again, the MMMA was expanded to incorporate an additional occupied site.

Occupied Sites: 8

(Includes surveys areas ESF93, ESF106, ESF152, GEN Puckett Creek, GPSC Puckett Creek General Survey, and Grid 26E)

G.2.23. Lower Totten MMMA (EST. 2003)

82 Acres

During the second year of protocol surveys of Lower Totten Group in 2003, there were seven surveys with multiple presence detections and one survey during which two murrelet pairs were seen flying at 1.0 canopy height. The MMMA was established in 2003 based on these detections. There were no detections during the first year of survey effort, or during previous surveys in the area in 1994. Grid surveys conducted in 2002 resulted in a single auditory presence detection.

Occupied Sites: 1

(Includes survey area ESF80, ESF129, and ESF Grid 13)

G.2.24. Luder Footlog MMMA (EST. 2002)

129 Acres

During grid surveys in 2002, two intensive surveys reported sub-canopy marbled murrelets. That same year, contractor surveys in the East Luder survey area resulted in eighteen presence detections, but no sub-canopy marbled murrelets were observed. The MMMA was established in 2002 incorporating the sub-canopy detections at the ridgetop and down into the Luder Creek drainage. Previous surveys for Luder Forks in 1992, had recorded a total of two presence detections over a span of three surveys in the vicinity.

Occupied Sites: 1

(Includes survey areas ESF133, ESF926, and ESF Grid 26S)

G.2.25. Luder Umpqua MMMA (EST. 2002)

338 Acres

The Luder Umpqua MMMA was delineated after grid surveys in 2002 revealed occupied marbled murrelet behaviors during two general surveys and ten intensive surveys. No marbled murrelets were detected in the Luder Forks area during ODF staff surveys in 1992.

Occupied Sites: 4

(Includes survey areas ESF926, Grid 25, Grid 25N, Grid 25S, Grid 26, Grid 26E, and Grid 26S)

G.2.26. Marlow Bottom (EST. 2001; Revised 2006)

170 Acres

Surveys commenced in the South Marlow Ridge area in 1999 and ran through 2001. Sub-canopy behaviors were observed during three surveys. The MMMA was established in 2001

following these surveys. Additional survey effort in the South Marlow Switch area in 2003 resulted in one additional survey with sub-canopy behavior reported in the southern half of the MMMA. Surveys continued in the vicinity of this MMMA in 2005 and 2006 under the name South Marlow Switch A:1. Contractors reported two surveys with marbled murrelet presence detections in 2005. During surveys in 2006, five surveys reported marbled murrelet presence detections, including one survey with a single sub-canopy observation. As a result of the sub-canopy marbled murrelet behavior reported during 2006 surveys, 23 acres were added to the Marlow Bottom MMMA. Previous surveys in the South Marlow area in 1994 detected marbled murrelet presence.

Occupied Sites: 3

(Includes survey areas ESF78, ESF95, and ESF134)

G.2.27. Marlow Lockhart MMMA (EST. 2002; Revised 2006)

325 Acres

Surveys in 2001 and 2002 in the Marlow Lockhart Trio area (ESF108), resulted in four sub-canopy marbled murrelet observations. The MMMA was established in 2002 as a result of these detections. Locked Marlow was surveyed in 2003 and 2004, and resulted in additional surveys with marbled murrelet presence reported to the west of this MMMA. Surveys continued in the vicinity of this MMMA in 2006 under the site name Piledup Marlow No. 2. Eight surveys yielded marbled murrelet presence detections, including two surveys with multiple sub-canopy observations. As a result of the sub-canopy marbled murrelet behaviors reported during 2006 surveys, 55 acres were added to the Marlow Lockhart MMMA.

Occupied Sites: 3

(Includes survey areas ESF79, ESF99, ESF108, ESF138, and ESF167)

G.2.28. Middle Dean MMMA (EST. 2002)

85 Acres

Grid surveys in 2002 resulted in five observations of sub-canopy marbled murrelet behavior. An additional 17 surveys yielded presence detections. The MMMA was established in 2002 based on these detections. The MMMA overlaps with the Dean Johanneson Habitat Conservation Area.

Occupied Sites: 1

(Includes survey areas ESF Grids 16 and 16E)

G.2.29. Millicoma Schumacher MMMA (EST. 2002)

60 Acres

Surveys conducted in the vicinity in 1994, 2000, and 2001 resulted in no detections of marbled murrelets. Grid surveys in 2002 resulted in four surveys with sub-canopy marbled murrelets observed. More than 90 cumulative presence detections were reported during 2002. The MMMA was established in 2002 based on these sub-canopy observations.

Occupied Sites: 1

(Includes survey areas ESF80, ESF 97, and ESF Grid 7)

G.2.30. Palouse Larson MMMA (EST. 2002)

107 Acres

During grid surveys in 2002, contractors reported two surveys with sub-canopy marbled murrelet activity, as well as 13 surveys with presence. A MMMA was established in 2002 following these surveys.

Occupied Sites: 1

(Includes survey area ESF Grid 5)

G.2.31. Panther Bench MMMA (EST. 2006)

38 Acres

Five of the surveys initiated in Panther Headwaters No. 3 in 2006 recorded marbled murrelet presence, including two surveys with observations of sub-canopy behavior. A MMMA was established based on these observations.

Occupied Sites: 1

(Includes survey area ESF166)

G.2.32. Panther Headwaters MMMA (EST. 1994)

367 Acres

Surveys by ODF staff at East Fork Howell Creek No. 2 in 1992 resulted in no detections of marbled murrelets. ODFW visits to the nearby Howell Top area (ESF41)in 1993 resulted in a single marbled murrelet presence detection. Contractors took over the Howell Top surveys in 1994 and observed the first sub-canopy marbled murrelet. The South Panther area (ESF70) was also surveyed in 1994 with sub-canopy marbled murrelet behavior being reported during three surveys. Two of these three surveys with sub-canopy behavior occurred at stations outside the current MMMA boundary in adjacent non-habitat. The MMMA was established in 1994 based on these observations. A nest research project failed to turn up marbled murrelets at Howell Top in 1995 and Panther Elk Plot in 1996.

Occupied Sites: 2

(Includes survey areas ESF41, ESF70, ESF911, and ESF 933)

G.2.33. Right Fork Johnson MMMA (EST. 2004)

54 Acres

This area was first surveyed in 2002 as Two Bowls A:1 (ESF 121) with presence detected. It was again surveyed in 2003 with multiple audio and circling above canopy presence detections at Station 1 late in the survey season. Additional surveys were recommended in 2004. This area was included into another sale in 2004 and surveyed as Trout Dry Bowl A:1 (ESF156) with two sites. Twenty presence (audio and fly over) and over thirty cumulative sub-canopy behaviors were observed during three surveys throughout the survey season in site 1, at the same station location that recorded audio and circling above canopy detections in 2003. Based on 2004 survey and behavior information, the Right Fork Johnson MMMA was drawn encompassing portions of site 1. Trout Head A:1 was surveyed by contractors in 2005 with one auditory presence detection reported.

Occupied Sites: 1

(Includes survey areas ESF121 and ESF156)

G.2.34. Roberts Ridge MMMA (EST. 1994; Revised 2002)

664 Acres

ODF staff surveyed the Roberts Creek No. 6 area (ESF2) in 1992 and observed a single sub-canopy marbled murrelet landing in a tree near a ridgetop. The USFWS visited the location in 1992, and indicated a strong belief that birds were using the stand for nesting. The ODFW recommended that the stand be considered occupied. During 1993 surveys in the same area, one presence detection was recorded approximately 2,000 feet away at the bottom of the draw. General surveys, performed by contractors in the Roberts Creek General Survey area in 1994 (over one mile from the ridgetop detection), reported presence detections on four occasions. The MMMA was established in 1994 based on the sub-canopy observations and recommendations by agency biologists. In 2002, grid surveys southwest of this MMMA resulted in sub-canopy detections during eight surveys. The MMMA was expanded to include this area of detections. In 2005, a station within the MMMA was surveyed once as part of a monitoring effort, and tallied zero detections.

Occupied Sites: 3

(Includes survey areas ESF2, ESFMMMA3, GEN Roberts Creek General Survey, ESF Grid 35, ESF Grid 37, ESF Grid 38, and ESF Grid 41)

G.2.35. Schumacher Headwaters MMMA (EST. 1994)

169 Acres

The first year of survey effort at Schumacher Ridge No. 2 (ESF29) was 1993. The ODFW observed four sub-canopy marbled murrelet detections over a two-survey span, with additional presence detections during the later part of the survey season. One sub-canopy detection and presence detections were recorded during year 2 by contractors. The MMMA was established in 1994 based on these detections. Surveys were resumed in 2000 and 2001 in the Schumacher Ridge No. 3 area (ESF97), with one survey reporting sub-canopy behavior in the southern portion of the MMMA.

Occupied Sites: 2

(Includes survey areas ESF29, ESF74, and ESF97)

G.2.36. South Umpcoos MMMA (EST. 1994)

877 Acres

The ODF first surveyed this area in 1992 as Slingshot Ridge and West Fork Headwaters, and had no marbled murrelet detections. The ODFW surveyed this area in 1993 for Millicoma Maid (ESF927), Slingshot Ridge (ESF936), West Fork Headwaters (ESF941), and Salander Headwaters (ESF28). Sub-canopy marbled murrelet behaviors were detected during five surveys. In 1994, contracted surveyors reported one survey with sub-canopy behavior in the Salander Headwaters area. In total, 112 visits occurred at 56 stations on approximately 1,130 acres. Eight of these surveys were conducted at six stations and recorded observations of sub-canopy behavior. Presence was also detected during four visits to other stations. The MMMA was established in 1994 to incorporate these occupied sites.

Occupied Sites: 3

(Includes survey areas ESF10, ESF28, ESF55, ESF59, ESF111, ESF151, ESF159, ESF927, ESF936, ESF941, and ESFMMMA1)

G.2.37. Sullivan Headwaters MMMA (EST. 1994)

190 Acres

The ODF and contractors surveyed the Sullivan Creek Headwaters area (ESF12) in 1992 and 1993. There was one sub-canopy detection and other surveys with presence detections. The Sullivan Creek Headwaters area was surveyed by contractors in 1994, resulting in an additional detection of sub-canopy behavior to the south. The MMMA was established in 1994 to encompass these two occupied sites. The Western Sullivan area was surveyed by contractors for a three-year duration starting in 2002. There were no reports of marbled murrelets resulting from these surveys.

Occupied Sites: 2

(Includes survey areas ESF12, ESF123, and ESF939)

G.2.38. Trout Mouth MMMA (EST. 2001)

276 Acres

Contractor surveys began in the Panther Creek and Ramrod Ridge No. 2 in 1994, with one marbled murrelet presence detection reported. In 1995, at the Ramrod Ridge No. 2 survey area (ESF69), a single survey with sub-canopy marbled murrelet activity was recorded by contractors. However, no MMMA was established at this time because the observation was of birds near a ridgetop, and they were not believed to be associated with the habitat at the survey station. In 2001, two surveys of Beartooth Point (ESF109) resulted in sub-canopy detections of marbled murrelets. Additional surveys of Stulls Ridge No. 3, Beartooth, and Beartooth Point areas in 2001 and 2002 resulted in no further sub-canopy detections. The MMMA was established based on the 2001 detections. The sub-canopy observation from 1995 was included within the MMMA boundary. Bowl Bound Beaver area surveys in 2004 and 2005 resulted in one survey where marbled murrelet presence was reported.

Occupied Sites: 1

(Includes survey areas ESF69, ESF87, ESF98, ESF109, ESF155, and FCS Panther Creek)

G.2.39. West Charlotte MMMA (EST. 2002)

71 Acres

This area was surveyed by contractors as West Charlotte Creek and as Grid 15 in 2002. Presence was recorded in four of eight intensive surveys at West Charlotte Creek. A single sub-canopy behavior was recorded during one intensive Grid survey (ESF Grid 15). This MMMA was established in 2002 based on these observations of marbled murrelet activity.

Occupied Sites: 1

(Includes survey areas ESF118 and ESF Grid 15)

G.3. MARBLED MURRELET OBSERVATIONS OUTSIDE OF MMMAS

G.3.1. Alder Fork No. 4

A single sub-canopy detection by the ODFW in 1993 occurred in non-habitat. The stand is 28 years old and composed primarily of alder. No occupied site was designated due to the lack of suitable habitat.

Occupied sites: 0

(Includes survey area ESF900)

G.3.2. Big Little Salander

One survey was conducted with a single sub-canopy detection in 2005. There were no further detections of murrelets at this survey site during nine protocol surveys in 2006. Sale unit and occupancy determination are deferred pending further surveys.

Occupied sites: pending

(Includes survey area ESF159)

G.3.3. Fish Ridge No. 3

One survey in May 1994 by a contractor biologist recorded 56 total detections, including 2 that were sub-canopy. Six follow-up surveys at the same station that year revealed no marbled murrelets. Numerous surveys in the vicinity in 1994 and in previous years also yielded no detections of marbled murrelets. The ODF consulted with the ODFW, and both agencies agreed that the stand with the detections did not appear to have a significant level of suitable nesting platforms, and that the detections recorded on the one survey did not indicate a nesting location in that stand. This consultation was formalized in a Memorandum of Agreement signed by representatives of both agencies. No occupied site was designated because of the lack of suitable habitat.

Occupied sites: 0

(Includes survey area ESF40)

G.3.4. Grid No. 20

Grid surveys in 2002 resulted in one presence detection and one detection of a single bird at 1.0 canopy during a single general survey visit. No occupied site was designated because the sub-canopy observation was not verified. Further protocol surveys of the area would be required prior to including the area in a proposed timber sale.

Occupied sites: 1

(Includes survey area GRID20)

G.3.5. Johanneson Creek No. 1

A general survey by contracted biologists in 1994 yielded four sub-canopy detections. These detections are located within the riparian zone adjacent to the Dean Johanneson Habitat Conservation Area.

Occupied sites: 1

(Includes survey area ESF923)

G.3.6. Larson Ridge No. 6

Four sub-canopy detections were reported by a contractor biologist during a single visit in 1995, including two birds circling below the canopy. The behavior was observed in riparian habitat along Larson Creek, in a stand lacking apparent marbled murrelet nesting structure. Mapped marbled murrelet habitat is located approximately 800 feet to the south and to the north of the detections. There were presence detections nearby during surveys in 2001 and in 2005. No occupied site was designated due to the lack of suitable habitat. It was determined that the behaviors observed were most likely those of birds commuting to or from suitable habitat upstream or downstream of the survey station.

Occupied Sites: 0

(Includes survey area ESF66)

G.3.7. Lone Buck

There was one detection of a marbled murrelet at canopy height in 2003. No birds were detected during an extra survey three days later or during two additional protocol surveys conducted that year. The area was not surveyed again in 2004 because the survey site for the planned timber sale was redrawn and the District had no plans to harvest in the area in the near future. There is mapped marbled murrelet habitat near the survey station. No occupied site was designated because the sub-canopy observation was not verified. Further protocol surveys of the area would be required prior to including the area in a proposed timber sale.

Occupied sites: 1

(Includes survey area ESF140)

G.3.8. Lower Deer

Two detections of sub-canopy marbled murrelets were observed during one survey at the Lower Deer site in 2006. The observations took place in close proximity, and in between, two MMMAs along the West Fork Millicoma River. The West Fork Millicoma River is likely functioning as a flight corridor for marbled murrelets. Future survey information may

be helpful in determining if the survey area is occupied by murrelets or is being used as a flight corridor. Sale unit and occupancy determination deferred pending further surveys.

Occupied sites: pending

(Includes survey area ESF168)

G.3.9. Lower Fish Nest Site Search

Two silent marbled murrelets were observed during a nest search survey in 1995 at 96 percent canopy, entering the stand to the immediate southeast of the surveyor. The station is located in a young plantation, and the stand the marbled murrelets entered is unsuitable habitat but is within 400 feet of mapped habitat. This station was not included in the adjacent MMMA and T&E core because of the lack of suitable habitat.

Occupied sites: 0

(Includes survey area NSS81)

G.3.10. Puckett Creek

Contractor general surveys in July 1994 recorded one bird flying through the canopy at this station. The station was located in a 31-year-old stand adjacent to young plantations. An occupied site was not established due to a lack of suitable habitat. The station is located approximately ¼ mile from the Lower Mill MMMA, and likely indicates a marbled murrelet commuting to or from that area

Occupied sites: 0

(Includes survey area GEN Puckett Creek)

G.3.11. Umpcoos Ridge A:2

One survey was conducted with a single stationary detection in 2005. The surveyor reporting this detection was not experienced. There were no other detections at this survey site during nine protocol surveys in 2006. Occupancy determination was postponed pending further surveys.

Occupied sites: pending

(Includes survey area ESF164)

G.3.12. West Fork Headwaters No. 2

There were two sub-canopy detections in 1993 during one survey by the ODFW. A follow-up survey in 1993 and four surveys in 1994 failed to detect marbled murrelets at this location. The station is located near a ridgetop between two occupied sites (Panther Headwaters and Umpcoos Ridge MMMAs). Although this station is adjacent to mapped

habitat, it was thought that the marbled murrelets observed were commuting through a saddle in close proximity to the survey station. For this reason, no occupied site was designated. The area being surveyed has since been harvested.

Occupied sites: 0

(Includes survey area ESF10)

Table G-1
Marbled Murrelet Occupied sites, Marbled Murrelet Management Areas, and HCP T&E Core Areas HCP T&E Core Areas

Marbled Murrelet Management Area	HCP T&E Core Area
Beaver Headwaters	Beaver Headwaters
Benson Headwaters	Benson Top
Big Deer	Middle Deer, Big Otter
Charlotte Headwaters	Middle Charlotte
Daggett Headwaters	None
Dry Ridge	Dry Ridge
Elk Forks	Elk Forks
Elk Pass	Elk Pass
Fish Knife	Fish Knife
Footlog Ridge	None
Glenn Headwaters	Glenn Headwaters
Goody Ridge	Goody Ridge
Henrys Bend	Marlow Henry
Indian Charlie Johanneson	Johanneson
Joe Buck	Joe Buck
Kentuck Ridge	Stonehouse Point
Knife Forks	Knife Forks
Knife Point	None
Larson Bottom	Larson Bottom
Larson Point	Larson Point
Lower Charlotte	Luder Umpqua
Lower Mill	Lower Mill
Lower Totten	None
Luder Footlog	Luder Footlog

Marbled Murrelet Management Area	HCP T&E Core Area
Luder Umpqua	Luder Umpqua, Lower Mill
Marlow Bottom	Marlow Bottom
Marlow Lockhart	Marlow Lockhart
Middle Dean	Dean Creek
Millicoma Schumacher	Millicoma Schumacher
Palouse Larson	Larson Palouse
Panther Bench	Panther Bench
Panther Headwaters	Panther Howell
Right Fork Johnson	Right Fork Johnson
Roberts Ridge	Lower Roberts
Schumacher Headwaters	Schumacher Headwaters
Sullivan Headwaters	Sullivan Creek
South Umpcoos	Old Maids Cabin
Trout Mouth	Trout Mouth
West Charlotte	None

Appendix H
Report: Marbled Murrelet Habitat Mapping and Validation

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H.1. BACKGROUND

H.1.1. Introduction

The Oregon Department of Forestry (ODF) Habitat Conservation Plan (HCP) for the northern spotted owl and marbled murrelet on the Elliott State Forest was approved by the U.S. Fish and Wildlife Service (USFWS) in 1995. The Incidental Take Permit (ITP) issued to the ODF for the marbled murrelet was for six years; that permit expired in 2001. The ODF is interested in re-establishing the marbled murrelet as a covered species in the HCP.

In the 1995 HCP, suitable marbled murrelet habitat was defined as stands 100 years old and older. Before any timber harvest operations were planned, all stands at least 100 years old were ranked as "low quality," "medium quality," or "high quality" habitat; these designations were based on a field survey on the characteristics of marbled murrelet habitat.

Hamer Environmental was contracted to test and validate the habitat rating procedure described in the HCP. Hamer Environmental found that, while the rating procedure correctly predicted occupied stands, it was not accurate in predicting unoccupied stands. Thus, Hamer Environmental developed a simpler, more accurate habitat rating strategy using a standardized, repeatable, reliable field method of measuring habitat conditions on the Elliott State Forest (Hamer and Meekins 1996). This alternative strategy used transects covering 10 percent of the stand area to collect data on only two variables: number of platforms and percent slope. A logistic regression model was then developed using these data to rate stands as having either a low, medium, or high probability of occupancy. One limitation of this model is that it was based on only a portion of stands in the Elliott State Forest, and these stands were not randomly selected. Nevertheless, this alternative procedure was adopted for rating the probability of occupancy by marbled murrelets in stands 100 years old and older on the Elliott State Forest.

The ODF would like to develop a method of identifying marbled murrelet habitat that focuses on structure rather than age, and that does not require application on an operational basis. Marbled murrelet surveys and research on the characteristics of marbled murrelet habitat on state forest lands in the Oregon Coast range (Nelson and Wilson 2002) have shown that marbled murrelets may use stands younger than 100 years old if they contain the appropriate nesting structure, and that stands greater than 100 years old may not contain nesting structures. By using age to define suitable habitat, some important habitats may be overlooked, and stands without nesting structure may be considered suitable habitat based on age alone.

The method chosen involved the use of aerial photos to identify areas of the forest containing potentially suitable marbled murrelet nesting structures. This method focused on stand structural characteristics that are visible from aerial photos; because it did not require field surveys, all habitat could be identified at once rather than on an operational basis.

H.1.2. Marbled Murrelet Habitat Delineation

Two persons from Hamer Environmental and Bob Fields and Norma Kline with ODF, identified potential marbled murrelet habitat by analyzing orthophotos and aerial photos for areas that appeared to contain suitable structures for marbled murrelets. This exercise was performed in 2002, using orthophotos constructed from a orthophoto flight in 1996 as the base layer and stereo pairs of aerial photos (2001) for verifying questionable areas. This mapping project utilized Bob's and Norma's knowledge of the Elliott State Forest and skills in interpreting textural differences on aerial photos. Marbled murrelets nest on large branches, which are typically associated with large trees, and which in turn can be identified on aerial photos by their height and crown spread.

Bob has worked as a forester on the Elliott State Forest since 1976. Since 1992, he has been the district contact for marbled murrelet survey projects and habitat research. In this role, Bob assessed habitat on the forest for the need to conduct marbled murrelet surveys, conducted such surveys, located nesting areas for marbled murrelets, and assisted researchers Tom Hamer and Kim Nelson with their Elliott State Forest marbled murrelet research projects. Norma has worked as a forester on the Elliott State Forest since 1996. Because her knowledge of marbled murrelets on the forest is less extensive than Bob's, she utilized a different perspective in observing the forest. Both foresters examined orthophotos for the entire forest, and drew polygons designating the suitable habitat directly on the photos. They digitized the results into the ArcView geographic information system.

After the initial mapping exercise, the resulting habitat layer was refined. Mapped habitat that was within the boundaries of sold timber sales was deleted. Habitat polygons were cross-checked with stand age, polygons in stands less than 65 years old were rechecked on aerial photos, and stand data were examined for any noted residual trees. Stands without evidence of residual trees were deleted from the habitat layer.[1] The orthophotos tended to have reduced resolution, particularly around the edges. The orthophotos were examined for any polygons located in these "fuzzy" areas. The polygons were then rechecked on the aerial photos, and any polygons that did not appear to have marbled murrelet structures in the aerial photos were deleted from the habitat layer. Polygons less than five acres also were reexamined on the aerial photos. If appropriate, these slivers were connected with adjacent polygons of habitat. Otherwise, most of the polygons were redrawn to include at least five acres around the habitat patch. Finally, all of the corrections were double checked for accuracy. Figure H-1 shows the resulting mapped marbled murrelet habitat on the Elliott State Forest. There are a total of 662 polygons of mapped habitat (17,381acres).[2] The average polygon size is 29 acres, with a minimum of 2 acres, and a maximum of 665 acres.

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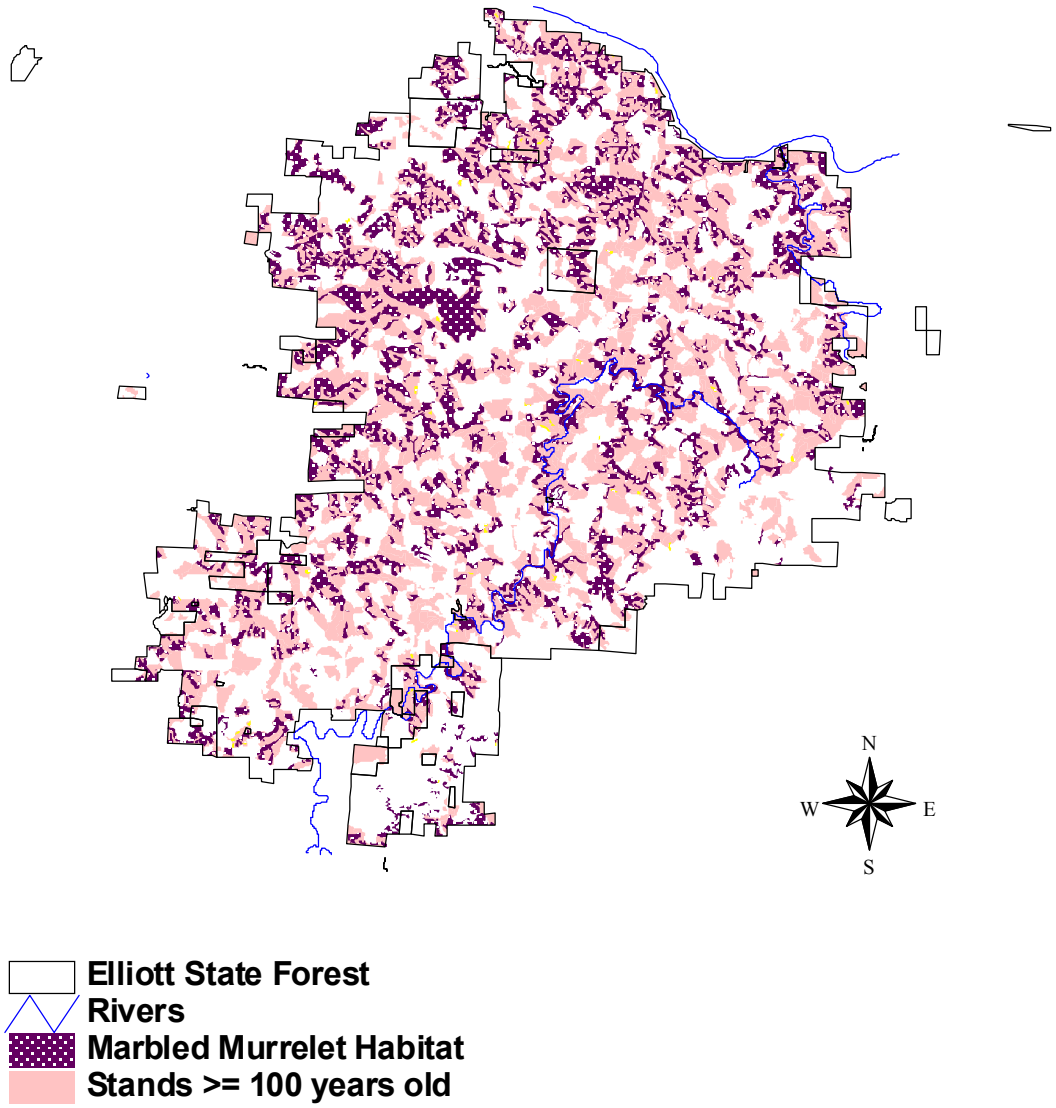
[1] Although the majority of occupied stands on the Elliott State Forest are over 100 years old, subcanopy behaviors have been observed in stands as young as 70 years, and in younger stands elsewhere. Because of the age structure of the Elliott, 65 years was considered a reasonable minimum age for finding occupied stands on the Elliott State Forest.

[2] This acreage has since been updated to be consistent with the current condition of the forest, and to account for habitat that has been harvested since the 1996 orthophotos.

Figure 1. Mapped marbled murrelet habitat on the Elliott State Forest and stands at least 100 years old.



H.2. METHODS

H.2.1. Study Design Overview

A study was designed and implemented to determine whether the marbled murrelet habitat layer resulting from the mapping exercise is an adequate representation of suitable marbled murrelet nesting habitat on the Elliott State Forest. The study compared vegetation characteristics associated with marbled murrelet occupancy or nesting (such as platform density and moss cover) in the mapped polygons ("mapped") to those same characteristics in known occupied stands ("occupied") and in mature stands (more than 65 years old) that were not mapped as habitat ("unmapped"). This was designed to demonstrate that characteristics in the mapped habitat were similar to the same characteristics in the occupied stands, and that the characteristics differed between mapped habitat and unmapped stands.

The study involved several steps:

1. Determining an adequate number of stands to sample such that differences could be detected. The assumptions and calculation are described in Section H.2.2, "Sample Size."
2. Ensuring that enough stands were available in each habitat type for an adequate sample. Although a sufficient number of mapped polygons and unmapped stands were available from which to draw a sample, the number of known occupied stands was not adequate for the required sample size. For this reason, additional marbled murrelet surveys were conducted in an effort to locate more occupied sites. These surveys are described in more detail in Section H.2.3, "Additional Marbled Murrelet Surveys."
3. Devising a sampling scheme for the collection of habitat data in the three habitat types. The design of this sampling is described in Section H.2.5, "Plot Selection."

Results from the data collection and analysis are described in Section H.3, "Results." Lisa Ganio, a consulting statistician, was consulted in the study design and analysis of results.

H.2.2. Sample Size

A sample size estimate was calculated using the following formula:

$$\eta = (Z_{\alpha/2} + Z_{\beta})^2 s^2/(\mu_A - \mu_0)^2$$

where Z is the Z-statistic, α is the Type I error rate, β is the Type II error rate, s^2 is an estimate of the population variance, and $\mu_A - \mu_0$ is the effect size.

The calculation for sample size used the population variance for the mean number of platforms from Kim Nelson's research on state forest lands, including the Elliott State Forest (Nelson and Wilson 2002). Nelson collected data on variables, including platform density in 25-meter-radius (0.49-acre) plots centered on nest trees, and randomly selected trees without

nests. One of the findings from this study was the significant difference between the mean number of platforms in nest and non-nest plots, at p less than 0.0001. The mean number of platforms in nest plots was 112.8 [Standard Error (SE) equals 13.8, number of samples (n) equals 32], and the mean number of platforms in non-nest plots was 61.8 (SE equals 6.0; n equals 131). The population variance for the mean number of platforms in nest plots was 78.

We made the following assumptions for the other variables for the calculation of sample size: a Type I error rate of 0.05, a Type II error rate of 0.2, and an effect size of 30. The sample size estimate using these numbers was 53. That is, detecting a difference of 30 or more platforms among habitat types, with only a 5 percent chance of finding a difference that does not exist (Type I error) and a 20 percent chance of missing an effect that does exist (Type II error), given a population variance of 78, would require that 53 plots be sampled per habitat type (mapped, occupied, and unmapped), for a total of 159 plots sampled.

Of the three habitat types, there are 610 polygons of mapped habitat, 1,138 polygons of stands aged at least 65 years that were not mapped, and 50 polygons representing occupied stands (see Figure H-1).

H.2.3. Additional Marbled Murrelet Surveys

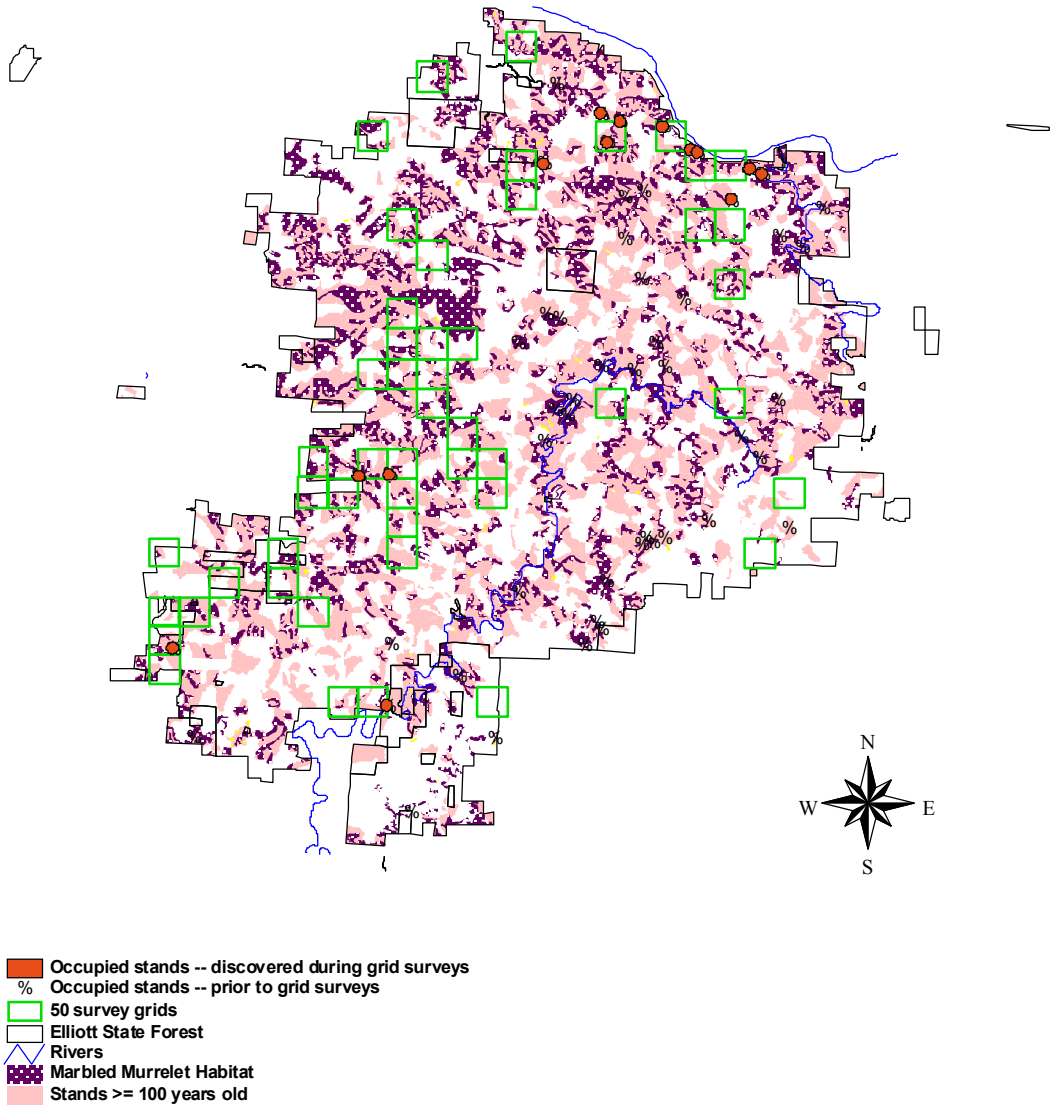
At the beginning of this study, the locations of 50 occupied stands for marbled murrelets were known. These stands were discovered as a result of surveys conducted between 1992 and 1995, and beginning again in 1999 to 2001. Most of these surveys were performed in timber sale areas, although some were conducted for research purposes. During that period, few timber sales were planned in the western management basins on the forest, where northern spotted owls were resident. As a result, timber sale activity, and thus survey effort, was concentrated in the eastern management basins, and most of the known occupied marbled murrelet stands are located in this part of the forest.

Based on the sample size calculation, this number of known occupied sites was not sufficient for the study. In addition, the locations of these sites were biased to certain parts of the forest. Marbled murrelet surveys were planned to locate additional occupied sites that were more representative of the forest as a whole. This was accomplished by a random selection of survey sites. First, a grid of the forest was created, using a 240-acre cell size. This size was selected because it could be covered efficiently in a general habitat survey. Grid cells meeting the following criteria were eliminated from the sample pool:

- Cells containing sold sales or within one-quarter mile of sold sales. This was a necessary practical consideration to avoid potential disturbance from sale operations, conflicts with marbled murrelet surveys for timber sales, and potential contractual conflicts with the sales.
- Cells already containing an occupied stand.

A total of 50 grid cells were randomly selected for survey from the resulting pool of grid cells. This was the highest number of cells that could be surveyed within the financial constraints. Figure H-2 shows the location of the randomly selected grid cells.

Figure 2. Location of 50 survey grids and occupied stands before and after grid surveys.



Professionally trained and certified surveyors conducted the marbled murrelet surveys (Turnstone Environmental 2002) using the 2000 version the Inland Survey Protocol (Evans et al. 2000) as a guideline. Survey stations were established and mapped in sufficient number to adequately cover potentially suitable habitat within each grid.

Because the objective of the surveys was to locate as many occupied sites as possible, rather than to establish probable absence of marbled murrelets in an area, the survey methodology employed for this study differed from the inland survey protocol. Both general and intensive surveys were used in an effort to observe the marbled murrelet interacting with its nesting habitat. General surveys were used at the start of the field season to survey larger tracts of suitable habitat. All grid cells received at least one general survey, conducted between June 16 and July 5. (Previous surveys have indicated that over 80 percent of detections on the Elliott State Forest have occurred after June 16.) In some cases, general surveys were repeated to obtain additional information for a future intensive survey.

Once marbled murrelet presence was established using the general surveys, intensive surveys were used to gather more site-specific information. Not all grid cells received intensive surveys. Intensive surveys were conducted between July 1 and July 31 at or near the location of the detections recorded during the general survey. Multiple intensive surveys were conducted in grids with high activity levels. In addition, five new survey areas were added when surveyors observed occupied behaviors adjacent to the selected grid cells. Surveyors re-evaluated their locations on a daily basis, and modified subsequent survey locations based on the area of the last detections. Surveyors continued to monitor high activity grids until occupied behavior was observed in site-specific stands.

Surveyors recorded significant detections in ten of the 50 grid cells. Presence was only detected at an additional 14 grids. Detections from established grids and areas adjacent to the established grids were analyzed, identified ten new occupied stands were identified.

Survey methods and results are described in more detail in *Marbled Murrelet Surveys for the Elliott State Forest Habitat Conservation Plan, Final Report* by Turnstone Environmental Consultants, Inc. (2002).

H.2.4. Delineating Occupied Stands

Once all of the occupied stands were identified, these areas were required to be mapped and then excluded from the selection pool for the mapped and unmapped plots. The following process was used to map the occupied stands to exclude from the selection pool.

All Marbled Murrelet Management Areas (MMMAs) were excluded from the selection pool for mapped and unmapped habitat. MMMAs are areas designated by the ODF and the Oregon Department of Fish and Wildlife for the protection of marbled murrelets, and include occupied stands discovered prior to 2001.

For occupied sites discovered during the additional surveys described above, 645-foot-radius circles (30 acres) were delineated around the point identified as the center of marbled murrelet activity. Thirty acres is the maximum field survey coverage that can be

accomplished from one point (station) according to the inland survey protocol. These 30-acre circles also were excluded from the selection pool for mapped and unmapped habitat.

H.2.5. Plot Selection

H.2.5.1. Plot Selection for Mapped and Unmapped Habitat

A one-half-acre grid was created on the forest and associated with a sequentially numbered table. Grid cells were selected randomly and assigned as locations for mapped or unmapped plots according to which type made up the majority of the cell (before all categories filled), or according to which category had not been filled. If the selected random cell was located entirely in a MMMA or occupied habitat circle, or entirely in a polygon not falling in any of these categories (i.e., "non-habitat" [age less than 65]), it was thrown out and replaced by the next number on the list. These steps were repeated until 53 cells were selected in each of the mapped and unmapped populations.

After random cells were selected, the plot point was placed within the habitat type assigned for the cell. The plot points were located in the center of the cell if that represented the habitat type assigned to the cell, or in the center of the habitat type. Points were moved to avoid known obstacles, such as a road intersection or the face of a cliff. Data in each plot were collected from entirely within the designated habitat type. Figure H-3 shows the location of all 159 plots sampled in the forest.

H.2.5.2. Plot Selection for Occupied Habitat

For occupied stands, an effort was made to locate the plot center as near as possible to probable nest locations. There were seven known nest tree locations on the Elliott State Forest. However, for the most part, actual nest locations were not known. When nest locations were not known, data from surveys were used to estimate probable nest locations from evidence of marbled murrelet interaction with a stand. The plot location was determined using one of the three methods listed below. Bracketed figures indicate the number of plot centers identified using that specific method. Table H-1 lists all occupied plots selected, the method used for plot selection, the basis for the plot location, and the date of the observations.

- Method 1 involved locating plots at or in near proximity of known nest trees (NEST) discovered during tree climbing projects conducted by the Oregon Cooperative Fish and Wildlife Research Unit (Nelson and Wilson 2002).
- Method 2 involved selecting the plot center based on the best estimate of the center of the marbled murrelet activity from the results of the 2001 additional surveys. A group consisting of ODF biologists, contract administrators, and surveyors (GROUP) evaluated the results from the general and intensive surveys (described in Section F.2.3 above), and selected the plot center.
- Method 3 involved locating plots based on marbled murrelet detection data recorded during marbled murrelet surveys conducted between 1992 and 2001 in timber sale units.

Figure 3. Location of 159 vegetation sampling plots by type.

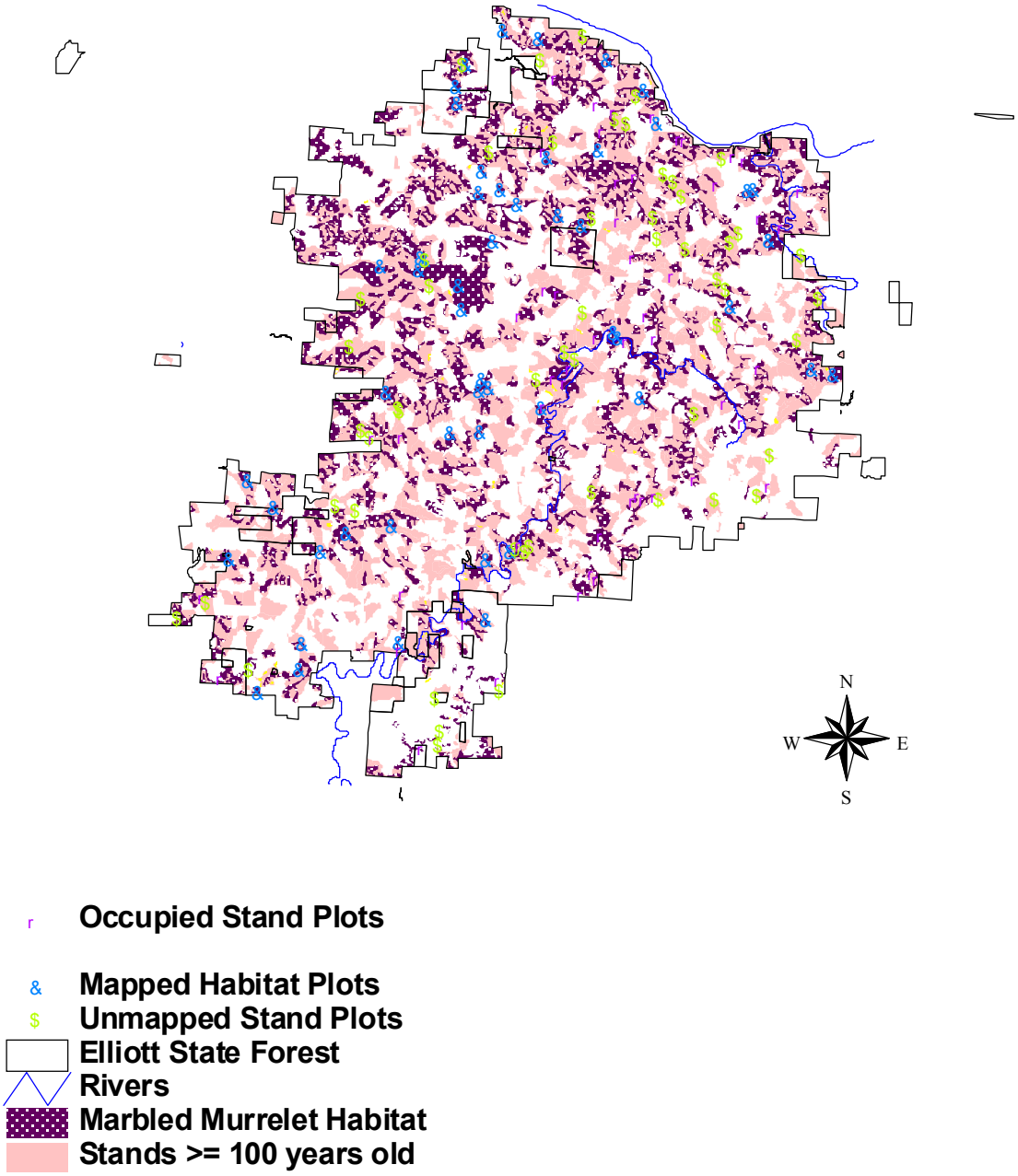


Table H-1
Occupied Plots, Method Used for Plot Selection, and Information Used to Establish Plot Location

Plot #	Method	Plot Location	Location Name	Site	Station	Date
Plot 107	3	Personal Comm.	Fish Ridge No. 2	1	5	19930623
Plot 108	3	Station	Charlotte Luder	1	4	19930712
Plot 109	3	Personal Observ.	Elk Pass No. 3	1	5	19930713
Plot 110	3	Personal Observ.	Slingshot Ridge	1	3	19930716
Plot 111	3	Personal Comm.	Beaver Creek No. 2	1	4A	19930720
Plot 112	3	Personal Observ.	West Fork Glenn Creek No. 3	1	5	19930725
Plot 113	3	Station	Johanneson Creek No. 1	1	3	19940731
Plot 114	3	Station	Charlotte Luder	2	7	19920729
Plot 115	3	Station	Buck Ridge	3	4A	19930722
Plot 116	3	Personal Observ.	Camp Creek No. 3	1	2	20010723
Plot 117	3	Station	Marlow Lockhart Trio	1	6	20010719
Plot 118	3	Station	Salander Headwaters	2	4	19930723
Plot 119	3	Station	Schumacher Ridge No. 2	1	4	19930719
Plot 120	3	Station	Knife Forks	1	1F	19940724
Plot 121	3	Station	Deer Creek No. 5	3	3	19940730
Plot 122	3	Personal Observ.	Elk Creek Divide	2	2	19930715
Plot 123	3	Personal Comm.	Elk Creek Divide	2	5A	19930721
Plot 124	3	Station	Fish Ridge No. 3	2	3	19940520
Plot 125	3	Station	Upper Deer Creek	1	4	19940801
Plot 126	3	Personal Comm.	Bickford Creek Thinning	1	1	19940511
Plot 127	3	Station	Deer Knife Thinning	2	2	19940722
Plot 128	3	Personal Comm.	Henry's Bend	1	1	19940726
Plot 129	3	Personal Comm.	West Fork Headwaters	2	1	19930713
Plot 130	3	Personal Comm.	Sullivan Creek Headwaters	1	6	19930724
Plot 131	3	Station	Upper Joes Creek Thinning	1	3	19940720
Plot 132	3	Station	Fish Ridge Thinning	1	3	19940718
Plot 133	3	Station	South Marlow Ridge No. 9	2	2	20000802

Table H-1 – continued

Plot #	Method	Plot Location	Location Name	Site	Station	Date
Plot 134	3	Station	Panther Creek		3	19940622
Plot 135	3	Station	Puckett Creek	1	4	19940722
Plot 136	1	Nest	Beaver Creek Nest Tree			
Plot 137	3	Station	Knife Otter Nest Search		D	19940713
Plot 138	1	Nest	Elk Forks	1	1	19950802
Plot 139	3	Station	Beartooth Point	1	3	20010620
Plot 140	1	Nest	Silver Creek Nest Trees			
Plot 141	1	Nest	Howell Creek Nest Tree			
Plot 142	1	Nest	Fish Creek Nest Tree			
Plot 143	1	Nest	Knife Creek Nest Trees			
Plot 144	1	Nest	Buck Creek Nest Tree			
Plot 145	2	Group	Grid 24			
Plot 146	2	Group	Grid 25 North			
Plot 147	2	Group	Grid 25			
Plot 148	2	Group	Grid 26 East			
Plot 149	2	Group	Grid 26 Mill			
Plot 150	2	Group	Grid 26 South			
Plot 151	2	Group	Grid 37			
Plot 152	2	Group	Grid 38			
Plot 153	2	Group	Grid 7			
Plot 154	2	Group	Grid 15			
Plot 155	2	Group	Grid 16 East			
Plot 156	2	Group	Grid 5			
Plot 157	2	Group	W. Charlotte Creek - West			
Plot 158	2	Group	W. Charlotte Creek - East			
Plot 159	3	Personal Comm.	Camp Creek No. 3			20010605 PM

The survey stations with the best information on marbled murrelet use were chosen, rather than using random selection. To determine which stations had the best information, individual visits to survey stations were ranked based on the quantity and type of marbled murrelet detections observed. Each visit point for each detection recorded was assigned one of three significant behavior categories, indicating marbled murrelet activity within a stand (circle below, fly through, landing). The selected stations and their rankings are shown in Table H-2. Plots were located at or in proximity to survey stations (STATION) where significant behaviors were observed, unless the ODF District Contract Administrator and Coordinator had personally observed marbled murrelets at that location (personal observation) or received personal communication from the on-site surveyor (personal communication) to indicate a specific location that the marbled murrelets were using.

Table H-2
Ranking of Timber Sale Survey Areas According to Quality of Information on Marbled Murrelet Behavior in the Area, Used to Select Occupied Stands in Method 3

Rank	Survey Area Name	Site	Station	Date	Circle Below	Fly Thru	Landing	Total Rank[a]
1	Camp Creek No. 3	1	2	20010723	22	21	0	108
2	Deer Creek No. 5	3	3	19940730	9	21	0	69
3	Henry's Bend	1	1	19940726	13	8	0	55
4	Fish Ridge Thinning	1	3	19940718	9	0	0	27
5	Knife Otter Nest Search		D	19940713	2	10	0	26
6	South Marlow Ridge No. 9	2	2	20000802	2	5	0	16
7	Panther Creek		3	19940622	4	2	0	16
8	Knife Forks	1	1F	19940724	4	0	0	12
9	Upper Deer Creek	1	4	19940801	1	4	0	11
10	Elk Pass No. 3	1	5	19930713	3	1	0	11
11	Beaver Creek No. 2	1	4A	19930720	1	4	0	11
12	Deer Knife Thinning	2	2	19940722	0	3	1	9
13	Bickford Creek Thinning	1	1	19940511	2	1	0	8
14	Upper Joes Creek Thinning	1	3	19940720	2	1	0	8
15	Elk Creek Divide	2	2	19930715	2	1	0	8
16	Slingshot Ridge	1	3	19930716	0	4	0	8
17	Fish Ridge No. 2	1	5	19930623	1	1	1	8
18	Johanneson Creek No. 1	1	3	19940731	2	1	0	8
19	Puckett Creek	1	4	19940722	1	2	0	7
20	Schumacher Ridge No. 2	1	4	19930719	1	2	0	7

Table H-2 – continued

Rank	Survey Area Name	Site	Station	Date	Circle Below	Fly Thru	Landing	Total Rank[a]
21	Charlotte Luder	1	4	19930712	0	3	0	6
22	West Fork Glenn Creek No. 3	1	5	19930725	0	3	0	6
23	Beartooth Point	1	3	20010620	1	1	0	5
24	Salander Headwaters	2	4	19930723	1	1	0	5
25	West Fork Headwaters	2	1	19930713	1	1	0	5
26	Fish Ridge No. 3	2	3	19940520	0	2	0	4
27	Charlotte Luder	2	7	19920729	0	2	0	4
28	Buck Ridge	3	4A	19930722	0	2	0	4
29	Sullivan Creek Headwaters	1	6	19930724	0	2	0	4
30	Elk Creek Divide	2	5A	19930721	1	0	0	3
31	Marlow Lockhart Trio	1	6	20010719	0	1	0	2
32	Camp Creek No. 3	2	3	20010606	0	1	0	2

[a] Significant behaviors were weighted as follows: Circle below = 3 points; Landing = 3 points; Fly through = 2 points. Numbers of behaviors were multiplied by weighting factor and added together for total rank.

H.2.6. Vegetation Sampling Design

H.2.6.1. Shape and Size of Plots

A one-half-acre rectangular plot was used for collection of vegetation data in the habitat types. The one-half-acre plot size was used to correspond with the plot size used in (Nelson and Wilson 2002) for comparing nest and non-nest plots. However, rather than using a circular plot, a rectangular plot 132 feet wide by 165 feet long was used; this plot could be fully covered by the samplers walking parallel transects along the steepest portion of the slope. Because of the steepness and ruggedness of terrain on the Elliott State Forest, this design was chosen as a more efficient sampling method to cover an equivalent area. The rectangular plots were centered on selected points.

H.2.6.2. Variables

Hamer Environmental was contracted to collect data in vegetation plots. Variables measured in each plot are shown in Table H-3. These variables were chosen after the examination of variables that differed in nesting stands collected in other studies of marbled murrelet habitat (Hamer and Meekins 1996; Nelson and Wilson 2002), as well as personal communication with biologists (Tom Hamer, Hamer Environmental; Lee Folliard, USFWS). See *Marbled Murrelet Habitat Measurements for the Elliott State Forest* (Hamer Environmental 2002) for more details on variables and methods of collection.

Table H-3
Variables Measured in ½-Acre Plots

On All Plots	For All Trees ≥ 8" DBH	For Conifer Trees ≥ 24" DBH	Calculated for Each Plot
Percent slope	DBH	Live crown ratio	Number of trees per acre
Aspect	Height[a]	Number of platforms	Trees per acre ≥24" DBH
	Species	Size of platforms[a]	Trees per acre with platforms
		Moss cover on limbs[a]	Average DBH of trees with platforms
		Moss depth on limbs[a]	Standard deviation of tree height

[a] Categorical variables

DBH = diameter breast height

H.2.7. Data Analysis

The data were compiled in Excel (Microsoft Excel 97, Microsoft Corporation) and variables analyzed using the STATISTIX7 (Analytical Software 1985, 2000) statistical package for conducting univariate analyses and SAS (SAS Institute, Inc. 1999–2000) for conducting multivariate analyses. Variables were assessed for normality and constant variance using residual plots and box plots of residuals, and were transformed as necessary to meet the assumptions for analysis of variance (ANOVA) and multivariate analyses. A Spearman Rank Correlation table was constructed for the variables to examine correlations between variables.

ANOVA was used to compare variables that conformed to assumptions of constant variance and normal distribution (in either an original or transformed state) among the plot types. The non-parametric Wilcoxon Rank Sum test was used to examine variables that did not conform to either the constant variance or normalcy assumptions.

For multivariate analyses, multivariate analysis of variance (MANOVA) and Discriminant Function Analysis were used to examine how multiple variables might be working together to produce the differences in habitat types that were observed. Only variables that met the assumptions for these analyses were used. A P-value of 0.05 was considered to be significant, consistent with the calculations for sample size.

H.3. RESULTS

Results from Spearman's Rank Correlation are shown in Table H-4. Variables that were highly correlated with each other included MOSS DEPTH and MOSS PERCENT (0.89) and NUM. LARGE PLATFORMS and PLATFORMS PER PLOT (0.99). MOSS DEPTH and MOSS PERCENT also were correlated with diameter breast height (DBH), NUM. LARGE PLATFORMS, and PLATFORMS PER PLOT. TREES W/PLATFORMS was correlated with NUM. LARGE PLATFORMS, and PLATFORMS PER PLOT. Finally, correlations with values between 0.5 and 0.8 were observed between TREES W/PLATFORMS and SD_HEIGHT, and between DBH and HEIGHT.

H.3.1. Univariate Analyses

Plots that were included in polygons mapped as suitable marbled murrelet habitat were characterized by more trees with platforms, taller trees, larger trees, trees with a higher percent cover of moss, deeper moss, and a higher variation in tree heights than plots in stands greater than 65-years-old but that were not mapped as suitable marbled murrelet habitat (Table H-5). Plots in mapped polygons were similar to plots in occupied stands with respect to these characteristics. Plots in occupied stands had more platforms per plot and more large platforms than plots in either mapped or unmapped polygons. Plots in all three habitat types were similar with respect to the number of large conifer and hardwood trees, live crown ratio, slope, and aspect (Table H-5).

H.3.2. Multivariate Analyses

MANOVA was used to compare the three plot types using different combinations of variables. The MANOVA that included all variables meeting the assumptions of constant variance and normal distribution, DBH, (LOG)LCR, MOSS PERCENT, HEIGHT, SD_HT, (LOG) MOSS DEPTH AND NUM. CONIFER gave a result indicating that plots in the three habitat types differed with respect to the combination of these variables [F equal 7.46 (Wilk's Lambda); p less than 0.0001].

A discriminant function analysis was conducted to find the combination of variables that best discriminated the habitat types. The combination of DBH, MOSS PERCENT, LOG_LCR, HT, MOSS DEPTH, and NUM. CONIFERS was most effective in properly classifying plots. Using this combination, mapped plots were misclassified as unmapped 19 percent of the time; occupied plots were misclassified as unmapped 12 percent of the time; and unmapped plots were classified correctly 73 percent of the time.

Table H-4
Spearman Rank Correlations

Variable	Aspect	Average Live Crown Ratio	Average Height of Conifer Greater than 24 inches DBH	Average Number of Large Platforms	Average Moss Depth	Average Moss Percent	Average DBH of Conifer Greater than 24 inches DBH	Number of Conifers Greater than 24 inches DBH	Number of Hardwoods Greater than 24 inches DBH	Number of Large Platforms per Plot	Standard Deviation of Heights	Slope
Average Live Crown Ratio	.07											
Average Height of Conifers Greater than 24 inches DBH (Height)	.07	.08										
Average Number of Large Platforms (No. Large Platforms)	.01	.21	.31									
Average Moss Depth (Moss Depth)	.12	.36	.32	**.55**								
Average Moss Percent (Moss Percent)	.14	.18	.27	.48	**.89**							
Average DBH of Conifer Greater than 24 inches DBH	.15	.43	**.57**	.48	**.61**	**.51**						
Number of Conifers Greater than 24 inches DBH (Num. Conifers)	.14	.23	.05	.00	.26	.26	.16					
Number of Hardwoods Greater than 24 Inches DBH (Num. Hardwoods)	.18	.22	.19	.17	.39	.36	.40	.33				

Table H-4 – continued

Variable	Aspect	Average Live Crown Ratio	Average Height of Conifer Greater than 24 inches DBH	Average Number of Large Platforms	Average Moss Depth	Average Moss Percent	Average DBH of Conifer Greater than 24 inches DBH	Number of Conifers Greater than 24 inches DBH	Number of Hardwoods Greater than 24 inches DBH	Number of Large Platforms per Plot	Standard Deviation of Heights	Slope
Number of Large Platforms Per Plot (Platforms Per Plot)	.01	.21	.29	**.99**	**.55**	.46	.46	.05	.17			
Standard Deviation of Heights (Standard Height)	.04	.04	.50	.42	.17	.15	.46	.31	.08	.39		
Slope	.19	.34	.08	.07	.17	.09	.32	.09	.11	.09	.10	
Number of Trees with Platforms (Trees with Platforms)	.06	.02	.31	**.63**	.33	.30	.30	.49	.04	**.66**	**.53**	.04

Notes:

DBH = diameter breast height

Correlations greater than 0.5 are highlighted in bold.

Table H-5
Characteristics of Variables Measured in Mapped, Unmapped, and Occupied Plots [Mean, (Standard Error), Range]

Variable	Habitat Type			F-Statistic (ANOVA)	Wilcoxon Rank Sum
	Mapped	Unmapped	Occupied	P-value	
Height (Feet)	172.43 (3.17) 115-210 **A**	153.53 (6.08) 0-203.33 **B**	171.69 (4.28) 0-210.00 **A**	.0155	
LOG_LCR	33.60 (1.48) 15.29-70 **A**	28.92 (2.14) 0-75 **A**	30.69 (1.57) 0-65 **A**	.1582	
SD_Height	51.63 (1.85) 27.42-78.22 **A**	40.86 (2.03) 9.27-75.49 **B**	51.12 (1.81) 9.26-74.64 **A**	.0001	
DBH (Inches)	38.35 (1.02) 24.71-60.00 **A**	31.45 (1.36) 0-61 **B**	37.75 (1.26) 0-62 **A**	.0001	
Number of Conifers	12.19 (1.04) 1-31 **A**	11.49 (1.12) 0-32 **A**	12.68 (.92) 0-28 **A**	.7159	
Number of Hardwoods	1.02 (.25) 0-9 **A**	.57 (.18) 0-7 **A**	.94 (.21) 0-7 **A**		1) .1267 2) .9108
Log_Moss Depth	.58 (.06) .05-1.8 **A**	.28 (.05) 0-1.8 **B**	.64 (.05) .05-1.8 **A**	.0000	
Moss Percent	55.24 (3.19) 8.33-95.00 **A**	36.9 (3.13) 0-95 **B**	57.65 (2.63) 8.24-90.00 **A**	.0000	
Trees With Platforms	6.20 (.66) 0-20 **A**	2.52 (.41) 0-14 **B**	7.50 (.77) 0-23 **A**		1) .2462 2) .0000
Number of Large Platforms	.20 (.05) 0-1.4 **A**	.04 (.01) 0-.6 **B**	.55 (.11) 0-3.25 **C**		1) .0051 2) .0006
Platforms Per Plot	6.4 (1.66) 0-63 **A**	1.19 (.41) 0-15 **B**	14.55 (2.47) 0-78 **C**		1) .0060 2) .0011
Slope (Percent)	70.09 (3.28) 15-125 **A**	68.45 (3.09) 10-105 **A**	59.15 (4.20) 0-125 **A**	.0670	
Aspect (Azimuth)	N 26% S 28 % W 21% E 25% **A**	N 6% S 13 % W 43% E 21% **A**	N 23% S 26 % W 23% E 23% **A**	.3483	

Notes: Categories with different letters are significantly different. P-Values ≤ 0.05 were considered significant.

H.4. DISCUSSION

Mapped plots were similar to occupied plots for many characteristics, and differed only in that occupied plots had more platforms per plot and more large platforms than either mapped or unmapped plots. Also, the mapped plots were significantly different from plots in stands that were not mapped in several key characteristics (DBH, HEIGHT, SD_HT, MOSS PERCENT, MOSS DEPTH, TREES W/PLATFORMS). These results suggest that the mapping process was successful in selecting areas of the forest that are similar to occupied stands in characteristics that may be biologically meaningful to marbled murrelets and in screening out areas having less habitat suitability for marbled murrelets.

Obviously, characteristics such as moss percent, moss depth, and presence and number of platforms are not visible from aerial photos. However, these characteristics are fairly highly correlated with tree size, which can be identified on aerial photos by a combination of height and crown spread. The characteristics of stands most likely to be discernable from aerial photos include tree height, tree density, live crown ratio, and variation in tree heights.

All plot types had a similar number of large (greater than 24 inches DBH) conifers, although both mapped and occupied plots had significantly more trees with platforms than did unmapped plots. However, tree density was a factor in distinguishing among stand types with the multivariate models. This result may indicate that large tree density in and of itself does not indicate suitable habitat. Other conditions must also be present for platform development to occur.

Because tree crowns are visible from aerial photos and contribute to the perceived “texture” of a stand, live crown ratio is expected to differ between mapped and unmapped plots. In addition, large tree crowns would be expected to provide better platform cover than small tree crowns, and thus indicate more suitable habitat. Although mapped plots had a higher live crown ratio on average than unmapped plots, the difference was not significant. As expected, occupied plots and mapped plots were similar in this characteristic. Live crown ratio was a factor in distinguishing among stand types with the multivariate models.

The standard deviation of tree height was analyzed as an indicator of tree height diversity, and the resulting crown complexity and potential vertical cover, within a plot. This measurement was higher in mapped and occupied plots than in unmapped plots. However, it was not included in the combination of variables that best discriminated the plot types.

Another variable expected to differ among stand types was percent slope. In its logistic regression modeling using Elliott State Forest data, Hamer Environmental (Hamer and Meekins 1996) found that occupied stands were on significantly flatter slopes than unoccupied stands. Similarly, Nelson and Wilson (2002) found slopes to be significantly different between nest and non-nest plots on the Elliott State Forest. Occupied plots were found to have less slope than either mapped or unmapped plots, although the difference was not significant at p equals 0.05. This study is the only one of the three in which plots were selected completely at random, and this may account for the slightly different finding.

Mapped plots and occupied plots were not similar in all characteristics. Occupied plots had more platforms per plot and more large platforms than mapped plots. This suggests that the mapped polygons have a larger variation in platform density than the occupied polygons.

Nelson and Wilson (2002) also found that trees with platforms were more numerous in nest plots than in non-nest plots. However, their nest and non-nest plots did not differ with respect to tree height or diameter. Nelson and Wilson did not compare variation of tree heights, moss percent, moss cover, or number of large platforms in their nest and non-nest plots, although they did examine some of these variables in nest trees compared to other platform trees without nests. Nelson and Wilson (2002) found that platform trees in nest plots were larger than platform trees in other site plots, and that the percent moss on the tree was greater for nest trees than other platform trees. They also found that substrate (moss) depth was greater on nest trees than other platform trees, but this difference was not significant for other platform trees in nest plots. Their multivariate analyses confirmed that number of platforms and percent substrate were important variables distinguishing nest trees from platform trees without nests. Hamer Environmental (Hamer and Meekins 1996) found that platform density and percent slope were stand characteristics most predictive of stand occupancy on the Elliott State Forest.

The results of the current study may differ from previous studies on the Elliott State Forest due to differing study designs. This study chose plots randomly from the mapped, unmapped, and occupied stands throughout the Elliott State Forest. In addition, surveys for marbled murrelets were conducted at randomly selected grids across the forest to increase the sample size of occupied stands and to search for marbled murrelets in unbiased locations. Previous studies on the Elliott State Forest were limited to known occupied sites that were located primarily by timber sale surveys, and thus were biased to certain areas of the forest where timber sales were being planned. Because of this random design, these results are applicable to the area of the Elliott State Forest. Finally, the sample size in the current study was robust enough to have reasonably high power (0.80) to detect differences in characteristics among stands. Therefore, it is likely that any differences in characteristics among stand types that exist were detected with this study.

There are limitations to using aerial photo analysis to identify suitable habitat for marbled murrelets, and it is possible to miss suitable habitat in typing using aerial photos. However, some suitable habitat would likely also be missed using other methods of identifying suitable habitat, such as plots or transects.

There are several advantages to using aerial photo analysis as a method of identifying suitable habitat for marbled murrelets. Aerial photo analysis allows for identification of microsites of suitable habitat, at a scale that timber stand inventory is not generally collected. In addition, aerial photo analysis uses available resources (aerial photos) to delineate suitable habitat all at once, rather than the method employed in the previous HCP in which data on habitat characteristics were collected on an operational basis.

Appendix I
Elliott State Forest Harvest Modeling

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I.1. DESCRIPTION OF THE HARVEST SCHEDULING MODELS

The Harvest Scheduling Models were developed by Oregon Department of Forestry (ODF) staff, in cooperation with Professor John Sessions of Oregon State University to assist the ODF in evaluating policy alternatives for the *Elliott State Forest Management Plan* (FMP) and Habitat Conservation Plan (HCP). The models provided information on harvest levels, revenue, and vegetation conditions for a planning horizon of 150 years.

The models combine a spatial representation of land classifications, ODF inventory data with growth and yield projections, and management goals; they utilize a search technique to allocate timber management activities over the planning area throughout the planning horizon.

In the model versions before 2004, the ODF's stand inventory database was stratified into strata of like species, size classes, and density. For each timber strata, a number of treatment alternatives were developed as potential management regimes that could be assigned to timber stands to meet management goals.

The ORGANON model was used to project the growth and yield for the strata's management regimes for 30 five-year periods. In 2004, the inventory data were updated, and the growth and yield model was changed to the U.S. Forest Service's (USFS') Forest Vegetation Simulator (FVS), Pacific Northwest Coast Variant, to project growth and yield for the stands under up to 125 potential management regimes for 30 five-year periods. In 2006, the stand inventory no longer used strata. Sampled stands were selected to represent non-sampled stands making the inventory stand-based.

To maintain spatial feasibility, a heuristic search procedure was chosen to assign the eligible management regimes to timber stands to meet management goals. Assignment of management regimes to timber stands required tracking contiguous areas of mature forest habitat, areas of young stands, land classification restrictions, and the coordination of riparian and upslope management regimes. The search procedure is guided by an objective function that minimizes deviations between goals for timber supply and forest structure while secondarily seeking to maximize present net value.

The ODF considered four primary management goals for modeling: 1) maximize long-term revenue to the Common School Fund; 2) produce a sustainable, even-flow harvest of timber; 3) maintain properly functioning aquatic habitat conditions; and 4) provide habitats that contribute to maintaining or enhancing wildlife populations at self-sustaining levels.

The search procedure begins with an initial assignment of timber regimes that result in a feasible initial spatial solution. Following the initial assignment of timber regimes, the search procedure tests a trial move by randomly selecting a timber stand, randomly selecting a timber regime eligible for the stand, and evaluating the change in the objective function. If the objective function value improves, the trial move is accepted. If the objective function value does not improve, it still may be accepted if the loss in value does not exceed certain

criteria. The theory behind accepting a non-improving trial move is to prevent the search from becoming stalled in a local maximum rather than continuing to search for higher values.

Different solutions can be explored by weighting the coefficients of the objective function to increase or decrease the relative importance of the different goals. Goals could be either one-way or two-way. One-way goals penalize either overachievement or underachievement, thus using the goal as a maximum or minimum, respectively. Two-way goals penalize both overachievement and underachievement, thereby seeking the specified goal as a target. Goals can also be weighted such that larger deviations from a goal are penalized proportionately more than small deviations.

The ODF chose the heuristic search procedure because it is better able to solve spatial problems than optimization methods such as linear programming. Although linear programming has been widely used in forest management planning, it cannot solve a spatial problem at the scale of this planning area due to the large number of variables and constraints required to formulate the problem. The Elliott State Forest planning area contains approximately 2,100 stands divided into 62,456 upland and riparian parcels with a planning horizon of 30 five-year periods. Depending on the degree of spatial representation, up to 500,000 variables could be required.

Other alternative approaches could solve the nonspatial problem first, and then either try to fit the nonspatial solution to a map or ignore the spatial requirements. These alternative approaches might be adequate for comparative analysis, but may over-represent the attainment of goals by not considering the spatial constraints. The ODF chose to maintain spatial representation, recognizing that a heuristic search procedure cannot find the “optimal” solution, but instead finds the best of many feasible solutions. Heuristic search procedures have been shown to produce good solutions in a number of industries, including forestry.

I.2. USE OF MODELS FOR DECISION SUPPORT

The goals of modeling for the Elliott State Forest planning process are to:

- Establish a baseline of the 1995 FMP and HCP outputs.
- Explore various management scenarios early in the revision process.
- Display a relative comparison of resource conservation and fiscal tradeoffs for decision-makers and the public.
- Compare modeling outputs to narrow the focus of the revision process.
- Possibly provide a basis for alternatives in the National Environmental Policy Act process.

In 2001, the Elliott State Forest core planning team developed eight different management scenarios for the forest, including the 1995 FMP. The ODF staff worked with Dr. Sessions to translate these parameters into spatial computer models. The eight models represented a wide range of possible management scenarios, ranging from an emphasis on conservation to an emphasis on timber production. The model displays the impacts and outputs of those management strategies throughout 30 five-year periods. Outputs are displayed through various quantitative tables and geographic map displays.

In 2002, the core team and steering committee analyzed the outputs from the eight scenarios to help narrow the focus of the planning effort and identify strategies that would best accomplish the resource goals for the forest. From this analysis, the steering committee identified three concepts for the core team to include in the planning effort: 1) conservation areas for protection of important habitat; 2) revised aquatic/riparian strategies; and 3) use of stand structure concepts in defining habitat.

Using the three concepts, the core team developed a draft Integrated Landscape Strategy. This draft strategy was modeled to help determine how well the strategies achieved the goals for the forest. Initial model runs of the draft landscape strategy were conducted in early 2004. The inventory data used in the models were updated to include recent stand data collected since 2000.

In addition to the eight original management scenarios and the draft Integrated Landscape Strategy (ninth scenario), three other scenarios were identified for analysis; however, one was a variation of the draft Integrated Landscape Strategy and was not modeled. Each of the management scenarios that were chosen were then used for comparative purposes in developing the draft landscape strategy.

During 2004, new yield tables incorporating the latest Stand Level Inventory (SLI) data for the Elliott State Forest were developed in collaboration with a contractor, and were incorporated into the models in early 2005. To help inform decision-makers and represent a broad range of possible management alternatives, the draft Integrated Landscape Strategy and several of the original 12 management scenarios were selected for analysis in the revised HCP and updated with the new yield tables and spatial data.

In addition to the 12 original management scenarios, one additional scenario was developed in 2006 in response to public scoping comments for the Environmental Impact Statement (EIS). In the EIS, three alternatives were analyzed in detail: 1)the 1995 HCP (no change); 2) ODF's proposed revised HCP (preferred); and 3) a modified version of the Forest Ecosystem Management Assessment Team's stream buffers and reserve areas for northern spotted owls and marbled murrelets. The third alternative allocated 50 percent of the forest to reserve areas for listed species and stream buffers, and applied intensive forest management on the remaining 50 percent of the forest. All three alternatives were modeled once more in 2006 with updated spatial layers and inventory information. Outputs from these models were used by the EIS contractor, Jones & Stokes Associates, Inc., to analyze effects of the alternatives in the EIS.

In addition to the modeling for the EIS analysis, in 2006, the ODF also modeled two versions of take avoidance. One management scenario assumed no HCP and applied ODF take avoidance policies for both the northern spotted owl and the marbled murrelet. The second take avoidance scenario assumed no HCP and delisting of the marbled murrelet. This scenario then applied ODF take avoidance policies for the northern spotted owl. This information was used to help inform decision-makers in the HCP development process.

I.3. SUMMARY OF THE ELLIOTT STATE FOREST HARVEST SCHEDULE MODELING ASSUMPTIONS

The following information provides an informational brief on the policy/rules that were applied to the various models, and indicates the associated assumptions that were input into the models to reflect the resource conservation, operational constraints, and fiscal objectives. Certain modeling assumptions were common to all of the modeling scenarios and are provided first on the following pages; other modeling assumptions are scenario-specific and are categorized by scenario.

I.4. DOCUMENTATION FOR ELLIOTT STATE FOREST MODELING SCENARIOS, MODELS 9U2, 6U2, 5B2, 2B2, 2C2, AND 12U2

I.4.1. Reports for All Models

To facilitate comparisons and analyses, modeling solutions will include acreages in specified stand structure and age classes. These are identified in column (structure types) heading definitions in the Adobe Acrobat and/or Excel tables, and are as follows:

- NF = non-forested
- EARLY = Early Structure
- INT = Intermediate Structure
- ADV1 = Advanced Structure
- ADV2 = Advanced Structure, with eight trees per acre (TPA) or more that are 32 inches diameter breast height (DBH) or greater
- ADV3 = Advanced Structure, with eight TPA or more that are 32 inches DBH, including four TPA or more that are 38 inches DBH or greater
- GT 95 = Forest is 100 years old or older
- GT75 = Forest is 80 years old or older
- GT65 = Forest is 70 years old or older

These acreages will be reported using the 13 management basins identified in Model 9 as the geographic base for all models.

I.5. DRAFT SUMMARY FOR ELLIOTT STATE FOREST HARVEST SCHEDULE MODELING ASSUMPTIONS COMMON TO MODEL 9U2, MODEL 6U2, AND MODEL 5B2, MODEL 2C2, MODEL 2B2, MODEL 12U2

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
Model Assumptions			
1.	Model *Starting Inventory and Modeled Periods*	The length and number of modeled periods were directed by the Harvest and Habitat Executive Team. The initial inventory was current as of December 31, 2003. The model outputs reflect data at the approximate mid-point of each five-year period.	The initial inventory is current and updated to December 31, 2005. It included 2,139 stands, 1,090 of which are sampled. The model will reflect outputs for 30 five-year periods for a total of 150 years. The model outputs reflect data at the mid-point of each five-year period. Because five is not evenly divisible by two, the output data are reported after two years of growth. Period 0 is 2005, period 1 is 2007. See Table I-1 for the percent of each district's acres and stands that were inventoried at the time the yield tables were created.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
2.	Model *Model Goals/ Constraints*		Each goals can be "on" or "off" for a model run. Goal description: <u>Primary Goals</u> • Harvest volume goal of millions of board feet of volume harvested per five-year period • Goal for acres of Advanced 1 structure that is outside core, SUV, and "no harvest" stream buffer per basin. • Districtwide goal that at least 50 percent of the Advanced 1 is Advanced 2. • Goal for acres of thinning in period 1 • Goal to maximize net present value <u>Constraint</u> • Amount of marbled murrelet habitat that can be clearcut per period with incentive for new development
3.	Model *Growth Model for Projection*	The growth models used for creating the yield tables were recommended by Mason, Bruce and Girard, Inc. as part of the deliverables for the Yield Table Creation Contract. By contract specification, each district approved the growth model selection. The stand characteristics, volume estimates, and structure development of the current inventory were projected for 150 years, by five-year intervals, using a currently available growth and yield model.	The USFS' FVS was recommended for use in creating the models' yield tables on all harvest and habitat planning districts by Mason, Bruce and Girard. The FVS is an individual-tree, distance-dependent growth and yield model. The Pacific Northwest Coast Variant, was recommended to create model yield tables for the Elliott State Forest. The model was calibrated to a maximum SDI of 600 for Douglas-fir and 720 for western hemlock. Flewelling's taper equations were used to calculate tree volume.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
4.	Model *Inventory Stratification*	The ODF SLI provides a stratification of stands into 70 Forest Projection System groups based on species groups, diameter classes, and tree density. Because the ODF district stands do not have current inventory for all stands, the SLI stand stratification methodology was employed for the model to represent the inventory. Not all strata were represented on every district. For modeling purposes, the inventory was further stratified into 105 groups. The additional strata were derived from dividing the high density group into medium and high and the 8-inch- to 20-inch-diameter group into 8-inch to 14-inch and 14-inch and 20-inch. The stratification for the Elliott model was based on: • Species Groups: 1D, 1W, 1H, DX, WX, HX, OT • DBH Classes: 0- to 8-inch, 8- to 14-inch, 14- to 20-inch, 20- to 30-inch, 30-inch+ Density Classes: low = 0 to 30 SDI; medium = 30 to 50 SDI, and high = 50+ SDI.	Each of the 1,090 sampled stands has a yield table based on the inventory tree list that becomes a strata based on the stand's tree list. The unsampled stands were assigned to a sampled stand based on their similarity to species, tree size, stand density, and site. Strata were grown in three site groups. The group ranges were derived by ordering the district stands by site index and grouping them into thirds. The representative site for each group was the average of the sites. The following are the group ranges and midpoint. The strata number that represents each spatial polygon was derived from concatenating district number, sampled stand number, and site group. Non-tree strata are assigned a strata number = 888; non-ODF is assigned strata number = 999. Existing stands with strata XC1N are clearcut stands in the inventory with no plantation inventory specified. They were assigned the plantation strata appropriate for the spatial location. Site groups are: • Site 1: greater than 125 SI, average 128 • Site 2: 113 to 124, average 117 • Site 3: less than 113, average 109
Policy/Rule Modeling Assumptions			
5.	Policy/Rule *No Harvest Areas*	Forest Land Management Classification is the administrative rule that contains the basic requirement for the State Forester to classify all forestlands within the planning area. Oregon Administrative Rule 629-035-0050	SUVs classified as "special" stewardship with a subclass of Administrative sites, Cultural Resource, Operationally Limited, Visual, or Wildlife have been included in a SUV layer and are "off-base" to harvesting. No harvest outside fund 51 or 52 and in non-forested areas.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
6.	Policy/Rule *Non-declining, Even Flow*	The Department of State Lands Asset Management Plan states that "Forest lands are to be managed primarily to produce a sustainable, even-flow harvest of timber, subject to economic, environmental and regulatory considerations, according to specific plans developed by forest managers."	The Steering Committee determined that the desirable pattern of harvest volume is even flow with volume trending upward during the 150-year modeling period.
7.	Policy/Rule *Maximum Clearcut Size and Green-up Requirements of Harvest Areas*	The FPA requires a maximum clearcut size of 120 acres and planted trees to be four feet tall or four years old and "free to grow" before an adjacent stand can be final harvested (FPA 527.740).	A maximum of 120 acres of contiguous stands can be harvested in each five-year period. This restriction is assumed to meet FPA reforestation and "green-up" rules.
Operational/Economic Modeling Assumptions			
8.	Operational *Harvest Units*	The Coos District created a digital representation of logical operational clearcut harvest units for use by the model to schedule harvests.	HUs delineate clearcut units with the appropriate logging system.
9.	Operational *Thinning Prescriptions*	Timber harvest modeling requires a description of the silvicultural management regimes that will likely be implemented. The Coos management team designed 63 regimes that would likely be used during a stand's rotation.	Each strata was projected for up to 123 silvicultural prescription pathways for 30 five-year periods. Prescription pathways simulating current forest management practices were developed having zero to four thinnings starting at age 35, removing a specified percent of trees in stand diameter classes down to a specified SDI between 10 and 40. 30 five-year interval thinning pathways were described for single or multiple thinnings using the criteria of age at thinning and residual stand density index after thinning. The general density target to trigger a thinning was the achievement of 50 to 55 SDI. Prescriptions were written to produce complex structure,

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
			maximize volume, or accommodate prescription limitations in land classifications such as riparian, northern spotted owl, and marbled murrelet areas. Prescription series were numbered in the yield tables as follows: • 100 – existing strata - regular • 200 – existing strata - fertilization • 300 – existing strata - thin before age 80 • 400 – plantation strata - regular • 500 – plantation strata - fertilization • 600 – plantation strata - thin before age 80 Every polygon was assigned the "grow only" prescription at the start of the annealing process. Minimum harvest volume for clearcut and thinning is 3 MBF per acre. Prescriptions assume natural seed-in (ingrowth) of trees after each thinning (see Table I - 4). The TPA and species are dependent on the residual SDI of the thinning and the species group of the original stand. Defect and breakage assumed is four percent of the harvest volume for stands less than less than 80 years old and eight percent for stands greater than age 80.
10.	Operational *Natural Disturbance*	The Coos District has a low rate of natural disturbance of fire, pest infestation, and disease. Landslides occur under extreme rain conditions. SNC disease is light to moderate.	SNC is a minor issue on the Elliott Forest and is not being modeled. Effect of natural disturbances from fire, insects, and landslides are not modeled.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
11.	Operational *Harvest Units*	The district has delineated 1,904 harvest settings to be used as harvest units. They are based on topography and road access.	HU is eligible for harvest if less than 10 percent of HU is under age 40. Eligible acres are ODF acres that are not in Core, SUV, Riparian=1 and adjusted Vegetation Identifier=888. The polygon age is found in the GIS spatial data (age 2006) and in the yield tables. Age was assigned by the district. Each HU is assigned a logging system: cable, tractor, or helicopter. Logging costs are specified for each logging system.
12.	Operational *Planted Stands (Plantations)*	At regeneration, the district plants different TPA and species composition depending on the slope and location within the SNC affected zone. Yield tables for 30 periods were developed for the plantations that have grown with all of the silvicultural prescriptions.	Each district identified plantations described as species, TPA, DBH, and height to be planted on specific locations based on spatial criteria after clearcut. See Table I-3. Yield tables for simulated plantations assumed natural regeneration and live tree retention. Some plantations assumed that a precommercial thinning occurred at age 15. Plantation strata are numbered 8710, 8720, 8730, and 8740. Plantations were assigned based on their spatial location, and were grown for each average site. The yield table assigned was based on the site group that the stand's site fell within. Three plantations are used on the east side of the district (eastwest=0), and are assigned based on probability of 70 percent, 15 percent, and 15 percent. One plantation is assigned to the west side (eastwest=1). Each plantation is developed for three different site indices, 128, 117, and 109.
13.	Operational *Precommercial Thinning*	These are standard practices in precommercial thinnings.	Plantations planted with 500 or more TPA are assumed to have a precommercial thinning at age 15.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
14.	Operational *Live Tree Retention*	Residual live trees were retained to meet the short-term habitat needs of wildlife species, to serve as a source of future snags and downed wood, and to provide legacy trees in future stands.	Live tree retention was accounted for in two ways in the model. There was a volume and value reduction at clearcut harvest to account for the live trees that were left for the purpose of live tree retention, snags, and downed wood. There were yield tables created for these values: summaries_leave_tree_vol.txt summaries_leave_tree_value_rem.txt Live trees were added to plantations that replaced a clearcut stand to account for the competition from the overstory residual live trees.
15.	Operational *Natural Reproduction*	Natural reproduction occurs in stands after thinning. The rate and species of reproduction is determined by the species on the site and the amount of growing space available for survival (residual density of thinning prescription). Foresters on each district provided data for the reproduction simulated in the yield tables. Natural reproduction species, diameter, TPA, and height were provided for trees greater than two inches DBH.	The projected stands added natural reproduction after a thinning to simulate the ingrowth of trees after thinnings. TPA and species added were described by the district and differed based on the residual SDI, SLI species groups, and number of thinnings. The trees were added to the yield tables the number of years after thinning that corresponds to the age of the reproduction. The number of TPA of reproduction added to a thinned stand decreased after the second thinning because of competition from previous reproduction.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
16.	Operational *Fertilization*	ODF Policies and Guidelines ODF Swiss Needle Cast Strategic Plan Fertilizer Response Information written by Doug Robin on May 18, 2004	The yield tables have prescriptions that used fertilization (from Doug Robin's recommendation on May 18, 2004) in these circumstances: • Species group "1D" both in existing stands and in plantations. • All site groups (recommendation was to apply fertilization for Site class II (site 140) and below). There was a priority for fertilization of III, IV, and II, in that order. • Fertilization was to occur after the first and second thinning. • Stands that will be regeneration harvested or thinned within 10 years. • Fertilization was not allowed in root rot or SNC severe stands or riparian special classifications. • The cost for fertilization was $75 per acre. • Fertilization will be added to pathways 101, 102, 104, 105, 106, 108, 109, and 110 after the first and second thinnings only (200 series in prescriptions). • Fertilization increases the site index by 10 points for 10 years.
17.	Operational *Roads*	Acres out of production and average hauling costs are estimated.	Road locations are taken from the ODF Coos GIS road layer. Road right-of-way is estimated to be 30 feet total road width. The right–of-way acres are subtracted from the polygon acres when calculating volume and value. It is not subtracted from the acres when calculating acres of structure.

No.	Assumption Type/Issue	Policy/Rule	Modeling Assumption
18.	Economics *Costs*		Volume is based on 32-foot logs, 5-inch top diameter inside bark, 12-foot minimum log, and 1-foot stump height. Administrative costs are $25 per acre per year. Road maintenance cost is $12 per MBF. Project cost of $19/MBF is subtracted from the pond values. Precommercial thinning cost is $85 per acre applied to 25 percent of the clearcut acres at age 15. Regeneration costs are $500 per acre and include planting and all activities to get free-to-grow. Fertilization cost is $75 per acre. A bid-up factor of 1.12 is applied to the pond value net of logging costs and project costs. For stands less than age 76, a bid-up factor of 1.38 is applied. Logging costs (including hauling costs) per MBF are: Clearcut / Thin Tractor/Cable 137 280 Difficult Cable 165 380 Helicopter 300 430

Notes:

FPA = Forest Practices Act

GIS = geographic information system

HU = harvest unit

MBF = thousand board feet

SDI = stand density index

SNC = swiss needle cast disease

SUV = steep, unique, or visual land

Model 9u2 Preferred Alternative (Integrated Landscape Strategies) Assumptions			
Row heading definitions in the Adobe Acrobat and/or Excel tables are: • "TE" includes all acres within T&E Cores. • "SUV" includes only SUV acres that are not also within a T&E Core. • "Stream Buffer" includes only stream buffer acres that are not also T&E or SUV. • “Production” includes all acres not in conservation areas (T&E, SUV, or Stream Buffer). Acreages identified in the Adobe Acrobat and/or Excel tables meet the Stand Structure (biological) definitions specified in the 2007 Elliott State Forest HCP. The **Advanced* Target Outside Conservation Areas (acres)** identified in **Table I-1** are administratively determined based on the crediting of all conservation acres as Advanced Structure			
1.	Model 9 *Live Tree Retention and Downed Wood*	Three TPA will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from the Northwest Oregon State Forests FMP. Clearcut harvest volume and value are reduced by three TPA, depending on the age of the stand. This retention accounts for the trees left in both the riparian focused and the upland portion of the stand.

Model 9u2 Preferred Alternative (Integrated Landscape Strategies) Assumptions			
2.	Model 9 *Riparian Management Zone Buffer Width*	The riparian strategies are similar to those developed for the Northwest Oregon State Forests Management Plan. Two riparian buffer designations, special and focused, are derived from management objectives based on stream size and type for all perennial and intermittent streams. The stream layer that was used to create the buffered riparian data was created by the Coos District GIS specialist from a merging of the "stream" layer and "draw" layer. The “draw” layer was included to account for additional small intermittent streams, all of which were not represented in the “stream” layer.	Timing of thinnings in the riparian zone will be associated with either clearcut or thinning in the upland portion of the stand. Buffer widths for each side (horizontal distance) are as follows: • Special: 100 feet - all Type F streams and large and medium Type N streams • 50 feet - small Type N perennial streams (25 feet for FMP requirements and an additional 25 feet for operational considerations); 25 feet - small Type N intermittent streams Focused: The buffer extends outward from the edge of the Special buffer to 160 feet on all perenniel and seasonal streams. In the model, Focused buffers do not have any specific riparian harvest restrictions. They are eligible to receive the same prescriptions as the upland portion of the stand. The rationale is that, when clearcutting, the live tree retention in the upland portion accounts for the trees retained in the Focused buffer.

Model 9u2 Preferred Alternative (Integrated Landscape Strategies) Assumptions			
		The "draw" layer was developed by a contractor in the 1990s that created a line feature to designate a stream in all drainage depressions using the digital elevation model. Because the streams were not ground-truthed, the "draw" layer was thought to over-estimate the stream miles. The "stream" layer was a further refinement of the "draw" layer by another contractor that eliminated streams where streams were thought not to exist. A polygon layer representing the streams buffered with the "special" and "focused" Forest Land Classification buffer widths were sent to the modeling coordinator for use in the harvest scheduling models. These data provide the best available information to represent riparian acres with prescription limitations ("Special" and "Focused") due to the riparian strategies for projected estimates of forest structure and harvest volume.	Prescriptions: Riparian Special. May have one or two thinnings before age 80. After the stand reaches age 80, no harvesting of any type is allowed. Riparian Focused. There are no harvest restrictions.
3.	Model 9 *T&E Core Areas*	Thirty-three core areas with a total of approximately 13,500 acres were developed from northern spotted owl activity centers, northern spotted owl core use areas, marbled murrelet use areas, and other unique habitats. Core areas are conservation areas that are permanent and fixed in their location. Harvest activities may be conducted to enhance advanced habitat characteristics.	No regeneration harvesting in core=1. Thinning is permitted if stand age is less than 80. Use the riparian thinnings in column 4 of the valid_rx.txt file.

Model 9u2 Preferred Alternative (Integrated Landscape Strategies) Assumptions			
4.	Model 9 *Advanced Habitats*	Approximately 23,236 acres of advanced habitat, in addition to Cores, SUVs, and Riparian Special, will be managed. Each basin has a specified target of complex acres that must be attained and maintained. The function of advanced habitat is to provide additional habitat for species of concern, connectivity among conservation areas, and dispersal habitat on the landscape. Structure classes are defined as: **Early:** Less than 15 years old **Intermediate:** Not advanced or early **Advanced1**: Greater than 20 TPA greater than 18 inches DBH that includes: • greater than ten TPA greater than 24-inches DBH, • Quadratic mean diameter of trees greater than 8-inches DBH at least 15 inches DBH, and • 150 to 325 square feet of basal area **Advanced2**: greater than 20 TPA greater than 18 inches DBH that includes: • greater than ten trees per acre greater than 24 inches DBH, • greater than eight trees per acre greater than 32 inches DBH. and • 150 to 325 square feet of basal area	Basin goal: Each basin has a goal for the amount of Advanced 1 structure that should be developed. (See Table I-1 for Basin Target for Advanced Acres.) Acres that count toward the basin advanced (Advanced 1) target are those ODF advanced acres outside the Core, SUV, and Riparian Special (right-of-way is not subtracted from the acres). There are no basin targets for Advanced 2 and Advanced 3; however, their acres are listed in the reports. District-wide structure goal: The district acres of Advanced 2 should be at least 50 percent of the district acres of Advanced 1. An entire HU is advanced if greater than 50 percent of the clearcut harvestable acres are advanced. If less than 50 percent, the HU is not advanced.

Model 9u2 Preferred Alternative (Integrated Landscape Strategies) Assumptions			
		Advanced3: • greater than 20 TPA greater than 18 inches DBH that includes: • greater than ten TPA greater than 24 inches DBH, • greater than eight TPA greater than 32 inches DBH, • greater than four TPA greater than 38 inches DBH, and • Quadratic mean diameter of trees greater than 24 inches DBH at least 35.2 inches DBH, and • 150 to 325 square feet of basal area	

Notes:

MBF = thousand board feet

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Model 6u2 No Action Alternative (1995 ESF - HCP) Assumptions			
Row heading definitions in the Adobe Acrobat and/or Excel tables are: • "TE" includes all acres within conservation areas and marbled murrelet management areas. • "SUV" includes only SUV acres that are not also within T&E designations. • "Stream Buffer" includes only stream buffer acres that are not also TE or SUV. "Production" includes all acres not in conservation areas (T&E, SUV, or Stream Buffer).			
1.	Model 6 *Live Tree Retention and Downed Wood*	Three TPA will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from the NW FMP (Oregon Department of Forestry. 2001a) Clearcut harvest volume and value are reduced by three TPA depending on the age of the stand. This retention accounts for the trees left in both the riparian focused and the upland portion of the stand.
2.	Model 6 *Riparian Management Zone Buffer Width*	The riparian strategies are as stated in the 1995 Elliott State Forest HCP (pg. V-35). Riparian buffer width for perennial streams is 100 feet on fish-bearing streams and 50 feet on non-fish-bearing streams. Buffer widths for intermittent are 75 feet on fish-bearing streams and no buffer on non-fish-bearing streams. However, for this analysis, all fish streams, both perennial and intermittent, were buffered with a 100-foot slope distance buffer converted to a 95-foot horizontal distance.	Timing of thinnings in the riparian zone will be associated with either clearcut or thinning in the upland portion of the stand. Buffer widths for each side (slope distance converted to horizontal distance) are as follows: • All Type F streams: 95 feet (perennial and intermittent) • All Type N streams: 45 feet (perennial only) Prescriptions: Riparian Buffers. May have one or two thinnings before age 80. After the stand reaches age 80, no harvesting of any type is anticipated. Riparian Buffers. At clearcut harvest, buffers may be wider than required and include an upland portion of the stand. These areas would be credited as leave trees.

Model 6u2 No Action Alternative (1995 ESF - HCP) Assumptions			
3.	Model 6 *Conservation Areas*	Twenty-one areas with a total of approximately 6,370 acres. These were considered northern spotted owl and marbled murrelet use areas, plus other unique habitats. Conservation areas are permanent and fixed in their location. Harvest activities may be conducted to enhance habitat characteristics in stands less than 80 years old.	No regeneration harvesting in conservation areas. Thinning is permitted if stand age is less than 80 years. Use the riparian thinnings in column 4 of the valid_rx.txt file.
4.	Model 6 *Marbled Murrelet Management Areas*	ODF survey protocol is simulated for take avoidance. As of December 2005, there were 36 areas with a total of approximately 10,000 acres. These areas were designated using the ODF Marbled Murrelet Management Policy. Up to an additional 5,000 acres of MMMAs could be identified during the modeling process to simulate "Take Avoidance" and occupied stand protection.	No regeneration harvesting in MMMAs. New MMMAs will be approximately 100 acres. The maximum number that may be created in a period is 25 percent of the HUs in that period. When the current MMMA and newly found MMMA reach 15,000 acres, the model will stop looking for new MMMAs. Thinning is permitted in MMMAs if stand age is less than 80. Use the riparian thinnings in column 4 of the valid_rx.txt file.

Model 6u2 No Action Alternative (1995 ESF - HCP) Assumptions			
5.	Model 6 *Habitats*	Three habitat types and related constraints were identified in the 1995 Elliott State Forest HCP. **Northern Spotted Owl:** Dispersal. Forest vegetation with at least 40 percent canopy closure and an average stand diameter of 11 inches or more. Each of the 17 management basins is required to maintain 50 percent of its geographical area in acreage that has an average tree diameter of 11 inches. Nesting, Roosting, Foraging. Habitat with the forest structure, sufficient area, and adequate food source to meet the need of a nesting pair of northern spotted owls. Each management basin has an acreage stipulation related to the amount of this structure type required in the basin. **Marbled Murrelet:** Nesting Stands. Mature or old-growth forest with large trees that have broad crowns and large, flat limbs, or platforms suitable for nests.	Structure classes are defined in the model. Northern Spotted Owl: Dispersal. Stands with at least 40 percent canopy closure and an average stand diameter of 11 inches or more. Any thinning or clearcut is allowed as long as 50 percent dispersal is maintained. If a basin does not have at least 50 percent dispersal, thinnings must maintain a minimum of 35 SDI, and no clearcutting is allowed. Nesting, Roosting, Foraging. Stands in the 80+ age classes (age greater than 75) were designated as containing the structural characteristics to qualify as Nesting, Roosting, and Foraging habitat types. Thinning is allowed in Nesting, Roosting, Foraging habitat to a residual SDI of at least 40 (light thinning). Clearcutting is allowed only when the basin Nesting, Roosting, Foraging habitat acres meet or exceed the basin Nesting, Roosting Foraging targets. The acres that count toward the Nesting, Roosting, Foraging targets are acres outside of conservation areas, riparian buffer, and SUVs (not MMMAs). Marbled Murrelet: Nesting Stands. Stands in the 100+ age classes (age greater than 95) were designated as containing the structural characteristics to qualify as Nesting stands. If less than target Nesting, Roosting, Foraging habitat, no clearcut in basin. If greater than target Nesting, Roosting, Foraging habitat, maintain minimum of target amount.

Notes:

MMMA = Marbled Murrelet Management Area

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Model 5b2 Combined Reserve and Intensive Forestry Assumptions			
Row heading definitions in the Adobe Acrobat and/or Excel tables are: • "TE" includes all acres within conservation areas and MMMAs. • "SUV" includes only SUV acres that are not also within TE designations. • "Stream Buffer" includes only stream buffer acres that are not also TE or SUV. • “Production” includes all acres not in conservation areas (T&E, SUV, or Stream Buffer).			
1.	Model 5 *Live Tree Retention and Downed Wood*	Three TPA will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from the NW FMP (Oregon Department of Forestry. 2001a). Clearcut harvest volume and value are reduced by three TPA depending on the age of the stand. This retention accounts for the trees left in both the riparian focused and the upland portion of the stand.
2.	Model 5 *Riparian Management Zone Buffer Width*	The riparian strategies simulate the Forest Ecosystem Management Assessment Team buffers. Riparian buffer widths include the Elliott FMP riparian buffers, and also include additional areas between the buffers that are operationally not feasible to harvest. They apply to all perennial and intermittent streams	Riparian buffers are “no harvest.” Buffer widths for each side (horizontal distance) are as follows: • All Type F streams: 160 feet • All Type N streams: 100 feet
3.	Model 5 *Reserves*	Reserves include acres in conservation areas and MMMAs.	Reserve attribute is a combination of conservation areas and MMMAs, and has a value of “1.” Reserve is “no harvest” designation.
4.	Model 5 *New 50 Reserves*	Approximately 50 percent of the district has been designated as a “no harvest” reserve. The 50 percent is composed of conservation areas, MMMAs, riparian buffer, and SUVs.	New_50_reserve attribute has a value of “1” when SUV=1, Stream=1 or Reserve=1.

Notes:

MMMA = Marbled Murrelet Management Area

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Model 2c2 ODF Wood Emphasis (Take Avoidance for Northern Spotted Owl and Marbled Murrelet) Alternative Assumptions			
Row heading definitions in the Adobe Acrobat and/or Excel tables are: • "TE" includes all acres within northern spotted owl cores and MMMAs. • "SUV" includes only SUV acres that are not also within T&E designations. • "Stream Buffer" includes only stream buffer acres that are not also TE or SUV. • "Production" includes all acres not in conservation areas (T&E, SUV, or Stream Buffer).			
1.	Model 2 *Live Tree Retention and Downed Wood*	Two 14-inch DBH TPAs will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from FPA. Clearcut harvest volume and value are reduced by two 14-inch DBH TPAs. No merchantable volume is used to meet the down wood requirement.
2.	Model 2 *Riparian Management Zone Buffer Width*	The riparian strategies simulate the FPA buffers. Buffers for fish-bearing streams are on both perennial and intermittent streams. Non-fish-bearing streams have only perennial stream buffers.	Riparian buffers are "no harvest." Buffer widths for each side (horizontal distance) are as follows: • Large Type F streams: 100 feet • Medium Type F streams: 70 feet • Small Type F streams: 50 feet • Large Type N streams: 70 feet • Medium Type N streams: 50 feet

Model 2c2 ODF Wood Emphasis (Take Avoidance for Northern Spotted Owl and Marbled Murrelet) Alternative Assumptions			
3.	Model 2 *Northern Spotted Owl*	ODF circle strategy is used for take avoidance.	Northern Spotted Owl core has no harvest. Northern spotted owl inner 0.7-mile radius circle has a goal of at least 50 percent of the circle's acres with at least age 75. Northern spotted owl 1.5-mile radius circle has a goal of at least 40 percent outside the inner circle with at least age 75. Specific acres within the northern spotted owl circles have no harvest for 25 years. They are eligible for harvest in period 6. Nesting, Roosting, and Foraging habitat and dispersal are not in this model.
4.	Model 2 *Marbled Murrelet*	ODF survey protocol is simulated for take avoidance. As of December 2005, there were 36 areas with a total of approximately 10,000 acres. These areas were designated using the ODF Marbled Murrelet Management Policy. Up to an additional 5,000 acres of MMMAs could be identified during the modeling process to simulate "Take Avoidance" and occupied stand protection.	No final harvesting in MMMAs. New MMMAs will be approximately 100 acres. The maximum number that may be created in a period is 25 percent of the HUs in that period. Thinning is permitted if stand age is less than 80. Use the riparian thinnings in column 4 of the valid_rx.txt file.

Notes:

FPA = Forest Practices Act

MMMA = Marbled Murrelet Management Area

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Model 2b2 ODF Wood Emphasis (Take Avoidance for Northern Spotted Owl) Alternative Assumptions			
Row heading definitions in the Adobe Acrobat and/or Excel tables are: • "TE" includes all acres within northern spotted owl cores. • "SUV" includes only SUV acres that are not also within TE designations. • "Stream Buffer" includes only stream buffer acres that are not also TE or SUV. • "Production" includes all acres not in conservation areas (T&E, SUV, or Stream Buffer).			
1.	Model 2 *Live Tree Retention and Downed Wood*	Two 14-inch DBH TPAs will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from FPA. Clearcut harvest volume and value are reduced by two 14-inch DBH TPAs. No merchantable volume is used to meet the down wood requirement.
2.	Model 2 *Riparian Management Zone Buffer Width*	The riparian strategies simulate the FPA buffers. Buffers for fish-bearing streams are on both perennial and intermittent streams. Non-fish-bearing streams have only perennial stream buffers.	Riparian buffers are "no harvest." Buffer widths for each side (horizontal distance) are as follows: • Large Type F streams: 100 feet • Medium Type F streams: 70 feet • Small Type F streams: 50 feet • Large Type N streams: 70 feet • Medium Type N streams: 50 feet

Model 2b2 ODF Wood Emphasis (Take Avoidance for Northern Spotted Owl) Alternative Assumptions			
3.	Model 2 *Northern Spotted Owl*	ODF circle strategy is used for take avoidance.	Northern spotted owl core has no harvest. Northern spotted owl inner 0.7-mile radius circle has a goal of at least 50 percent of the circle's acres with at least age 75. Northern spotted owl 1.5-mile radius circle has a goal of at least 40 percent outside the inner circle with at least age 75. Specific acres within the northern spotted owl circles have no harvest for 25 years. They are eligible for harvest in period 6. Nesting Roosting, and Foraging habitat and dispersal are not in this model.
4.	Model 2 *Marbled Murrelet*	This alternative assumes that marbled murrelets are not listed.	

Notes:

FPA = Forest Practices Act

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Model 12u2 FPA Wood Emphasis (Take Avoidance for Northern Spotted Owl) Alternative Assumptions			
Row heading definitions in the PDF and/or Excel tables are: • "TE" includes all acres within northern spotted owl cores. • "Steep" includes only steep acres that are not also within TE designations. • "Stream Buffer" includes only stream buffer acres that are not also TE or Steep. • “Production” includes all acres not in conservation areas (T&E, Steep, or Stream Buffer).			
1.	Model 12 *Model Goals and Constraints*		No minimum clearcut age. Ending inventory goal outside “Steep, Cores, and Riparian Buffer” that is at least equal to the 50-year old regulated forest. Runs that maximize the first 30-year harvest and also: • has no other flow constraints • permits maximum 5-year harvest deviation of 25 percent around the 30-year period harvest average. • non-declining flow • stabilizes volume at an output equal to that of a regulated forest under 50-year rotation within 50 to 70 years • permits a maximum of 20 percent deviation from the previous decade
	Model 12 *Thinning Prescriptions*	The model has the option to choose prescriptions both with and without fertilization. Only commercial thinnings with at least eight MBF per acre will be conducted.	Minimum volume to permit a thinning is eight MBF per acre.

Model 12u2 FPA Wood Emphasis (Take Avoidance for Northern Spotted Owl) Alternative Assumptions			
2.	Model 12 *Live Tree Retention and Downed Wood*	Two 14-inch DBH TPAs will be retained outside riparian special zone to account for live tree retention.	Live tree retention and downed wood rules are from FPA. Clearcut harvest volume and value are reduced by two 14-inch DBH TPAs. No merchantable volume is used to meet the downed wood requirement.
3.	Model 12 *Riparian Management Zone Buffer Width*	The riparian strategies simulate the FPA buffers. Buffers for fish-bearing streams are on both perennial and intermittent streams. Non-fish-bearing streams have only perennial stream buffers.	Riparian buffers are "no harvest." Buffer widths for each side (horizontal distance) are as follows: • Large Type F streams: 100 feet • Medium Type F streams: 70 feet • Small Type F streams 50 feet • Large Type N streams: 70 feet • Medium Type N streams: 50 feet
4.	Model 12 *Northern Spotted Owl*	Northern spotted owl protection is the 70-acre core habitat.	Northern spotted owl core has no harvest. Core stay on the landscape for the entire planning horizon.
5.	Model 12 *Marbled Murrelet*	This alternative assumes that marbled murrelets are not listed.	

Notes:

FPA = Forest Practices Act

MBF = thousand board feet

SUV = steep, unique, or visual land

T&E core = threatened and endangered core

Table I-1
Model 9 Basin Targets for Advanced 1 Structure Acres

Basin	Advanced [a] Target Outside Conservation Areas (acres)	Advanced Target Outside Conservation Areas (%)	Non-Conservation Areas (acres)	Conservation Areas [b] (acres)	Basin Acres
1	0	0%	2,661	2,695	5,356
2	66	1%	3,919	2,503	6,422
3	2,327	32%	5,975	1,321	7,296
4	2,024	41%	4,020	970	4,990
5	2,505	32%	6,417	1,406	7,823
6	2,653	36%	5,620	1,797	7,417
7	2,859	45%	5,388	934	6,322
8	1,599	25%	4,870	1,671	6,541
9	0	0%	5,701	2,583	8,284
10	206	3%	4,764	1,748	6,512
11	2,785	27%	8,222	2,651	10,873
12	1,466	13%	8,254	3,060	11,314
13	825	20%	2,891	1,241	4,132
Total	**19,315**	**21%**	**68,702**	**24,580**	**93,282**

[a] Advanced areas are not spatially designated

[b] Conservation Area acres include core, SUVs (steep, unique, or visual lands), and riparian reserves

Table I-2
April 2006 Yield Table Pond Values (dollars/MBF)

Species	Price 1	Price 2	Price 3	Price 4	Price 5	Price 6
CX	423	423	423	400	380	0
DF	668	668	668	638	605	0
IC	724	724	724	708	708	0
PC	611	611	611	611	611	0
RA	610	610	610	610	610	0
RC	900	900	900	850	743	0
SS	423	423	423	400	380	0
WH	452	452	452	441	416	0
WP	432	432	432	406	406	0

Note: MBF = thousand board feet

Species

RA = Red alder

CX = unknown conifer

DF = Douglas fir

IC = Incense cedar

WP = White Pine

WH = Western hemlock

RC = Western Red cedar

SS = Sitka spruce

PC = Port Orford cedar

Table I-3
Species Composition for Yield Table Plantations - Fall 2004

Strata Codes	ID #		Total TPA	Species 1	%	DBH	Ht	Species 2	%	DBH	Ht	Species 3	%	DBH	Ht	Species 4	%	DBH	Ht	Location
78710x	1a	Plant	436	DF	100	0	1.5													Non SNC east side
1DR1	1a	Age 15	300	DF	95	6	28	RA	5	7	45									Non SNC east side - use 70% of time
78720x	1b	Plant	538	DF	50	0	1.5	WRC	50	0	1.5									Non SNC east side
DXR2	1b	Age 15	400	DF	50	6	28	WRC	50	4	22									Non SNC east side - use 15% of time
78730x	1c	Plant	538	DF	50	0	1.5	WH	50	0	1.5									Non SNC east side
DXR3	1c	Age 15	400	DF	50	6	28	WH	50	4	22									Non SNC east side - use 15% of time
78740x	2	Plant	538	DF	50	0	1.5	WRC	25	0	1.5	WH	25	0	1.5					SNC west side
DXR4	2	Age 15	400	DF	45	6.5	35	WRC	23	4.5	25	WH	22	5	30	RA	10	7.5	45	SNC west side

Notes:

DF = Douglas fir

HT = Height

RA = Red alder

SNC = swiss needle cast

WH = Western Hemlock

WRC = Western Red cedar

Table I-4
Natural Regeneration Assumed 15 years after First Thinning by SDI or Age

Species Group	SDI 10 - 19			SDI 20 - 29			SDI 30 - 39			SDI 40 +		
	TPA/ Species	DBH	Ht	TPA/ Species	DBH	Ht	TPA/ Species	DBH	Ht	TPA/ Species	DBH	Ht
1D	50 DF	5	30	30 DF	3	20	10 DF	2.5	15			
	200 WH	5	25	150 WH	3	20	100 WH	2.5	15			
	20 WRC	5	25	20 WRC	3	20	20 WRC	2.5	15			
	20 WRC	5	25	20 WRC	3	20	20 WRC	2.5	15			
1W	1000 WH	2.5	10	750 WH	2.5	20	300 WH	2.5	15	100 WH	1	10
DX	300 WH	5	25	100 WH	3	15	50 WH	3	15			
WX	1000 WH	2.5	10	750 WH	2.5	10	300 WH	2.5	10	100 WH	1	10
	75 DF	2.5	15	75 DF	2.5	15	50 DF	2.5	15			
HX	300 WRC	3	15	200 WH	2.5	10						

Notes:

DF = Douglas fir

Ht = height

RA =Red Alder

SNC = swiss needle cast

WH =Western hemlock

WRC =Western red cedar

Species Groups:

1D = Douglas-fir;

1W = Western hemlock

DX = DF majority mix

WX = Hemlock majority mix

HX = Hardwood majority mix

OT = Other species, singular or mixes

The trees per acre are reduced by one third for each successive thin.

Table I-4 continued

Species Group	Age 55			Age 65			Age 80 (Alder Stand Dies)		
1H	10 WH	3	15	10 WH	7	30	10 WH	15	80
				10 WH	3	15	10 WH	7	30
							10 RC	3	15

Notes:

RC = Western Red cedar

WH = Western hemlock

Species Groups:

1H = Hardwood

Table I-5
Volume and Value Deleted from Regeneration Harvest Stand for Live Tree Retention

Stand Age	Live Tree Retention	Volume per Tree	Volume per Acre	Value per Acre	DWD per Volume per Acre
40 - 60	3	250	750	$267	250
60 - 90	3	500	1,500	$675	500
90 - 120	3	1,000	3,000	$1,440	1300
120 - 160	3	1,800	5,400	$2,808	1300
160 +	3	2,400	7,200	$4,320	1300

Note:

DWD = downed woody debris

Table I-6
Trees Added to Plantations to Represent Live Trees Retained from the Previous Stand

Plantation No.	Species	TPA	DBH	Height	Crown Ratio
Plantation_1a	DF	1	24	140	30%
	WH	1	20	120	35%
	WRC	1	20	120	35%
Plantation_1b	DF	1	24	140	30%
	WH	1	20	120	35%
	WRC	1	16	80	40%
Plantation_1c	DF	1	24	140	30%
	WH	1	20	120	35%
	WRC	1	20	120	35%
Plantation_2	DF	1	24	140	30%
	WH	1	20	120	35%
	WRC	1	16	80	40%

Notes:

DF = Douglas fir

WH = Western hemlock

WRC = Western Red cedar

Appendix J
Annual HCP Stand Structure Reporting Process Using Oregon Department of Forestry's Stand Level Inventory

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J.1. OVERVIEW

The Oregon Department of Forestry's (ODF's) State Forests Stand Level Inventory (SLI) provides current or recent information about forest vegetation characteristics and where they occur on the landscape. The SLI system is used for information-based decision making, focusing on facilitation and assessment of operational forest management activities. Information on vegetation elements, including live and dead trees, non-tree vegetation (herbs-shrubs-grasses), and downed woody material, is gathered via field sampling techniques within stratified forest stands. The current field sampling protocol is described in the SLI Field Guide (Version ODFSLI 2.00, October 2004).

The ODF's State Forests Program's long-term goal in using SLI is to achieve and maintain the following current inventory information:

- 100 percent of stands, from seedling stage to when they first become merchantable
- 50 percent of merchantable stands

Once 50 percent of the merchantable stands have been measured, the inventory amount will be reduced to a maintenance mode of four to five percent per year, assuming that this amount of inventory will provide an adequate degree of confidence in the data assigned to non-measured stands. Data for non-measured stands will be derived by extrapolating data from measured stands to similar stands that have not been measured.

Data from the Young Stand Inventory completed in 1998 and the Mature Stand Inventory completed in 2000 were collected using a sampling protocol other than SLI, but approximately the same level of information on the vegetation characteristics was gathered. These data have been reformatted to SLI descriptions.

Data for certain stand structure attributes, such as the snag and downed wood components, are collected during the SLI process, but not at a sampling level that would allow an acceptable statistical representation of these attributes on a stand level basis. Sample data from individual stands can be combined to reduce statistical limitations for indicating the level of intensity for these types of structure components over a larger geographic area (i.e., management basin level) or overall in a stand structure class (intermediate structure, advanced structure).

J.1.1. Current Status

As of December 2005, approximately 50 percent of the stand polygons on the Coos district State Forest Ownership have been sampled, which is approximately 61 percent of the acreage on the ownership. The district's processing format (updating of re-digitized stand polygons and insertion of new inventory data) is an ongoing process as the information becomes available. By December of each year, all changes in the data files and geographic information system (GIS) files are compiled and archived, and the new updated version is distributed for use in planning and tracking efforts.

J.2. SLI DATA COLLECTION

By December of the seventh year after approval and issuance of an Incidental Take Permit by the regulatory agencies, using SLI sampling protocol, the Coos district State Forest Program will collect and compile data on 100 percent of age class 70, and older, stands located outside designated conservation areas on the Elliott State Forest.

J.2.1. Stand Structure Summaries

The Coos district State Forest Program's annual updating process is described in the following pages. Table J-1 (at the end of this appendix) displays the reporting format. The structure class assigned to any one stand polygon has the potential to change annually based on harvesting prescriptions, stand management activities, projected stand growth, or newly collected SLI data. An annual stand structure summary would be generated and distributed each January. This report would provide acreages and related percentages of the stand structures (early, intermediate, advanced, and other iterations of advanced - inclusive of mapped marbled murrelet habitat) as identified in the Elliott State Forest Habitat Conservation Plan (HCP).

J.2.2. Structure Report – Annual Updating Process

The structure report relies on the following data sources:

- SLI stand polygon boundaries (GIS data)
- SLI attribute data
- Management basin boundaries (GIS data)
- Riparian management area (RMA) boundaries (GIS data)
- Steep, unique, and visual land (SUV) area boundaries (GIS data)
- Threatened and endangered core (T&E core) areas (GIS data)
- Marbled murrelet habitat areas (GIS data)

J.3. PREPARING THE BASE DATA

J.3.1. Stand Level Inventory Stand Polygon Boundaries (GIS Data)

The district's stand boundaries will be updated to reflect any changes that have occurred in the previous year. Stand boundaries may change due to harvesting, fire, insects, diseases, improved knowledge of correct boundary locations, and other factors.

J.3.2. Stand Level Inventory Database Attribute Data

1. The SLI attribute data will be updated to reflect changes that have occurred in the previous year. (Examples of SLI changes include incorporating harvesting activities, importing newly collected information, and growing the previously collected stand data to the current year.) The update process is documented in detail in the Reforestation Organization Operations Tracking System (ROOTS) Manual (Oregon Department of Forestry 2006b).
2. The SLI data will be re-compiled.
3. The older SLI data will be grown forward to the current year.
4. For stands that have not yet been inventoried, data from similar SLI inventoried stands will be assigned.
5. The stand structure for all stands will be calculated.

J.3.3. Structure Data Theme

A GIS theme will be created that contains the stand polygon boundaries, joined with the associated structure information for the stand (from the SLI database). Using GIS software, the SLI stand polygon boundaries theme will be intersected with the management basin boundaries theme. The resulting structure data theme will contain the stand ID, the stand structure, and the management basin where the stand is located.

Because stands can and do straddle basin boundaries, this process splits boundary-crossing stands into pieces, one for each management basin into which they fall.

J.3.4. Other GIS Data

If any changes have occurred to the following information during the year, those changes will be incorporated into the appropriate GIS data:

- Management basin boundaries (GIS data)
- RMA boundaries (GIS data)

- SUV area boundaries (GIS data)
- T&E species core areas (GIS data)
- Mapped marbled murrelet habitat areas (GIS data)

If changes are made, they will usually be based on improved knowledge of correct boundary locations.

J.4. GETTING DATA FOR THE STRUCTURE REPORT

J.4.1. Report Structure

The report will contain the following ten columns (see Table J-1):

1. Basin number and name (Basin)
2. Acres in basin
3. Acres of conservation areas (CAs)
4. Acres of advanced structure outside of CAs
5. Acres in advanced structure and CAs
6. Advanced structure percent
7. Advanced structure target percent
8. Acres of intermediate structure
9. Acres of early structure
10. Acres of mapped marbled murrelet habitat

J.4.2. Data Sources and Calculations

1. Basin number and name (Basin) (column 1)

   Basin number and name will come from the management basin boundaries (GIS data) data source.

2. Acres in basin (column 2)

   Basin acres will come from the management basin boundaries (GIS data) data source. The **acres in basin** will be calculated using GIS software, and are the total acres in the basin.

3. Acres of CAs (column 3)

   A. The following three data sources will be joined into one GIS theme using GIS software:

      - RMA boundaries (GIS data)
      - SUV area boundaries (GIS data)
      - T&E species core areas (GIS data)

      (Note: The GIS union process ensures that no "double-counting" of conservancy areas occurs.)

B. The resulting unionized GIS theme will be used to erase the CAs from the management basin boundaries (GIS data) data source. The resulting theme will be the management basin theme minus the CAs.

C. The acres in each basin will be recalculated.

D. The **acres of CAs** in each basin will be calculated as follows: the **acres in basin** (column 1) minus the recalculated acres from step 3B.

4. Acres of advanced structure outside of CAs (column 4)

   A. The unionized CAs theme created in step 3A will be used to erase the CAs from the structure data theme (GIS data) data source. The resulting theme will contain the stand structures outside the CAs.

   B. Re-calculate the acres of the structure data theme resulting from step 4A.

   C. GIS software will be used on the recalculated theme (step 4B) to summarize the acres by management basin and structure classification.

   D. The acres in the three advanced structure classifications for each basin will be added together. This will be the **acres of advanced structure outside of CAs**.

5. Acres in advanced structure and CAs (column 5)

   column 5 = column 3 + column 4

6. Advanced structure percent (column 6)

   column 6 = (column 5 / column 7) x 100

7. Advanced structure target percentage (column 7)

   This will come from the basin-specific percentage targets documented in the HCP.

8. Acres of intermediate structure (column 8)

   The acres of intermediate structure for each basin will be derived from the output of step 4C.

9. Acres of early structure(column 9)

   The acres of early structure for each basin will be derived from the output of step 4C.

10. Acres of mapped marbled murrelet habitat (column 10)

Table J-1
Reporting Format for Coos District State Forest Program's Annual Updating Process

Basin	Acres in Basin	Acres of Conservation Areas (CAs)	Acres of Advanced. Structure outside CA	Acres in Advanced Structure and CA[a]	Advanced Structure %[b]	Advanced Structure Target %	Acres of Intermediate Structure	Acres of Early Structure[c]	Acres of Mapped Marbled Murrelet Habitat
1 – Mill Creek	5,356	2,654	516	3,170	59%	50%	3,256	60	939
2 - Charlotte-Luder	6,422	2,514	2,711	5,225	81%	40%	1,886	248	1,609
3 - Dean-Johanneson	7,296	1,044	3,138	4,182	57%	50%	3,430	24	1,766
4 – Scholfield Creek	4,990	774	1,583	2,357	47%	60%	2,971	101	1,185
5 - Big Creek	7,823	1,227	3,551	4,778	61%	50%	3,191	174	2,420
6 - Benson-Roberts	7,417	1,669	3,262	4,931	66%	60%	2,698	319	1,726
7 – Johnson Creek	6,322	745	2,954	3,699	58%	60%	2,680	219	1,119
8 - Palouse-Larson	6,541	1,561	1,915	3,476	53%	50%	3,287	450	841
9 - Henry's Bend	8,284	2,344	1,194	3,538	43%	30%	4,772	1,004	828
10 - Marlow-Glenn	6,512	1,654	663	2,317	35%	30%	4,269	847	462
11 - Millicoma Elk	10,873	2,400	3,860	6,260	57%	50%	4,036	1,256	1,846
12 - Trout Deer	11,314	2,806	2,333	5,139	45%	40%	,5388	1,994	1,466
13 - Ash Valley	4,132	1,206	877	2,083	50%	50%	2,226	202	473
Forest Total	**93,282**	**22,598**	**21,183**	**51,155**	**54%**	**47%**	**45,740**	**7,000**	**16,680**

[a] This column is the sum of advanced structure outside of CAs and all CA acres.

[b] No clearcut harvesting can occur in a basin unless this percentage exceeds the percentage in the adjacent column to the right.

[c] Acreage not to exceed a Forest Total of 13,992 (15 percent of 93,282).

Based on USFWS ***December 23, 1998, DRAFT*** (rev. Aug. 5, 2004)

IMPLEMENTING AGREEMENT

for the

STATE OF OREGON

for

THE ELLIOTT STATE FOREST

[*DATE*]

March 19, 2008 DRAFT

Including Previous Joint Edits of ODF, FWS and NMFS, species corrections by ODF, as of 1-18-08, and ODF's changes after NMFS announced on 2-4-08 listing of Oregon coastal coho salmon as threatened)

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1.0 PARTIES

The parties to this Implementing Agreement ("Agreement") are the State of Oregon, acting by and through the Oregon Department of Forestry and the Department of State Lands ("State"); the United States Fish and Wildlife Service ("FWS"); and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service ("NMFS"). In this Agreement, FWS and NMFS are referred to collectively as the "Services." The State and the Services are referred to collectively as "the Parties," and each individually as a "Party."

2.0 RECITALS AND PURPOSES

2.1 Recitals. The Parties have entered into this Agreement in consideration of the following facts:

(a) The Elliott State Forest has been determined to provide, or potentially provide, habitat for the following listed species:

Northern spotted owl (*Strix occidentalis*), Marbled murrelet (*Brachyramphus marmoratus*), Bald eagle (*Haliaeetus leucocephalus*), and Coho salmon (*Oncorhynchus kisutch)*.

(b) The Elliott State Forest has also been determined to provide, or potentially provide, habitat for the following species not presently listed:

Birds - Northern goshawk (*Accipter gentilis*), Olive-sided flycatcher (*Contopus cooperi*), Western bluebird (*Sialia Mexicana).*

Fish - Chinook salmon (*Oncorhynchus tshawytscha),* Steelhead trout (*Oncorhynchus mykiss*), Coastal cutthroat trout (*Oncorhynchus clarki clarki),* Chum salmon (*Oncorhynchus keta),* Pacific lamprey (*Lampetra tridentata),* River lamprey (*Lampetra ayresi*), Western brook lamprey (*Lampetra richarsoni*).

Mammals –Fisher (*Martes pennanti*)

Amphibians - Red-legged frog (*Rana aurora*), Southern seep salamander (*Rhyacotriton variegates*), Tailed frog (*Ascaphus truei).*

(c) State has developed a series of measures, described in the HCP as the basis for the Permits being issued by FWS and by NMFS (collectively, the "Permits"), to minimize and mitigate to the maximum extent practicable the effects of take of Covered species incidental to the State's Covered activities. The Permits will authorize any incidental take of Covered species to the extent such take might occur in connection with Covered activities on Covered lands.

2.2 Purposes. The purposes of this Agreement are:

(a) To ensure implementation of each of the terms of the HCP;

(b) To describe a dispute resolution process, and remedies and recourse should any Party fail to perform its obligations as set forth in this Agreement and in the HCP; and,

(c) To provide assurances to the State that as long as the terms of the HCP, the Permits, and this Agreement are performed, no additional conservation or mitigation measures will be required of the State, with respect to Covered species, except as provided for in this Agreement or required by a change in law.

3.0 DEFINITIONS

The following terms as used in this Agreement will have the meanings set forth below:

3.1 Terms defined in Endangered Species Act. Terms used in this Agreement and specifically defined in the federal Endangered Species Act ("ESA") or in regulations adopted by the Services under the ESA have the same meaning as in the ESA and those implementing regulations, unless this Agreement expressly provides otherwise.

3.2 "Changed circumstances" means changes in circumstances affecting a Covered species or the geographic area covered by the HCP that can reasonably be anticipated by the State and that can reasonably be planned for (e.g. the listing of a new species, or a fire or other natural catastrophic event in areas prone to such event). Changed circumstances and the planned responses

to those circumstances are described in Section 9 of this Agreement. Changed circumstances are not Unforeseen circumstances.

3.3 "Covered activities" means certain forest management activities carried out by the State on Covered lands that may result in incidental take of Covered species. Covered activities include forest management activities as described in Section 1.4.3 of the HCP, whether conducted by the State or by entities authorized by the State, provided that these activities are otherwise lawful. Covered activities include:

- Mechanized timber management;
- 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 and terrestrial habitat restoration;
- Rock pit development and use;
- Other management activities, including vertebrate control and harvesting of minor forest products; and
- Research and monitoring.

3.4 "Covered lands" means the lands and waters upon which the Permits authorize incidental take of Covered species and the lands and waters to which the HCP's conservation and mitigation measures apply. Those lands are described in Exhibit A of this agreement. Covered lands include any land added by modification under Section 12.1 of this Agreement or by amendment under Section 12.2 of this Agreement.

3.5 "Covered species" means the species (including all populations and subspecies on the Covered lands), identified in Section 1.3 of the HCP, each of which the HCP addresses in a manner sufficient to meet all of the criteria for issuing an incidental take permit under ESA § 10(a)(1)(B).

3.6 "ESA" means the federal Endangered Species Act, codified at 16 U.S.C. 1531 to 1544.

3.7 "HCP" means the habitat conservation plan prepared by the State and approved by the Services for the Elliott State Forest, as it may be amended from time to time.

3.8 "Listed species" means a species (including a subspecies, or a distinct population segment of a vertebrate species) that is listed as endangered or threatened under the ESA.

3.9 "Party" or "Parties" means party to this Agreement, as specified in Section 1.0 of this Agreement.

3.10 "Permits" means the incidental take permits issued separately by FWS and by NMFS to the State pursuant to Section 10(a)(1)(B) of the ESA for take incidental to Covered activities on Covered lands, as they may be amended from time to time.

3.11 "Unforeseen circumstances" means changes in circumstances affecting a species or geographic area covered by the HCP that could not reasonably have been anticipated by the State or the Services at the time the HCP was completed, and that result in a substantial and adverse change in the status of a Covered species.

3.12 "Unlisted species" means a species (including a subspecies, or a distinct population segment of a vertebrate species) that is not listed as endangered or threatened under the ESA.

4.0 OBLIGATIONS OF THE PARTIES

4.1 Obligations of the State. The State will fully and faithfully perform all obligations assigned to it under this Agreement, the Permits, and the HCP, to the extent that each is in effect.

4.2 Obligations of the Services. The Services will fully and faithfully perform all obligations assigned to them under this Agreement, the Permits, and the HCP, to the extent that each is in effect. Upon execution of this Agreement by all Parties, and satisfaction of all other applicable legal requirements, FWS and NMFS will each issue to the State a Permit under Section 10(a)(1)(B) of the ESA, authorizing incidental take by the State of each listed Covered species under their respective jurisdictions resulting from Covered activities on Covered lands. The Permits will be consistent with this Agreement and the HCP.

4.2.1 Permit coverage – Species Under FWS's Jurisdiction. The Permit issued by FWS will identify all Covered species under FWS's jurisdiction. The Permit will take effect for listed Covered species at the time the Permit is issued. Subject to compliance with all other terms of this Agreement, the Permit will take effect for an unlisted Covered species automatically upon the listing of such species.

4.2.2 Permit Coverage – Species Under NMFS's Jurisdiction. The Permit issued by NMFS will identify all Covered species under NMFS' jurisdiction. The Permit will take effect for listed Covered species at the time the Permit is issued. Subject to compliance with all other terms of this Agreement, the Permit will take effect for an unlisted Covered species automatically upon the listing of such species.

4.2.3 "No surprises" assurances. Provided that the State has complied with its obligations under the HCP, this Agreement, and the Permits, the Services can require the State to

provide mitigation, or to take or refrain from taking any action beyond that provided for in the HCP, this Agreement or the Permits only under unforeseen circumstances, and only in accordance with the "no surprises" regulations at 50 C.F.R. §§ 17.22(b)(5), 17.32(b)(5), and 222.307(g), which are set forth in Exhibit B to this Agreement.

The Services shall notify the State if any changes in the ESA, regulations adopted by the Services implementing the ESA, other changes in federal law, or court decisions alter or eliminate the "no surprises" assurances provided in connection with the HCP, the Permits, or this Agreement.

4.2.4 Use of best data. In making determinations, findings, and decisions under this Agreement, including without limitation decisions regarding modifications to mitigation measures or to any action the State is required to take or refrain from taking under the Changed circumstances, Unforeseen circumstances, and adaptive management provisions of this Agreement, the HCP, or the Permits, the Services will use the best scientific and commercial data available.

5.0 INCORPORATION OF HCP

The HCP and each of its provisions are intended to be, and by this reference are, incorporated herein. In the event of any direct contradiction between the terms of this Agreement and the HCP, the terms of this Agreement will control. In all other cases, the terms of this Agreement and the terms of the HCP will be interpreted to be consistent with each other.

6.0 TERM

6.1 Initial Term. This Agreement and the HCP will become effective on the date on which a permit is first issued by either FWS or NMFS. This Agreement, the HCP, and the Permits will remain in effect for a period of 50 years, except as provided below. In the event that the Permits issued by FWS and NMFS are not in effect within 180 days of the execution of this Agreement by all Parties, the State may in its sole discretion terminate this Agreement.

6.2 Permit suspension or revocation. The Services may suspend or revoke the Permits for cause in accordance with the laws and regulations in force at the time this Agreement was executed. (See 5 U.S.C. § 558; 50 C.F.R. §§ 13.27 - 13.29, 222.306, 15 C.F.R. Part 904.) Such suspension or revocation may apply to the entire Permits, or only to specified Covered species, Covered lands, or Covered activities. If applicable federal regulations are modified subsequent to the effective date of this Agreement, those modifications will apply only to the extent required by subsequent enactment of Congress or court order, or upon agreement of all the Parties. Unless prohibited by law, the Services shall provide the State with 120 days prior written notice of any proposed suspension or revocation of the Permits, and an opportunity to discuss the grounds for the proposed action, the means to cure the basis for the suspension or revocation of the Permits, and alternatives to such action. Suspension or revocation will trigger the post-relinquishment mitigation review process described in Section 6.3.2 of this Agreement, beginning with the Services providing

notice to the State of any required mitigation within 120 days of suspension or revocation. The State's obligations under this Agreement will continue only to the extent described in Section 6.3.2.

6.3 Relinquishment of the Permits.

6.3.1 Generally. The State may relinquish the Permits at any time for any reason, in whole or only as it applies to specific Covered species, Covered activities, or Covered lands. Such relinquishment will be in accordance with the procedural regulations of the Services in force on the date of such relinquishment. (Those regulations are currently codified at 50 C.F.R. §§ 13.26, 306(d)). Notwithstanding relinquishment of the Permits, the State will be required to provide post-relinquishment mitigation for any take of covered species that the Services determine will not have been fully mitigated in accordance with the HCP by the time of relinquishment, as described in Section 6.3.2 of this Agreement. The Services and the State agree that the strategies described in the HCP, including adaptive management, are intended to minimize and mitigate the impacts of take on all Covered species associated with the Covered activities to the maximum extent practicable, on a "pay as you go" basis throughout the term of the Permits. The intent is that the incidental take of all Covered species at any given point in time would be offset by the strategies described in the HCP that have been implemented up to that point in time. Thus, with the State's implementation of the strategies as identified in the HCP, the Services and the State anticipate little or no mitigation will be required should the State relinquish the Permits during the term of the Permits.

6.3.2 Procedure for relinquishment. If the State elects to relinquish the Permits in whole or in part before expiration of the full term of the HCP, the State will provide written notice to the Services at least 120 days prior to the planned relinquishment. Such notice will include a status report in substantially the same form as Appendix J to the HCP, detailing the nature and amount of potential incidental take of all Covered species. Such take will be expressed as the quantity of early, intermediate and advanced structure habitat, including mapped murrelet habitat, harvested to date. The notice will describe the status of the State's implementation of the strategies described in the HCP. The notice also will report the status of the State's compliance with other terms of the HCP pertinent to the relinquishment or partial relinquishment.

Within 90 days after receiving written notice and the status report meeting the requirements of this section, the Services shall give notice to the State stating whether any post-relinquishment mitigation is required and, if so, the amount and terms of such mitigation, and the basis for the Services' conclusions. The Services may determine that post-relinquishment mitigation is required only if the Services find that the State has not implemented the strategies as identified in the HCP, which the State and the Services agree are intended to minimize and mitigate the impacts of take on all Covered species associated with the Covered activities to the maximum extent practicable, on a "pay as you go" basis throughout the term of the Permits.

Should the Services determine that post-relinquishment mitigation is required, the Services shall use the reporting and monitoring information referenced in Section 8.1 of this Agreement to calculate the amount of such mitigation. The Services shall take into account the current status of Covered species and shall take into account and give credit for any change in state or federal law that has the effect of modifying forest land management practices in a manner that

provides greater habitat protection than existed at the time the HCP was adopted.

If the Services determine that no post-relinquishment mitigation is required, and the relinquishment is a complete relinquishment, all obligations assumed by the Parties under this Agreement will terminate upon the Services' issuance of such notice and this Agreement will terminate on that date. If the State relinquishes the Permits only in part, then upon the Services' issuance of such notice, those obligations attendant to the portions of the Permits that the State is relinquishing will terminate on that date.

If the State disagrees with the Services' determination regarding whether mitigation is required or the amount of such mitigation, the State may invoke the dispute resolution procedures described in Section 13 of this Agreement. The Parties will continue to carry out their obligations under the Permits, the HCP and this Agreement until any such dispute is resolved, or until the Services notify the State that all post-relinquishment mitigation required by the Services is completed. If the Parties are unable to agree, the Services will have the final authority to determine whether the State is required to provide post-relinquishment mitigation, provided, however, that the State shall be required to mitigate only for take that occurred but that has not been fully mitigated before it relinquished the Permits, or before the Permits were suspended or revoked. Unless the Parties agree otherwise, the Services may not in any event require more mitigation than would have been provided if the State had carried out the full term of the HCP.

6.4 Effect of suspension, revocation, or relinquishment

6.4.1 Generally. It is intended that the HCP, the Permits, and this Agreement will terminate concurrently. Therefore, this Agreement will terminate as of the effective date of any termination of the HCP or the Permits, including any voluntary relinquishment of the Permits in whole by the State, revocation of the Permits by the Services, or court order revoking the Permits. If the HCP or the Permits are suspended, this Agreement also will be suspended, except that the State and the Services agree to the extent reasonably possible to refrain from taking any action inconsistent with the continuation of the HCP, the Permits or this Agreement in order to be able to resume their respective rights and obligations in the event that the HCP, the Permits and the Agreement come back into effect.

6.4.2 Relationship of documents. Any suspension of the Permits, in whole or in part, automatically suspends the relevant commitments of the HCP and this Agreement. Further, if either Permit is suspended in part, the State may suspend the HCP and Permit in full because the HCP and Permits are intended to function as an integrated whole and it may be unreasonable for the State to continue accepting the burdens of the HCP without obtaining the full benefits of the Permits.

6.4.3 No retroactive liability. Any suspension, revocation, or relinquishment of the HCP, the Permits, or this Agreement will subject the Covered activities to all applicable ESA take prohibitions. However, the Parties do not intend that any retroactive liability will be imposed for actions taken in a good faith belief that the HCP and Permits were in effect at the time such actions were taken. The Services are expected to exercise prosecutorial

discretion as necessary to avoid imposing retroactive liability for such actions. If citizen suits are brought with respect to alleged take attributable in whole or in part to actions taken at a time when the HCP and Permits had not been suspended or terminated by notices published in the Federal and state registers or by a court order, the Services will provide such factual documents as may be reasonably requested by the defendants to establish that the HCP and Permits appeared by their terms to be in effect and had not been suspended or revoked as of specified dates.

6.5 Treatment of unlisted species. For purposes of Sections 6.2 and 6.3 of this Agreement, unlisted Covered species within the Services' jurisdiction will be treated as though they were listed Covered species in determining the amount of take authorized under the HCP and the mitigation required. With respect to unlisted Covered species within the Services' jurisdiction, the State will not be subject to the provisions of Sections 6.2 and 6.3 of this Agreement when permit revocation, suspension or relinquishment has occurred before such species is listed. The parties agree that the State may terminate, in whole or in part, the commitments of the HCP and this Agreement regarding Covered species not listed at the time this Agreement is executed, upon 75 days' written notice to the Services. Termination of the commitments of the HCP with regard to such Covered species relieves the Services of their obligations contained in this agreement and the HCP to issue a permit.

6.6 Extension of the Permits. Upon agreement of the Parties and compliance with all applicable laws, the Permits may be extended beyond their initial term under regulations of the Services in force on the date of such extension. If the State desires to extend the Permits, it will so notify the Services at least 180 days before the then-current term is scheduled to expire. Any extension of the Permits would constitute extension of the HCP and this Agreement for the same amount of time, subject to any modifications that the parties may agree to at the time of extension.

7.0 FUNDING

7.1 State funding. The State will provide such funds as may be necessary to carry out its obligations under the HCP, provided, however, that the State's obligations to pay any funds in connection with the HCP, the Permits or this Agreement are subject to the restrictions of Article XI, Section 7 of the Oregon Constitution. The State by and through the Oregon Department of Forestry shall use good faith and best efforts to secure authorization from the Oregon legislature for any State appropriation or expenditure limitation reasonably necessary in connection with the State's obligations under this Agreement. This will include submission of a budget each biennium and best faith efforts to ensure that the budget receives legislative authorization.

7.2 Federal funding. The Services shall include in their annual budget requests sufficient funds to fulfill their respective obligations under the HCP, the Permits, and this Agreement.

7.3 Cooperation. All Parties at all times will support efficient and effective use of available funds to accomplish the purposes of the HCP, the Permits, and this Agreement, to the maximum extent practicable.

7.4 Limitations. Implementation of the HCP, the Permits, and this Agreement by the Services is subject to requirements of the federal Anti-Deficiency Act, and implementation by the State is subject to analogous provisions of the state constitution, state laws, and the availability of appropriated state and federal funds. Nothing in this Agreement will be construed to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury or any State funds; however, a failure to appropriate funds sufficient to carry out the requirements of the HCP may be cause for suspension or revocation of the Permits. The Parties acknowledge that they will not be required under this Agreement to expend any federal or state agency's appropriated funds unless and until an authorized official affirmatively acts to commit to such expenditures as evidenced in writing.

8.0 MONITORING AND REPORTING

8.1 Planned periodic reports. As described in Section 11.1.8 of the HCP, the State shall submit periodic implementation and monitoring reports describing its activities and results of the monitoring program provided for in the HCP. Every eight years, the State shall present those reports to the Services in a combined format. Within 90 days of receipt thereof, the Services shall determine the status of the State's compliance with the terms of the HCP, and shall provide written notice to the State of any outstanding mitigation that the Services believe the State is required to perform as of the date of the State's report. Any such mitigation identified by the Services shall be limited to commitments made by the State in accordance with the HCP.

8.2 Other reports. The State will provide, within 30 days of being requested by the Services, any additional information in its possession or control related to implementation of the HCP that is requested by the Services for the purpose of assessing whether the terms and conditions of the Permits and the HCP, including the HCP's adaptive management plan, are being fully implemented. This provision shall not be construed to waive any privilege provided by law, including the attorney-client privilege. If the State determines that collection, copying and delivery of such information would require significant amounts of overtime costs or otherwise divert significant resources from other HCP compliance duties, it may inform the Services of that problem and request the Services to take any of the following actions: (1) reduce the scope of their requests, (2) provide funds for the State to retain temporary staffing to meet the Services' requests, (3) send people to gather, copy and deliver the requested information under the State's direction. The Parties then will meet and confer to agree on reasonable, prudent, and practicable ways to gather sufficient information for the Services to perform their ESA duties without imposing unreasonable burdens on the State.

8.3 Certification of Reports. All reports required under Section 8.1 will include the following certification signed by a responsible State official who supervised or directed preparation of the report:

> I certify that, to the best of my knowledge, after appropriate inquiries, the information submitted is true, accurate, and complete.

8.4 Monitoring by Services. The Services may conduct inspections and monitoring in connection with the Permits in accordance with their regulations. (See 50 C.F.R. §§ 13.47, 222.301(j).) Within 120 days after completion of such inspections and monitoring, the Services will provide the State a copy of any non-privileged written report that the Services have prepared that documents observations made during such inspection or monitoring.

9.0 CHANGED CIRCUMSTANCES

9.1 State-initiated response to changed circumstances. The State will give notice to the Services within 30 days after determining that any of the changed circumstances listed in Chapter 11 of the HCP have occurred. The State and the Services will then cooperate to implement the responses to changed circumstances described in Chapter 11 of the HCP, in accordance with the type of changed circumstance at issue. As soon as practicable thereafter, but no later than 60 days after determining that a changed circumstance has occurred, the State will modify its activities in the manner described in Chapter 11 of the HCP to the extent necessary to mitigate the effects of the changed circumstances on Covered species, and will report to the Services on its actions. The State will make such modifications without awaiting notice from the Services.

9.2 Service-initiated response to changed circumstances. Services will give notice to the State within 30 days after determining that any of the changed circumstances listed in Chapter 11 of the HCP have occurred. The State and the Services will then cooperate to implement the responses to changed circumstances described in Chapter 11 of the HCP, in accordance with the type of changed circumstance at issue. If the Services determine that the State has not responded in accordance with Chapter 11 of the HCP, the Services will so notify the State, describing what actions the Services believe need to be undertaken. The Services and the State will consult regarding the proposed action. Within 60 days after receiving such notice, the State will make the required changes and report to the Services on its actions. Such changes are provided for in Chapter 11 of the HCP, and hence do not constitute unforeseen circumstances or require amendment of the Permits or HCP.

10.0 ADAPTIVE MANAGEMENT

10.1 State-initiated adaptive management. The State will implement changes to management approaches or practices based upon the adaptive management provisions in Chapter 11 of the HCP, when the State determines that such changes are appropriate to achieve the HCP's requirements or to respond to monitoring results or new scientific information. The State will make such changes without awaiting notice from the Services, and will report to the Services on any actions taken pursuant to this section. Changes that result from the adaptive management process described in Chapter 11 of the HCP do not require amendments to the HCP except as provided in Sections 10.3 and 10.4 of this Agreement.

10.2 Service-initiated adaptive management. If the Services determine that one or more

of the adaptive management provisions in the Chapter 11 of the HCP have been triggered and that the State has not changed its management practices in accordance with Chapter 11 of the HCP, the Services will so notify the State, describing what actions the Services believe need to be undertaken, and will consult with the State on making the required changes. Within 60 days after receiving such notice, the State will make the required changes and report to the Services on its actions. Such changes are provided for in the HCP, and hence do not constitute unforeseen circumstances or require amendment of the Permits or HCP, except as provided in this section.

10.3 Reductions in mitigation. The State may implement adaptive management changes that result in different types or levels of mitigation than provided for Covered species under the original terms of the HCP, if the Services first provide written approval. The Parties acknowledge that conservation objectives may be achieved through different techniques without causing a reduction in mitigation. The State may propose any such adaptive management changes by notice to the Services, specifying the adaptive management modifications proposed, the basis for them, including supporting data, and the anticipated effects on Covered species, and other environmental impacts. Within 120 days of receiving such a notice, the Services will take one of the following actions: approve the proposed adaptive management changes; approve them as modified by the Services; or notify the State that the proposed changes may constitute Permit amendments that must be reviewed under Section 12.2 of this Agreement.

10.4 No increase in take. This section does not authorize any modifications to the HCP that would result in an increase in the amount and nature of take of Covered species authorized by the Permits. Any such modification must be reviewed as a Permit amendment under Section 12.2 of this Agreement.

11.0 LAND TRANSACTIONS

11.1 Acquisition of land by the State. Nothing in this Agreement, the HCP, or the Permits limits the State's authority to acquire additional real property in connection with the Elliott State Forest. Except as otherwise provided in Section 12.1 of this Agreement, lands that the State may acquire to add to the Elliott State Forest will not be Covered Lands except upon amendment of the Permits as provided in Section 12.2 of this Agreement.

11.2 Disposal of land by the State. The State has a program of land acquisition and disposition, including but not limited to transfers, sales, exchanges, and purchases. During the first ten years of HCP implementation, Covered lands to be disposed of will not include T&E core areas.

At least 90 days before the completion of any conveyance of Covered lands to another person or entity, the State shall provide written notice to the Services. The notice shall include:

1. A description of the land to be conveyed;
2. A statement as to whether the prospective new owner will become a party to the HCP;
3. A statement regarding any habitat modifications under the Permits on the particular land during the term of the Permits up to the time of the conveyance;

4. A statement of the extent of mitigation accomplished, if any, to offset such habitat modification; and
5. Any changes to the mitigation necessary to offset any adverse effect of the conveyance.

Transfers of Covered lands will be processed as minor modifications when consistent with the criteria of Section 12.1 of this Agreement. In addition, transfers of Covered lands will be processed as minor modifications in accordance with Section 12.1 of this Agreement if:

(a) The land will be transferred to an agency of the federal government and, before transfer, the Services have determined that transfer will not compromise the effectiveness of the HCP based on commitments by that agency regarding management of such land;

(b) The land will be transferred to a non-federal entity that has entered into an agreement acceptable to the Services (e.g., an easement held by the State with the Services as third-party beneficiaries) to ensure that the lands will be managed in such a manner and for such duration so as not to compromise the effectiveness of the HCP;

(c) The land will be transferred to a non-federal entity that, before completion of the land transaction, has agreed to be bound by the HCP as it applies to the transferred land and has obtained an incidental take permit for Covered species; or

(d) The Services determine that the cumulative amount of land to be transferred in any single transaction does not exceed 640 acres and will not have a material impact on the ability of the State to comply with the requirements of the HCP and the terms and conditions of the Permits.

Land dispositions under paragraph 11.3 (d) of this Agreement may include, at the sole discretion of the State, a requirement of the recipient to commit to managing the disposed land in accordance with the Permits, the HCP and this Agreement. If the acquiring entity commits in writing to the State that the disposed lands will be managed to maintain the commitments of the Permits, the HCP, and this Agreement, the State will continue to be given credit for such lands for the purpose of determining compliance with the HCP, this Agreement, and the Permits. If the management of new lands or disposition of lands results in incidental take beyond the level authorized in the Permits, an amendment of the Permits as provided in Section 12.2 of this Agreement may be required by the Services to define additional, mutually-agreed-upon mitigation measures.

12.0 MODIFICATIONS AND AMENDMENTS

12.1 Minor modifications.

(a) Any Party may propose minor modifications to the HCP or this Agreement by providing notice to all other Parties. Such notice shall include a statement of the reason for the proposed modification and an analysis of its environmental effects, including its effects on operations under the HCP and on Covered species. The Parties will use best efforts to respond to

proposed modifications within 60 days of receipt of such notice. Proposed modifications will become effective upon all other Parties' written approval. If, for any reason, a receiving Party objects to a proposed modification, it must be processed as an amendment of the Permits in accordance with Section 12.2 of this Agreement. The Services will not propose or approve minor modifications to the HCP or this Agreement if the Services determine that such modifications would result in operations under the HCP that are significantly different from those analyzed in connection with the original HCP, adverse effects on the environment that are new or significantly different from those analyzed in connection with the original HCP, or additional take not analyzed in connection with the original HCP.

(b) Minor modifications to the HCP and IA processed pursuant to this subsection may include but are not limited to the following:

(1) Correction of typographic, grammatical, and similar editing errors that do not change the intended meaning;

(2) Correction of any maps or exhibits to correct errors in mapping or to reflect previously approved changes in the Permits or HCP;

(3) Minor changes to survey, monitoring or reporting protocols;

(4) With agreement of the State and the Services, coverage by the HCP and the Permits of additional parcels of land contiguous with the Elliott State Forest that the State may acquire, so long as any one parcel at the time of acquisition does not exceed 640 total acres.

(c) Any other modifications to the HCP or IA will be processed as amendments of the Permits in accordance with Section 12.2 of this Agreement.

12.2 Amendment of the Permits. The Permits, the HCP or this Agreement may be amended by the Parties' mutual agreement in accordance with all applicable legal requirements, including but not limited to the ESA, the National Environmental Policy Act, the Services' permit regulations, and State law governing the management of the Covered lands. The Party proposing the amendment shall provide a statement of the reasons for the amendment and an analysis of its environmental effects, including its effects on operations under the HCP and on Covered species.

13.0 REMEDIES, ENFORCEMENT, AND DISPUTE RESOLUTION

13.1 In general. Except as set forth below, each Party shall have all remedies otherwise available to enforce the terms of this Agreement, the Permits, and the HCP.

13.2 No monetary damages. No Party shall be liable in damages to any other Party or other person for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement or any other cause of action arising from this Agreement.

13.3 Injunctive and temporary relief. The Parties to this Agreement acknowledge that injunctive and temporary relief may be appropriate to ensure compliance with the terms of this Agreement.

13.4 Enforcement authority of the United States. Nothing contained in this Agreement is intended to limit the authority of the United States government to seek civil or criminal penalties or otherwise fulfill its enforcement responsibilities under the ESA or other applicable law.

13.5 Dispute resolution. The Parties recognize that disputes concerning implementation of, compliance with, or termination of this Agreement, the HCP, and the Permits may arise from time to time. Examples of such disputes include, without limitation: whether and to what extent post-termination mitigation may be required; whether the State is in compliance with the terms of the Permits or the HCP; whether adaptive management is called for under Section 10 of this Agreement; and whether or not changed or unforeseen circumstances exist and, if so, what response is appropriate. The Parties agree to work together in good faith to resolve such disputes, using the informal dispute resolution procedures set forth in this section, or such other procedures upon which the Parties may later agree. However, if at any time any Party determines that circumstances so warrant, it may seek any available remedy without waiting to complete informal dispute resolution.

13.5.1 Informal dispute resolution process. Unless the Parties agree upon another dispute resolution process, or unless an aggrieved Party has initiated administrative proceedings or suit in federal court, the Parties may use the following process to attempt to resolve disputes:

(a) The aggrieved Party will notify the other Parties of the provision that may have been violated, the basis for contending that a violation has occurred, and the remedies it proposes to correct the alleged violation.

(b) The Party alleged to be in violation will have 30 days, or such other time as may be agreed, to respond. During this time it may seek clarification of the information provided in the initial notice. The aggrieved Party will use its best efforts to provide any information then available to it that may be responsive to such inquiries.

(c) Within 30 days after such response was provided or was due, representatives of the Parties having authority to resolve the dispute will meet and negotiate in good faith toward a solution satisfactory to all Parties, or will establish a specific process and timetable to seek such a solution.

(d) If any issues cannot be resolved through such negotiations, the Parties will consider non-binding mediation and other alternative dispute resolution processes and, if a dispute resolution process is agreed upon, will make good faith efforts to resolve all remaining issues through that process.

(e) This Section 13.5.1 survives any termination or relinquishment of the HCP, the Permits and this Agreement to the extent necessary to resolve any disputes arising while this

Agreement was in effect and any disputes related to the Parties' post-termination rights or obligations.

14.0 MISCELLANEOUS PROVISIONS

14.1 No partnership. Neither this Agreement nor the HCP shall make or be deemed to make any Party to this Agreement the agent for or the partner of any other Party.

14.2 State management. Nothing in this Agreement limits the State's ability to manage and protect these lands in accordance with the State Constitution, Statutes and other state or federal law, and Administrative Rules. However, in the event that changes in State law render the State unable to fulfill any of its obligations under the HCP or this Agreement, the Services reserve the right to suspend or revoke the Permits in accordance with Section 6.2 of this Agreement.

14.3 Notices. Any notice permitted or required by this Agreement shall be in writing, delivered personally to the persons listed below, or shall be deemed given five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested and addressed as follows, or at such other address as any Party may from time to time specify to the other Parties in writing. Notices may be delivered by facsimile or other electronic means, provided that they are also delivered personally or by certified mail. Notices shall be transmitted so that they are received within the specified deadlines.

Assistant Regional Director
United States Fish and Wildlife Service
911 N.E. 11th Ave.
Portland, Oregon 97232-4181
Telephone: 503-231-6159
Telefax: 503-231-2019

Regional Administrator
National Marine Fisheries Service
7600 Sand Point Way N.E.
Seattle, Washington 98115-0070
Telephone: 206-526-6150
Telefax: 206-526-6426

State Forester
Oregon Department of Forestry
2600 State Street
Salem, Oregon 97310
Telephone: 503-945-7200
Telefax: 503-945-7212

Director

Oregon Department of State Lands
775 Summer Street NE, Suite 100
Salem, Oregon 97301
Telephone: 503-378-3805
Telefax: 503-378-4844

14.4 Entire agreement. This Agreement, together with the HCP and the Permits, constitutes the entire agreement among the Parties. It supersedes any and all other agreements, either oral or in writing, among the Parties with respect to the subject matter hereof and contains all of the covenants and agreements among them with respect to said matters, and each Party acknowledges that no representation, inducement, promise or agreement, oral or otherwise, has been made by any other Party or anyone acting on behalf of any other Party that is not embodied herein.

14.5 Elected officials not to benefit. No member of or delegate to Congress shall be entitled to any share or part of this Agreement, or to any benefit that may arise from it.

14.6 Duplicate originals. This Agreement may be executed in any number of duplicate originals. A complete original of this Agreement shall be maintained in the official records of each of the Parties hereto.

14.7 No third-party beneficiaries. Without limiting the applicability of rights granted to the public pursuant to the ESA or other federal law, this Agreement shall not create any right or interest in the public, or any member thereof, as a third-party beneficiary hereof, nor shall it authorize anyone not a party to this Agreement to maintain a suit for personal injuries or damages pursuant to the provisions of this Agreement. The duties, obligations, and responsibilities of the Parties to this Agreement with respect to third parties shall remain as imposed under existing law.

14.8 Relationship to the ESA and other authorities. The terms of this Agreement shall be governed by and construed in accordance with the ESA and applicable federal law. In particular, nothing in this Agreement is intended to limit the authority of the Services to seek penalties or otherwise fulfill their responsibilities under the ESA. Moreover, nothing in this Agreement is intended to limit or diminish the legal obligations and responsibilities of the Services as agencies of the federal government. Nothing in this Agreement will limit the right or obligation of any federal agency to engage in consultation required under Section 7 of the ESA or other federal law; however, it is intended that the rights and obligations of the State under the HCP and this Agreement will be considered in any consultation affecting the State's use of the Covered lands.

14.9 References to regulations. Any reference in this Agreement, the HCP, or the Permits to any federal or state law or regulation shall be deemed to be a reference to such law or regulation in effect at the time an action is taken, except that the State may elect to rely on federal laws and regulations in effect at the time this Agreement was executed if necessary to protect its rights under the Sections of this Agreement addressing "No Surprises" Assurances, Suspension, Termination, Relinquishment, and Term.

14.10 Applicable laws. All activities undertaken pursuant to this Agreement, the HCP, or

the Permits must be in compliance with all applicable state and federal laws and regulations.

14.11 Successors and assigns. This Agreement and each of its covenants and conditions shall be binding on and shall inure to the benefit of the Parties and their respective successors and assigns. Assignment or other transfer of the Permits shall be governed by the Services' regulations; under the regulations in force on the effective date of this Agreement, a permit issued under ESA Section 10(a) may be assigned or otherwise transferred only in accordance with the regulations at 50 CFR § 13.25.

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Implementing Agreement to be in effect as of the date on which a Permit is first issued by either FWS or by NMFS .

BY _____ Date _____
Deputy Regional Director
United States Fish and Wildlife Service
Portland, Oregon

BY _____ Date _____
Regional Administrator
National Marine Fisheries Service
Seattle, Washington

BY _____ Date _____
Marvin Brown, State Forester
Oregon Department of Forestry
Salem, Oregon

BY _____ Date _____
Louise Solliday, Director
Department of State Lands
Salem, Oregon

EXHIBIT A

ELLIOTT STATE FOREST

DOUGLAS COUNTY

Township 22 South, Range 10 West, Willamette Meridian:

Section 07:	E½SW¼, NW¼SE¼, S½SE¼, SW¼NE¼, SE¼NW¼, Lots 1, 2, 6 thru 9 and a portion of Lot 3
Section 08:	Lots 5 and 7
Section 14:	Lot 9 and SE¼SW¼
Section 15:	Lots 9, 10, a portion of Lot 7, and SE¼SE¼
Section 17:	E½SW¼, SW¼SE¼, Lots 5 thru 8 and 10 thru 15
Sections 18 thru 20:	All
Section 21:	All except Lot 18
Section 22:	All
Section 23:	Lots 5 thru 11, SW¼NE¼, E½NW¼, NE¼SW¼ and N½SE¼
Sections 26 thru 34:	All
Section 35:	E½SW¼ and a portion of S½SE¼

Township 22 South, Range 11 West, Willamette Meridian:

Section 01:	Lots 5 and 9 thru 14
Section 02:	S½NW¼, SW¼NE¼, N½SE¼, NE¼SW¼ and Lots 5 thru 9
Section 03:	NW¼NE¼, SE¼NE¼, E½SE¼, Lot 1 and a portion of SW¼NE¼
Section 09:	Lots 1 thru 4, N½S½, NE¼ and SE¼NW¼
Section 10:	Lots 2 and 3, N½SW¼ and NW¼

Section 11: Lots 1, 4 thru 7, a portion of Lot 3, NE¼NW¼, NE¼, NE¼SE¼, and a portion of NW¼SE¼

Sections 12 thru 14: All

Section 15: S½, NW¼ and a portion of S½NE¼

Township 22 South, Range 11 West, Willamette Meridian:

Section 16: All

Section 17: N½SW¼, SE¼SW¼, W½SE¼, SW¼NE¼, SE¼NW¼ and Lots 5 thru 7

Section 19: S½NE¼, NE¼NE¼, SE¼ and Lots 1 thru 4

Section 20: S½NW¼, W½E½, SW¼ and Lots 1 thru 4

Sections 21 thru 36: All

Township 22 South, Range 12 West, Willamette Meridian:

Section 24: Lots 2 thru 4, W½SE¼, SW¼NE¼, SE¼NW¼ and E½SW¼

Section 25: Lot 4, SW¼SE¼ and S½SW¼

Section 26: N½SE¼ and SE¼SE¼

Section 35: NE¼NE¼, SW¼NE¼ and a portion of E½SE¼

Section 36: All

Township 23 South, Range 9 West, Willamette Meridian:

Section 06: W1/2NW1/4 and a portion of S1/2

Township 23 South, Range 10 West, Willamette Meridian:

Section 02: Lots 1 thru 13, 16 thru 21 and W½SW¼

Section 03: All

Section 10: All

Section 11: Lots 1, 4, 5, 8 and 9, SE¼NW¼, E½SW¼, and SE¼

Section 14: N½NE¼ and NW¼

Sections 15, 22 and 23: All

Section 24: Portions of SE¼ and NW¼

Township 23 South, Range 10 West, Willamette Meridian:

Section 26: SW¼

Section 27: All

COOS COUNTY

Township 23 South, Range 10 West, Willamette Meridian:

Sections 04 thru 09, 16 thru 21 and 28 thru 30: All

Section 31: W½NW¼, NE¼, NW¼SE¼, NE¼SW¼, Lots 1 thru 5 and a portion of Lot 6

Section 32: N½NE¼, SW¼NE¼, NW¼ and NW¼SE¼

Section 33: W½NE¼, NW¼, NW¼SW¼ and a portion of NW¼NE¼NE¼

Township 23 South, Range 11 West, Willamette Meridian:

Sections 01 thru 06: All

Section 07: E½W½, E½ and Lots 2, 3 and 4

Sections 08 thru 17: All

Section 18: N½, N½SE¼, Lot 3 and a portion of NE¼SW¼

Section 19: S½NE¼NW¼, NE¼, SE¼NW¼, SE¼, E½SW¼, Lots 2 thru 4 and a portion of Lot 1

Sections 20 thru 25: All

Section 26: S½, N½N½, SW¼NW¼, SE¼NE¼, portions of SE¼NW¼ and SW¼NE¼

Sections 27 thru 29: All

Section 30: Lots 1, 3 and 4, SE¼, E½SW¼, N½NE¼ and NE¼NW¼

Sections 31 thru 36: All

Township 23 South, Range 12 West, Willamette Meridian:

Section 01: Lots 1 thru 4

Section 12: S½NE¼, SE¼NW¼ and SE¼

Section 13: NE¼ and E½NW¼

Section 16: N1/2SW1/4

Section 25: E½SE¼

Section 27: SE¼SE¼ and a portion of SW¼SE¼

Section 34: E½NE¼, S½S½ and NE¼SE¼

Section 35: S½, NE¼, W½NW¼ and SE¼NW¼

Section 36: S½SE¼, SW¼, N½NE¼, W½NW¼, portions of S½NE¼ and N½SE¼

Township 24 South, Range 10 West, Willamette Meridian:

Section 06: Lots 1 thru 4 and 7 thru 18

Township 24 South, Range 11 West, Willamette Meridian:

Sections 01 and 02: All

Section 03: Lots 1 thru 4, S½N½, SE¼, E½SW¼ and portions of W½SW¼

Section 04: All except a portion of SE¼SE¼

Sections 05 thru 08: All

Section 09: N½, SW¼, N½SE¼ and SW¼SE¼

Section 10: All

Section 11: N½, N½S½

Section 12: N½

Sections 15 and 16: All

Section 17: N½, N½SW¼, NW¼SE¼, Lots 1 thru 3 and a portion of SE¼SE¼

Township 24 South, Range 11 West, Willamette Meridian:

Section 18: All

Section 19: A portion of N½NE¼

Section 20: A portion of Lot 1, Lots 2 thru 7, NE¼SE¼ and a portion of E½NE¼

Section 21: All

Section 22: N½, N½S½ and Lots 1 and 2

Section 27: Lots 4 and 5, W½SW¼, SE¼SW¼ and SW¼SE¼

Sections 28 and 29: All

Section 30: A portion of Lot 1

Section 32: N½, N½SW¼ and NW¼SE¼

Section 33: NW¼, N½NE¼ and SE¼NE¼

Section 34: N½N½

Township 24 South, Range 12 West, Willamette Meridian:

Sections 01 and 02: All

Section 03: All except a portion of SW¼SE¼

Section 04: NE¼SE¼ and SE¼NE¼

Section 09: SE¼SE¼ and a portion of E½NE¼

Sections 10 thru 14: All

Section 15: E½, NE¼NW¼, Lot 1, portions of Lot 2 and SE¼SW¼

Section 16:	S½N½ and N½NE¼
Section 22:	NE¼, SE¼NW¼, NE¼SW¼ and N½SE¼
Section 23:	All except SE¼SE¼NE¼
Section 24:	Lots 1 and 2, NE¼NE¼, W½E½, SE¼SE¼, S½NW¼, SW¼ and a portion of SE¼NE¼
Section 25:	Lots 1 and 2, N½NE¼ and a portion of S½NW¼

EXHIBIT B

50 C.F.R. §17.22(b)(5) provides:

(5) Assurances provided to permittee in case of changed or unforeseen circumstances. The assurances in this paragraph (b)(5) apply only to incidental take permits issued in accordance with paragraph (b)(2) of this section where the conservation plan is being properly implemented, and apply only with respect to species adequately covered by the conservation plan. These assurances cannot be provided to Federal agencies. This rule does not apply to incidental take permits issued prior to March 25, 1998. The assurances provided in incidental take permits issued prior to March 25, 1998 remain in effect, and those permits will not be revised as a result of this rulemaking.

(i) Changed circumstances provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and were provided for in the plan's operating conservation program, the permittee will implement the measures specified in the plan.

(ii) Changed circumstances not provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in the plan's operating conservation program, the Director will not require any conservation and mitigation measures in addition to those provided for in the plan without the consent of the permittee, provided the plan is being properly implemented.

(iii) Unforeseen circumstances. (A) In negotiating unforeseen circumstances, the Director will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee.

(B) If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Director may require additional measures of the permittee where the conservation plan is being properly implemented, but only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

(C) The Director will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The Director will consider, but not be limited to, the following factors:

(1) Size of the current range of the affected species;

(2) Percentage of range adversely affected by the conservation plan;

(3) Percentage of range conserved by the conservation plan;

(4) Ecological significance of that portion of the range affected by the conservation plan;

(5) Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the conservation plan; and

(6) Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

(6) Nothing in this rule will be construed to limit or constrain the Director, any Federal, State, local, or Tribal government agency, or a private entity, from taking additional actions at its own expense to protect or conserve a species included in a conservation plan.

(7) Discontinuance of permit activity. Notwithstanding the provisions of § 13.26 of this subchapter, a permittee under this paragraph (b) remains responsible for any outstanding minimization and mitigation measures required under the terms of the permit for take that occurs prior to surrender of the permit and such minimization and mitigation measures as may be required pursuant to the termination provisions of an implementing agreement, habitat conservation plan, or permit even after surrendering the permit to the Service pursuant to § 13.26 of this subchapter. The permit shall be deemed canceled only upon a determination by the Service that such minimization and mitigation measures have been implemented. Upon surrender of the permit, no further take shall be authorized under the terms of the surrendered permit.

(8) Criteria for revocation. A permit issued under paragraph (b) of this section may not be revoked for any reason except those set forth in § 13.28(a)(1) through (4) of this subchapter or unless continuation of the permitted activity would be inconsistent with the criterion set forth in *16 U.S.C. 1539*(a)(2)(B)(iv) and the inconsistency has not been remedied.

50 CFR § 17.32(b)(5) provides:

(5) Assurances provided to permittee in case of changed or unforeseen circumstances. The assurances in this paragraph (b)(5) apply only to incidental take permits issued in accordance with paragraph (b)(2) of this section where the conservation plan is being properly implemented, and apply only with respect to specifies adequately covered by the conservation plan. These assurances cannot be provided to Federal agencies. This rule does not apply to incidental take permits issued prior to March 25, 1998. The assurances provided in incidental take permits issued prior to March 25, 1998 remain in effect, and those permits will not be revised as a result of this rulemaking.

(i) Changed circumstances provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and were provided for in the plan's operating conservation program, the permittee will implement the measures specified in the plan.

(ii) Changed circumstances not provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in the plan's operating conservation program, the Director will not require any conservation and mitigation measures in addition to those provided for in the plan without the consent of the permittee, provided the plan is being properly implemented.

(iii) Unforeseen circumstances. (A) In negotiating unforeseen circumstances, the Director will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee.

(B) If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Director may require additional measures of the permittee where the conservation plan is being properly implemented, but only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

(C) The Director will have the burden of demonstrating that such unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The Director will consider, but not be limited to, the following factors:

(1) Size of the current range of the affected species;

(2) Percentage of range adversely affected by the conservation plan;

(3) Percentage of range conserved by the conservation plan;

(4) Ecological significance of that portion of the range affected by the conservation plan;

(5) Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the conservation plan; and

(6) Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

(6) Nothing in this rule will be construed to limit or constrain the Director, any Federal, State, local, or Tribal government agency, or a private entity, from taking additional actions at its own expense to protect or conserve a species included in a conservation plan.

(7) Discontinuance of permit activity. Notwithstanding the provisions of § 13.26 of this subchapter, a permittee under this paragraph (b) remains responsible for any outstanding minimization and mitigation measures required under the terms of the permit for take that occurs prior to surrender of the permit and such minimization and mitigation measures as may be required pursuant to the termination provisions of an implementing agreement, habitat conservation plan, or permit even after surrendering the permit to the Service pursuant to § 13.26 of this subchapter. The permit shall be deemed canceled only upon a determination by the Service that such minimization and mitigation measures have been implemented. Upon surrender of the permit, no further take shall be authorized under the terms of the surrendered permit.

(8) Criteria for revocation. A permit issued under paragraph (b) of this section may not be revoked for any reason except those set forth in § 13.28(a)(1) through (4) of this subchapter or unless

continuation of the permitted activity would be inconsistent with the criterion set forth in *16 U.S.C. 1539*(a)(2)(B)(iv) and the inconsistency has not been remedied.

50 CFR § 222.307(g) provides:

(g) Assurances provided to permittee in case of changed or unforeseen circumstances. The assurances in this paragraph (g) apply only to incidental take permits issued in accordance with paragraph (c) of this section where the conservation plan is being properly implemented, and apply only with respect to species adequately covered by the conservation plan. These assurances cannot be provided to Federal agencies. This rule does not apply to incidental take permits issued prior to March 25, 1998. The assurances provided in incidental take permits issued prior to March 25, 1998, remain in effect, and those permits will not be revised as a result of this rulemaking.

(1) Changed circumstances provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and were provided for in the plan's operating conservation program, the permittee will implement the measures specified in the plan.

(2) Changed circumstances not provided for in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in the plan's operating conservation program, NMFS will not require any conservation and mitigation measures in addition to those provided for in the plan without the consent of the permittee, provided the plan is being properly implemented.

(3) Unforeseen circumstances. (i) In negotiating unforeseen circumstances, NMFS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee.

(ii) If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, NMFS may require additional measures of the permittee where the conservation plan is being properly implemented. However, such additional measures are limited to modifications within any conserved habitat areas or to the conservation plan's operating conservation program for the affected species. The original terms of the conservation plan will be maintained to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

(iii) NMFS has the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. NMFS will consider, but not be limited to, the following factors:

(A) Size of the current range of the affected species;

(B) Percentage of range adversely affected by the conservation plan;

(C) Percentage of range conserved by the conservation plan;

(D) Ecological significance of that portion of the range affected by the conservation plan;

(E) Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the conservation plan; and

(F) Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

Appendix L
Team Members

Steering Committee

The planning process for the Elliott State Forest was guided by a steering committee composed of managers from the Departments of Forestry, State Lands, Fish and Wildlife, and Justice; a Coos County Commissioner; and the Superintendent of the South Coast Education Service District. The 11-person group was advisory to the State Forester and the Director of the Department of State Lands on the Elliott State Forest planning process. It provided overall direction to the planning team and comments on key issues during the process. In addition, the steering committee members informed community leaders and others regarding planning issues and plan progress.

Steering Committee Members

- Dan Shults, Southern Oregon Area Director, Chair
- Ray Craig/Steve Thomas/Jim Paul/Nancy Hirsch, Assistant State Foresters
- John Lilly/Steve Purchase, Department of State Lands, Assistant Directors
- Mike Bordelon/Ross Holloway/Lisa DeBruyckere/Nancy Hirsch/Mike Cafferata, State Forests Program Directors
- Jim Young, Coos District Forester and Project Leader
- Mike Schnee/Barbara Lee, State Forests Program Policy and Planning Managers
- Cary Greenwood/Dan Postrel, Oregon Department of Forestry, Agency Affairs Directors
- Steve Denney, Oregon Department of Fish and Wildlife, Southwest Region Assistant Director
- Ian Whitlock/Michele Logan/Jas Adams, Department of Justice
- John Griffith, Coos County Commissioner
- Rick Howell, South Coast Education Service District Superintendent

Core Planning Team for the Elliott State Forest Management Plan

The Department of Forestry formed a Core Planning Team to be responsible for developing revisions to the Forest Management Plan and Habitat Conservation Plan. The team developed resource goals and strategies for the management of the Elliott State Forest. Team members brought a wide range of disciplines to the revision process. The group met nearly monthly, beginning in October 2000.

Core Planning Team Members

- Jim Young, Coos District Forester and Project Leader
- Greg Kreimeyer, Coos District Representative
- Larry Sprouse/Bob Fields/Jennifer Wright, Coos District, Project Coordinators
- Marcia Humes, Oregon Department of Forestry, State Forests Program Wildlife Biologist
- Logan Jones, Oregon Department of Forestry, State Forests Planning Coordinator
- Mike Schnee/Barbara Lee, Oregon Department of Forestry, State Forests Program Policy and Planning Managers
- Jeff Brandt, Oregon Department of Forestry, State Forests Adaptive Management Unit Manager and Program Research and Monitoring Coordinator
- Liz Dent, Oregon Department of Forestry, State Forests Program Riparian and Aquatic Specialist
- John Seward, Oregon Department of Forestry, Southern Area Geotechnical Specialist
- Doug Robin, Oregon Department of Forestry, State Forests Program Silviculturalist
- Jane Hope/Roger Welty, Oregon Department of Forestry, State Forests Program Planning Specialists
- Jasen King, Oregon Department of Forestry, Unit Forester, Southwest Oregon District, and Project Technical Writer
- Jeff Foreman, Oregon Department of Forestry, Public Information Officer
- Randy Smith, Oregon Department of Forestry, Southern Oregon Wildlife Biologist
- Marnie Allbritten, Oregon Department of Fish and Wildlife, Wildlife Biologist
- Howard Crombie/Tom Loynes/Alan Ritchey, Oregon Department of Fish and Wildlife, Fisheries Biologists

Contributors from Other Resource Agencies

- Jon Germond and Rod Krahmer, Oregon Department of Fish and Wildlife
- Kevin Maurice / Brian Cox / Lee Folliard / Richard Szlemp, U.S. Fish and Wildlife Service
- Frank Bird / Chuck Wheeler, National Marine Fisheries Service

Additional Resource Specialists

- Wildlife: Randy Smith/Mike Wilson/Matt Gostin Oregon Department of Forestry
- Watershed Assessment: Dan Clough, Oregon Department of Forestry
- Geotechnical: John Seward/Jason Hinkle/Keith Mills, Oregon Department of Forestry
- Social & Economic: Gary Lettman, Oregon Department of Forestry
- Forest Modeling: Pam Overhulser/Norma Kline/Robert Fields, Oregon Department of Forestry/Dr. John Sessions, Oregon State University
- GIS: Chris Bradberry/Lisa Zwart/Ryan Miller, Oregon Department of Forestry
- Mapping: Terry Lieschner, Oregon Department of Forestry
- Stand Level Inventory: Mike DeLaune/Dave Enck/Terry Leischner, Oregon Department of Forestry
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